

Social learning about climate adaptation: global and local perspectives

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Abstract

Solutions to contemporary environmental challenges will require dialogue and learning among stakeholders with different perspectives. Moreover, enhancing the potential for social learning can be seen as a strategy for meeting the inherent complexity and uncertainty on global change. Social learning processes have been studied in the context of co-management of resources and as a feature of international environmental governance, with increasing recognition of the links between governance levels. This paper explores social learning about climate adaptation in relation to the architecture of climate governance. It compares the potential for social learning at the international level with a local perspective based on preliminary results from a case study of climate adaptation in the Stockholm region, Sweden. In focus are conditions that have been shown to influence social learning in other issue areas, with special attention to boundary organizations and arenas for bridging across scale perspectives and governance levels, shadow systems for developing knowledge outside the norm, and the role of conflicting goals. The paper concludes that there is a need for arenas for social learning about *local* adaptation that embrace have enough diversity among participants to be able to address conflicting goals in addition to sharing of knowledge. It also suggests that research on social learning would benefit from more attention to influences across governance levels.

Introduction

It is becoming increasingly apparent that adaptation to climate change will be necessary regardless of efforts to reduce emissions of greenhouse gases. In 2007, the IPCC concluded that “observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases”(IPCC 2007: SPM p 8) and that “even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades, which makes adaptation essential, particularly in addressing near-term impacts”(IPCC 2007:20).

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In the context of global environmental change, adaptation refers to a process, action or outcome that make a system better able to cope with or manage changing conditions, hazards, risks or opportunities (Smit & Wandel 2006). The framing of adaptation has evolved over time, from a focus on model-based impact studies to addressing vulnerability, adaptive capacity (Smit & Wandel 2006), and recently to also addressing adaptation policies (Füssel & Klein 2006). A major lesson from vulnerability research is that climate change is one of many relevant factors in the analysis and that adaptation depends on complex relationships between processes in many subsystems – social, economic, technological and ecological (Brooks 2003; Füssel & Klein 2006; Thomalla et al. 2006). Studies in the Arctic have for example highlighted the importance not only of climate change but also of changes in global trade patterns, along with national policy processes and local networks (Keskitalo 2008). Similarly, the concept “double exposure” captures how economic globalization and climate change can interact to increase vulnerability (O'Brien & Leichenko 2000).

The insight that vulnerability and adaptive capacity are the result of complex interactions highlights a need to look at adaptation to climate change as a complex systems challenge. Not only do processes in multiple subsystems interact, these processes cover a range of temporal and spatial scales and our understanding of the dynamics at one scale may not be applicable to other scale perspectives. For example, spatial cross-scale studies of vulnerability to climate change have revealed that, although the overall vulnerability of a country is low, certain subgroups of the country's population may still be strongly affected (O'Brien et al. 2004). Moreover, environmental issues are defined by society to be tackled at a particular scale. Adger argues that “understanding adaptation therefore requires consideration not only of different scales of human action but also of the social construction of appropriate scales by institutions to further their own aims” (Adger et al. 2005:80). Although cross-scale interactions are commonly seen as important in social processes, the dynamic nature of linkages between levels of governance is not well understood and the politics of the construction of scale are often ignored in adaptation studies.

Other features of complex systems that has been highlighted in the literature is uncertainty that cannot be controlled and that change may occur as difficult-to-foresee rapid systemic transformations (Norberg & Cumming 2008). One strategy for governing dynamic complex systems in situations of inherent and unavoidable uncertainty is to create governance structures that have capacity for continuous learning and adaptation as new knowledge and new challenges emerge (Folke et al. 2005). The role of continuous learning is thus a central theme in the literature on adaptive governance. To the extent that adaptation to climate change is similar to

other governance challenges in complex social-ecological systems, learning to learn can thus be identified as a potentially important strategy for creating resilience, and possibly also for managing system transformations. Conflicting perceptions among stakeholders and a need for fundamental shifts in understanding and behaviour also point to learning as a fundamental part of successful governance of many environmental challenges, including adaptation to climate change.

Social learning in environmental governance

The literature on learning in the context of environmental challenges ranges from studies of the international system of environmental governance to local resource management regimes. The focus is often on what is called ‘social learning.’ The concept was originally developed in behavioral psychology to emphasize the social aspect of individual learning (Bandura 1973; Bandura & Walters 1963). In the literature on environmental governance, studies of social learning have focused on collective entities, e.g. organizations, and recently also on the relational spaces between organizations and other actors (Mostert et al. 2007; Pahl-Wostl et al. 2007; Tabara et al. 2009). In the context of this paper, we are interested in the architecture of governance, including both vertical and horizontal linkages. Following a definition used by Tabara (2009), we view social learning as the process by which agents and organisations continuously frame and reframe the issues at stake and develop enhanced content and relational capabilities to deal with common problems which individuals often cannot resolve on their own.

In the resource management and environmental policy literature, social learning has become recognized as an important complement to conventional environmental policy instruments (cf. Blackmore et al. 2007; Paquet 1999). For example, several authors (Armitage et al. 2008; Folke et al. 2005; Pahl-Wostl et al. 2007) emphasize learning as an aspect of co-management of natural resources and thus as a way to address complexity, change, and the linkages of processes across spatial and temporal scales. There is also some empirical evidence that multi-stakeholder interactions in co-management regimes lead to enhanced understanding of natural and human systems, and increased public awareness of conservation issues (Pinkerton 1989; Borrini-Feyerabend 1996). Another example deriving from the co-management literature is the recognition of joint ownership of knowledge as one necessary ingredient in avoiding the tragedy of commons (Ostrom et al. 1999). Going from the local context to environmental policy integration at the national level, Gerger-Swartling and Nilsson (2007) highlight that policy is formed in networking processes with multiple actors with different perspectives and interests and that the learning takes place as part of strategic network building.

In the international context, Haas and Haas (1995) has emphasized learning to learn as a possible way to create resilience in the face of the increasing complexity of international society, and the Social Learning Group (2001:140) has used similar ideas to analyze the factors and forces that have shaped the international environmental governance system from the early development in the 1970s, including questions why some environmental changes became viewed as risks. Issues of networks, actor coalitions, and institutions were placed in focus, and learning emphasized as a particularly relevant agent of change because of the knowledge intensive and diffuse character of global environmental management (Social Learning Group 2001:6). Since the seminal work of the Social Learning Group, several studies have also highlighted the role of social learning in the establishment of international environmental policy regimes (Haas & McCabe 2001) and their evolution, e.g. Siebenhüner's study of the IPCC (Siebenhüner 2006). Underdal (2001) describes international negotiations as large-scale exercises in learning through which at least some parties modify their perceptions of the problems in ways that can lead to them adjusting their behavior.

While the early work on learning in international environmental governance focused on the interplay among scientific research and political actions, it typically stayed short of analyzing scientific knowledge production *per se* as part of this learning process. However, scholarship within science and technology studies has addressed how scientific knowledge is socially constructed (e.g. Latour 1987), with an emphasis on the *co-production* of science and policy (Jasanoff 2004; Jasanoff & Wynne 1998). Similar to the literature on co-management of natural resources, studies of policy-relevant science, such as environmental assessments, place an increasingly normative stance towards co-production. Credibility, legitimacy and salience towards a range of stakeholders is seen as essential for success in bringing science to policy, and joint knowledge production becomes a mean to this end (Farrell & Jäger 2006; Mitchell et al. 2006). Concepts that have come to the fore also include boundary management, which explicitly addresses how to create environments that favor learning across communities of practice, such as the scientific and policy worlds (Guston 2001; Miller 2001).

Common to the diverse strands of scholarship is the growing attention to the role of social learning as a powerful governance mechanism for issues that are 'wicked' in nature, meaning that there are no simple one-time solutions and many different valid perspectives that need to be considered to find ways forward (Rittel & Webber 1973). In contrast to policy instruments that create incentives for changes in behavior without affecting underlying values (e.g. environmental taxes), social learning incorporates cognitive, normative and affective elements. In order to achieve such goals, the literature emphasize social learning as an on-going social proc-

ess focused on dialogue and exchange that can incorporate knowledges from various perspectives and different social levels. An example in the literature on local co-management is the increasing emphasis on including other knowledge traditions than western science (Berkes et al. 2003; Reid et al. 2006; Berkes et al. 1998). A similar point of recognizing others' perspectives and interests as legitimate comes through in social learning studies of local planning processes (Forester 1999).

Social learning may appear as less effective than conventional command and control policy instruments in the short term, but may nevertheless become a necessary component of environmental governance when dealing with complex systems in times of rapid change. As an analytical tool social learning can be used for exploring the adaptation process because it highlights shifts in understanding in a situation where no single person has a comprehensive picture of risks and barriers, and where there is a need to identify imaginative out-of-the-box solutions. By analyzing the conditions for social learning, it is also possible to highlight some strengths and weaknesses in the architecture of a governance system in facing complex issues where new ways of framing them may facilitate development in policy and implementation.

Mechanisms of social learning

The conditions that have been shown to favor social learning include openness and transparency in decision making processes, participation, dialogue, trust, and social networks that cut across various communities of practice. Based on studies on the mechanisms of social learning in co-management regimes, organizations, and assessments (Mostert et al. 2006; Pelling et al. 2008; Siebenhüner 2006), a number of analytical themes can be identified that would be relevant for investigating the potential for social learning regarding climate adaptation. They include questions about the participating stakeholders (who is present, power relations), the process (the nature of participation and facilitation), and the horizontal and vertical linkages to processes in other organizations or at other governance levels. Other factors that have been highlighted are linked to the institutional contexts, including the norms and social interactions that they foster. Such factors include boundary management (Guston 2001; Miller 2001), legitimacy (Mitchell et al. 2006), shadow systems (Pelling et al. 2008) and trust (Mostert et al. 2007; Pahl-Wostl et al. 2007). Also relevant are overarching questions such as key features of the policy arena, e.g. whether the challenge at hand is one of coordination (a benign problem) or resolving conflicting interests (a malign problem) (Underdal 2001).

Using a broad framework based on the literature above and applying it to a review of the international and local contexts, we have identified three themes that appear as particularly rele-

vant for comparing the social learning potential in relation to climate adaptation at these two levels. They are:

1. **Bridging and boundary organizations:** These concepts highlight how the organizational structure and the architecture of governance can bring together different communities of practice. The term ‘bridging organizations’ stems from the literature on adaptive co-management in social-ecological systems, where they have been found to play a key role in “trust-building, vertical and horizontal collaboration, learning, sense-making, identification of common interests, and conflict resolution” (Hahn et al. 2006:586). The term ‘boundary organization’ stems from studies of science-policy interactions and refers to arenas for scientists and decision makers to reach common understanding of the issues at hand, for example by providing incentives to create boundary object and involving participants from both distinct social worlds and by being accountable to both spheres (Guston 2001).
2. **Shadow systems:** Shadow systems refer to informal interactions existing outside of, but interacting with, formal institutions and inter-relationships (Stacey 1996). Pelling (2008:868) uses a similar concept, ‘shadow spaces,’ to describe the relational spaces that “allow individuals or subgroups within organizations to experiment, imitate, communicate, learn and reflect on their actions in ways that surpass the formal processes within policy and organizational settings.” We use the term in a broader sense to also include relational spaces in the architecture of governance (as a complement to focusing on the dynamics within organizations).
3. **Conflicting goals:** In the political science literature, goal conflicts play a central role for explaining difficulties in reaching consensus (Underdal 2001). Sometimes, cooperation is only possible once the actors have redefined their self interests. One way in which self interest can be redefined is if there is a change in the framing of an issue. Such reframing can sometimes be brought about by scientific assessments (seen as social processes rather than reports only), especially if they are credible, legitimate and salient to the important actors (Farrell and Jäger 2006). Shifts in framing over time, and thus the perceptions of potential goal conflicts, can be a sign of social learning if the shift is a result of social interactions that alter individuals’ perception of the issue of concern.

Focusing on these three themes, the question in the remainder of the article is if and how the current architecture of climate governance provides a potential for social learning that could facilitate climate adaptation. The analysis starts with a review of issue development at the in-

ternational level to provide a global outlook. This bird's eyes view is complemented with preliminary findings from an ongoing case study of climate adaptation in the Stockholm region, Sweden, to provide some reflections on social learning and adaptation from a local perspective in a developed country.

Adaptation in international climate science and policy

The history of international climate science and its relationship to policy has been described by several authors representing various perspectives (e.g. Miller & Edwards 2001; Agrawala 1998; Agrawala 1998; Bodansky 2001; Bolin 2007; Franz 1997; IPCC 2004; Nilsson 2007; Weart 2003). It can be roughly divided into three time phases: pre-regime knowledge networking, negotiating initial climate change mitigation, and implementation of mitigation and refocusing on impacts/adaptation, each with its own dynamics in relation to social learning regarding climate adaptation.

Pre-regime knowledge networking (-1992)

The first phase of climate policy development – pre-regime knowledge networking – has its roots over a century ago in growing transnational cooperation among meteorological experts to improve weather forecasting. This network within the expert community became the basis for the World Meteorological Organization (WMO), which was created in 1950 and soon became a United Nations special agency. The WMO and the research programs it developed together with the International Council of Scientific Unions (ICSU) provided a forum for political perspectives to enter into a dialogue with meteorological research. This was evident in relation to how US geopolitical wishes for a new world order were used by the scientific community for furthering its emerging interest in global biogeochemical dynamics (Miller 2001; Weart 2003). The most prominent example is the International Geophysical Year in 1957/58 (Shadian & Tennberg 2009). From a social learning point of view, the WMO can be seen as an early boundary organization.

In connection with the UN Conference on the Human Environment in Stockholm in 1972, the international perspective gained salience in relation to environmental politics. The Stockholm conference also led to the creation of the United Nations Environment Programme (UNEP), which provided an arena for merging scientific interests in the global climate system with a new policy focus on the environment. This new boundary organization went beyond the meteorological and earth science communities and provided links to the emerging international politics of the atmosphere (Nilsson 2007). UNEP played an active role in linking climate change research to policy, most notably by co-sponsoring a major scientific assessment of cli-

mate change together with the WMO and ICSU. This assessment was finalized during a conference in Villach, Austria, and included a call for considering a global convention on climate change (Bolin et al. 1986; Agrawala 1998; Franz 1997). In studies of the global climate system, impacts of climate change had not been a major issue, but the Villach meeting included not only the global systems perspectives but also government experts with knowledge about the potential impacts of weather variability in various sectors in society (Franz 1997). The pivotal role of this assessment is evident in a shift in framing that took place and made the impacts of climate change on society a new issue.

The assessment was followed by the creation of an expert group: the Advisory Group on Greenhouse Gases (AGGG), but competition over the ownership of the climate issue left this group to the wayside and instead led to the creation of the Intergovernmental Panel on Climate Change (IPCC) in 1988 (Agrawala 1998). With the IPCC, climate change knowledge synthesis became an intergovernmental issue where states entered as new stakeholders in the dialogue. While the task was initially a matter of synthesizing knowledge among different experts to better understand the challenge of climate change, conflicting interests were also coming to the fore. Most prominent were the conflicting interests and lack of trust between the global North and South that had been apparent already in Stockholm in 1972 (Linnér & Jacob 2005; Selin & Linnér 2005). These concerns played a major role in the early life of the IPCC, where developing countries did not see this organization as legitimate, which in turn led to the creation of an intergovernmental negotiating committee leading up to the UN Convention on Climate Change (UNFCCC) (Miller 2006).

Adaptation was not a major issue in the first phase of climate change policy and framed mainly in relation to impacts and ecological limits of tolerance, i.e. something for which society did not need explicit policies (Klein 2002; Schipper 2006). However, the first IPCC report, published in 1990, noted that “should significant adverse climate change occur, it would be necessary to consider limitation and adaptation strategies as part of an integrated package in which policies adopted in the two areas complement each other so as to minimize costs” (IPCC 1990:27). Both IPCC’s first assessment and the UNFCCC highlighted coastal vulnerability as a key issue, which became a starting point for scientific efforts to assess vulnerability to climate change (Klein 2002) that would become important later in the development of adaptation research.

With the start of negotiations for a convention, the issue of adaptation fell to the side, in spite of the fact that nations that will be highly affected began to have a voice. In a review of adaptation in the UNFCCC process, Schipper (2006) notes that there were proposals to develop

a research and policy framework on adaptation that did not come about. Instead, a framing of adaptation was early on established in which adaptation was pitted against mitigation, as a way to avoid costly changes in the emission of greenhouse gases. Moreover, adaptation could potentially be linked to accepting responsibility, which developed countries wanted to avoid (Schipper 2006). One can thus conclude that, although the emerging climate regime represented a potential arena for social learning in that it brought together actors with various perspectives in an interactive process, conflicting political interests along with the lack of trust between the global North and the global South left little room for social learning about climate adaptation at the political level.

Negotiating initial mitigation

The UNFCCC was signed at the Earth Summit in Rio de Janeiro in 1992 and went into force in 1994, signaling a new phase in climate policy. The political context was a new diplomacy for sustainable development that had started to emerge in connection with the Rio Summit (Kjellén 2007). With the UNFCCC in place, the political demands on the IPCC increased, both on the agenda for the assessments and in creating a transparent participatory process (Siebenhüner 2002). A major issue were procedures for improving participation by scientific expertise from developing countries (IPCC 2004; Miller 2006). Other changes were new rules that allowed NGOs and industry as observers, and a more thorough review procedure that involved both scientific and policy communities. Although developing country objections initially prevented a formal connection between the IPCC and the UNFCCC (Miller 2006), the first meeting of the Conference of the Parties, in 1995, requested UNFCCC's Subsidiary Body for Scientific and Technological Advice (SBSTA) to seek advice from IPCC on development, improvement and refinement on methodologies on a number of specific topics. They included regional impacts of climate change and adaptation responses (IPCC 2004).

After the UNFCCC went into force, the climate policy discourse continued to focus on mitigation, with the negotiations for binding emissions targets raising the stakes compared to the framework convention. Scientific uncertainty about the extent of human-induced climate change was still an issue and the political debate was accompanied by increasing challenges of the scientific process and critique of the IPCC on both scientific and political grounds (Miller 2006). In the policy discussions, adaptation was still seen as a way to avoid mitigation efforts, which continued to be a major obstacle in placing adaptation on the international policy agenda (Schipper 2006). IPCC's second assessment, published in 1995, included discussion about adaptation both in relation to feasibility of political strategies and in relation to impacts of climate change (Watson et al. 1996). However, in a comment on the report, Kates (1997) noted that

only a few pages were devoted to this topic and that this bias could be explained by two schools of thought, ‘preventionist’ that placed the focus on mitigation and ‘adaptionist’ that argued that societies would always adapt, neither of which placed any emphasis on understanding adaptation as a phenomenon. Even if there were calls for more focus on adaptation in its own right (e.g. Pielke 1998), Smit and Wandel (2006) describe adaptation research during this time as mainly framed in relation to whether climate change constituted “dangerous anthropogenic influence.” Meanwhile, IPCC’s engagement in coastal zone vulnerability studies had continued, including development and application of a common assessment methodology (Klein 2002). The fact that the IPCC was able to maintain a broader focus and consider climate change as an additional stress in the context of vulnerability may indicate that the division of responsibilities between the UNFCCC and the IPCC had created a shadow space that was less politically charged than the political negotiation and thus an arena to synthesize adaptation-relevant knowledge in new ways.

Further insight about the conditions for social learning about adaptation and the connections to an emerging vulnerability perspective are presented in a comparative study of agricultural impact and coastal zone management by Long Martello and Iles (2006). They describe how early climate impact assessments relied heavily on computer models with coarse geographic resolution and where the experts had very limited knowledge about farming practices. Even if recommendations from the IPCC brought an increasing attention to integrated modeling, the communities involved in the assessment remained limited. They place this situation in contrast to assessments of coastal zone impacts, which have a tradition of including practical knowledge from coastal management, and where adaptive strategies appeared in early IPCC assessments as possible responses to climate change. In addition, the IPCC introduced a vulnerability framework for the assessments that emphasized the distributive cost of climate change and the human dimensions of who would suffer the impacts. According to Long Martello and Iles, the vulnerability framework appeared to facilitate inclusion of knowledges with different perspectives regarding both time frames and spatial scales in a process that made the new information salient and legitimate to a range of stakeholders. We suggest that in this particular case, the IPCC was able to serve as a bridging organization for various scale perspectives.

By the late 1990s the IPCC started looking for ways to use these lessons for other climate impact sectors (Long Martello & Iles 2006), and the vulnerability framing became further developed in the 1997 assessment of regional impact of climate change, as well as a core aspect of the third IPCC assessment that was presented in 2001. This included a major report on adaptation and vulnerability that highlighted a number of new issues for climate science, including

interactions with other stressors, relationship to sustainable development and equity, climate extremes and variability, and the value of adaptation (McCarthy et al. 2001; see also Füssel & Klein 2006). The IPCC report became a seminal paper for further citation in this field (Janssen et al. 2006). A study of the scientific literature on adaptation, vulnerability, and resilience (Janssen et al. 2006) shows that although the absolute number of publications continued to grow in all three fields after 1990, the relative number of publications using only an adaptation perspective actually declined, at the same time as the number of publications combining adaptation and vulnerability increased. This mirrors an ongoing reframing of adaptation in the scientific sphere, part of which may have its origin in the processes described by Long Martello and Iles. According to Janssen et al. (2006), the citation map (showing who cites whom) suggests that international scholarly networks centered around the IPCC may have facilitated this connection between different research traditions, which further supports such a conclusion.

Another impetus for the reframing of adaptation was probably a growing recognition that it would become necessary to adapt to climate change as the difficulties of reducing emission of greenhouse gases were becoming apparent (Schipper 2006). Shortly after IPCC's 2001 report, adaptation was brought up on the political agenda where the UNFCCC requested SBSTA to initiate work on scientific, technical and socio-economic aspects of impacts, vulnerability and adaptation to climate change (10/COP. 9).

This breakthrough for adaptation in the climate policy debate illustrates the role of effective horizontal links between two parts of the climate regime, the UNFCCC and the IPCC, and how shadow networks connected to scientists in the IPCC could play a role in reframing the issue of adaptation in such a way that it was possible to discuss the issue also in the political context of negotiations. It also illustrates that the boundary management between policy and science was efficient enough to allow the IPCC to develop the scientific discourse and create new linkages between issues without being stalled by the contentions in the political negotiations.

Implementation and refocus

The period following the publication of the 2001 IPCC report can be characterized as one of increasing scientific and political consensus that anthropogenic climate change was actually occurring. The definitive consolidation of this consensus came with the fourth IPCC assessment and its documentation of changing climate from many parts of the world (IPCC 2007). Although the policy discussion were still dominated by mitigation issues, especially in finalizing the details of the Kyoto Protocol and implementing the various financial mechanisms, the task started to shift towards longer term commitments including the involvement of developing countries. At the sub-national level and in the private sector, the number of initiatives on cli-

mate mitigation grew rapidly, including cities and states setting emission targets that were more stringent than the international agreements (Bulkeley & Betsill 2005; Selin & VanDeveer 2007).

With scientific consensus, some of the barriers that previously hindered discussions about adaptation in the international negotiations have now disappeared. However, the space that is available in the legal framework has made adaptation a developing-country issue, closely linked to issues of funding, where supporting adaptation has become synonymous with supporting development (Schipper 2006). Adaptation has thus become part of the political discourse on sustainable development and increasingly linked with other international policy initiatives, including the Millennium Development Goals. This has brought new actors into the discussion, including development agencies at the international and national levels as well as funding bodies such as the Global Environmental Facility, the World Bank and various donor organizations, where mainstreaming of adaptation into development and sectoral policies has become a major goal (Schipper 2006). The changed framing of adaptation creates new opportunities for social learning in the international context insofar as other experiences are brought into the discussion. In addition, the growing number of sub-national and local initiatives creates a potential for shadow systems that can function in parallel with the formal international arenas, also across national boundaries. Although conflicting goals may remain as a major stumbling block in furthering adaptation efforts, such shadow systems could potentially create enabling conditions for the negotiations or even put pressure on negotiators to bring certain concerns and ways of framing climate change to the fore.

Some non-state transnational networks have also gained power with the increasing emphasis on vulnerability, in particular networks of indigenous peoples across the world. An example of a reframing that places the human face of climate change to forefront is the Arctic Climate Impact Assessment (ACIA 2004; ACIA 2005) with its strong involvement of indigenous peoples in the scientific process (Nilsson 2007). Since the ACIA and partly as a result of this process, there have been indigenous initiatives to frame climate change impacts as a human rights issue (Koivurova 2007). With the denser map of actors and actor coalitions come an increasing potential for horizontal and vertical linkages to actors and arenas that have not previously been central in the climate debate. But there are also remaining obstacles to social learning about adaptation, most notably the fact that the debate at the international level is linked to issues of funding, with tensions between viewing it as compensation for damage by emitters of greenhouse gases or as an integrated or mainstreamed component in official development aid (Klein

& Persson 2008). The international negotiations thus still harbor many elements of a malign problem where conflicting interests are at stake.

What future arenas for social learning about adaptation may the current international development open up? Some arenas may develop in connection with a line of research that Füssel and Klein (2006) have labeled 'adaptation policy assessment' which aims at meeting the needs of planners and policy makers. Another set of arenas will no doubt be created in the surge of capacity-building initiatives that have come in recent years, many of which are aimed at building networks among local and sub-national initiatives around the world that allow practitioners to share perspectives and experiences. An example is the web-based platform for knowledge sharing among organizations working with adaptation 'weADAPT' (www.weadapt.org). The scientific scene is also changing. In contrast to the early research on impacts and adaptation, many of the newer studies take their starting point in local vulnerability assessments placed in a larger context where both local and broader-scale determinants are included in the analysis and where there is an explicit recognition that the scales of adaptive capacity are not independent or separate (Keskitalo 2008; Smit & Wandel 2006). Another feature of this research is the close involvement of the communities themselves in assessing the situation, where participatory methods bring practitioners in to work alongside with researchers (Smit & Wandel 2006). These research initiatives are often embedded in international research networks, which provide horizontal bridging opportunities to other case studies as well as vertical bridging opportunities to international adaptation science, including future IPCC assessments. The participatory methods may help build legitimacy for climate science towards audiences at the local level. The next section provides an example of a local case study focusing on the current adaptation process. It highlights some aspects of social learning that are not as apparent from the international context described above.

Climate adaptation in the Stockholm region

In the international discussion, adaptation to climate change has mainly been a developing country issue. Although many developing countries are particularly vulnerable to climate change because of their relative low adaptive capacity (Smith et al. 2003), adaptation will become necessary also in advanced countries. In order to understand the opportunities for social learning about climate adaptation from a local developed country perspective, we have applied the three analytical themes (bridging and boundary organizations, shadow systems, and conflicting goals) to a case study of climate adaptation in the Stockholm region. It highlights the perspectives of practitioners involved in urban planning of the region.

Background

The greater Stockholm region is home to 1.9 million people spread throughout 26 municipalities with varying socio-economic profiles and exposures to impacts of climate change. The largest municipality is the City of Stockholm, which is the capital of Sweden. Similar to the way climate change has been framed at the international level, as well as at the national level in Sweden, local climate-related activities have primarily been associated with mitigation, e.g. efficient transport and sustainable energy. The issue of adaptation to climate change has not been prominent on the policy agenda until very recently. A major shift came after several cases of damage from extreme weather events in Sweden in 2005-2006, which was followed by a government-appointed commission releasing an assessment of climate and vulnerability in the fall of 2007. The report identified increased risks of flooding, landslides and erosion along with the need for financial support to costly adaptation measures (Commission on climate and vulnerability 2007). It came at a time of general increased attention to climate change in 2007, e.g. in connection with the IPCC reconfirming impacts of climate change (IPCC 2007). Several adaptation-related projects were also initiated at the national level around this time, including climate coaching to support adaptation activities in small municipalities (run by the Swedish Environmental Protection Agency in collaboration with a network of 'climate municipalities') and a research programme aimed at developing tools that will support social planners and decision makers in their efforts to adapt to climate change (Climatools, www.climatools.se).

The growing general awareness about the need for climate adaptation is mirrored on the website of the City of Stockholm, which states that "Even if we succeed in reducing today's emissions to a level that the IPCC considers a low risk, we need already now start to start preparing ourselves for a changed climate. We therefore direct on-going and planned activities both at continued reduction of greenhouse gas emissions and adapting the city to a changed climate" (our translation of text from (<http://www.stockholm.se/KlimatMiljo/Klimat/Det-har-gor-vi/>)). However, a recent review of official City of Stockholm documents relating to climate change shows that the majority of strategic documents mentioned climate change only in association with the Swedish environmental quality objectives (e.g. climate mitigation) and that adaptation was only apparent in a few documents relating to flood risks (André 2008). At the regional level, a consultant report has summarized some of the major adaptation challenges in relation to known risks and development. Issues specific to the Stockholm region include high water levels in Lake Mälaren in connection with extreme precipitation, which can potentially flood the subway system and important infrastructure tunnels. Precipitation is also likely to affect the water quality of Mälaren. In addition, Mälaren connects to the Baltic Sea in the cen-

tral parts of Stockholm. Sea-level rise may therefore influence flooding risks in the long run and may potentially also affect Mälaren's water quality through salt-water intrusion. This would be a major concern in relation to Mälaren's role as the major drinking water reservoir for the Stockholm region. Increased demands on water supply would compound pressures from the growing population in the region (Rudberg 2009).

Case study of the Stockholm region

In order to gain a better understanding of the process of adaptation at the local level, the Mistra-Swedish Research Programme on Climate, Impacts and Adaptation, *Mistra-SWECIA* (2008-2012, see <http://www.mistra-swecia.se/>) is conducting a case study of adaptation in the Stockholm region. This particular study concerns stakeholder perceptions of climate risks, the need for adaptation and the factors and processes that affect climate adaptation. In addition, there is a focus on how social learning processes can influence the capacity of the region to adapt to climate change. The qualitative data derives from focus groups and a larger stakeholder workshop conducted over a two-month period (September - November 2008). The stakeholders were selected based on their professional position in organizations, companies and municipal governance, i.e. actors that are likely to become affected by adaptation and actors who determine adaptation efforts in the urban region. The issue in focus was the relative exposure to water-related risks (e.g. flood control, water quality and infrastructure sensitive to flooding). The participants in the four focus groups included representatives from four urban municipalities. They were from 1) technical departments, 2) environmental and planning departments, 3) regional organizations, and 4) public and private water, energy and insurance companies. Within each focus group session, the participants' perceptions and framing of climate change was explored with participatory techniques, such as ranking, diagram exercises and brainstorming sessions.

The first meeting explored participants' risk perceptions before they had received any specific information about climate change. In the second meeting they were presented scientific information (scenarios of climate change, impacts on land use and hydrology) to create opportunities to discuss the relative significance of scientific knowledge for their assessments of adaptation needs. The third session focused on participants' visions of future regional climate change adaptation efforts and the organizational landscape. The fourth meeting gathered all four stakeholder groups to allow them to share their experiences and perspectives on climate adaptation efforts and propose pathways for future regional adaptation action.

Preliminary results

The output from the participatory exercises (transcripts, questionnaires, stakeholder-produced material) indicate changes over time with respect to stakeholder framing of climate change and increasing insights into the complexity of the factors affecting adaptation needs and options. For example, at the first meeting most stakeholders that were represented only had vague notions of ongoing adaptation activities in the region and how these could become more effective. It appears that, at that time, climate change discussions in the respective organizations tended to focus on mitigation strategies and many of them did not have formalised adaptation policies. Notwithstanding, most participants clearly recognised that their work related to adaptation strategies. They also perceived climate adaptation to be of immediate importance and necessary to pursue within their organisations.

The vague conceptions of adaptation needs in the early stakeholder meetings contrast with our observations later in the process when written outputs and discussions from final stakeholder workshop indicate increased insights into the complexity of the issue. This was clearly illustrated in break-out sessions where group members described how the urban region was performing with regards to adaptation efforts, as well as what would be required to strengthen ongoing adaptation initiatives over the next 10 years. The results indicate a sophisticated and pragmatic awareness of adaptation needs, barriers and opportunities that had not been apparent in the previous sessions. Another difference over time was a wider understanding of the organisational landscape concerning local climate adaptation efforts. Initially, the participants focused on their own organisations and organisations with which they already had close collaborations, e.g. neighbour municipalities. This contrasts with the discussion towards the end of the process when mapping exercises illustrated a more complex organisational landscape that included several more groups of actors, representing both the public and private spheres, though almost only from the national context. An example is provided in Figure 1.

An outcome of specific relevance in relation to horizontal and vertical integration of knowledge was a widely perceived need for a strong regional policy arena, where relevant actors could meet to exchange ideas and experiences and establish collaborative links across sectors and municipalities. Mapping exercises in the focus groups showed that the links between the local practitioners and the regional organizations were very weak. There were especially strong wishes for the County Administrative Board to take responsibility for the overall coordination of the Stockholm County's adaptation to climate change.

Most participants claimed they had benefited from the scientific input in the form of climate, land use and hydrology model results and had suggestions for how this kind of scientific

knowledge could be better adjusted to local planning processes. While many respondents claimed they have access to similar scientific data already, they typically called for shorter time scales, higher resolution of scenarios /diagrams, and more user-friendly exposition of data.

Altogether the results from these four meetings over a two month period, along with expressed wish from participants to continue such meetings, indicate that supporting social learning opportunities at the local level can potentially enhance stakeholder engagement in local adaptation to climate change and raise awareness about the need for municipal and company-related adaptation activities. It also appears that such participatory learning exercises can enhance horizontal network building among municipal actors by simply providing a space for sharing knowledge and perspectives about ongoing and planned activities.

For each group, the participants represented people with similar professional roles and organizations at the same governance level. The call for more engagement from the regional governance level (Länsstyrelser) may indicate a void in the governance system where the increased attention to adaptation at the national level in 2007 has not yet led to any great change in capacity building at the local level. A study by Storbjörk (2006) indicates that local actors have waited for initiatives from the national and regional levels and the 2007 report on climate and vulnerability recommended a stronger role for regional governance level in coordinating adaptation activities. When the political-follow up to the report was presented in March 2009, the government bill included new roles for this regional level (Swedish Government Bill 2008/09:162). In the next Regional Development Plan for the Stockholm Region, (according to a version that was subject to consultation June-November 2008), adaptation for climate change will be included, with an emphasis of avoiding further risks when making long-term infrastructure investment, mapping of risks and enhanced risk management, and using municipal planning processes to prevent new housing in flood-prone areas. The Regional Development Plan especially highlights the responsibilities of municipalities in ensuring that further risks are not built into society (Office of Regional Planning and Urban Transportation 2008). If the clarified role of the regional authorities and the increased awareness called for in the consultation version of the plan paves the way for new arenas for social learning among local actors in the Stockholm region, the positive learning outcome of the four focus group meetings point to a potential for increased stakeholder awareness about and commitment to adaptation in the Stockholm region in the next few years.

In contrast to the discussions in the international climate regime section, the preliminary results from the Stockholm region case study indicate that there has not been a shadow system at the local level that has brought climate adaptation work forward in spite of the lack of national

and regional recognition of the need to plan for adaptation. In Sweden, the municipalities have power over many adaptation-relevant questions, such as spatial and infrastructural planning. Lack of power over the issue of adaptation is therefore not a likely explanation for the generally low awareness at the onset of the Stockholm case study. However, lack of ownership and power over specific decisions was raised in the group discussions. Examples include that planners claimed they cannot steer building design and other adaptation-related decisions where the power rests with businesses or individuals.

The role of conflicting goals is difficult to judge from the participatory process in and of itself as the groups were rather homogeneous. However, comments from participants highlighted that ‘short-term economic growth thinking’ often come in conflict with long-term adaptation goals. Moreover, in the rating of factors affecting adaptation action, short-term thinking and political priorities, along with the economy, were often listed as barriers to adapting to climate change. Barrier refers to a problem that the participants saw as impossible to overcome. This highlights a perceived conflict between economic development and climate adaptation also in a highly developed country context, along with a need for local social learning opportunities that could potentially resolve it.

Conclusions

Below we summarize and discuss the main findings of the global and local case studies by applying our three analytical themes.

Bridging and boundary organizations: The initial framing of climate change as a major global environmental challenge is closely connected to effective linking of scientific and political concerns in boundary organizations such as the WMO, UNEP and the IPCC. Based on our experiences from Sweden, it appears that one cannot expect such boundary work at the international level to automatically benefit local processes of co-production of science and knowledge. Rather, the international discourse cemented a framing of climate change as mainly a global concern, where there appears to have been a substantial inertia before local perspectives have entered the knowledge base. IPCC’s work on linking vulnerability and adaptation, especially the 2001 assessment, provided an arena for overcoming this lack of vertical knowledge integration, but the Stockholm case study suggests that the change in framing that is apparent in the international scientific discourse did not carry over to the local level in Sweden. In fact, concerns about adaptation needs were not emerging in the public debate in Sweden until in the aftermath of extreme weather events in 2005 and 2006 and the resulting government-commissioned assessment on climate and vulnerability in 2007. The Stockholm case study

instead points to a lack of boundary and bridging organizations to which local planners have access and where they can express their concerns and exchange relevant knowledge. In the stakeholders' own mapping of actors that are relevant in the local adaptation work, links to scientists are very weak. Moreover, the global governance level (i.e. IPCC and UNFCCC) does not appear as relevant for these stakeholders. Rather, it seems that local action mainly depends on national priorities, activities and incentives, and that a lack of a clear signal from the national level, or its regional representation in the County Administrative Board, can be part of the explanation behind the inertia in the local adaptation process. The major link to the international discourse appears to go via media and the issues it chooses to highlight, e.g. high attention to climate change in 2007.

Shadow systems: The IPCC appears to have served as a shadow system in relation to the politicized discussion in the UNFCCC in developing knowledge about adaptation. By contrast, the Stockholm case study suggests that the Swedish governance system has not allowed space for a shadow system in which local actors have been able to pursue co-production of knowledge and sharing of perspectives about climate impacts and adaptation independently of national policy priorities. This is in spite of Swedish municipalities having formal power over issues such as spatial planning. The participatory study suggests that general lack of awareness in the population and among politicians, along with too many more immediate tasks to prioritize, have contributed to the absence of bottom-up initiatives that could have challenged the weak signals from the national level. Regarding mitigation, several authors have highlighted the role of local and other sub-national actors in pushing the agenda forward (Bulkeley & Betsill 2005; Selin & VanDeveer 2007). The Stockholm region case study suggests caution in assuming that adaptation efforts will grow spontaneously from the bottom up.

Conflicting goals: The perceived conflict between adaptation and mitigation from an early stage in the international policy discussions has played a major role in delaying discussions about adaptation at the international level. Even if there is no equivalent outspoken political dispute at the local level in Stockholm, a strong Swedish national priority on mitigation (following the international discourse) appears to have cemented mitigation as the primary climate change concern. The Stockholm case study, along with surveys of other Swedish actors, shows that it is only recently that adaptation has gained a place in the policy debate.

While there is a demand for networking opportunities and more locally relevant information about climate change, the empirical study of the Stockholm region indicates that supporting such initiatives is not likely to be sufficient because conflicting goals may still be a major barrier to future adaptation planning and action. These conflicting goals are expressed in relation

to short-term budget thinking and lack of time because more immediate concerns are perceived to need to be addressed. A common feature of the conflicts at the global and local levels is the difficulties in handling short-term and long-term time perspectives at the same time, even if the specific short term priorities are different in nature. These competing goals suggest that there may be a need to create opportunities for social learning that include actors with diverging interests and different perspectives also at the local level. This would be much more heterogeneous groups of people than those who were represented in the Stockholm regional case study, and will most likely need to involve private actors and local politicians, along with local planners.

A final conclusion from this study is that there is a need for arenas for social learning about *local* climate adaptation that embrace more than sharing of knowledge and which have enough diversity among participants to be able to address conflicting goals. Adaptation is often framed as a local or possibly regional concern (Klein et al. 2007), yet it appears that local planners are also strongly influenced by the international discourse (i.e. the emphasis on mitigation) and dependent on national developments. In studies of complex social-ecological systems, interactions among processes at different scales have been shown to play a role in systemic changes; hence research on social learning about climate adaptation would benefit from more attention to the vertical linkages in the governance system. Another policy priority is to find ways that would make local progress less vulnerable to national and international dynamics, e.g. by promoting shadow systems. Such shadow system would be a way of providing diversity in the governance systems, which has been shown to be important for the resilience of social-ecological systems (Norberg et al. 2008).

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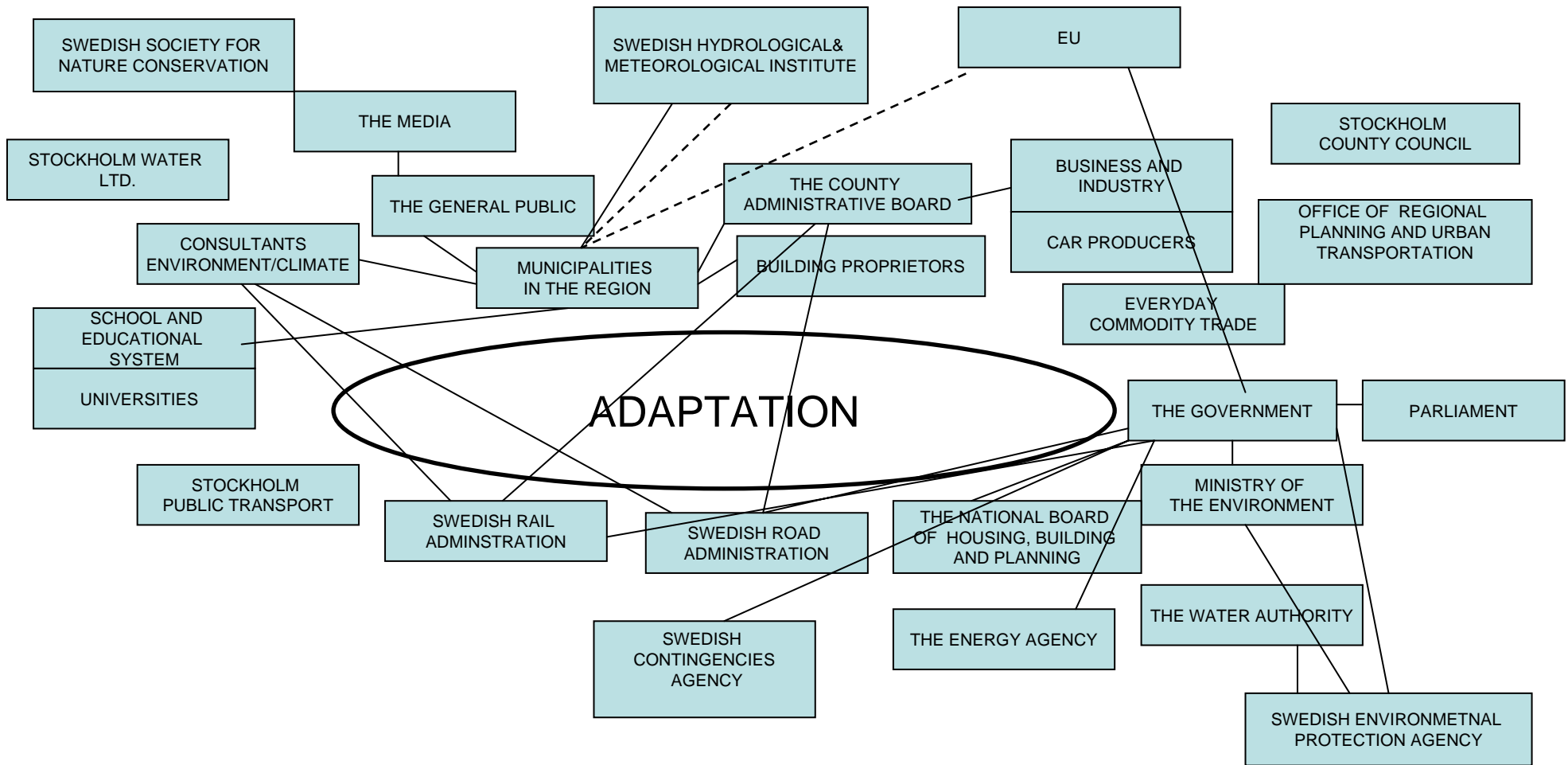


Figure 1. Map of stakeholder groups identified by Group A as relevant for the adaptation work in the Stockholm region. The proximity to the "Adaptation circle" corresponds to the perceived level of importance of actors for future adaptation efforts. The actors are also clustered on the basis of their general level of cooperation with each other. The lines represent established collaboration considered relevant to local adaptation action whereas the broken lines reflect the group's concerns about "too weak" collaborative links (October 2008).