

Executive summary:

Increasingly, climate change is recognized not only as having humanitarian impacts due to rising sea levels or extreme weather events such as floods and droughts becoming more frequent, but also political and security risks that can affect national and regional stability and the welfare of people. This has led to an increasing political interest in climate change, water and security. However, due both to complexities within natural systems and their interlinkages to social, economic and political conditions a highly complex nexus evolves that connects climate change, water conflicts and human security. Understanding links within this nexus challenges the scientific community. This report presents the research, main results and recommendations of the CLICO research project that tried to address this challenge by conducting inter-disciplinary, cross-comparative research focusing on the geographical area of the Mediterranean, Middle East, and Sahel.

Results confirm that climate and hydrological factors, socio-economic, institutional and political conditions are all important drivers of human insecurity, but their relative importance depends on the specific context in which they interact. Adaptation plays a key role in determining whether climate change is likely to undermine human security. The adaptive capacity of individuals, groups or nations varies, depending for instance on existing institutions and their functionality, knowledge, and access to assets. Adaptation processes can both reduce and increase insecurities. State-led adaptation is important for providing human security but there are also unintended, potentially negative consequences, particularly if adaptation policies are insufficiently implemented. State-led adaptation can initiate far-reaching transformations of existing or traditional adaptations and values, priorities, and needs of affected people might differ from those put forth by the state.

A strong state can influence or even suppress individual adaptive capacity. Adaptation can reinforce or widen inequalities of different social groups. Who bears the negative and positive consequences of adaptation and which dimensions of human security are prioritized depends on power relations, existing marginalization of certain groups, as well as governance and institutional structures. Diverse "conflict contexts" exist ranging from silent or masked conflicts to frequent and sometimes violent conflicts. CLICO identified stronger links between political, economic and social factors and water-related conflict than between climate-related variables and water conflict. However, in the future these relationships might change. Mechanisms to address future environmental and hydro-climatic but also socio-economic and political uncertainties in transboundary basins are under-represented due to high transaction costs. Also, policies more explicitly aiming at conflict reduction are missing.

Several recommendations were made to guide policy-makers at various levels and policy areas. Specifically:

- (1) Increase knowledge – particularly as regards root causes of vulnerability, conflict and human insecurity – and facilitate knowledge sharing by strengthening research capacity and information transfer at all scales.
- (2) Promote and strengthen the accountability and functioning of institutions. This refers to existing institutions by reinventing the modalities of their functioning but also the development of new

institutions, if necessary. An important characteristic of good governance is the empowerment of marginalized groups and effective participation of all affected groups in policy-design and implementation.

(3) Elaborate a normative framework for adaptation, which can help balance unequal impacts of climate change, related adaptation actions or policies and their implementation.

(4) Improve capacity to implement policies, as in many cases appropriate policies exist but are insufficiently implemented.

(5) Improve communication, coordination and cooperation between actors and develop conflict resolution mechanisms can help achieve successful adaptation.

(6) Mainstreaming climate change adaptation and disaster risk reduction means integrating them with existing policies which helps achieve synergies and facilitates harmonized approaches.

(7) Strengthen social security systems and civil protection to reduce vulnerabilities and help maintain or improve human security.

(8) Keep planning flexible in policy cycles (early warning systems can be useful) and use early ex-ante measures to address systemic issues.

Project Context and Objectives:

The pace of changes now underway in the earth's climate has no precedent in the history of civilization (IPCC, 2007). UN Secretary-General Ban Ki-moon and the Security Council recognized climate change as a threat to security (Ban, 2007). Potential links between natural hazards or scarcities and conflict have been publicly acknowledged by top political and military officials (e.g. McGowan, 2007) and made their way into international forums such as the Rio Declaration on Environment and Development (Principle 25, UNCED), the European Security Strategy, and the UN High Level Panel on Threats, Challenges, and Change. The Mediterranean, Middle East and the Sahel (hereinafter MMES) are among the regions in the world most exposed and vulnerable to floods and droughts (Kallis, 2008).

However, whereas apocalyptic headlines come from reports of think tanks, NGOs and public officials, there is inadequate scientific evidence or peer-reviewed studies to substantiate and elaborate claims beyond speculation or reasonable concern (Nordas and Gledisch, 2007). Claims about a causal relationship between water scarcity and conflict are often based on single case studies and have not been confirmed by large comparative studies (Wolf, 1999). The vulnerability, capacity to adapt and resilience of different regions and communities to climate change differs a lot, and so does the propensity for conflict. In some cases extreme climate events happened but the population remained resilient against the change while in other cases the change in climate was moderate but it caused tremendous impacts and conflicts. Whereas we get to know increasingly more about the drivers of vulnerability to climate change (Kelly and Adger, 2000), we still know little about vulnerability to socio-economic stressors acting in concert with climate change (Gallopin, 2006). The concept of security is under-specified and used differently in different contexts, and the links between security, vulnerability and conflict are poorly understood (Barnett and Adger, 2007).

As a result the capacity to forecast and avoid hydro-climatic threats to human security through monitoring and mediation remains, at best, rudimentary (Shira et al., 2003). Whereas in some places the lack of understanding of the complex climate-resource-society dynamics is used as an excuse for not taking measures, in other places it is likely that inappropriate measures are taken. The motivation for the CLICO project has been to address this gap in basic knowledge and hence help design better policy responses.

To achieve this aim, the project pursued the following objectives:

- i) To understand and model the relationships between hydro-climatic hazards, climate change vulnerability, human security and conflict, on the basis of theoretically-informed, comparative empirical research.
- ii) To map international and national policies for security and adaptation in water resources and hazard management, and develop a policy model for security against hydro-climatic hazards ("hydro-security") in the region, applicable to the UN, EU and national states.

Meeting these objectives entailed delivering:

- i) an integrated theory of climate change impacts, security and conflict

- ii) an in-depth analysis of hydro-security hotspots in a variety of geographical and socio-economic contexts
- iii) a map with cooperative and conflictive domestic water events in the countries of the study region for the time period 1998-2007
- iv) a regression analysis-based identification of the drivers of domestic water conflicts and the factors that determine intra-state hydro-security
- v) an inventory of international and national policies dealing with responses to climate change, water resources management, responses to hazards and disasters and security in the region
- vi) a proposal for a suitable policy framework to integrate security, climate change adaptation and water management issues and specific recommendations for policy streamlining at the UN, EU and national levels
- vii) an evaluation of the adaptive capacity of institutions in the shared, international basins in the study region
- viii) a content analysis-based assessment of the ways in which climatic uncertainties are (or are not) taken into account in international water treaties

The results of the project have been synthesised in a "Regional Assessment and Policy Guidelines" report that aimed at:

- i) enhancing understanding of the structure of security in relation to climate change and hydrological hazards,
- ii) improving capacity to identify potential security and conflict hotspots in the MMES, and
- iii) providing a better basis for planning mitigation and adaptation policies to climate change and its impacts on water resources.

A conceptual framework underpinned our research, and we here provide a description of its main elements. Climate change is expected to have an impact on water resources and on the magnitude and/or frequency of extreme climate events such as floods and droughts. Hydro-climatic hazards (floods, droughts and water scarcity) interact with other global stressors (e.g. economic recession, geo-political changes) and local stressors (e.g. increased intensity of resource use, population growth, urbanisation and industrial development) to produce impacts. Vulnerability and adaptive capacity stand between hazards and impacts. Under certain circumstances, the direct and indirect impacts of climate change cause conflict, which in turn undermines human security. An alternate route is that as vulnerability increases, so does the sense of insecurity, which in turn leads to tensions and conflict. Conflict is not inevitable. In many cases, scarcities, hazards or impacts trigger cooperation. Or conflict may trigger a negative feedback and responses that lead to co-operation. Indeed, the literature suggests that hydro-cooperation between trans-boundary countries is more frequent than hydro-conflict (Wolf, 2007).

The starting point of the CLICO project has been to shed light on the complex dynamics and interactions between hydro-climatic change and human security and explored the conditions and settings under which climate change may lead to insecurity and conflict or alternatively to cooperation. Several aspects may complicate this reality. For example, there might be situations with conflict or insecurity, but not both (e.g.

a declared security condition without conflict, or a conflict where most people are still secure). There are also very different shades of conflict, from war and deadly violence, to non-lethal or psychological violence, to social tensions and disrupting, political conflict. Cooperation may also not always be beneficial and might mask domination of one group by another, building-up insecurity and conflict potential.

Our approach has been based on empirical research. We followed Barnett and Adger's (2007) call to develop studies in areas where "impacts are likely to be greatest" and focused on the following under-explored factors:

- i) the specificities of a hazard, its interactions with vulnerability and the causal routes between vulnerability, impacts, conflicts and security;
- ii) the determinants of vulnerability and adaptive capacity under multiple stressors;
- iii) the conditions that lead actors to engage in conflict;
- iv) the role of States in providing security.

CLICO took on this research challenge and carried out in-depth studies of several hydro-security hotspots in the MMES with diverse scalar, geographical, socio-economic and historical characteristics and with different types of hazards and conflicts. The theoretical framework and the four questions above structured comparative case-study research. In addition a second research avenue complemented individual case studies: a large-N statistical regression analysis that sought to identify the factors that determine domestic water conflict and cooperation and determine national and local hydro-security. The results from these two research endeavours were synthesised and provided an integrated theory of the causal structure of hydro-security. Finally, a third block of research analysed the attributes of appropriate policies for promoting adaptation, peace and security at the local, national and international levels, by mapping existing policies and initiatives and assessing the capacities and resilience of transboundary institutions.

Project Results:

I. PROJECT FINDINGS

1. Complexity of social-ecological interactions

(i) Drivers of human security and vulnerability

Climate and hydrological factors, socio-economic, institutional and political factors are all drivers of human security but their relative importance depend on the context (Gerstetter and McGlade 2012). Economic conditions and political freedom are seen as factors more closely linked to human security than environmental pressure (Kallis and Zografos, 2012). This complexity of socio-ecological interactions validates the CLICO approach to look at various scales, contexts and drawing from a variety of methods.

Vulnerabilities and mechanisms at play

A number of mechanisms underpin how risks and vulnerabilities amplify each other at different scales. The Niger (Snorek et al., 2012b), Turkey (Turhan, 2012b) and Ethiopia (Milman and Arsano, 2012) case studies explore the idea that social vulnerabilities are linked to issues of social justice and human rights and that social marginalisation can worsen vulnerability to climate stresses and insecurity. Turhan (2012b) details how social and political factors have increased the human insecurity of a rural migrant population as well as their vulnerability to climate impacts. Human security in Gambella, Ethiopia is affected by a variety of factors such as pre-existing tensions between different ethnic groups, food insecurity, poor service provision and vulnerability to climate impacts. In light of these factors climate change is a "multiplicative stressor" (Milman and Arsano, 2012, p.8). In the case of the Ras Sudr, the isolation of the Bedouin population, illiteracy, low awareness of climate change and a sensitive ecosystem are factors increasing vulnerability to climate change (Tawfic Ahmed, 2012). In Sarno, at the sub-national scale, negative human security outcomes and increased vulnerability have resulted from the stifling of political debate and conflict with regards to response strategies to environmental hazards by a hegemonic state (D'Alisa 2012b). Hydro- and human insecurities do not originate only locally and nationally but are also shaped by the global political economy and global geopolitical structures such as in Ethiopia (Milman and Arsano, 2012) and Sudan (Selby and Hoffman, 2012). Long term socio political insecurities linked with aspects of the political economy play an important role in hydro-(in) security. The political economy of an area determines which adaptive responses and aspects of human security will be prioritized.

Perceptions of policy makers on human security

Among policy makers climate change is widely perceived as an added risk in relation to human security and conflicts, but not the singular or primary risk. Stakeholders demonstrated concern for environmental risks, yet in many cases were dismissive of the comparative importance of climate change in light of existing drought and environmental conditions, socioeconomic capacities and political tensions. However, the added pressure of climate change, combined with key social (e.g. development needs, lack of financial capacity, population growth) and political (e.g. state conflict, existing resource disputes, mistrust) factors, was commonly seen as amplifying human security and conflict risks. Prior disagreements over water between users and uses are anticipated to increase the likelihood of and serve as the basis for potential conflict under changing environmental conditions. Interviewees mainly mentioned

hypothetical relationships between climate change and conflict (e.g. increased migration inducing conflicts over resources), and no concrete examples of conflicts (or increased conflicts). Interviewees repeatedly expressed that "the conflict exists already," and "climate change increases the conflict". When conflicts and tensions already exist between parties, competing demands for water resources are more likely to result in conflict. Thus, it was expected by most interviewees that if future conflicts over water are to arise, it would be in relation to existing tensions, and non-environmental conditions and forces. However, this is not necessarily the case, because measures aimed at mitigating the impacts of climate change are sometimes already in place (e.g. producing water from non-conventional sources in Israel).

(ii) Drivers of conflict

Evidence for violent water-related conflicts is extremely rare (Bernauer et al. 2012). CLICO research puts forth an array of examples demonstrating the variety of factors such as political, economic, social and others which shape conflict. Most case studies and the large N study point towards stronger links between political, economic and social factors and water-related conflict than between climate-related variables and water conflict. The large N study finds that demand side drivers and "restraint" factors (e.g. political system and political stability) are more important than climatic variables that influence the supply of water.

Evidence drawn from several CLICO case studies suggests that conflict emerges through societal responses to hydro-climatic stress rather than the impacts of hydro-climatic stresses themselves (Albizua and Zografos, 2012; Milman and Arsano, 2012; Snorek et al., 2012b, Gebert et al. 2012). As suggested by the large N study, political, economic and social factors play a greater role in the majority of conflicts studied than hydro-climatic stresses (Fischhendler and Katz, 2012; Snorek et al., 2012b). For example in the Israeli - Palestinian conflict over water, Bar-On and Gerstetter (2012) observed that, many stakeholders and experts believe that climate change will have a much lower impact on water availability for Palestinians than the ongoing political conflict between the two countries over water allocations. However, the negative impact climate change will have on human security may also increase the possibility of conflict between different social groups of the West Bank region (Tamimi and Jamous, 2012). For the case of Sudan, Selby and Hoffman (2012) even suggest that water and climate conflict may be related to an abundance of water resources rather than to climate induced water scarcity.

Links between different factors and types of uncertainties (e.g. political uncertainties) can affect other uncertainties (Fischhendler and Katz, 2012) and worsen existing conflicts (Milman and Arsano, 2012; Snorek et al., 2012b, Tamimi and Jamous, 2012). Factors influencing conflict are multi-scalar and may develop over large time scales as in the case of Sudan with political and historical factors predominantly affecting conflict and environmental vulnerabilities (Selby and Hoffman, 2012). In Niger, the current political and economic context is linked to the origin of water-related conflict with conflict emerging as a political response to the marginalization of certain groups' livelihoods needs over others and exacerbated by environmental change (Snorek et al., 2012b).

Altogether, there is a lack of evidence to confirm that climate change, and water scarcity cause conflict. However, as all these assessments are

based on the investigation of past events, it is possible that in the future these relationships might change.

2. Links between adaptive capacity, adaptation and human security

Impacts of climate/water stresses were investigated in the context of societal response including adaptation to these changes. Thereby, the research focused on the mutual impacts and the respective outcomes for human security and conflict arising from the diversity of adaptation strategies followed by different groups in society and by governments through their policies. Adaptation can occur on several levels, ranging from adaptation at the individual, household or social groups level and states can lead or govern adaptations by their institutions and policies (IPCC, 2001). In that sense, one set of impacts on human security can evolve from the way states govern adaptation within their policy and institutional frameworks, and how they interact with societal adaptation aspirations, as well as the way adaptation occurs within and between society and social groups. Often, state led adaptation is referred to as being more planned and structured than individual or civil society's adaptation. But the evidence shows that within a complex vertical and horizontal state architecture where multiple stakeholders take independent and interest driven decisions, unintended effects of adaptation policies can occur impacting human security. Some case studies demonstrate that state actors and policies are adopting a climate change discourse to dominate the adaptation agenda for their own interests (Milman and Arsano, 2012; Turhan, 2012b). Thus, also within governments the design of adaptation policies and their implementation are generally determined by the heterogeneity of existing interests, norms, values, cultures, and individual behavior, and existing social and institutional frameworks but also related to the frequency, magnitude, and suddenness of a (hazardous) event or change.

Informal, non-state-led adaptation responses, e.g. self-adaptation, can also have impacts on other groups' livelihoods and adaptation actions or development choices (see for instance Snorek et al. 2012b). Furthermore, state led adaptation responses and their impact on human security were investigated in the Sarno (D'Alisa, 2012b), Alexandria (Gebert et al, 2012) and Ethiopia (Milman and Arsano, 2012) case studies. The degree to which people's preferences and the benefits they receive from state-led planned adaptation programmes are matched is thought to be a key determinant for human security outcomes (Albizua and Zografos, 2012; Gebert et al., 2012). In certain situations, change has been undertaken without state intervention, through collaboration with different actors as exemplified by the Cyprus case study (Charalambous et al., 2012). In this case, economic benefits have been found to drive changes in the tourist industry (Weaver, 2011).

Determinants of varying adaptive capacity (e.g. institutions, knowledge, access to assets)

To understand drivers of adaptation and their outcomes investigating adaptive capacities of key stakeholders within an adaptation process is important. The research found that the adaptive capacity of different social groups varies greatly. In Gambella for instance, the loss of property and assets of displaced persons has greatly reduced their adaptive capacity and generated feelings of insecurity and competition for resources (Milman and Arsano, 2012). In Sudan, violent conflict and resulting displacement have destroyed many traditional livelihoods and adaptation practices leading to environmental degradation and widespread vulnerability and insecurity among the population. Displaced households

are lacking knowledge on how to cope with the new environments they are facing, and, given that their adaptive capacity is low, makes them particularly vulnerable (Hoffmann and Selby, 2012). In Niger, pastoral communities have been well adapted to the prevalent climatic uncertainties they need to tackle, but socio-economic and political conditions, such as lack of institutional enforcement, have increased competition for resources. The adaptations of farmers and agro-pastoralists have lessened the adaptive capacity of pastoralists. As a result, many pastoralists transform their livelihoods becoming agro-pastoralists (Snorek et al., 2012b). Frequent droughts and the inability of institutions to respond to this threat in Ras Sudr, Egypt, have left the affected populations unprotected. Unable to adapt, many Bedouins migrated to distant places leaving those left behind in even greater vulnerability (Tawfic Ahmed, 2012).

The international climate change adaptation community supports governments' roles in climate change planning (UNFCCC, NAPAs). But they have varying capacities to implement effective adaptation policies and the research revealed that governments could be weak in implementing adaptation policies. Thus, the question arises: What role could governments play in climate change adaptation, given the conditions on the ground?

The South Sudan case exemplifies how low government capacity and the resulting high dependency on international donor and aid communities with regard to nation and peace building contributes to the difficulty of a consolidated and coordinated effort to implementing adaptation policies. The Arab Spring Revolution in Egypt is another example of governmental reorganization processes that weaken the current ability of the state to implement adaptation strategies in the short term. However, a successful transformation to a redistributive and people-centered government system might in the long-run increase the adaptive capacity of the country. The case study of Sarno exemplifies a massive scale state-led intervention process and showcases a strong governmental response to a hydro-climatic hazard. Many case studies confirm that institutional structures and their functioning are key variables that determine a community's level of adaptive capacity.

State-led policy for adaptation and adaptive capacity

Different perspectives on the role of the state in adaptation and what constitutes adaptive capacity were adopted throughout the research. Overall, the nation state is recognized as the main institution in charge of adaptation planning by the international community. Gerstetter et al. (2012) reveal that the state has an overarching role in managing adaptation for individuals, organisations and communities and in setting the framework governing adaptation actions, with some countries where the state rather than individuals is the entity promoting adaptation. Politics, power relations, marginalization of groups and economy are important factors that determine which adaptations are prioritised, how adaptation policies are formulated and implemented and, hence, influence the outcomes and the ways adaptation occurs.

- States can facilitate adaptation, particularly if people are unable to adapt themselves. This is exemplified by the case study in Alexandria, where people are trapped in conditions that make them unable to adapt themselves.
- But government-led adaptation can also have a range of negative or unintended impacts when they are insufficiently implemented as it is the

case in Niger, when they transform existing traditional adaptations as in Gambella, when they influence or even suppress individual adaptive capacity as described in the Sarno case study and, generally, when there is a mismatch between preferences or needs of affected people (Gambella, Ebro case studies).

If failing to consider the different preferences and contexts, state led adaptation can fail to meet the adaptation needs of certain parts of the population (Gebert et al., 2012; Milman and Arsano, 2012; Turhan, 2012b).

- Turhan (2012b) demonstrates that due to inadequate state policies the responsibility of adaptation falls upon individuals who are themselves powerless to change structures and conditions that are responsible for their marginalisation. Vulnerable groups can become more vulnerable, reinforcing the social hierarchies and marginalized status of certain groups (Turhan 2012b, Snorek et al., 2012b).
- Milman and Arsano (2012) demonstrate how state development and adaptation policies perceive traditional livelihoods as 'backward' and uncondusive to economic growth, failing to recognize the role of mobility of these traditional societies as a resilience strategy in response to climate variability.
- The lack of enforcement of policies in Niger resulted in individuals being insufficiently supported in their adaptation efforts (Snorek et al., 2012b).
- An over reliance on state institutions can weaken the independent adaptive capacity of communities and individuals affected by hazards (Dalby, 2012).
- State led securitisation of adaptation can increase human-insecurities was explored in the Sarno research (D'Alisa 2012b).

Here, emerges a situation in which de-politicisation of decision-making can silence some voices. Existing adaptation discourses can be used by state actors for other aims. It underlines how this occurrence can aggravate human insecurity linked to environmental hazards through the de-politicisation of issues and the minimization of alternative disaster responses and adaptation strategies. In the Ebro Delta, a related similar, potential outcome of securitisation danger was identified (Albizua and Zografos, 2012).

The case studies have shown that adaptation can reinforce and increase inequality but also increase equality between different groups. The unequal effects of adaptation between diverse social groups may increase tensions and conflicts between these as is the case in the Ebro delta (Albizua and Zografos, 2012). Throughout the CLICO research, there have been indications of tensions (e.g. Ebro Delta) or conflict (e.g. Niger) emerging through unequal effects of adaptation between different social groups. Milman and Arsano (2012) emphasize that winners and losers of adaptation policies need to be identified to evaluate trade-offs and adjust policies to well-balance their impacts. Factors that play a role in shaping adaptation outcomes are manifold and highly context specific. CLICO has used and developed concepts of divergent adaptation and maladaptation to measure these unequal impacts and the factors that determine them:

Divergent adaptation

Divergent adaptation is a concept that describes those adaptations that promote the adaptive capacity of one individual, groups or community, potentially leading to a reduced, unchanged or improved adaptive capacity

of an alternative individual/community in a shared ecosystem. One outcome related to processes of divergent adaptation is the creation and reinforcement of existing and creation of new inequalities. The case study in Niger (Snorek et al. 2012b) is a prominent example of how the successful adaptation of one group evolves at the expense of another group. Agro-pastoralism has become a widespread adaptation to environmental as well as socio-economic and demographic pressures even in the former purely pastoral zones of Niger. These drivers together with an insufficient institutional support weaken pastoralists' access to resources. Agro-pastoral communities from the dominant ethnic groups and the pastoral groups in the North with greater economic power have a greater adaptive capacity and exhibit divergent adaptations.

"Mal-adaptation"

The term describes in general poor or inadequate adaptation (Merriam Webster online Dictionary). More specifically, it refers to action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups (Barnett and O'Neill, 2009). In Gambella traditional lifestyles could be disregarded in order to ensure (short-term) food security (Milman and Arsano, 2012). In Alexandria, in order to avoid the negative impacts of sea level rise and associated floods, relocation programs may result in new livelihood risks if not properly planned and conducted (Gebert et al. 2012).

The improvement of the adaptive capacity of state institutions can be a crucial factor for improving the adaptive capacity of populations (Gebert et al., 2012; Selby and Hoffman, 2012; Snorek et al., 2012b). Improved coordination between sectors and actors is emphasized for improving institutional adaptive capacity at various levels (Gerstetter et al., 2012). But in many cases, multiple uncertainties translate into barriers to planning adaptive responses and in others institutional and infrastructural gaps capacity and poor access to data strongly affected the development of adaptive capacity (Selby and Hoffman, 2012).

Furthermore, social and political discussion on the useful role that well-established civil security/ protection and social security systems can play in the prevention of water-related hazards and response seems to be often absent (Kallis and Zografos, 2012). Exchanging ideas on values, representation and voice, equity and fair distribution of risks and impacts are also crucial for determining adaptive responses to climate change and human security (Adger, 2010; Adger, 2010 in Turhan, 2012b). A political and societal dialogue about the dimensions and scales of human security which are prioritized by certain policies at the expense of other dimensions and a debate about policy alternatives for addressing uneven impacts is often missing.

3. The nature of conflicts

Conflicts studied through the CLICO project can take many different forms ranging from low level, 'silent' or latent such as in the Ebro Delta (Albizua and Zografos, 2012) to conflict involving violence such as in Niger (Snorek et al., 2012b) and Gambella (Milman and Arsano, 2012). The severity, time scale and level of violence of a conflict can add considerable vulnerability to climate change such as the example in the Jordan West Bank (Tamimi and Jamous, 2012), the Gambella region (Milman and Arsano, 2012) and the Sudan case study (Selby and Hoffman, 2012) demonstrate. The versatility of conflict as a social phenomenon can result in being beneficial, helping to reduce vulnerability and improving

adaptive capacity in certain situations (e.g. oppressive situations) (Kallis and Zografos (2012) as in cases of "adaptive" conflicts between herders and farmers in the Western Sahel (Turner, 2004). Additionally, it is important to consider conflict not only from an international and civil war perspective on a nation-state level but also to consider sub-national scales. It is also relevant to distinguish between armed, social or political conflict (Kallis and Zografos, 2012).

Factors influencing the nature of conflicts

The nature of conflict is also influenced by the degree of political freedom (Böhmelt et al., 2012). On the one hand, in democratic countries where a 'political space' for disputes is induced by economic prosperity and political freedom could make low-level conflicts more likely while violent conflicts are far more prevalent in non-democratic settings than in democratic ones. In addition, consensus building processes which can be described as cooperation may emerge through low-level conflict in democracies.

On the other hand, the debate of alternatives may be muffled even in democratic countries through the securitization of relevant issues (Albizua and Zografos, 2012; D'Alisa, 2012b). In Seyhan, class-based conflicts have been prevented through the lack of organisation and union membership of seasonal migrant workers (Turhan, 2012b). In the Palestinian Territories human security and an inadequate access to water is shaped by transboundary tensions, political and social tensions and uncertainties in combination with capacity constraints (Tamimi and Jamous, 2012).

Policies and mechanisms to address conflicts

Hardly any policies explicitly target the link between climate change, water conflicts and human security; and policies directly aiming at conflict reduction are missing (Gerstetter et al. 2012). But there is a wide range of policies that support adaptation and are thus indirectly useful to prevent or reduce conflicts in the light of climate change.

The CLICO research demonstrated that Conflict Resolution Mechanisms are underrepresented in transboundary institutions and treaties although growing uncertainties in the face of climate change might make disagreements between riparian nations about the management of the shared water resources more likely. The costs associated with decision-making for institutional change and implementing institutional reforms and policy changes and set-up of new institutions are an important factor that can hinder the adoption of conflict resolution mechanisms.

4. Cooperation

Slightly more cooperative events than conflictive ones were recorded in the database of water related events at the sub-national scale while half of these events were neither cooperative nor conflictive (Bernauer et al., 2012). Only very few instances of direct links between human (in)security and cooperation could be observed. Instances of cooperation were reported between Morocco and Spain (Pascual et al., 2012), Greek Cypriot and Turkish Cypriot communities. In the event of the Red/Dead Sea Canal being approved, potential for collaboration between Israel, Jordan and Palestine could arise (Gerstetter et al., 2012). Through the IBRM common framework and cooperation channel, stability, security and sustainable development have increased in the region. In spite of this, the weak implementation of current laws and policies, duplication among institutions and low levels of public participation and absence of the

population in water management are obstacles to the effective management of the Reserve (Abdul Malak et al., 2012).

As pointed out in the Ebro Delta case study, certain types of collaboration, e.g. a forced-upon agreement on water transfers, may only strengthen unequal situations (Albizua and Zografos, 2012) instead of mutually beneficial cooperation (Zeitoun and Warner, 2006). Transaction costs rather than any environmental variability or an individual's adaptive capacity are determinants of decisions to cooperate or not in the face of conflict as exemplified in the case of Israel (Fischhendler and De Bryune, 2012; Fischhendler and Katz, 2012). Additionally, international institutional capacity as well as national and sub-national abilities to cooperate at different scales determine climate change adaptation in a transboundary river basin (Milman et al., 2012b; Kranz et al., 2010).

5. Uncertainties

Uncertainty is a key factor influencing climate change adaptation, policy formulation and institutional setups. It describes a situation in which no comprehensive understanding of a system exists (Brugnach et al. 2008). Uncertainty may exist regarding environmental and climate factors. Existing climate and hydrological models have difficulties to predict the future situation and planning and management can suffer from contradictory results of those models. Uncertainty also stems from social dimensions and interactions (including political aspects), economic development and technological progress. Factors such as political instability, transformation or conflict complicate adaptation planning and management even more. The importance of political uncertainty is highlighted as a factor of the political environment contributing to weak state institutional capacity to cope with insecurity (Gebert et al., 2012; Tamimi and Abu Jamous, 2012). Similarly, political stability is found to have a conflict-reducing effect (Tribaldos, 2012).

Uncertainties, often in combination with poor data availability, challenge governance structures at all political levels but particularly in transboundary basins, where additionally values perceptions and behavior between co-riparian nations may differ. Mechanisms to address uncertainty in transboundary agreements exist and the research by Fischhendler and De Bruyne (2012) reveals that in transboundary agreements conflict resolution mechanisms have the potential to consider future uncertainty, improve flexibility, impose commitments and address potential disputes, but that they are underrepresented. In order to formulate adaptation strategies, systems need to be able to manage high uncertainty and remain dynamic enough to adapt to changing conditions (Ostrom, 2005; Pahl-Wodt, 2009; Snorek et al., 2012b).

It has been put forward that uncertainties could lead to cooperation in negotiations between Israel and Palestine over transboundary water management. This hypothesis is supported by theory (Keohane, 2005; Zeitoun and Mirumachi, 2008). At the transboundary scale evidence of conflict or uncertainties promoting cooperation was found (Fischhendler and Katz, 2012).

At the national or case study level, the role of uncertainties is further investigated. In Alexandria, relocation responses are hindered by uncertainties related to the future of the environment and social and political conditions and their importance (Gebert et al., 2012). In the Ebro Delta, differing perceptions between the affected and decision

makers about the proper scale of concerns need to be addressed by adaptation interventions and are important determinants in the Delta regarding the need to adapt to threats to water resources (Albizua and Zografos, 2012).

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

A range of factors shape water availability and vulnerability to climate change in the different CLICO case studies:

- socio-economic pressures, a growing population and a reduction in water availability (IBRM);
- transboundary tensions, political and social tensions and uncertainties in combination with capacity constraints (Jordan basin);
- isolation of the Bedouin population, illiteracy and low awareness of climate change, fragile ecosystem influenced by climate variability, strong local knowledge of the ecosystem by the Bedouins (South Sinai);

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

The following different mechanisms were identified:

- Social vulnerabilities are linked to issues of social justice and human rights and social marginalisation can worsen vulnerability to climate stresses and insecurity (Niger, Turkey, Ethiopia).
- Social and political factors can increase the human insecurity of rural populations as well as their vulnerability to climate impacts (Seyhan).
- Human security is affected by a variety of factors such as pre-existing tensions between different ethnic groups, food insecurity, poor service provision and vulnerability to climate impacts; climate change can act as a "multiplicative stressor" (Ethiopia).
- 'Divergent adaptations' that improve the adaptive capacity of some groups while reducing that of others can occur (Niger).
- Planned state led relocation may reduce risks associated with flooding but may also increase vulnerability through displacement and removal of sustainable livelihood strategies (Sarno, Alexandria, Ethiopia).
- The degree to which people's values regarding their social and natural environment are considered in state-led planned adaptation priorities and initiatives is a key determinant for successful and legitimate human security planning policy (Ebro Delta, Alexandria).
- The securitisation of issues by the state can aggravate human insecurity linked to environmental hazards through the de-politicisation of issues and the minimization of alternative disaster responses and adaptation strategies (Sarno, Ebro Delta).
- Multiple uncertainties related to the future of the environment and social and political conditions hinder relocation responses (Alexandria).

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

- Human security will be negatively impacted by climate change which may also increase the possibility of conflict between different social groups of the region (Jordan basin).
- Uncertainties of one type, such as political ones, can overlap and have an impact on water uncertainties. Other factors such as the type of persons involved in the negotiations and the type of cooperative mechanisms proposed play a role in the outcome in terms of increased cooperation or conflict. Certain actions intended to reduce physical uncertainty generate other uncertainties, hindering cooperation (Fischhendler and Katz, 2012) while in certain situations shared water-

related threats to human security can provide incentives for more cooperation.

- Political and historical factors predominantly influence conflict and environmental vulnerabilities rather than resource scarcity induced through environmental change (Sudan).
- Water-related conflict originates from the current political and economic context, with conflict emerging as a political response to the marginalization of certain groups' livelihood needs over others and exacerbated by environmental change (Niger).
- Class-based conflicts have been prevented through the lack of organisation and union membership of affected groups, e.g. seasonal migrant workers in Seyhan.
- Differing perceptions between those affected and decision makers about the proper scale of concerns need to be addressed by adaptation interventions to reduce chances of water-related conflicts (Ebro Delta).
- Research does not reveal climatic factors directly shaping conflict. However, socio-political interactions in the region are influenced by current policies intended to decrease vulnerability to climate stresses and lead to new insecurities and opportunities for conflict (Ethiopia).

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

- Instances of cooperation were reported (Morocco and Spain, Greek Cypriot and Turkish Cypriot communities) as well as potential for collaboration (Israel, Jordan and Palestine).
- Certain types of collaboration premised upon security arguments, e.g. a forced-upon agreement on water transfers, may only strengthen unequal situations (Ebro Delta).
- Transaction costs rather than environmental variability or an individual's adaptive capacity are determinants of decisions to cooperate or not in the face of conflict (Israel and Palestine).

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

- Uncertainties may lead to vulnerability-reducing cooperation in negotiations over transboundary water management (Israel and Palestine) as sustained by theory (Keohane, 2005; Zeitoun and Mirumachi, 2008).
- In transboundary agreements conflict resolution mechanisms have the potential to consider future uncertainty, improve flexibility, impose commitments and address potential disputes (Fischhendler and De Bruyne 2012).
- At the sub-national scale, negative human security has resulted from the stifling of political debate and conflict with regards to response strategies to environmental hazards by a hegemonic state (Sarno).

Question 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?

- Weak implementation of current laws and policies, duplication among institutions, low levels of public participation and absence of the local population priorities in water management are obstacles to effective management (IBRM).
- Customary hierarchical institutions have enhanced institutional capacity but in other cases institutions have had negative influence increasing the potential for conflict (Niger).
- The 2011 political events hindered the short-term capacity of institutions to develop adaptive relocation policies effectively to face sea level rise (Alexandria).

- Institutional and infrastructural gaps are resulting in poor environmental management and human insecurity (Sudan and South Sudan). The strengthening of state institutions can be a major factor for both countries to withstand hydro-climatic stresses and may help future adaptation and development planning related conflicts (Selby and Hoffmann, 2012).
- The role of the state and societal transformations administered by states where transformation adaptive agendas for agriculture and livelihoods have given preference to certain lifestyles and aspects of human security over others are questioned (Ethiopia).
- The failure to deal with the root causes of disaster and to implement long lasting measures to ensure the human security of the population was caused by the state's massive scale intervention (Sarno).

Question 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?

- Restructuring negotiations, through the separation of the roles of politicians and technical professionals and integrating climate change adaptation measures in the future national and transboundary IWRM plans (Jordan basin).
- It is crucial to understand and integrate different values and perceptions of climate change in adaptation planning as well as pushing for more dialogue (Alexandria, Ethiopia, Seyhan).
- The need for greater participation and integration of local knowledge when putting together interventions is important (IBRM) as well as the need for institutional appropriateness (Niger). Still, the important role state interventions play in shaping adaptation of individuals and communities needs be highlighted (Gerstetter et al., 2012).
- Challenges linked to relocation can be overcome if they are integrated to previous and current institutional frameworks (Alexandria).
- The direct effects of climate change but also the indirect processes that could aggravate those effects should be integrated to adaptation policies.

Question 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?

- State managed adaptation policies have further alienated actors already disapproving of the state (Ethiopia) (Vidaurre and Tedsen, 2012). Two key policies: The Villagization Program and the Agricultural Development Led Industrialization have had negative impacts on human security and have aggravated existing tensions in the region (Ethiopia).
- State-led adaptation policies shifted the responsibility of adaptation to the individual (Turkey). Policies and interventions reinforce the marginalized position of migrant groups in Turkey as they overlook values, perceived adaptation needs and the root causes responsible for the vulnerability of those groups (Turkey).
- Multiple institutions and actors may lead to a reduction of vulnerability of a group while reducing the adaptive capacity of another (Niger). Insufficiently planned adaptation (e.g. relocation) would increase insecurity of a group while reducing their adaptive capacity (Alexandria).
- Conflict and environmental degradation matters should be scrutinized through the lens of a history of neglect and exploitation linked to the nature of state agency (Sudan). Therefore, it is probable that adaptation in the region is shaped and contributes to conflict. Climate change

adaptation does not have high priority for policymakers in both Sudans owing to the current high level of conflict and insecurity.

6. Conditions for successful adaptation

Perspectives taken play a large role in the outcome of adaptive responses with diverging values and preferences leading to different adaptation outcomes. Tensions and maladaptation risks emerge when differing values, perspectives, cultures and traditions are ignored (Albizua and Zografos, 2012; Gebert et al., 2012; Milman and Arsano, 2012; Turhan, 2012b). Although scientific knowledge is both crucial and well-accepted as central for designing response to climate change, tensions may also emerge in cases where expert and scientific knowledge are over-privileged over other types of knowledge (Albizua and Zografos, 2012). Open processes of adaptation planning and development which include diverse perspectives can enhance policy legitimacy and effectiveness (Albizua and Zografos, 2012; Pascual et al., 2012). On the other hand, the less powerful may end up facing manipulation even within deliberative processes (Chilvers, 2009), which suggests that deliberative processes are not a panacea per se as they may have controversial normative effects upon social practices (Zografos and Howarth, 2010).

In order to overcome barriers to transboundary water cooperation, Fischhendler and Katz (2012) propose restructuring negotiations, through the separation of the roles of politicians and technical professionals. Furthermore, in the future, national and transboundary IWRM plans should have the capacity to integrate climate change adaptation measures, leading to increased confidence on all matters (Tamimi and Jamous, 2012). For interventions to be effective it is important to consider the household level and to incorporate individuals in climate change adaptation (Albizua and Zografos, 2012; Paavola and Adger, 2006; Renn and Schweizer, 2009).

Values, representation and voice, equity and fair distribution of risks are also crucial to determining adaptive responses to climate change and human security (Adger, 2010; Adger, 2010 in Turhan, 2012b). As such a lack of understanding of value-based approaches can be responsible for maladaptive responses (Albizua and Zografos, 2012) as the examples of the Alexandria, Gambella and Seyhan show (Gebert et al., 2012; Milman and Arsano, 2012; Turhan, 2012b). Through the Ebro Delta case study, Albizua and Zografos (2012) assert that an essential part of policy making resides in acknowledging people's values and perceptions of climate change, calling for more dialogue, debate and deliberation to feed in adaptation decision-making.

The need for greater participation and integration of local knowledge when putting together interventions is proposed by Pascual et al. (2012), while, the important role state interventions play in shaping adaptation of individuals and communities is highlighted by Gerstetter et al. (2012). In Niger, institutional appropriateness is emphasized when dealing with vulnerability reduction and sustaining adaptive capacity (Snorek et al., 2012b).

Challenges linked to relocation in Alexandria could be overcome if they are integrated to previous and current institutional frameworks (Gebert et al., 2012). Finally, Albizua and Zografos (2012) suggest that not only the direct effects of climate change, but also the indirect processes that could aggravate those effects should be integrated to adaptation policies.

Concerns are raised over adaptation that changes existing livelihoods significantly (Milman and Arsano, 2012; Gebert et al., 2012) as these had negative consequences for human security and increased vulnerability of the rural population in Gambella (Milman and Arsano, 2012). Through the case studies of Alexandria (Gebert et al., 2012) and Gambella (Milman and Arsano, 2012) a well-balanced adaptation is advocated.

Key messages

- Climate and hydrological factors, socio-economic, institutional and political factors are all drivers of human security but their relative importance depends on the context
- There are great uncertainties to assess the relative importance of environmental risks as compared to social and political factors
- Political, economic and social factors and water-related conflict than between climate-related variables and water conflict
- in future these relationships might change
- The role of states and state-led adaptation was found to play a prominent role in human security
- Adaptation can both reduce and exacerbate insecurities for certain groups
- power relations, marginalization, governance („role of state") play a prominent role
- It is important to analyze the political economy in an area /country to understand state-led adaptation

State-led adaptation

- facilitates adaptation, particularly if people are unable to adapt themselves (e.g. Alexandria)
- leads to potential of unintended consequences or are insufficiently implemented (Niger)
- transforms existing traditional adaptations (Gambella)
- does not consider mismatches between preferences or needs of affected people (Gambella, Ebro)
- influences/suppresses individual adaptive capacity (Sarno)

Inequality

- reinforces inequalities of different social groups
- who and which dimensions and scales are prioritized
- varying capacities of states to implement effective adaptation policies (e.g. South Sudan, Egypt)

Conflict and cooperation

- slightly more cooperative than conflictive events
- cooperation less represented in case studies
- policies more explicitly aiming at conflict reduction are missing, CRM in transboundary institutions underrepresented
- diverse set of „conflict-contexts"
- not yet existing conflict related to SLR (Alexandria)
- silent conflicts (Ebro)
- frequent and sometimes violent conflicts (Niger, Gambella)
- political conflicts arising from short-term politically-derived development goals vs. Long-term adaptation needs

Uncertainty

- environmental/climate factors: difficult to predict/contradictory
- socio-economic development, political instability, transformation, conflict

-governance challenges: mechanisms to address uncertainty in transboundary basins are under-represented

II. POLICY RECOMMENDATIONS

The CLICO research has shown that the climate-water-security nexus is highly context specific, because it depends on the various social, economic, political and environmental factors and the institutional landscape within and between countries. Consequently, how a policy in a specific country should look, and what concrete issues, population groups, and sectors should be addressed is also highly context-specific. However, from the research carried out, certain overarching and more general insights could be garnered on how the adaptive capacity to climate change related hydro-hazards can be improved and what issues suitable policies addressing human security and conflict prevention in the context of climate change should take into account.

CLICO Research confirms the important role of the state in climate change adaptation

The government has a certain function in planning and facilitating adaptation by providing the regulatory framework that governs adaptation actions taken by individuals, groups, and institutions/organizations. State-led adaptation can be very useful if population groups are trapped in insecure living conditions and cannot adapt themselves. Selby and Hoffmann (2012) recommend improving the adaptive capacity of state institution as one important factor to improve the adaptive capacity of the population. Besides these very positive aspects of state-led adaptation, there is also a significant risk of failure of governmental adaptation policies- at least in certain aspects. In Seyhan, inadequate state policies shift the responsibilities of adaptation to individuals and migrant agricultural workers who are unable to change the socio-economic structures and conditions and can only adapt in a way that makes them even more marginalized than before. In Gambella, the strong state adaptation did not reflect and address the needs of the entire population. Similarly, values and preference of affected people in the Ebro-delta in Spain are underrepresented in governmental strategies. States might be unable to capture the diversity of livelihoods, preferences and the social, political and environmental context framing adaptation, particularly of marginalized groups (Milman and Arsano, 2012, Turhan 2012b). The way authority, interests, and power are distributed and interrelated within governmental authorities at all levels impacts the types of adaptation policies that can be implemented.

Keeping this in mind, the recommendations for policy makers at various levels range from stressing the importance of increasing policy relevant scientific knowledge and respective mechanisms for their dissemination, strengthening accountable institutions to the development of normative frameworks upon which conflict sensitive and adaptation policies can be mainstreamed and sector specific measures implemented. Moreover, to the report provides recommendations that are particularly addressed to international policy makers. The following recommendations are based mainly on Gerstetter et al. 2012 and Gerstetter and McGlade 2012, but draw also from insights derived in all other CLICO work packages.

1. Increase knowledge and knowledge sharing by strengthening research capacity and information transfer

(i) Conduct vulnerability and socio-economic impact assessments of (potential) adaptation policies

- Assess root causes of vulnerability: In-depth vulnerability assessments based on rich sources of information in relevant fields are needed to target future efforts to reduce vulnerability, exposure and sensitivity. It is useful to draw from various lines of research and interdisciplinary research methods and build upon existing experiences and practices in various contexts. It is essential to tailor research according to the scale at which it is needed from local to transboundary scales depending on the type of effects of climate change and adaptation.
- Socio-economic impact assessments for a range of different adaptation options and policies: Here, research and tools are needed to identify adaptation trade-offs including potential "winners and losers" prior to the implementation of adaptation policies, as well as evaluating the impacts of respective policies in place. Useful theoretical concepts are the concepts of "divergent adaptation" (Snorek et al., 2012b) or of mal-adaptation. Impact assessments need to include all elements of human security, including temporal aspects, personal, state and community security, at differentiated geographical/administrative scales (Milman and Arsano 2012, Vidaurre and Tedsen 2012). The potential impacts of adaptation measures for all parties should be thoroughly considered and well-balanced before adaptation policies are implemented (Gerstetter et al. 2012).

(ii) Advance knowledge management, sharing and transfer

In general, to increase the adaptive capacity of decision makers to climate change, measures that facilitate information and knowledge sharing are recommended. An improved dialogue between the scientific and policy-making communities is necessary to improve linkages between policy needs and research activities as well as to enhance the accessibility of scientific knowledge to policy makers.

- Provide scientists with the ability to access data easily from multiple sources by advocating open-access to data.
- Increase the capacity of state institutions to integrate scientific knowledge into decision making and thereby, improve the link between research, the public sector and private sector. This will also serve to increase knowledge transfer from science to policy making and to build comprehensive, knowledge-based climate change adaptation policies and strategies that address the root causes and causal chains of vulnerabilities and low adaptive capacity to climate change.
- Develop decision support systems for policy makers to improve their ability to quickly make informed decisions.
- Share and disseminate knowledge within regions and with others who face similar challenges at a global level. For instance, form global alliances for data and knowledge transfer to measure but also systematically acknowledge local knowledge/ expertise and facilitate access to it.

(iii) Raise awareness on climate change impacts, vulnerability and human (in-) security

- Improve awareness of water-related impacts of climate change among the general population: Raising public awareness of climate change impacts helps to ensure that citizens are conscious of climate-induced risks. This can help to increase acceptance of measures that might initially be unpopular, such as establishing 'no-build zones' which prohibit construction in areas vulnerable to flash flooding and can also increase participation in resettlement programs for people already living in flood-prone or sea-level rise exposed areas.

- Advocate the concept of good citizenship in terms of rights, duties and responsibilities of citizens
- Water-saving and alternative water-usage campaigns addressing the demand side of management, can help reduce water needs, and educate people on alternatives such as freshwater-reuse. As the large-N-study has shown, demand side factors are important factors that influence the likelihood of water-related conflicts. Addressing these factors and reducing demand for water are useful measures to maintain or improve human security in the future in the face of increased natural scarcity of resources.
- Early awareness of the impacts associated with climate change can also help sectors to take adaptation measures well in advance. As the Cyprus case study on tourism has shown, there is a need to raise awareness of climate change for the tourism sector and adapt to reduced water availability in future (Charalambous et al. 2012).

2. Promote and strengthen accountable and functioning institutions

Thus, the development of accountable and functioning institutions requires the responsible use of political power and equity based management of public resources by the state. Essentially, it is about the interaction between democracy, social welfare and the rule of law. Economic and political factors as well as "political economy" have been shown to be important in affecting adaptive capacities and conflicts (Milman et al. 2012b, Bohmelt et al. 2012). Poorly coordinated, corrupt institutions with badly trained staff are unlikely to be able to develop and implement effective policies to counter the effect of climate change. This, for example, is an important concern in the Jordan (Tamini and Jamous, 2012) and Alexandria case studies (Gebert et al., 2012). Thus, climate change and human security can most effectively be addressed once underlying systemic institutional and governance issues within a given country or region is resolved (Gerstetter et al. 2012).

- Improve transparency and functioning of institutions: Not only reinforce existing institutions but also reinvent/re-think the modalities of institutions and their policy implementation. Also, legitimacy of existing institutions needs to be gained, maintained and repaired to build trust in institutional support. Build new institutions if needed.
- Draw on existing local institutions, social structures and networks: Strong social networks e.g. at the community and family level exist and can be strengthened to facilitate adaptation to climate change. Involving communities in the management of natural resources can facilitate adaptation. In many places, there are traditional mechanisms for conflict resolution at the local or community level. These mechanisms can be used to help resolve local conflicts over resources - with or without climate change (Gerstetter et al., 2012).
- Implement and enforce existing policies related to climate change adaptation. The policy analysis revealed that many climate change adaptation policies already exist. Stakeholders perceived them to be sufficient in many cases (Gerstetter et al. 2012). Many case studies confirm that appropriate policies are in place but suggest that there is a lack of monitoring, compliance and legal enforcement of existing policies in various policy areas, which leads to low effectiveness of these policies. The current legislation needs to be more effectively enacted and better communicated to the key groups who are affected by it.
- Improve capacity to implement suggested adaptation for all actors. Though existing on paper, policy-implementation often lacks the political will, human resources (particularly in regional level government), etc. Besides this, a need for training, awareness raising and capacity

building within governmental structures is also present. One method for doing this is by clarifying and reducing the overlap of responsibilities by different governmental bodies as observed, for instance, in Niger (Snorek et al., 2012).

- Facilitate and encourage the empowerment of affected groups to increase their participation in adaptation decisions with regard to policy design and implementation. CLICO research has shown that there are many benefits of participatory decision-making and that there is a need to improve participation processes to make sure that the values and perceptions of all groups are reflected. In the Ebro-case study, participation processes, even if existent, are often considered unsuccessful (Albizua 2012). CLICO research has highlighted several examples of exclusion of the interests and values of marginalized affected groups in state-led adaptation (Tamini 2012, Turhan, 2012b, Milman and Arsano, 2012). Since these groups are trapped in political and economic marginalization, it is difficult to decrease their vulnerability to climate change without empowering them first (Gerstetter and McGlade 2012). As maintaining or increasing existing inequalities increases the risk of conflicts or tensions (e.g. D'Alisa, 2012b), targeted strategies to reduce inequalities are needed (Gerstetter et al. 2010).

Moreover, through participation of these groups, local knowledge can be included in adaptation policies which will greatly improve the applicability and efficiency of these policies given the local context (Tamini, 2012). Local farmers, pastoralists and other people have for centuries adapted to changing and often adverse environmental conditions. This type of knowledge combined with traditional technology can often be used effectively for climate change adaptation (Gerstetter et al., 2012). The consideration of bottom-up approaches, such as indigenous water management systems and locally developed adaptation mechanisms, needs to be acknowledged and synergized (Gerstetter et al, 2012).

- Co-responsibility of the population in water management (Pascual et al. 2012). This is best operationalised by integration of local knowledge and by facilitating affected populations' contribution, and influence on decision-making.

- Identify cases where appropriate policies are missing: In Sarno for instance, future climate change seems not to be changing the priorities of political action. This may result in existing policy measures to address hazards soon becoming insufficient (D'Alisa 2012b). Gerstetter et al. (2012) raise concerns about missing policies which are particularly addressing conflict reduction.

3. Elaborate a normative framework for adaptation

All kinds of adaptive actions and adaptation policies ("state-led adaptation") may lead to unequal impacts on human security of different population groups, or privilege certain scales such as the national and international scale at the expense of others (e.g. local scales). The elaboration of a normative adaptation framework that safeguards equity based and sustainable adaptation policies is important. Such a framework can provide guidance to assessing and improving the governance of climate adaptation. This would include all kinds of research, political and social dialogue and exchange in order to provide appropriate principles to ensure legitimacy, equity and justice. Such a framework can be built upon the concept of divergent adaptation and enriched with various widely accepted principles and approaches such as community and human security, "do-no-harm" and conflict sensitive approaches, as well as the precautionary and human rights principle. Moreover, the temporal aspects of

a normative framework are important to consider by acknowledging the trade-offs between urgently needed short term development goals and long-term adaptation requirements.

4. Cooperation and conflict resolution

(i) Increase Cooperation

Communication, coordination, collaboration and cooperation proved to be essential features of adaptive capacity in transboundary basins. While many transboundary basins have developed good cooperation at the national levels, channels for cross-border community and social dialogue still need to be created; this has been demonstrated by the Jordan basin case study. Building confidence between states is an essential prerequisite for cooperation as demonstrated by the research on the Jordan basin and Sudan. Trust and cooperation at all governmental levels are needed. Government officials at middle and regional levels need to ensure the widespread, coordinated and well-communicated dissemination of policies that ensure both, human security and the effective implementation of adaptation measures.

(ii) Adopt conflict resolution mechanisms

At the national level, many policies in various fields (particularly agriculture and water management) exist that address human security concerns indirectly, but policies more explicitly aiming at conflict prevention are often missing (Gerstetter et al. 2010). Also at the transboundary level, although managing uncertainty by incorporating tools for conflict resolution into transboundary agreements (Fischhendler and De Bryne, 2012) allows for better coping with multiple uncertainties inherent in the climate and human system, there is currently a systematic lack of conflict resolution mechanisms in transboundary institutions. This finding can be explained by high transaction costs (e.g. costs related to negotiating, information sharing etc. between states). Measures that reduce transaction costs such as data sharing and shared norms make the adoption of conflict resolution mechanisms more likely and are in general useful measures to increase the overall adaptive capacity to climate change of transboundary basins. Conflict resolution mechanisms are not only useful at transboundary scales, but also others of concern.

5. Mainstreaming

The research revealed that changes in socio-economic and political conditions are more likely to reduce the vulnerability of specific groups, improve human security, and make water conflict less likely (Gerstetter and McGlade, 2012). Thus, climate change is a cross-cutting issue that does not fit into "ministerial boxes", which suggests the need for broader integration of adaptation relevant issues into existing policy sectors (Gerstetter et al. 2012).

- Therefore, integrate socio-economic (e.g. economic development and redistribution, social security) and political (e.g. levels of democracy, political stability) concerns and measures into existing policies. Changes and improvements in socio-economic and political conditions are more likely to improve human security and reduce vulnerabilities.
- Harmonize and coordinate policies in order to create synergies: Framing adaptation measures in a way that they are relevant to current socio-economic or political debates is important, for example in the context of economic crises, and can facilitate the political will to put adaptation high on the political agenda. Cross sector synergies that save resources and increase policy impact adds to this. As an example, Turhan (2012b) recommended policy makers in the adaptation domain to identify and manage

these links, synergies and overlaps in social, agricultural and environmental policy. Current policy interventions that deal with seasonal agricultural workers do not address anticipated changes in the climate and environmental risks. Also in the Sarno case study future climate change seems to have no effect on the priorities of political action; therefore, existing policy measures that address hazards might become insufficient (D'Alisa 2012b). Furthermore, sector-specific guidelines on standards for climate adaptation measures can help to ensure that all institutions and departments can fully and practically integrate adaptation concerns in their day-to-day work routines (Gerstetter et al. 2012).

- Incorporate flexible planning into existing policy cycles:

Uncertainties related to climate change impacts and the ways individual adaptation efforts to them will look like, challenges governmental planning and early-action. However, a case can be made for swiftly initiating adaptation efforts and for incorporating adaptation into mid- and long-term planning. As exemplified by the Alexandria case study, resettlement may become a viable adaptation option to sea-level rise in the future and governments need to ensure income and housing security for the relocated population. With the systemic problems inherited in the housing market and current agricultural development trends in Egypt, policy-makers need to tackle these issues now to be able to maintain human security for the affected population in the future (Gebert et al., 2012). This would also include promoting ex-ante adaptive measures rather than ex-post measures are recommended (Pascual et al. 2012).

Incorporating projected climate change impacts into planning requires ensuring that projects and plans are considered desirable within the whole range of projected future values. Flexible planning can also take the form of modular implementation, e.g. purposely designing measures so that they can be expanded in view of future requirements. In this way, adaptation needs can be taken account in long-term strategies; at the same time, these strategies will have to be evaluated systematically at shorter intervals, in light of the actual developments on the ground and new scientific insights (following e.g. adaptive management approaches). Incorporating periodic reviews in strategies and legislation ensure that this happens and improved or additional knowledge on climate impacts can be regularly incorporated into the planning cycle (Gerstetter et al. 2012).

- Develop cross sector and inter-institutional climate change impact and conflict risk early warning and response mechanisms: Early warning systems (EWS) on emerging climate change and conflict risks are a powerful tool for supporting flexible planning and providing decision support for adaptation policy design. Thereby, an early warning system can mean many things on the operational level. Many EWS in place are very technical, designed to exactly forecast hazardous events, such as floods or droughts. Others are rather horizontally and vertically institutionalized and coordinating platforms aiming to exchange knowledge on trends; e.g. in specific sectors or environmental and social conditions that might pose a certain risk to human security. Here, sectors of concern (for example; in agriculture, urban planning, and water management) need to be encouraged to ensure smooth data exchange and integration regarding to be defined vulnerability information. This especially accounts for long-term and creeping climate change processes, whose development paths can easily be monitored if a multi-sector approach towards early warning would be implemented. Moreover, appropriate settings are required those ensure citizen's pro-active

involvement in early warning dissemination and the elaboration of response strategies.

6. Sector specific measures

Strengthen social security systems and civil protection: Social security systems allow reducing vulnerability to climate change and related hazards tremendously. Advanced and functional social security and welfare systems support countries to better cope with the negative impacts of hydro-hazards and increase their capacity to adapt to climate change. The CLICO research has pointed mostly indirectly to the importance of social security and civil security institutions. Well-functioning civil protection and disaster response agencies, access to public hospitals and affordable health insurances can put people in a much better position when they face a hazard. Unemployment support and other social policies facilitate adaptation if people need to re-organize their livelihoods in the face of climate change hazards. Though it is still the responsibility of an individual or a community to adapt, state's adaptation strategies should include strong social safety nets.

Agriculture: A recommendation based on many case studies is the need to increase the adaptive capacity of agricultural- based livelihoods by maintaining land productivity and sufficient access to water. Basin reforestation, fluvial restoration, and conservation efforts need to be integrated into long-term land use planning. This needs to be accompanied by shifts of cropping patterns to crops with higher water efficiency, crop varieties which are drought-tolerant and the use of more efficient technologies in irrigation. Some case studies recommend facilitating investments of farmers that are targeted at increased efficiency in their agricultural production. Large, water-intensive agricultural developments such as irrigation projects should also be evaluated in terms of their implications for vulnerability to climate change as they can deteriorate human security in areas different to the focus of development, e.g. via downstream human population and ecological effects of reduced water availability. Finally, comprehensive land use and resource policy need to be formulated which are well monitored, with a high degree of compliance and legal enforcement.

Water management: Ensuring a fully integrated management of water resources based on a fair or equitable water allocation can increase efficiency and transparency of water management (e.g. as emphasized by Tamini (2012) for the Jordan River basin).

- Strengthen cooperation at all levels: Cooperation between local stakeholders will lead to better management and allocation of available water between sectors and users. Regional cooperation will enhance the implementation of necessary large scale projects to work on non-conventional water resources to reduce the gap between supply and demand for all uses.
- Raise public awareness about water scarcity to facilitate the adoption of unconventional techniques such as water reuse and desalinization and improvement of the infrastructure efficiency and reduction of the consumption. Water pricing may be a useful measure to set incentives for water saving and ensure its efficient use (Cyprus, IBRM).
- Ensure flood control measures and increase preparedness for floods and droughts. Develop response plans and communicate them well at all scales.

7. Migration and resettlement

Rural to urban migration has been mentioned in many case studies as a threat to human security as it may decrease agricultural production in

basins (IBRM) with potential negative impacts on regional food security and destroy traditional livelihoods and knowledge. Appropriate measures should be taken to manage migration and make agricultural livelihoods more attractive. In terms of flood management, restricting settlements in very exposed areas or designing incentive systems for voluntary resettlement should be given priority. It is also important to ensure long-term urban planning that acknowledges climate change impacts and development to safe areas. For all these measures, a proper political discussion on resettlement, values and priorities by all affected actors is essential (Alexandria, Sarno).

8. Infrastructure

Building up and maintaining protective structures such as flood resistant infrastructure ensuring flood control and taking care of unintended effects. Invest in infrastructure needed to ensure distribution of water, as well as water use efficiency. Desalination plants with properly treated wastewater and taking care of environmental impacts may become a useful option for some case studies such as Cyprus. Many more recommendations addressed to and based on the specific conditions in the case studies can be found in chapter 6.2.

9. Recommendations for international policy makers

(i) Strengthen support so that it becomes systematised, substantial and sustainable:

- Systematise support from the international community and focus on longer-term, interconnected interventions for positive outcomes in sustainable development, climate adaptation, conflict prevention and protection of human security.
- Strengthen large-scale and long-term finance for climate change adaptation and provide technical support and capacity building for developing countries to meet the sometimes complex and expensive requirements, both for obtaining finance and for absorbing the finance being provided.
- Develop cooperative and transboundary infrastructures to protect the immediate human security of migrants and people who are internally displaced by direct or indirect impacts of climate change, human security threats and conflict. Reduce the exploitation and illegal passage of migrants through livelihood diversification for traffickers who may themselves have turned to these activities as a cause of climate change impacts e.g. on farming.
- Raise awareness amongst policy makers on the need to act on less obvious and 'creeping' impacts of climate change such as drought and sea-level rise rather than focusing on sudden high-impact events such as floods. Provide support for developing longer term programmes in this regard. (Gerstetter et al. 2012)

(ii) Recognize and respect the boundaries of international action

- Build trust between donors and beneficiaries by supporting global action at UN level and ratifying and respecting international agreements on climate change and environment.
- Ensure that donors' and recipients' strategic frameworks, wishes and needs are increasingly aligned (in accordance with the 2005 Paris Declaration and the 2008 Accra Agenda for Action for aid effectiveness). Solutions should be demand-driven and based on in-depth analysis of the context to ensure their effectiveness.

(iii) Be aware of the impacts of support and finance

- Consider the potential effects that support and finance for adaptation or cooperation over water resources can have for creating new conflict or exacerbating existing tensions when planning policy interventions.
- Continue to improve inter-agency cooperation and coordination both within the UN and amongst international donors to avoid overlap and duplication of effort.
- Focus on technical assistance through providing and supporting exchange of scientific information, technical and financial support and capacity-building, especially at regional and local level to avoid the sometimes over-politicised nature of high-level regional cooperation that may produce barriers to information exchange. Where interaction is high-level, international actors should highlight and seek to bring forth the benefits of joint water resource management based on international law.

(iv) Provide implementation assistance

- Advocate for information to be placed in the public domain and exchanged without restrictions. Provide supportive mechanisms and platforms for global level information-exchange.
- Assist countries with climate change adaptation through issuing guidelines on best practice.
- International NGOs and donors should advocate for better cooperation between states over trans-boundary water management.
- Capitalise on existing social structures and bottom-up adaptation methods (Gerstetter et al. 2012)

Potential Impact:

PROJECT POTENTIAL IMPACT

A main aim of the CLICO project has been to influence and shift the debates regarding the links between climate change (with a focus on its hydrological aspects) and security, and in particular to provide empirical evidence that would help move beyond simplified visions of those links. The project has advanced this debate with empirical evidence from its case studies and the large N-study of conflict and cooperation events in Mediterranean, Middle-East and Sahel countries. These have generated not only evidence of the elements that are important to focus when considering more nuanced explanations of links between climate change and security, but also evidence of the need for policy to deal with the root causes of vulnerability to climate change and genuine stakeholder participation in relevant decisions.

The potential societal impact of this can be seen at different levels and relates to the outreach activities that CLICO undertook at those levels. Both at the national and international policy level, the fine-tuned explanations and policy suggestions given by the project through its Synthesis Report, its 'Adapting to Change' report, and its four policy briefs have the potential to influence future policies to more productive measures as regards reducing insecurity. The project has attempted that by making different policy communities aware of project results not only through disseminating the above key policy outputs but also via inviting members of those communities in CLICO-related events, such as for example the 'Rethinking Climate Change, Conflict and Security' International Conference held at the University of Brighton, UK in October 2012, and which involved members of the security (e.g. NATO representative) and foreign affairs (e.g. Foreign Office representative) communities. In this way, and through other public events where CLICO results were presented (and which are fully listed in this report's Template A2 of dissemination activities), policy communities were made aware of the project and its results, and obtained knowledge for shifting future policy interventions.

Moreover, the project has aimed at generating knowledge that will improve the relevance and quality of not only policy-makers but also stakeholders' contribution to development and evaluation of security options and adaptation policies in relation to climate change. Public workshops such as the ones in Ismailiya (Egypt) and Jerusalem (Israel) have been useful for locally disseminating project-generated knowledge as regards the complex nature but also the specific pathways and links between hydro-climatic change and security, in an attempt to help policy stakeholders with their implication and approach to policy-making regarding climate change. Also, by making stakeholders aware of CLICO results and studies conducted in their areas, such as with the Ebro Delta 'Results Return' workshop in June 2012 and the Gambela workshop in Ethiopia, the project contributed into moving climate change in a more central position (Ebro Delta) or even introduce it (Gambela) in the 'radar' of policy-makers and stakeholders who had previously not considered it as a main issue of concern. Similarly, all CLICO scenario workshops conducted in all case study sites achieved in getting stakeholders not only thinking about but also start talking to each other about different and common future challenges faced and about possible ways to resolve these.

As regards wider societal impacts and implications, the project has broadened the knowledge base that underpins European, national, and international policies that try to promote peace, security, and democracy, an impact aimed at by the 2008 Social Science and Humanities call to which the CLICO proposal responded. Through empirical quantitative and qualitative research, CLICO has advanced knowledge concerning climate change, peace and (human) security and linked this knowledge to the formulation and implementation of EU policies through both its public and policy outreach activities and the production of reports (Synthesis Report; 'Adapting to Change: the CLICO project' report) and annual policy briefs that have been disseminated to national and international policy-makers. WP4 has explicitly worked to deliver this impact by producing specific guidelines for improving and integrating EU policies for hydro-security. Those guidelines have built upon the contextual local knowledge that was produced by case-study research on the sites (WP2), to yield specific recommendations for policy that can improve security and avoid or productively mediate social tensions and conflicts. Summary of the policy briefs were translated into several case study site languages (e.g. Turkish, Greek, Arabic, Ahmaric, Italian, and Spanish) and were distributed to local policy makers and stakeholders. This has helped promote the advanced knowledge base generated by the project into national and local policy formulation and implementation of measures designed to promote security as well as greater participation and democracy in decision-making.

Similarly, the project has improved the knowledge base for climate change policy decisions by fostering interdisciplinarity in climate change research across social sciences and natural sciences. This was achieved by integrating hydro-climatic and social data both in the case-studies (WP2) and in the regression analysis (WP3). Inter-disciplinarity has also been promoted by bringing together for the first time scholars from fields that previously had not worked together, including climate change, water resource, vulnerability and peace studies. CLICO put together a uniquely inter-disciplinary consortium across the divides of resource, hazard and peace studies, compared cases from Europe and its neighbouring countries and assured the scientific dissemination of its results given the high academic status of its participants and their proven track record of publications.

Another wider impact involves the improvement in the cooperation between European teams and researchers from outside Europe. The project has significantly contributed to this by ensuring the active participation of a third country partners, specifically four ICPC partners from three countries (Egypt, Palestinian Territories, and Ethiopia) with an active role in the research conducted. Moreover, non-European PhD researchers were trained as part of CLICO research in the premises of European universities, CLICO case-studies covered and produced knowledge relevant to six ICPC countries and the large-N set covered all Mediterranean, Middle-East and Sahel countries.

DISSEMINATION ACTIVITIES

This section updates the project dissemination plan described in the DoW, putting detail as to how the activities envisaged in that plan were implemented during the project with specific outreach activity. A more detailed explanation of all project dissemination activities is provided in Template A2 of this report.

Overall, the project implemented a multi-faceted outreach strategy, targeting the following audiences:

- Media and Public
- Policy-Makers
- Peers/Scientists
- Young Researchers

The project's website has been at the core of dissemination. We developed a professional, interactive website at <http://www.CLICO.org> using the latest of Web 2.0 philosophy and tools. The website included basic information on the project and the consortium ("about the project", "teams and people", "results", "publications", "events") and provided links to major project deliverables through a CLICO Working Papers Series, which included uploaded project deliverables and outputs. The website included a space called "assessment", which includes a map of the region and key information from the case-studies research and the statistical analysis. We also created a blog page will be provided, where members of the consortium, the Council and registered users were given the opportunity to start their own discussion groups and post and exchange information on specific topics. A short (approx. 7-minute) video has been prepared and is available on the website, explaining the project to the public. The video includes interviews with the Project and the Scientific Co-ordinator, as well as excerpts of the talks given by Professor Gleditsch, Professor Adger, and Dr Renaud during the public event organised in the context of the project's First Partner Meeting in Barcelona in February 2010. Moreover, the website hosts full presentations from the event, as well as full presentations from the project's second public event on 'Climate change, human security, and conflict in Africa' that was held during the second project meeting in Berlin, in February 2011.

To reach also the broader public, an explicit media strategy has been pursued. We created national and international lists of policy-makers and journalists working on climate and water issues in the most important international and national (of partners and case-studies countries) daily newspapers and scientific/political magazines. Contact (e.g. via email) have been made with those journalists and policy-makers, informing them with short press briefs on results and their importance. A press conference was held in Barcelona at the beginning of the project inviting journalists from Spanish and Catalan dailies as well as the local correspondent of Associated Press. A press event was held also at the end of the project in Nicosia, Cyprus, and the launching of the project was made in the context of the Euro-Mediterranean Innovation Marketplace on 29 January in Cairo, Egypt, with a presentation of CLICO by the Research Co-ordinator. Research partners wrote popular press articles for newspapers and magazines e.g. in Norway and Turkey, based on their project activity and some of them gave interviews to various national radio and television channels in Spain, Norway, UK, and the Palestinian Territories.

ECOLOGIC has taken the lead as part of WP7 to reach more effectively policy-makers, especially at the EU level. The policy outreach strategy has benefitted from the interviews in WP4 that identified the needs and expectations of policymakers. Annual policy briefs, written in simple language accessible also to an informed public, were used to update policy-makers on the progress and results of the project. Furthermore, those policy briefs were disseminated to national policy stakeholders in both the countries where CLICO research was done and in the countries

where the seats of project partners are located. We created lists of possible interested organizations and individuals in EU institutions, national organizations and the UN and other international bodies and subscribed them to the policy brief. At the end of the project, those lists were used to send them the Synthesis report. The objective has been to diffuse project policy-relevant information to the maximum possible number of implicated individuals. Each partner identified the contact details of key recipients in each country, including policy-makers, private actors and civil society organizations to whom translated summaries of the project's four policy briefs were sent.

Scientific dissemination was ensured by the experience and long publication track record of most researchers in the CLICO consortium. Beyond selected publications in specialised disciplinary journals, we have maximised scientific impact by launching an edited (special issue) publication of the results of the project in a top-rated journal dealing with climate change and its impacts, namely the journal *Global Environmental Change*, which is the highest-impact journal in the disciplinarian area of environmental studies. We have opted for a special journal issue rather than an edited book publication, since most journals are now available on-line to the academic community, whereas books tend to be expensive and distributed only through the library channel, limiting accessibility. The preparation of the special issue is envisaged to be completed within 2013. In addition an international scientific conference was held towards the end of the project (10-11 December 2012) in Nicosia, Cyprus, presenting the results of the project but also involving acclaimed academics on climate, conflict and security issues, outside the CLICO consortium and from beyond Europe. We have published and advertised the conference and sent individual invitations to policy-makers, private actors and civil society organizations. The Proceedings of the Conference are available on-line at the project website. Other key academic events include the organisation of a high-level scientific conference on 'Rethinking climate change, conflict, and security' organised by the University of Sussex project partner and specifically the Sussex Centre for International Security between 18-19 October 2012.

Furthermore, in order to reach local audiences outside Europe, we have held public workshops in the location of three case-studies (Ismailia in Egypt, Nile Basin in Addis Ababa and Jordan Basin in Jerusalem). The workshops lasted a full day. CLICO researchers presented the key findings and policy conclusions of their research and invited selected experts from the regions for round-table discussions followed by an open Q&A. The events were open to the public and were publicised widely and beyond the academic community. Selected invitations were sent to important organizations, policy-makers, private entities and civil society organizations in the area.

Finally, an objective of the CLICO project has been to spread the knowledge it generated to young scientists, within and outside Europe, as well as to professionals and members of the civil society involved in related issues from national and regional governments, private sector and NGOs. A course curriculum (graduate level) was developed during the first year. This included a structure for topics/classes, selected readings (suggested by partners) and exercise activities (case-study material, media articles for discussion, etc). A summer school was conducted in Barcelona (July 2011) where researchers from the consortium and invited lecturers taught the curriculum. The school targeted graduate students and NGOs, as well as policy-makers from the project's area of study.

Moreover, CLICO trained a generation of young scientists in environmental sciences through the implication in project research activity of nine PhD researchers hosted by project partners. Additionally, CLICO partners have supervised some ten successful masters research projects in issues related to the climate change, vulnerability, adaptation, and human security.

The potential impact of CLICO research is evidenced by the considerable range of diverse stakeholders in Europe, the Mediterranean, Middle-East, and the Sahel, but also beyond this area where the project has operated, e.g. in forums in the USA, to which aspects of the project have been communicated during the project. Specifically, those presentations, face-to-face meetings, and communications have conveyed the project to communities such diverse as: international forums such as the UNFCCC (both Durban 2011 and Bonn 2010) and the Rio+20; local policy-makers and community leaders, e.g. in Egypt, rural Niger, Cyprus, and Italy; UN policy-makers and staff in Africa and Europe; the defence community, including military personnel (e.g. the US Air Force Academy) as well as security and stability advisors; international (e.g. WWF) and national (e.g. Ecologistas en Acción in Spain) NGOs; national meteorology specialists, e.g. in Niger, Cyprus, and the UK; EU government members and members of national parliaments; African, e.g. Sudan, and Middle-East, e.g. Palestinian Authority, government officials; foreign embassy representatives, e.g. Canadian embassy in Germany; conservation personnel, e.g. from Morocco and Spain; members of the European Commission and events organised by the European Commission, e.g. Brussels Green Week on Water in May 2012; national water and sewage board authorities; private sector stakeholders, e.g. in Cyprus; foreign affairs personnel, e.g. the UK Foreign and Commonwealth Office; on-the-ground NGO personnel, e.g. in Niger; representatives of multi-lateral organisations, e.g. Arab League of Nations; national climate change adaptation committees, e.g. in Egypt and Spain; elected local authority, e.g. mayors in Cyprus; irrigation and agricultural policy officials, e.g. in Turkey; local communities, e.g. the Bedouin communities in Sinai, Egypt; and, international development and aid agencies, e.g. the Belgian and German ones in Niger, and the Swedish development agency. The broad range of CLICO dissemination activities and particularly of receivers of information regarding the project is evidence of the fact that a significant number of diverse communities are aware of CLICO's research and results, which means that the potential for future project societal impacts is high.

List of Websites:

<http://www.clico.org>
<http://www.icrea.cat/Web/ScientificStaff/Georgios-Kallis--481>
<http://www.eco2bcn.es>