

CLICO Working Papers

Integrated theory of hydro-climatic security

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Abstract

This paper presents the updated conceptual framing of the CLICO research project, and evaluates the contribution of the CLICO research findings to theory on hydro-climatic security. We draw out the theoretical findings from twenty outputs of the five CLICO research work packages including twelve case studies in the Mediterranean, the Middle East and the Sahel region, where climate related water stresses threaten insecurity. We relate these findings to seven research questions. We then provide an updated conceptual framework of hydro-climatic security based on the findings and a summary of the key theoretical findings of the CLICO research.

We find that climate change and water related stressors may exacerbate human insecurity either directly by adding to existing sources of human insecurity, or through maladaptive policies and interventions designed by governments in the name of adaptation to climate change. Factors that influence conflict situations and human security are multi-scalar and in most cases, more dependent on political, social and economic conditions rather than environmental factors. Conflict that is severe and prolonged is a significant driver of vulnerability to hydro-climate stressors. Cooperation, and more specifically coordination and communication between groups and institutions is seen as an important contributor to adaptive capacity. Without this *divergent adaptation* can occur, where one individual or group's adaptation can reduce another's adaptive capacity. Some debate exists as to the desirability of state intervention in adaptation and what constitutes adaptive capacity. Adaptation planning can be conflictive and present risks to human security when it fails to take into account different perspectives, values and knowledge bases and is open to manipulation by state actors. Case study evidence also supports arguments in favour of a balance between incrementalism and transformation, since transformational adaptation risks exacerbating some types of human insecurities.

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1. Introduction

The CLICO project examines the relationship between climate change and hydro-climatic stressors, conflict and human security. The project consists of five research based work packages. Work package 1 is the theoretical framing of the project, of which this report is part. Work package 2 consists of twelve case studies of hydro-climatic hot spots in the Mediterranean, the Middle East and the Sahel region (see Figure 1 for a map showing the case study locations). Work package 3 is a large-N study of conflict and cooperation in domestic water related events. Work package 4 examines policies and institutional frameworks relevant for responses to hydro-climatic stresses. Work package 5 examines adaptive capacity and conflict resolution mechanisms at the international scale for transboundary river basins.

The CLICO project was underpinned by a conceptual framework developed by the consortium partners in the first six months of the project. The aim of the framework was to provide a guide for the research in the different work packages of the project and to stimulate suggestions of research hypotheses or questions that could be addressed. As a primary output of the project, CLICO aimed to develop and sharpen the concepts and relationships of terms used in this framework and contribute to the theoretical development of understandings of hydro-climatic security (how climate and water related hazards influence human security).

This report presents the conceptual framing of the CLICO research project developed during the first six months of the project and the seven initial research questions that guided the research in the four empirical work packages of the project. The report then evaluates the contribution of the research findings to theory on hydro-climatic security – an exploration of the relationship between water-related climate risks and human security. The report draws on these findings to propose a revised version of the conceptual framework and a set of key theoretical findings.

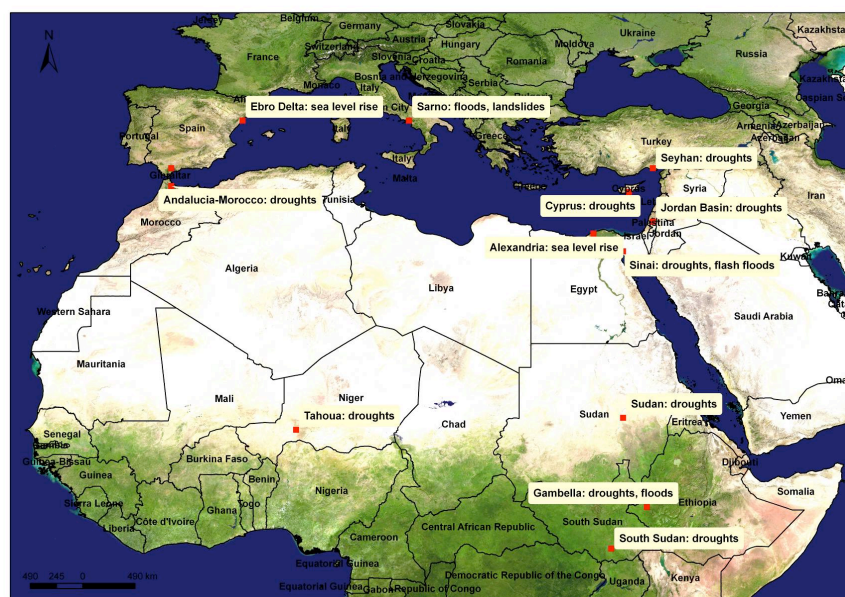


Figure 1: Map of the CLICO case study locations (Source: Bruggeman et al. 2012)

2. The CLICO conceptual framework

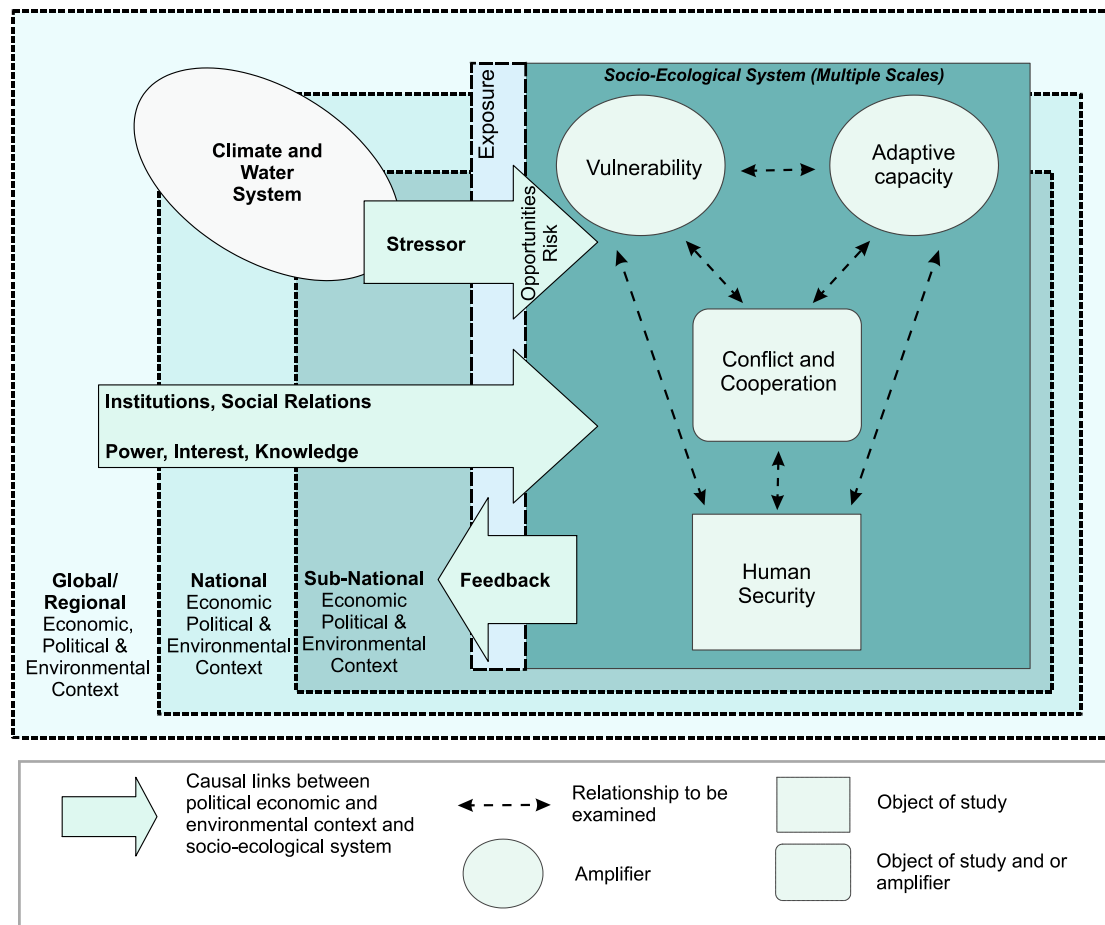


Figure 2: Multiple scale relations between the economic, political and environmental context, climate and water-related stressors, conflict and cooperation and human security.

The framework shown in Figure 1 focuses on the human security of elements within a social-ecological system and conflict and cooperation interactions within that system as the objects of study. A social-ecological system is one in which the linkages between society and the environment are considered (Gunderson and Holling, 2002, p122). In this conceptual framework we are interested in the social, political, environmental/ecological, and economic aspects of the system under study. The boundaries of the system under consideration must be defined and linkages between different scales are often important to recognise. Human security can be described as protection of individuals or communities from threats and disruption as well as protection of their rights and basic needs (Human Security Network, 2010; Kaldor, 2007; UNDP, 1994) and is closely related to concepts such as human well-being. Conflict and cooperation are terms often used to qualify interactions occurring at different intensities and geographic scales within or between individuals, communities and states, varying over time and frequently coexisting (Goulden et al., 2009; Keohane, 2005; Yoffe et al., 2003; Zeitoun, 2007; Zeitoun and Mirumachi, 2008). Conflict has also been distinguished by whether it is latent (not expressed), overt (or manifest, but non-violent) and violent (Lund, 2009). "Cooperation should not be viewed as the absence of conflict but rather as a reaction to conflict or potential conflict" (Keohane, 2005, p54). Keohane (2005) describes

cooperation as occurring “when actors adjust their behaviour to the actual or anticipated preferences of others” (p51).

The multiple spatial scales shown in Figure 1 recognise the importance of the global or regional¹, national and sub-national scale economic, political and environmental contexts. The social system depicted in Figure 1 can be examined at any of these spatial and temporal scales and may indeed cross scales, depending on the system being studied. We also recognise a need to incorporate an understanding of different temporal scales within the framework, although it was not practical to reflect this on the diagram.

CLICO research investigated the causal links between environmental factors (climate and water related stressors, being our focus) conflict and cooperation and human security as well as the causal links between political and economic factors, human security and conflict and cooperation, as indicated by the two large arrows in Figure 1.

The lower of the two large arrows depicts potential causal links from the multi-scale economic political and environmental context to the social-ecological system under study. Political and economic contexts influence socio-ecological systems in a variety of ways and at a range of scales, including for instance the systems’ integration into the international trade in food staples and ‘virtual water’ (Allan, 2001), international political relations with regional states and international donors, the domestic policies and capacities of state institutions, and internal unevenness in patterns of economic development. Analysis of these factors could involve consideration of institutions, social relations, power, interests and knowledge. Institutions and social relations also govern access to natural resources and influence the wider environmental context.

The upper large arrow depicts a hypothesized relationship between stressors or hazards related to the climate and water system, at a range of scales and the object of study, in terms of human security and cooperation and conflict interactions within the social-ecological system. We focus primarily on water related stressors associated with climate change and climate variability, for example droughts, water scarcity, extreme rainfall and sea level rise leading to flooding and salinisation of freshwater, however other climate change stressors such as extreme and increasing temperatures are also relevant, for some of the case studies. The term climate variability is used to describe shorter term variations in climate, for example of decades or less, whereas climate change refers to longer term variations in climate of several decades or longer and includes projections of change in climate for the future (Watson, 2001).

Exposure of the social-ecological system to climate and water related stressors leads to risks to the vulnerable elements of the socio-ecological system. We draw from the disaster risk reduction literature in recognizing that risks are the product of the interaction of the climate change related stressors or hazards and the vulnerability of the system, which is linked to its adaptive capacity (Birkmann, 2006; Wisner et al., 2004). We also recognize that there may be opportunities

¹ We use ‘regional’ to refer to regions within continents, e.g. eastern Africa, southern Europe.

associated with climate change, and for this reason we use the term stressor rather than hazard on the diagram.

Vulnerability has different dimensions (e.g. physical, social, environmental, economic, and institutional) and causal factors including exposure, sensitivity and adaptive capacity (Adger, 2006; Birkmann, 2006; Füssel, 2007). The *exposure* of the social-ecological system to stressors is the extent to which the system experiences the stress or hazard and is influenced by, for example, the location of the system and the magnitude, frequency, duration and geographical extent of the stressor. The system's *sensitivity* is "the degree to which a system is modified or affected" by stressors (Adger, 2006). Adaptive capacity can be related to the coping range or thresholds within which an individual, group or system is able to deal with or recover from stresses (Smit and Wandel, 2006) and is context and scale specific (Vincent, 2007). In addition to examining adaptive capacity we are also interested in understanding the actual goals, processes and outcomes of adaptation, defined by Brooks (2003) as 'adjustments in a system's behaviour and characteristics that enhance its ability to cope with external stress'. We are also interested in identifying instances and causes of 'maladaptation' (Barnett and O'Neill, 2010), i.e. adaptation that increases the vulnerability of some groups, sectors or systems.

The nature of the hypothesized relationships between human security and conflict and cooperation, vulnerability and adaptive capacity have been examined in the CLICO case studies and work packages as indicated by the dashed arrows in Figure 1. The human security of the system or social group under consideration was the main object of study in the CLICO research, although some case studies and work packages focused more on some elements of the framework than others. Although human security can be thought of as operating primarily at the sub-national level, there are cross-scale elements, e.g. safety-nets provided by governments, international solidarity. We suggest in the framework that human security may be influenced by the vulnerability and adaptive capacity of the system which may act as filters or amplifiers of risk associated with climate and water related stressors and other political-economic and environmental factors. Conflict and cooperation interactions were hypothesized as potential amplifiers of human security in addition to being an object of study.

The CLICO project adopts a political ecology approach for some of the case studies and in this theoretical analysis. Kallis and Zografos (2012) portray political ecology as a discipline that focuses attention on 'winners' and 'losers' and the distribution of costs and benefits of socio-environmental change, and which studies power over access and use of resources (Watts and Peet, 1996). Political ecologists consider the expansive metabolism of societies and the uneven processes of a globalising economy, side-by-side with uneven power distributions as the fundamental causes of unequal vulnerability distribution.

A set of seven research questions, listed in Box 1, were proposed alongside the conceptual framework to guide the research of the work packages, exploring different elements of the framework. The findings from CLICO research that relate to these questions are presented in section 3. In section 4 we present a revised theoretical framework of hydro-climatic security in response to the findings and in section 5 we provide a summary of the key theoretical findings of the CLICO project.

Box 1: Seven proposed research questions

1. How is human security affected by risks associated with water and climate-related stressors, societal vulnerability and social-political factors? This can be expanded into two sub-questions: What is the relative importance of environmental risks compared to social and political factors? And what are the mechanisms by which these risks and vulnerabilities amplify each other at different scales?
2. How do political, economic, environmental and climatic factors exacerbate or mitigate water-related conflict?
3. How does human security (or lack of it) affect the demand for cooperation?
4. Under what conditions may conflict reduce rather than exacerbate vulnerabilities?
5. What constitutes the capacity of states and their institutions and other organizations to implement change, or even radical change necessary under times of stress?
6. What interventions might be suitable for reducing risks and improving human security associated with climate and water related stressors, either by reducing the vulnerability of the system and increasing its adaptive capacity or by modifying the hazards?
7. Under what conditions might policies of adaptation to perceived or experienced climate change impacts increase the vulnerability of some groups and/or exacerbate social conflict?

Tables 1 and 2 show a list of the research outputs from the different work packages with an indication of which areas of the framework they addressed (Table 1) and which of the seven research questions their research is relevant to (Table 2). The next section reviews the findings of these papers, in particular drawing out their theoretical implications, and is organised by the seven research questions identified above.

Table 1. Mapping CLICO papers onto Conceptual Framework

Title	Authors	Socio-ecological system			Political/Economic stressors						Scale			
		Vul	AC/ adapt	Con/ coop	HS	Inst	SR	Power	Interest	Know	Glob/ reg	Nat	Sub-nat	
Work Package 1														
Hydro-climatic change, Conflict and Security.	Kallis and Zografos	✓	✓	✓	✓	✓		✓				✓	✓	✓
Work Package 2														
Water vulnerability (Morocco-Spain).	Pascual et al	✓	✓	✓	✓	✓				✓	✓			
Water and tourism (Cyprus).	Charalambous et al	✓	✓						✓				✓	
Value based approach (Ebro basin).	Albizua and Zografos	✓	✓			✓	✓		✓					✓
The impact of uncertainties: (Israel-Palestine).	Fischhendler and Katz			✓				✓				✓		
Divergent adaptation (Niger).	Snorek et al		✓	✓	✓	✓	✓							✓
IWRM implementation (West Bank).	Tamimi and Jamous					✓				✓	✓			
Human security policy (Sarno).	D'Alisa and Kallis	✓	✓		✓	✓		✓	✓					✓
Migrant agricultural labor, adaptation and state intervention (Turkey).	Turhan		✓			✓		✓					✓	
Climate change vulnerability (Sudr, Egypt).	Tawfic Ahmed	✓	✓		✓									✓
Forced and planned relocation (Greater Alexandria, Egypt).	Gebert et al	✓	✓		✓	✓	✓	✓	✓				✓	✓
The Politics of Human Security (Gambella, Ethiopia).	Milman and Arsano	✓	✓	✓	✓			✓	✓				✓	✓
Water, Climate Change and Conflict (Sudan and South Sudan).	Selby and Hoffman	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓
Work Package 3														
(WARICC): A New Event Dataset.	Bernauer et al			✓	✓	✓		✓					✓	✓
Domestic Water Conflict and Cooperation.	Bohmelt et al			✓	✓	✓		✓					✓	✓
Work Package 4														
Review of policies and institutional frameworks (D4.1)	Gerstetter et al		✓	✓	✓	✓						✓	✓	
Stakeholder perspectives and demands (D4.2)	Gerstetter et al		✓	✓	✓	✓						✓	✓	
Policy vision and guidelines (D4.3)	Gerstetter et al		✓	✓	✓	✓						✓	✓	
Work Package 5														
International water treaties.	Fischhendler and De Bruyne		✓	✓								✓		
Transboundary river basins Institutions.	Milman et al		✓	✓		✓						✓	✓	
Key to abbreviated column headings:														
Vul: Vulnerability	AC/adapt: Adaptive capacity and adaptation					Con/coop: Conflict and cooperation								
HS: Human Security	Inst: Institutions					SR: Social relations								
Know: Knowledge	Glob/reg: Global/ regional					Nat: National				Sub-nat: Sub-national				

Table 2. Mapping CLICO papers onto the conceptual framework suggested questions

Title	Authors	Research Questions						
		1	2	3	4	5	6	7
Work Package 1								
Hydro-climatic change, Conflict and Security.	Kallis and Zografos	✓	✓		✓		✓	
Work Package 2								
Water vulnerability (Morocco-Spain).	Pascual et al	✓		✓		✓	✓	✓
Water and tourism (Cyprus).	Charalambous et al						✓	
Value based approach (Ebro basin).	Albizua and Zografos		✓	✓				
The impact of uncertainties: (Israel-Palestine).	Fischhendler and Katz		✓					
Divergent adaptation (Niger).	Snorek et al	✓	✓			✓	✓	✓
IWRM implementation (West Bank).	Tamimi and Jamous	✓	✓		✓			
Human security policy (Sarno).	D'Alisa and Kallis	✓	✓			✓		
Migrant agricultural labor, adaptation and state intervention (Turkey).	Turhan		✓					✓
Climate change vulnerability (Sudr, Egypt).	Tawfic Ahmed	✓					✓	✓
Forced and planned relocation (Greater Alexandria, Egypt).	Gebert et al	✓			✓	✓	✓	✓
The Politics of Human Security (Gambella, Ethiopia).	Milman and Arsano	✓	✓			✓		✓
Water, Climate Change and Conflict (Sudan and South Sudan).	Selby and Hoffman		✓			✓		✓
Work Package 3								
(WARICC): A New Event Dataset.	Bernauer et al	✓	✓		✓	✓		
Domestic Water Conflict and Cooperation.	Bohmelt et al	✓	✓		✓	✓		
Work Package 4								
Review of policies and institutional frameworks (D4.1)	Gerstetter et al (a)	✓	✓			✓	✓	
Stakeholder perspectives and demands (D4.2)	Gerstetter et al (b)	✓	✓			✓	✓	
Policy vision and guidelines (D4.3)	Gerstetter et al (c)	✓	✓			✓	✓	
Work Package 5								
International water treaties.	Fischhendler and De Bruyne		✓			✓	✓	
Transboundary river basins Institutions.	Milman et al			✓	✓	✓	✓	

3. Findings

In this section we review the outputs from the CLICO research from work package 2 (twelve case studies of hot spots of hydro-climatic stress and human insecurity) and from work package 3 (large N statistical study of domestic water events), work package 4 (analysis of national and international policies) and work package 5 (analysis of transboundary river basin agreements and adaptive capacity). We draw out the theoretical implications of these studies by addressing the research questions posed in the previous section .

1. How is human security affected by risks associated with water and climate-related stressors, societal vulnerability and social-political factors?

The outputs of the CLICO research support the premise that human security is multi-faceted (UNDP, 1994) and influenced by a range of social-political, economic and environmental factors. To answer the above question we first look at the different factors that are identified in some of the CLICO case studies and their relative importance (Question 1a), and then examine whether there are any indications as to how these factors might amplify each other (Question 1b).

1 a) What is the relative importance of environmental risks compared to social and political factors?

Kallis and Zografos (2012) suggest that it is important to understand that there is no definitive causal relation between an individual's security and a particular aspect of their environment. They also note that separating the effects of hydro-climatic variables from other factors can be problematic (Kallis and Zografos, 2012). Instead, they suggest that it is more useful to identify factors that tend to dominate under different socio-environmental conditions and contexts, as has been done in the CLICO case studies, as we illustrate here.

One of the CLICO case studies examined the Intercontinental Biosphere Reserve of the Mediterranean (IBRM) in Morocco and Spain (Pascual et al., 2012). These two countries, operating under very different political and institutional environments, cooperate to secure the region's environmental and cultural diversity. Increasing socio-economic pressure in tandem with a growing population and decrease in water availability due to regional climate variability and climate change are exposing the local residents to an even more water-scarce environment in the future.

Transboundary tensions and political and social conflicts and uncertainties in the Palestinian Territories combined with capacity constraints are thought to be major factors in shaping the risks to human security posed by inadequate access to water (Tamimi and Abu Jamous, 2012). For example, Tamimi and Abu Jamous (2012) state that the average renewable water supply per capita in the Palestinian Territories is 500m³ a year, but that due to Israel's claims on much of this water,

which is located in transboundary aquifers and rivers, only 80m³ per person per year is available to Palestinians and even less than this is actually utilised by Palestinians because of a lack of infrastructure that prevents the full use of available water. This has a high impact in particular on the poor who are forced to pay more for water where piped water supplies are not available (Tamimi and Abu Jamous, 2012). Future risks include a possible decline in future water availability with climate change, in addition to the political, social and institutional uncertainties that are already factors in poor management of water (Tamimi and Abu Jamous, 2012). Bar-On and Gerstetter (2012) identify constraints resulting from the Israeli occupation as a factor constraining access to water for Palestinians and thus having a negative impact on human security. They observe that according to local stakeholders and experts, climate change will have a relatively insignificant impact on water availability for Palestinians as compared to the impact resulting from the ongoing conflict with Israel. Both of these papers illustrate the political nature of constraints on water management and water related human insecurities in the Palestinian territories, that are rooted in the power imbalance between Israel and the Palestinian Authority (Hoffman, personal communication).

In the Sudr region of Egypt, Tawfic Ahmed (2012) finds that factors leading to vulnerability to climate change include the isolation of the Bedouin population, illiteracy and low awareness of climate change, combined with a sensitive ecosystem, subject to extreme climate variability. However, a strong local knowledge of the ecosystem provides the Bedouin population with a high adaptive capacity, in particular those in urban areas who are less isolated. Tawfic Ahmed (2012) also observes that women are more vulnerable to climate/water hazards, such as floods and droughts, as they may be forced to travel long distances to collect natural resources such as wood and water. Furthermore, children are more vulnerable to diseases caused by scarcity of water and poor sanitation facilities.

The uncertainty of future environmental risks as well as social and political conditions makes prediction of the relative importance of these different factors into the future problematic. For example, Gebert et al. (2012) note a high degree of uncertainty in sea level rise predictions and also in social and political trends in Egypt. These multiple uncertainties affect the capacity to provide sustainable responses in the form of planned relocation for residents of the Nile Delta near Alexandria that is threatened by flooding as a result of sea level rise.

1 b) What are the mechanisms by which these risks and vulnerabilities amplify each other at different scales?

Reviewing the relevant literature, Kallis and Zografos (2012) explain that human security is considered to be more closely related to economic prosperity and political freedom rather than environmental pressure. However, studies so far have yet to investigate in depth the relationship between socio-economic elements and security. Results from the CLICO case studies shed some light on possible mechanisms by which the social, political, economic and environment contexts interact to amplify risks and vulnerabilities, as illustrated below.

Snorek et al. (2012) suggest that social vulnerabilities are related to issues of social justice and human rights and that social marginalisation can exacerbate vulnerability to climate stresses and

human insecurity. This is exemplified in several of the case studies including those conducted in Niger (Snorek et al., 2012), Turkey (Turhan, 2012) and Ethiopia (Milman and Arsano, 2012).

Turhan (2012) explains how social and political changes during the post-war 20th Century, including conflict in the late 1980s between Kurdish insurgents and the Turkish army, led to dispossession of the rural population and the creation of a migrant labour force in Turkey. The human insecurity of this population is due to its social and economic marginalisation in a neoliberal era which results in few employment rights and poor living conditions, increasing their vulnerability to climate impacts. The seasonal migrant agricultural labourers are vulnerable to market price fluctuations and social marginalisation as well as the impacts of climate variability and change. Climate impacts include delays to the harvest or poor harvests and flood damage to their temporary accommodation which have impacts on health and economic well-being (Turhan, 2012).

Milman and Arsano (2012) describe a range of factors influencing human security in the region of Gambella in Ethiopia, including existing tensions between and within different ethnic groups that have involved violence, as well as food insecurity, poor service provision and vulnerability to climate impacts. Competition for land and water resources has resulted from population growth as well as displacement of populations by conflict, and in some areas is exacerbated by policy interventions by the state. Given existing food insecurity and the vulnerability of the population to climate variability, Milman and Arsano (2012) describe climate change as a “multiplicative stressor meaning that even small biophysical changes could exacerbate existing and historically rooted forms of human insecurity, particularly if changes in water affect land use either via floods/droughts or if climate adaptation policies are interpreted as incorporating ethnic biases.” (Milman and Arsano, 2012, p8).

Several of the case studies explore the additional risks to human security posed by societal *responses* to climate/water stresses, either for those who are responding/adapting or other social groups negatively affected by particular responses/adaptation actions or development choices. Snorek et al. refer to this as ‘divergent adaptation’, which they define as “those adaptations that promote the success or adaptive capacity of one individual/community (User A) in a shared ecosystem which leads to a reduced adaptive capacity of an alternative individual/community (User B) in the same ecosystem” (Snorek et al., 2012, p6). For example, agro-pastoralists in Niger have adapted to poor yields from unreliable rainfall by expanding croplands and seeking payment in response to crop damage by grazing animals. These adaptations have lessened the adaptive capacity of pastoralists who find the area of grazing lands that they have access to have diminished and their expenses increased because they have to pay for crop damage by their herds (Snorek et al., 2012).

Other case studies highlight the additional risks posed by state led adaptation responses (Dalisa, 2012; Gebert et al., 2012; Milman and Arsano, 2012). For example, Gebert et al. (2012) consider risks to human security arising from sea level rise affecting low elevation coastal zones, in particular how planned relocation in response to risks to lives and livelihoods changes risks to human security. They suggest that relocation may reduce direct risks from sea level rise, such as danger from flooding, but expose people to new risks associated with displacement and removal of

sustainable livelihood strategies. Factors influencing potential human security outcomes include the impact of relocation on household asset portfolios and structures, and the preferences and priorities of households which affect the decision to participate in planned relocation. The incentives provided for relocation are also important and are influenced by the capacity of the country or region to provide conditions for sustainable long term solutions. A key influence on human security outcomes is thought to be the degree of match between people's preferences (such as housing requirements and livelihood opportunities) and the benefits provided by planned adaptation programmes sponsored by the state (Albizua and Zografos, 2012; Gebert et al., 2012;).

D'Alisa and Kallis (2012) suggest that securitisation of issues by the state can increase human insecurity associated with environmental hazards due to the de-politicisation of issues and the stifling of debate around alternative disaster response and adaptation strategies. By declaring environmental disasters as a 'state of emergency', such as that caused by the mudslides in the Sarno incident of 1998, the state is able to concentrate on responses that are populist rather than beneficial to long term human security in the wider region. Albizua and Zografos (2012) note a similar impact of securitisation in reducing debate in their Ebro delta case study (as discussed under the next question).

The role of adaptation policies in enhancing human security or exacerbating human insecurities will be returned to under question 7.

2. How do political, economic, environmental and climatic factors exacerbate or mitigate water-related conflict?

Kallis and Zografos (2012) and Selby and Hoffman (2012) identify a number of studies that postulate that water and climate conflict may result from either scarcity (Gleick, 1993) or an over abundance of water resources (Fairhead, 2001; Gleditsch et al., 2006). However, CLICO research questions any direct link between hydro-climatic influences and conflict and offers a wide range of examples that illustrate the multiplicity of political, economic, social and other factors that influence conflict.

Böhmelt et al. (2012) analyse time-series cross-section data pertaining to 10,352 water-related events in 35 countries in the Mediterranean, Middle East and Sahel from 1997-2009 derived from a database of media articles of domestic water related events (Bernauer et al., 2012). They explore the extent to which demand for water (measured using indicators for GDP, population density and agricultural productivity), supply (measured using indicators of climate variability) and restraint (institutional characteristics that may deter violence or conflict in general) determine whether interactions over water are conflictive or cooperative and the intensity of conflict or cooperation. The authors find that changes in water demand (affected primarily by economic development) and restraint factors influence domestic water-related interactions more than supply variations. Increased water demand (predicted by higher economic development) is associated with an increase in low-level conflict over water. Böhmelt et al. (2012) propose that economic prosperity and political freedom in democratic countries may allow 'political space' for disputes, whereas violent conflicts are far more common in non-democratic environments than democratic ones. Low level conflict in democracies may contribute over time to consensus building processes that could

be described as cooperation, hence there can be potential overlap between cooperation and conflict in decision making processes.

Tamimi and Jamous (2012) describe how existing insecurities due to political conflict and poor access to water increase the vulnerability of the population in Palestine. They conclude that climate change in the West Bank will not only impact human security but also strengthen the likelihood of conflict between different social groups in the region. Bar-On and Gerstetter (2012) describe how different narratives on the Israeli and Palestinian side make it difficult to reach agreement on water-related issues between both sides.

Fischhendler and Katz (2012) examine the influence of different sources of uncertainty, including political, social and environmental uncertainties, on the degree of cooperation or conflict associated with negotiations over transboundary water resources shared between Israel and Palestine. By examining documents related to a series of bilateral and trilateral negotiations held between 2007 and 2009 between Israeli, Palestinian and US negotiators, they find that political and social uncertainties dominate over physical uncertainties such as those associated with water resources and climate variability. However, they also found that uncertainties of one type can 'spill-over' to impact on water uncertainties. For example political uncertainties can threaten successful negotiations on water issues. The type of persons involved in the negotiations (whether politicians or technical officials) and the type of cooperative mechanisms proposed also influenced the outcome in terms of increased cooperation or conflict: legal mechanisms were more likely to receive objections from the parties compared to mechanisms such as exchange of information. However, mechanisms to address uncertainties were often cooperative on the surface, e.g. feasibility studies, but may have been intended to delay resolution rather than resolve differences.

Some measures to reduce physical uncertainty brought up new social and political uncertainties, acting as additional barriers to cooperation. An example that the authors cite is the building of desalination infrastructure by Israel, which reduces the incentive for Israel to cooperate since shared water resources become less important as a result of this new source of water. This example is also picked up by Gerstetter et al (2012) who found that in some cases mutual threats to human security from water related risks can instigate cooperation (for example a joint sewage management initiative for Nicosia in Cyprus reduced the threat to the population from untreated sewage), whilst in others, certain policies and resolution mechanisms that aim to lessen risk and conflict, sometimes trigger new disputes, for example desalination in Israel.

Using a case study of Sudan and South Sudan, Selby and Hoffman (2012) argue that processes and structures at multiple scales from the local to that of the global political economy are responsible for shaping the nature of the state's agency. They assert that the evidence for Sudan suggests that it is the historical context and current shape of the state and actions of its agents that influence conflict as well as contributing to environmental vulnerabilities, rather than any scarcity of resources imposed by environmental change. However, they find that the existing situation of high

insecurity, as well as changing economic conditions due to a drop in oil revenues², hampers the ability to create capacity to respond to potential climate and water related stresses.

According to Snorek et al. (2012) water-related conflict in Niger stems from the existing political and economic context. Snorek et al (2012) suggest that conflict is a political response to marginalization of certain groups' livelihood needs over others, a response that is exacerbated by environmental change. While institutions at multiple scales can either ease or compound ongoing latent conflicts/disputes between divergent groups, corruption, low accountability and low trust inhibit individuals from seeking solutions through institutions. In the Niger context, individuals exposed to both resource scarcity and a lack of institutional mechanisms to support livelihoods turn to conflict to establish control over assets or entitlements.

In contrast, Turhan (2012) describes how lack of organisation and union membership amongst seasonal migrant workers in Turkey "hinders the possible emergence of class-based conflicts" (p21) between workers and their employers in an era of changing agricultural systems of production.

Albizua and Zografos (2012) describe differing perceptions amongst those affected and decision makers regarding the need to adapt to threats to water resources in the Ebro river delta including salinisation, subsidence, sea level rise and the impacts of water transfers. Perceptions differ with proximity to the problem and the level of knowledge of the delta system. Conflict between actors is not overt and these differences in perceptions do not feed fully into debate on possible responses. Although scientific knowledge is key for dealing with vulnerability drivers, the authors point out that an overemphasis on expert scientific knowledge and arguments that emphasise the security implications of the risks facing the delta, risk a closing down of the debate that perpetuates inequalities between groups. Hence, they identify a persisting " "fear" of being disposed of water" (Albizua and Zografos, 2012, p15) in spite of state-led adaptation attempts. They draw on the point made by Zeitoun and Warner (2006) that "silent conflicts" are often caused by excessive water use, transfer or contamination by hydro-hegemonic actors.

Milman and Arsano (2012) describe multiple linkages between conflict and political, economic, environmental and climatic factors for the Gambella region of Ethiopia. Conflict has long been an outcome of competition for land and water resources between different ethnic groups, often exacerbated by contested state-led policies, such as resettlement programs. Although there is little evidence for climatic factors directly influencing conflict, current policies designed to reduce vulnerability to climate stresses, amongst other aims, give preference to some aspects of security over others, creating new insecurities and influences on conflict potential. This preference for addressing some aspects of security over others "both results from and influences socio-political interactions in the region" (Milman and Arsano, 2012, p12).

² Sudan lost two thirds of its oil resources when the south seceded in July 2011, but retained processing and export facilities. Disagreements between Sudan and South Sudan led to south Sudan stopping oil production in January 2012, reducing the income of both countries (BBC news, <http://www.bbc.co.uk/news/world-africa-1968670>).

3. *How does human security (or lack of it) affect the demand for cooperation?*

This question was relatively under developed in the CLICO research since direct links between human (in)security and cooperation were few. In the western Mediterranean, hydro-climatic change is expected to bring further human insecurities. To help mitigate for these changes, Morocco and Spain have created a reserve across the Basin, bringing cooperation between two countries that otherwise may not have worked together (Pascual et al., 2012). Other instances of cooperation were documented by Gerstetter et al. (2012) between the Greek Cypriot and Turkish Cypriot communities, who cooperate over sewage treatment works on the island of Cyprus, whilst the authors also noted the potential for collaboration between Israel, Jordan and Palestine if the Red/Dead Sea Canal is approved. Cooperation may be related to a complex range of historical and political influences, and it is not clear how much concerns over human security influence cooperation in these examples.

Although some literature supports the theory of mutually beneficial cooperation (Zeitoun and Warner, 2006), others believe that some kinds of collaboration may only seek to reinforce unequal situations (Albizua and Zografos, 2012). Some actors in the Ebro delta study expressed a strong aversion to uncertainty which was connected with support for state intervention and the use of the precautionary principle (Albizua and Zografos, 2012). However, those who were most aware of threats to their human security, because of a perceived inequality in the distribution of environmental impacts, feared the impact upon them of actions purporting to be 'cooperative' (such as water transfers) and rejected the possibility of losing their coastal land in the spirit of cooperation. Moreover, those actors who strongly favoured technological solutions such as dikes, had little faith in the capacity of public policy to overcome powerful interests and provide adequate solutions for their security (Albizua and Zografos, 2012).

Fischhendler and De Bruyne (2012) suggest that choosing to cooperate in the face of conflict often is determined more by transaction costs³ rather than any environmental variability or an individual's adaptive capacity. Unilateral measures by Israel such as building desalination plants to increase water security have possibly acted to reduce Israel's incentive to cooperate over shared water resources (Fischhendler and Katz, 2012).

4. *Under what conditions may conflict reduce rather than exacerbate vulnerabilities?*

Kallis and Zografos (2012) explain that conflict is a multi-faceted social phenomenon, which under certain circumstances (e.g. oppressive situations) can even be beneficial, help reduce vulnerability and improve adaptive capacity. For example "Adaptive" conflicts between herders and farmers in the Western Sahel have pushed for political change and State action to legitimize mobility, a vital adaptation strategy for drought-hit herders (Turner 2004). Conflict cannot be reduced to international and civil war only, i.e. conceived only at the nation-state level (which is often the case in the literature on climate security) as it frequently occurs at sub-national scales ranging from

³ Fischhendler and De Bruyne (2012) describe transaction costs in this context as the expense borne by negotiating parties in terms of political, monitoring and enforcement costs associated with negotiating and implementing conflict resolution mechanisms in treaties.

inter-communal conflict down to the household scale. Another distinction involves armed versus social or political conflicts that do not involve death-threatening violence, such as disagreements and disputes (Kallis and Zografos, 2012).

It has been argued that conflict can coexist with cooperation and even prompt cooperation (Keohane, 2005; Zeitoun and Mirumachi, 2008). Evidence for this arises from some of the transboundary scale CLICO studies. Fischhendler and Katz (2012) show that different sources of uncertainty could provoke cooperation in negotiations over transboundary water management between Israel and Palestine, but that political constraints remained. In their review of international water treaties Fischhendler and De Bruyne (2012) examine the adoption of conflict resolution mechanisms. They find that, by confronting underlying issues that otherwise may never have been raised or addressed, conflict resolution mechanisms in transboundary agreements have the potential to take into account future uncertainty, improve flexibility, impose commitments and address potential disputes (Fischhendler and De Bruyne, 2012).

At a sub-national scale D'Alisa and Kallis (2012) suggest that the silencing of political debate and conflict (dissent) over response strategies to environmental hazards by a hegemonic state leads to negative human security outcomes in the case of Sarno, Italy, since long term vulnerability to landslide hazards remains high in the region. This implies that a level of political conflict, including dissension and debate (rather than violent conflict) can provide positive conditions for a full range of adaptive responses to be considered.

5. What constitutes the capacity of states and their institutions and other organizations to implement change, or even radical change necessary under times of stress??

Coordination across institutions is emphasised by Milman et al (2012), who assess the adaptive capacity of transboundary river basin institutions to climate change using an indicators approach. They assert that adaptive capacity is determined more by an actor's ability to communicate, cooperate and coordinate rather than any financial, technical or human resources. They suggest that climate change adaptation in a transboundary river basin will not only be determined by international institutional capacity but also national and sub-national abilities to cooperate at different scales (Milman et al., 2012). Furthermore, Milman et al. suggest that effective transboundary institutions also tend to have a greater capacity to develop adaptation strategies (Kranz et al., 2010). Milman et al. (2012) investigated the influence of a 'weak link' (a basin that contains a nation with much lower adaptive capacity than other nations in the basin) on basin adaptive capacity and found that it was not a strong influence.

Through the creation of a common protected area (IBRM), institutions from Spain and Morocco have been working together on the creation of a common framework to foster sustainable territorial development and improve management of water resources in the region (Abdul Malak et al. 2012). The cooperation channel generated between both countries has led to the increase of stability, security and sustainable development within the region.

However, some elements are still considered as a barrier for an effective management of the Reserve, namely the weak implementation of current laws and policies, duplication among

institutions and the low levels of public participation and absence of co-responsibility of the population in water management (Abdul Malak et al. 2012).

The example of Niger shows that institutions can either enhance cooperation or hinder it. In some cases the customary hierarchical institutions were found to enhance cooperation but in others corruption and social marginalisation or entrenched social biases and inequities promote institutions that are destructive and increase the potential for conflict (Snorek et al., 2012). In this type of environment, mechanisms need to be in place to minimise policies and norms that encourage inequitable solutions. At the same time, institutions must be held accountable and rules must be enforced to ensure repeat mistakes are avoided (Snorek et al., 2012).

In Egypt, where sea level rise may require relocation policies to be implemented, actors are currently operating under uncertain conditions with the country still recovering from a civil uprising. As a result, institutions are unable to fully address the inherent complexities that need to be understood to plan and manage such adaptive measures effectively (Gebert et al., 2012). Snorek et al. (2012) emphasize that to frame adaptation actions effectively, systems need to be able to cope with high uncertainty whilst still being dynamic enough to adapt if conditions change (Ostrom, 2005; Pahl-Wostl, 2009).

Institutional and infrastructural gaps, such as poor access to reliable data, contribute to poor environmental management and human insecurity in the Sudan case study (Selby and Hoffmann, 2012). Sudan and South Sudan's future ability to cope with hydro-climatic stresses depends on a strengthening of state institutions. South Sudanese institutions have only recently emerged from conflict and have to adjust to the newly won independence of the young republic. North Sudanese state institutions, on the other hand, suffer from a high level of personalisation and politicisation of the bureaucracy. With more effective and accountable state actors, more universal access to justice may contribute to the avoidance of future conflict associated with adaptation and development planning (Selby and Hoffmann, 2012). This vision is in stark contrast to experience of implementation of recent and past development initiatives such as the construction of the Merowe dam and reports of leasing of land and water to Foreign Direct Investors that although potentially transformative, have indications of exploitation and exacerbation of social conflict (e.g. Deng, 2011).

Milman and Arsano (2012) point out that the nation state is conceived of as the institution responsible for climate change adaptation planning by the international community, under the UNFCCC. However, they question the role of the state and state-led societal transformation in adaptation. They raise concerns over transformative agendas for adaptation, describing how the state-led agendas for transforming agriculture and livelihoods in Gambella, Ethiopia, value certain lifestyles and aspects of human security over others and take time to implement. Thus notions of transformation for adaptation raise questions of "who and what is prioritized and how such determinations are made" (Milman and Arsano, p18).

Vidaurre and Tedsen (2012) observe that policy actors and actors interviewed were relatively satisfied with the adaptation-related policy frameworks in Ethiopia, criticising only a lack of implementation of the relatively recently adopted policies on the ground. Milman and Arsano

(2012) go on to explain how the capacity of the government to implement adaptations influences which adaptations are prioritized. For example, reducing risk from flooding by resettling populations is more achievable and has additional benefits to the government compared to the high technical and capital requirements needed to reduce threats to livelihoods from insufficient and erratic rainfall.

Milman and Arsano (2012) ask “how can traditional societies adapt to climate change” in a context where the state promotes agricultural modernization in order to meet development and adaptation needs? Their research explains how state development and adaptation policies in Gambella, Ethiopia are founded upon a view of traditional livelihoods as ‘backward’ and a barrier to economic growth. This view fails to recognise that the mobility involved in traditional livelihoods such as flood plain recession agriculture, pastoralism, shifting cultivation and harvesting of forest products provide a source of resilience to climate variability.

Dalby (2012) maintains that individuals and communities exposed to hazards can become too dependent on state institutions, reducing their independent adaptive capacity. Strong popular support for state interventions from those affected by disasters is illustrated by the case study of the Sarno basin in Italy where a series of mudslides resulted in a humanitarian disaster (D’Alisa and Kallis 2012). The authors describe how a massive scale intervention by the state provided protection to those individuals who had been affected but failed to solve the root causes of the devastation and left other areas just as at risk as before. The response ensured continued support for government in the area but failed to deliver radical change and protect human security, leaving much of the population at risk of the same thing happening to them in the future. D’Alisa and Kallis (2012) suggest that the populist and neo-liberal approach of the government, combined with the use of states of emergency to govern, result in a silencing of political debate and a reduced capacity to protect the human security of the population.

In some cases, actors must implement change without external assistance from the state or through co-operation with other actors. Charalambous et al. (2012) found that in Cyprus, which has experienced a number of severe droughts over the past two decades, 80% of the 51 tourist accommodation businesses that responded to their survey had installed at least one water saving device and 90% had encouraged water saving habits through staff training or notices for guests. Weaver (2011), however, describes how there is little incentive or pressure to alter operations in the tourist industry and refers to water savings notices as being motivated by economic benefits. The survey also indicated that there was little awareness in the tourism sector about climate change and its potential impacts, indicating that the relevant government authorities have not yet involved them in adaptation planning (Charalambous et al. 2012).

6. *What interventions might be suitable for reducing risks and improving human security associated with climate and water related stressors, either by reducing the vulnerability of the system and increasing its adaptive capacity or by modifying the hazards?*

Kallis and Zografos (2012) draw attention to the conspicuous absence from the literature of a discussion of the role that can be played by older notions of civil security/protection as well as social security, which were central in water hazard prevention and response debates⁴. This is important because the basic functions of social security and the welfare state are relevant for human security. Subsidised access to health services, state support for those who lose homes or work (e.g. after a hydro-climatic disaster), immigrant reception and integration, are all policies that help reduce the social vulnerability of disadvantaged groups. Those notions count with long-established institutions for their delivery: civil security/protection agencies are still in charge of flood prevention, emergency and reconstruction and therefore have an important role to play in ensuring human security. While climate change could comprise a powerful rationale for extending social and civil security systems in developing and emerging economies, what we instead evidence in recent years is the retreat of such security-enhancing arrangements even in developed economies. This, it could be argued, has increased vulnerabilities and related insecurities – though this question has not been studied.

Currently, policies explicitly designed to tackle the linkages between hydro climatic stressors, human security and conflict can mainly be found at the international or EU level (Gerstetter et al., 2012). However, the CLICO studies provide lessons for policies and interventions at a range of scales from the transboundary to the sub-national.

At the international river basin level, Milman et al. (2012) develop a typology of river basins which points to how interventions to bolster adaptive capacity will be more effective if tailored to the nature of the relationships within the basin. Moreover, Milman et al. explain how adaptation is a process and that building adaptive capacity includes not only building the resources and knowledge to address climate change but also a pathway through which these resources can translate into action.

Fischhendler and Katz (2012) suggest restructuring negotiations to avoid barriers to transboundary water cooperation caused by linkage and spill-over between different unrelated policies. They suggest separating the roles of politicians and technical professionals and leaving the latter group to negotiate on technical details at the end of the negotiations. Tamimi and Jamous (2012) suggest that both national and transboundary IWRM plans should be able to integrate climate change adaptation measures in the future, building confidence across all spatial scales.

Albizua and Zografos (2012) remind us that for interventions to be effective, there needs to be joint action at all spatial scales, but also uncoordinated changes need to take place at the household level (Paavola and Adger, 2006) and individuals need to be incorporated into climate change adaptation policy making (Renn and Schweizer, 2009). Adger (2010) asserts that any adaptive response to environmental change is determined by the values attached to the questions being asked. For

⁴ For an exception see: Heltberg et al. 2009.

instance, what might be worth preserving for one person, might not be for another. This is in line with the recognition of the importance of representation and voice, equity and fair distribution of risk for adaptation and human security (Adger 2010, in Turhan 2012). The link between planned large scale interactions and the values and responses of individuals, households and communities is a theme that many of the CLICO studies explore further.

Albizua and Zografos (2012) suggest that without a basic understanding of a value-based approach, policies and interventions can often result in maladaptive responses, as the Alexandria, Gambella and Seyhan case studies illustrate (Gebert et al. 2012; Milman and Arsano, 2012; Turhan, 2012). Turhan suggests that the “things, places and ideas” valued by marginalized and highly vulnerable social groups, such as seasonal migrant agricultural laborers in Turkey, need to be taken account of in adaptation interventions in order to have any chance of improving their wellbeing and reducing vulnerability. Similarly, Gebert et al. (2012) explain how the relocation needs, priorities and preferences of vulnerable groups in Alexandria, such as those working in the agricultural sector, need to be acknowledged in relocation policy to ensure human security and avoid maladaptation when it comes to livelihood reorganization.

Drawing on evidence from the Ebro delta case study, Albizua and Zografos (2012) propose that acknowledging people’s values and perceptions of climate change should be seen as an essential component of the policy making process. They also call for more dialogue, debate, and deliberation between those involved in managing and benefiting from the region’s resources to address their differing perceptions. They recognize a point made by O’Brien and Wolf (2010) that an individual’s response to climate change is determined to a large extent by how their specific well-being is impacted. Albizua and Zografos (2012) illustrate this by showing that the views of people most affected by threats to the Ebro delta in Spain had different perceptions of adaptation options to those decision makers who were more distant. They suggest differing values and perceptions, beyond those associated with scientific knowledge and economics, should be addressed using deliberative decision making processes, which they nevertheless acknowledge are themselves open to the influence of power of dominant actors and discourses. Value-based approaches can help understand the limits of adaptation, whilst at the same time discern how value prioritizations are controlled by those with political power (O'Brien and Wolf, 2010, in Albizua and Zografos 2012).

Pascual et al. (2012) also emphasise the need for greater public participation and integration of local knowledge into the development of interventions. They suggest as an example, giving the population a feeling of co-responsibility for the management of a resource such as a river. They consider that the current institutional capacity of the IBRM in the Morocco-Spain case study is sufficient to maintain human security even with future climatic and social changes, however efforts need to be made to implement current laws.

Gerstetter et al. 2012 emphasize that state interventions often influence the conditions under which individuals or communities can adapt (e.g. through setting legal frameworks or providing funding) and are therefore a necessary part of adaptation efforts at large. However, the Niger case study (Snorek et al. 2012) illustrates the need for institutional appropriateness when trying to reduce vulnerabilities and maintain adaptive capacity. Such interventions can respond to both

human and environmental processes, involve structural or behavioural outcomes, occur at different time scales and either protect, maintain actions or alter a situation completely (Snorek et al. 2012).

Gebert et al. (2012) examined the potential for forced or planned relocation in Alexandria, Egypt. Their results showed that this type of intervention has been relatively unexplored from an international policy perspective (Warner, 2011) and been mainly viewed as a “last resort” option. Although challenges exist regarding possible trade-offs, sustainability and security issues, Gebert et al. (2012) believe these can be overcome if integrated into previous and existing institutional frameworks. They suggest three criteria for successful planned migration interventions. First, planned relocation is a must for those without the means to migrate themselves. Second, programs need to adopt a long term outlook on potential migrants that addresses the sustainability of their livelihoods and policies need adjusting now so that sustainable relocation can be achieved in the future. Finally, tailor-made incentives are needed to target specific groups of people, given their income source and level.

Finally, Albizua and Zografos (2012) recommend that policies of adaptation should take into account not only the direct effects of climate change but also any other indirect processes that risk exacerbating these impacts, such as the downstream implications of expansion of large scale irrigation, for example.

7. Under what conditions might policies of adaptation to perceived or experienced climate change impacts increase the vulnerability of some groups and/or exacerbate social conflict?

Snorek et al. (2012) recognize that in some cases, adaptation policies reinforce social hierarchies in society (Adger et al., 2009). They refer to work by Engle (2011) who suggests that inequalities can be due to weak institutions that are unable to effectively determine who is most in need of adaptive resources. According to Snorek et al (2012) this relationship between adaptation to climate change and social justice is underappreciated.

There is some evidence in the CLICO case studies for tensions or conflict arising as a result of unequal effects of adaptations amongst different social groups, who might differ in their values. For example, perceptions of uneven distribution of benefits and the negative impacts of responses to threats to water resources in the Ebro delta were particularly strong amongst those who feared losing access to water (Albizua and Zografos, 2012). Albizua and Zografos (2012) go on to say that where policies are subject to the influence of economic and scientific arguments as well as power relations there is a risk that the debate on policy alternatives and their uneven impact is stifled.

Vidaurre and Tedsen (2012) identify instances in Ethiopia where state-led adaptation policies further antagonised actors who were already critical towards the state. Milman and Arsano (2012) examine two key policies designed for economic development and adaptation to climate variability in Gambella, Ethiopia: the *Villagization Program* and *Agricultural Development Led Industrialization*. They show how these policies are founded upon a view that simply agricultural modernization will transform societies, provide increased food security and reduce poverty and vulnerability to climate hazards. However, by prioritising some aspects of security over others, these programs

have led to declines in human security for the affected population, at least in the short term. For example, by moving people out of the flood plain to permanent settlements they have reduced their vulnerability to floods but increased their vulnerability to water scarcity, given the erratic rainfall in Gambella that is likely to increase with climate change. They also show how these policies have facilitated the allocation of land for new settlers and agricultural investors, thereby exacerbating the existing tensions in the region, resulting in a recent rise in violence.

Turhan (2012) shows how state-led adaptation policies in Turkey aimed at capacity building, focused on diversification and engagement in the market economy, combined with 'charitable' interventions on behalf of the state to improve living conditions of seasonal migrant agricultural workers, shift the responsibility of adaptation to the individual. By prescribing overly simplistic adaptation solutions, Turhan suggests that the state "aims at making vulnerable groups legible, simplified, homogenous and thus governable" (Turhan, p22). He also shows how these policies and interventions do nothing to respond to the values and perceived adaptation needs of the migrant workers themselves nor do they alter the structural conditions responsible for their vulnerability. He argues that this renders them 'invisible' to the state, maintaining their marginal position in society.

Snorek et al. (2012) suggest that multiple institutions and actors with differing objectives, have the potential to lessen the vulnerability of one group or individual, but simultaneously cause a reduction in the adaptive capacity of another (Moser and Ekstrom, 2010). For example, in Niger, the expansion of arable farming as an adaptive strategy has put greater stress on pastoral livelihoods in the region (Snorek et al. 2012). Another example comes from the Alexandria case study, where Gebert et al. (2012) suggest that poorly planned relocation would inevitably create significant insecurities for the non-migrant population, reducing their capacity to adapt. In these examples, one group's adaptive success reduces the adaptive capacity of another group in society, a social phenomena which Snorek et al. (2012) refer to as *divergent adaptation*. By increasing awareness of divergent adaptation Snorek et al. (2012) suggest that it is possible to improve the effectiveness of institutional capacities and promote collaboration between those who benefit from adaptation and those who suffer.

The high level of conflict and insecurity in the Sudans has a large impact on the ability to put in place development and adaptation plans. However, as Selby and Hoffman (2012) stress, conflict and environmental degradation issues need to be examined in the context of a history of neglect and exploitation associated with the nature of state agency, which should be seen as a process resulting from agents and structures at the local, national and global scale. Therefore, adaptation that is planned and implemented by the state must also be seen in this context. This raises the likelihood of adaptation being both shaped by and contributing to the conflict in the region.

Due to the existing high level of conflict and insecurity, climate change adaptation is not an immediate concern to policy makers in either Sudan or South Sudan. However planning for adaptation has begun at least on paper in Sudan, whilst South Sudan has little institutional capacity to deal with even the immediate challenges it faces such as provision of security, basic services and water management (Selby and Hoffmann, 2012). Selby and Hoffman (2012) suggest that adaptation to the decline in oil revenue by Sudan's elite is to be achieved by intensification of irrigated

commercial agriculture in the Nile valley (Verhoeven, 2011). A strategy such as this may risk additional conflict at the sub-national scale due to land appropriation and displacement of people, as has happened in the past (Selby and Hoffman 2012). There would also be implications for transboundary tensions over Nile water sharing if Sudan reaches its full quota of water allocated under the 1959 agreement, as it plans to do. This complicates potential negotiations over Nile quotas between Sudan and South Sudan, since South Sudan intends to pursue its own plans for irrigated agricultural expansion (Selby and Hoffman 2012).

4. Revised theoretical framework

Figure 3 illustrates a revised conceptual framework that builds on existing and new understandings of hydro-climatic insecurity from the CLICO studies. This builds on the conceptual framework in Figure 2 and other frameworks such as those of the resilience of socio-ecological systems (Folke, 2006) and framings of vulnerability around exposure and risk (Birkmann, 2006; Turner et al. 2003; Wisner et al. 2004).

Human (In-) Security is shaped by cross-scale dynamic processes of hydro-climatic stress (water related climatic stresses), responses and adaptation within social ecological systems, interactions (conflict and cooperation) and mutual impacts. The concept of human security is the all encompassing concept in the new framework and can be measured at all scales: from global and regional down to national, social-ecological systems, communities and individuals. The individual and community scale has been added since several of the CLICO studies emphasise the importance of actions and insecurities at this scale.

The starting point of the framework is that hydro-climate stresses as well as dynamic socio-ecological interactions at multiple scales are likely to influence exposure and vulnerability to water related stressors. This is indicated by the circle of responses and impacts in the framework represented by the two curved arrows.

Human security is operationalized by using the concepts of exposure and vulnerability as well as adaptation and adaptive capacity. These concepts can be used to measure the state of human security by including all the social-ecological interactions at multiple scales across all actors. Within the adaptation box we explicitly suggest various actors/entities, to accommodate the range of research within the CLICO project that focuses variously on individuals, communities and institutions.

Adaptation is a dynamic process, influenced by factors at various scales, including institutions, power, perceptions, and culture, the last two added because many CLICO case studies emphasize their importance. Responses to hydro-climate stressors and insecurities - such as adaptation - are embedded in processes of socio-ecological interactions where factors such as, power and interests, culture, perceptions, institutions, environmental conditions and social and economic relations play a role affecting the formation of adaptive capacity of different groups and actors and, consequently, the overall pathway of adaptation.

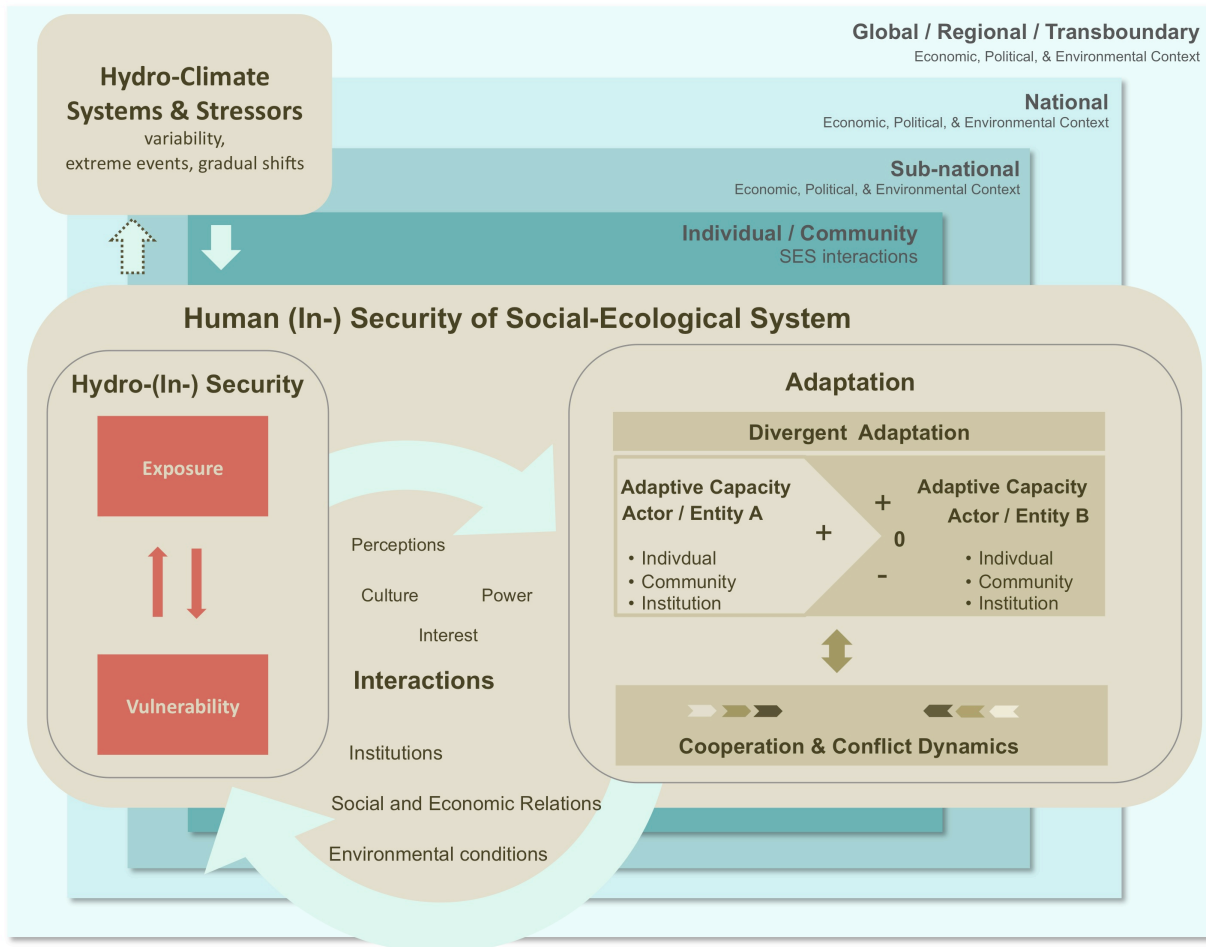


Figure 3: Revised conceptual framework of hydro-security. (This diagram and the accompanying text in this section were drafted by project partners from the United Nations University: Niklas Gebert, Julia Kloos, Fabrice Renaud, and Julie Snorek).

Adaptation outcomes/strategies are determined by the way adaptive capacities are formed and accumulated (strengthened or weakened) and then utilized by multiple actors leading to a diverse set of mutual impacts of adaptation. We introduce the concept of ‘divergent adaptation’ (Snorek et al. 2012) into the framework since it encapsulates the relationship between conflict and cooperation, adaptation and adaptive capacity, where adaptation strategies can result in different human security outcomes for different social groups or actors.

The origins of the term ‘divergent adaptation’ are in evolutionary biology, where it is defined as the accumulation of differences between groups located in separate environments that can lead to the formation of a new species (Anderson et al. 2010). In a social-ecological system, ‘divergent’ or deviating adaptation refers to the process of shifting adaptive capacities of alternate actors, entities, or livelihood systems. Thereby, adaptation of one individual or group can produce an increase (+/+), decrease (+/-) or neutral change (+/0) in another individual or group’s adaptive capacity in a shared ecosystem. An example of divergent adaptation is illustrated by the adaptive actions of the agro pastoralists in the Niger case study which reduce the adaptive capacity of the pastoralists (Snorek et al. (2012).

In the course of such a dynamic adaptation process and path, cooperation and conflict can coexist, mutually influence, amplify, or reduce adaptive capacity and adaptation strategies. The focus is on the dynamic interaction of conflict and cooperation between different actors (individuals, social groups, communities, governments at various levels). Both conflict and cooperation and the combination of the two can increase and decrease hydro-security and human security at the same time for different (interacting) actors.

This framework makes the dynamic nature of human security more explicit than before with its circle of stresses, responses, adaptation, impacts and feedbacks. This makes it applicable to cases where there are temporal trade-offs in human security, for example, in the Ethiopia case study (Milman and Arsano, 2012).

5. Summary of key theoretical findings

Climate change, hydro-security and human security: adaptation can both reduce and exacerbate insecurities

Climate change and water related stresses have an impact on human security in addition to a whole range of other social and political influences on human security. Policy responses in the name of adaptation (Milman and Arsano, 2012) and also autonomous responses of individuals and groups (Snorek et al. 2012) are one more channel through which hydro-climatic impacts can be experienced. Adaptations can have unequal impacts or increase the inequality between different groups. Divergent adaptation, which occurs where one individual or group's adaptive response reduces the adaptive capacity of another individual or group, can increase conflict and reduce human security (Snorek et al. 2012). Adaptation policy and interventions are subject to power relations that also play out in the way that diverging values, adaptation preferences and vulnerabilities are prioritised (Albizua and Zografos, 2012). Hegemonic power relations can result in some aspects of security being prioritised over others (Milman and Arsano, 2012). For example planned adaptation responses may reduce risks from some hydro-climate stressors but expose people to new risks or undermine human security in other ways, for example by reducing livelihood security (Gebert et al., 2012) or short term food security (Milman and Arsano, 2012).

Climate, water and conflict: the importance of social, political and economic factors

CLICO evidence suggests that conflict is associated with societal responses to hydro-climatic stress rather than with the impacts of hydro-climate stresses themselves (Albizua and Zografos, 2012; Milman and Arsano, 2012; Snorek et al., 2012). For the majority of conflict situations studied in the CLICO project, the political, economic and social factors are considered to be of greater importance now than the hydro-climatic stresses (Böhmelt et al., 2012; Fischhendler and Katz, 2012; Snorek et al., 2012), although how this balance may change in the future is not clear. However, there is much evidence for links between these different factors and one type of uncertainty or stress can impact upon others (Fischhendler and Katz, 2012) and exacerbate existing conflicts (Milman and Arsano,

2012; Snorek et al., 2012). Factors that influence conflict are multi-scalar and build up over long time scales, for example Selby and Hoffman (2012) emphasise that the conflict and environmental degradation seen in Sudan result from the historically shaped and evolving nature of the state and its institutions that are conditioned by agents and structures at the local, national and global scale.

The examples of conflict documented in the CLICO case studies take many different forms from low level, 'silent' or latent conflict, for example in the Ebro delta (Albizua and Zografos, 2012) to conflict involving violence, for example in Niger (Snorek et al., 2012) and Gambella (Milman and Arsano, 2012). Where conflict is severe and prolonged, and frequently violent, it can be a significant driver of vulnerability to climate change (for example in the Jordan West Bank case study (Tamimi and Abu Jamous, 2012), the Gambella study (Milman and Arsano, 2012) and the Sudan study (Selby and Hoffmann, 2012). The degree of political freedom experienced in a country appears to influence the nature of conflict: more democratic countries experience more conflictual events but a lower intensity of conflict (i.e. less violent instances of conflict) than non-democratic countries (Böhmelt et al., 2012). This suggests that political freedom can allow conflicting views to be expressed. However, freedom to debate alternatives can be closed down even in democratic countries by the securitization of relevant issues⁵ (Albizua and Zografos, 2012; Dalisa, 2012).

Links between conflict, cooperation and adaptive capacity

There was some evidence at the transboundary scale for conflict or uncertainties to promote cooperation (Fischhendler and Katz, 2012) and for conflict resolution mechanisms to address uncertainties and potential disputes (Fischhendler and De Bruyne, 2012). At the sub-national scale the database of water related events⁶ recorded slightly more cooperative events than conflictive ones, with nearly half the events recorded as neither cooperative nor conflictive (Bernauer et al., 2012). Cooperation or collaboration is seen as important for adaptive capacity, however transaction costs can influence the success of cooperation (Fischhendler and De Bruyne, 2012) and some types of cooperation can reinforce unequal situations .

State-led policy for adaptation and adaptive capacity

Studies diverged in their position regarding the role of the state in adaptation and what constitutes adaptive capacity. The nation state is adopted as the key institution for adaptation planning by the UNFCCC. On the one hand, Gerstetter et al. (2012) point out the state has a certain function in adaptation as it often defines the regulatory framework governing adaptation actions by individuals, organisations and communities. They describe how in some countries it is the state rather than individual actors that are pushing adaptation.

On the other hand, Milman and Arsano (2012) question the appropriateness of a strong role for the state in adaptation where the views of state actors are not representative of those of the entire population, as occurs in Ethiopia where the state adopts a view that modernisation should occur at

⁵ Securitisation refers to the framing of an issue "in terms of security... drawing on perceptions of national, local or individual (in)security" (Zeitoun, 2007: 115)

⁶ The database was compiled from media sources for 35 countries of the Mediterranean, Middle East and the Sahel between 1997 and 2009 (Bernauer et al. 2012).

the expense of traditional livelihoods. Milman and Arsano suggest that questions arise when the state intervenes as to “who and what is prioritised and how such determinations are made?” Adaptation interventions or policies promoted by the state can fail to consider the diversity of preferences and social, political and environmental contexts in which marginalised populations find themselves and therefore fail to meet their adaptation needs (Gebert et al. 2012, Milman and Arsano 2012; Turhan, 2012) Moreover, Turhan (2012) showed how inadequate state policies had shifted the responsibility of adaptation on to individuals (migrant agricultural labourers), who were unable to change the socio-institutional structure and conditions responsible for their marginalisation. In Niger, it was a lack of enforcement of policies that left individuals inadequately supported in their adaptation efforts (Snorek et al. 2012). Despite these reservations about state-led adaptation, some authors saw improvement in the adaptive capacity of state institutions as a necessary condition for improving the adaptive capacity of the population (Gebert et al., 2012; Selby and Hoffmann, 2012; Snorek et al., 2012).

With respect to institutional adaptive capacity, there was an emphasis on the importance of improved coordination between sectors and actors at multiple scales (Gerstetter et al., 2012) from the transboundary (Milman et al., 2012) to the local (Albizua and Zografos, 2012) as well as better access to knowledge, and sufficient ability of policy actors to respond to new challenges and financial opportunities (Gerstetter et al., 2012). In some cases, multiple uncertainties create complexities that acted as significant barriers to planning adaptive responses (Gebert et al., 2012) and in others institutional and infrastructural gaps and poor access to data were seen as key barriers to the development of adaptive capacity (Selby and Hoffmann, 2012). An improved accountability of state institutions (Selby and Hoffmann, 2012; Snorek et al., 2012), more universal access to justice, less corruption and adequate enforcement of appropriate rules (Snorek et al., 2012) were also seen as requirements for improved adaptive capacity.

Conditions for successful adaptation

The success of adaptive responses depends on the perspective taken. Diverging values and preferences account for different adaptation outcomes. Where different values, perspectives, culture and traditions are not taken into account there is a risk of tensions and mal-adaptation (Albizua and Zografos, 2012; Gebert et al., 2012; Milman and Arsano, 2012; Turhan, 2012). Although evidence is essential for making adaptation decisions, tensions could arise where expert and scientific knowledge is privileged over other types of knowledge (Albizua and Zografos, 2012). Processes of adaptation planning and development that are deliberative and incorporate multiple perspectives can improve policy effectiveness by reducing the risk of increased insecurities and conflict arising from adaptation (Albizua and Zografos, 2012; Pascual et al., 2012). However, deliberative processes are open to manipulation of the less powerful by those with more power and have high costs to implement (Chilvers, 2009).

Some of the findings add to the debate in the climate change adaptation literature about transformational versus incremental adaptation. Incremental adaptations, which maintain current functions of socio-ecological systems, are seen as potentially inadequate in some locations and systems for responding to the high rates of climate change predicted for the 21st century and beyond. Large changes in climate coupled with high vulnerability may in some locations require

transformational adaptation, involving new adaptations that transform places or change locations (Kates et al. 2012). Nevertheless, Milman and Arsano (2012) and Gebert et al. (2012) raise concerns about transformational adaptation, which in the Gambella case study, increased vulnerabilities to some risks and reduced the human security of the populations most affected, at least in the short term (Milman and Arsano, 2012). Gebert et al. (2012) recommended that planned resettlement, which could be considered a transformational adaptation, should address livelihoods sustainability and provide incentives that are targeted. These two cases of Alexandria (Gebert et al., 2012) and Gambella (Milman and Arsano, 2012) support an argument in favour of a balance between incrementalism and transformation in adaptation to climate change.

Lessons from a political ecology perspective: the role of the state in hydro and human security

Kallis and Zografos (2012) explain that a subject's exposure to hydro-climate stress and resultant hydro-insecurity is the function not only of their environment but also wider, long term socio-political insecurities associated with aspects of the political economy such as land investments and world markets. In addition, Milman and Arsano (2012) suggest that an under appreciation of the political ecology of climate change adaptation may also cause further conflict and human insecurities in the future. According to Milman and Arsano (2012) the costs and benefits of development interventions in vulnerable regions like Gambella, Ethiopia, are determined to a large extent by relationships between politics, economics and power. Consequently, the political economy of an area controls the type of adaptive response and also the component of human security prioritized. Milman and Arsano assert that more studies need to explore how authority, interests and power are distributed and how these forces influence climate adaptation outcomes.

Other findings raise attention on the power implications of de-politicising decision-making through state actions that securitise the issue of adaptation (Albizua and Zografos, 2012) or disaster response and reconstruction (D'Alisa and Kallis, 2012). Power effects are also evident in adaptation responses that may fail to consider value dimensions of climate change (Albizua and Zografos, 2012; Turhan, 2012) and hence result in the silencing of some voices that could lead to increased insecurity, a sense of injustice, and potentially conflict. Turhan (2012) describes state interventions in the name of adaptation as 'biopolitics' (Baldwin, 2012; Dalby, 2011; Reid, 2010, in Turhan 2012) since they attempt to "create adaptable individuals who neither threaten the existing economic nor the political order" (Turhan, 2012, p4). There is evidence in some case studies of state actors and policies adopting a climate change discourse to control the adaptation agenda for their own aims (Milman and Arsano, 2012; Turhan, 2012).

Selby and Hoffman (2012) draw attention to the experience of ecological degradation and the production of scarcity that result from state development policies and conflict in Sudan. They describe how these policies are themselves subject to social forces and interests that are made up of multiple actors that need to be recognised, rather than one abstract entity of 'the state'. Selby and Hoffman (2012) and Albizua and Zografos (2012) also raise the role of water demand, in particular for irrigated agriculture, in the social production of water scarcities. Such hydro-insecurities are created not only locally and nationally but mediated by the global political economy and global

geopolitical structures. Examples include the consequences for hydro-security of foreign direct investments in land in Ethiopia (Milman and Arsano, 2012) and Sudan (Selby and Hoffman, 2012).

Finally, studies also highlight the importance of political uncertainty as an element of the political environment that contributes to weak state institutional capacity to deal with insecurity (Gebert et al. 2012; Tamimi and Abu Jamous, 2012).

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