



Social Learning about Climate Adaptation: Global and Local Perspectives

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SUMMARY

Solutions to contemporary environmental challenges will require dialogue and learning among stakeholders with different perspectives. Moreover, improving the potential for social learning can be seen as a strategy for meeting the inherent complexity and uncertainty of 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 SEI Working 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. It focuses on conditions that have been shown to influence social learning in other areas, with special attention to “boundary organizations”; arenas for bridging across perspectives at different scales and levels of governance; “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 have enough diversity among participants to be able to address conflicting goals in addition to sharing knowledge. It also suggests that research on social learning would benefit from more attention to influences across governance levels.

1. INTRODUCTION

It is 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 2007:8) 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).

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 and Wandel 2006). The IPCC’s definition of adaptation adds more detail: “Adjustment in natural or *human systems* in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007:869). The focus is not on individual actions to adapt to climate change but on the context in which individuals are acting. An example could be a municipality, including its physical and social structures.

The framing of adaptation has evolved over time. The initial focus was on model-based impact studies. More recent research also addresses vulnerability and adaptive capacity (Smit and Wandel 2006). Studies on adaptation policies have also started to emerge (Füssel and 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 and 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 and Leichenko 2000).

The insight that vulnerability and adaptive capacity are the result of complex interactions suggests that adaptation to climate change should be viewed as a challenge involving complex systems. 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 others. 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, societies tend to define environmental issues at specific scales. 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 the literature highlights are uncertainty and change, which may occur as difficult-to-foresee rapid systemic transformations (Norberg and 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. The need to manage conflicting perceptions among stakeholders and to bring about fundamental shifts in understanding and behaviour are central to the successful governance of many environmental challenges, including adaptation to climate change. This indicates that learning must be a fundamental part of such governance.

1.1 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 and Walters 1963). In the literature on environmental governance, studies of social learning have focused on collective entities (e.g. organizations), and also recently 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 working 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 literature on resource management and environmental policy, 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 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 at the national level, Gerger Swartling and Nilsson (2007) highlight that policy is formed in networking processes involving 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) have emphasized “learning to learn” as a possible way to deal with the increasing complexity of international society. The Social Learning Group has used similar ideas to analyze the factors and forces that have shaped the international environmental governance system from its early development in the 1970s, including questions about 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 and McCabe 2001) and their evolution, for example 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 change their perceptions of the problems in ways that can lead them to adjust their behavior.

Often there is an implicit assumption that social learning promotes better environmental governance. However, the direction of change should not be taken as a given as it will depend on the dynamics among the actors present. Moreover, the concept itself assumes no clear definition of "better," as the desirable direction of change will depend on the priorities of the participants and their perceptions of the environment. The inclusion of scientific actors can, for example, lead to the vulnerability of natural systems being highlighted, such as natural boundaries for current system dynamics. However, social learning processes can also serve to challenge a normative stance based on narrow knowledge from a few scientific disciplines by bringing other perspectives to the fore. Our assumption is that scientific actors also sometimes change their initial analyses through participation in social learning processes.

While early work on learning in international environmental governance focused on the interplay among scientific research and political actions, it typically stopped short of analyzing scientific knowledge production *per se* as part of this learning process. However, science and technology studies have 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 and Wynne 1998). Similar to the literature on co-management of natural resources, studies of policy-relevant science, such as environmental assessments, take an increasingly normative stance towards co-production. It is seen as essential for success in bringing science to policy that scientific knowledge is viewed as credible, legitimate and salient by a range of stakeholders (Farrell and Jäger 2006; Mitchell *et al.* 2006). Joint knowledge production becomes a means to this end. 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-off solutions and that many different perspectives need to be considered to find ways forward (Rittel and 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 affect underlying values, the literature emphasizes social learning as an on-going social process focused on dialogue and exchange that can incorporate knowledge from various perspectives and different social levels. Literature on local co-management increasingly emphasises knowledge traditions other than western science (Berkes *et al.* 2003; Reid *et al.* 2006; Berkes *et al.* 1998). The importance of recognizing the legitimacy of others' perspectives and interests is also revealed in social learning studies of local planning processes (Forster 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 for imaginative solutions. Analyzing the conditions for social learning can also help to highlight strengths and weaknesses in the design of a governance system in facing complex issues, where new ways of framing these issues may lead to improved policy and implementation.

2. MECHANISMS OF SOCIAL LEARNING

The conditions that have been shown to favour social learning include openness and transparency in decision-making processes; participation; dialogue; trust; and social networks that cut across various communities of practice. Studies of the mechanisms of social learning in co-management regimes, organizations, and assessments (Mostert *et al.* 2006; Pelling *et al.* 2008; Siebenhüner 2006) highlight several analytical themes that are relevant for investigating how social learning can support 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. These studies also highlight factors linked to institutional contexts, including the norms and social interactions that they foster. They include boundary management (Guston 2001; Miller 2001a), 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, for example 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 relevant for comparing the social learning potential in relation to climate adaptation at the international and the local 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 objects” involving participants from both distinct social worlds, and by being accountable to both spheres (Guston 2001). A boundary object is an entity shared by several different communities but viewed or used differently by each of them.”(Star and Griesemer 1989).
- 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:** Goal conflicts can refer to actors having different primary goals or that two or more goals in and of themselves are in conflict with each other. We focus on goals as perceived by the actors, although the distinction is not always clear since goals can be redefined and this redefinition is at the heart of social learning processes. 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, for example because of a change in how an issue is framed. Such reframing can sometimes be brought about by scientific assessments (seen as social processes rather than simply reports), especially if they are credible, legitimate and salient to the 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 working paper is if and how the current architecture of climate governance provides a potential for social learning that can facilitate climate adaptation. The analysis starts with a review of issue development at the international 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 setting.

3. 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 and Edwards 2001; Agrawala 1998a,b; Agrawala 1998; Bodansky 2001; Bolin 2007; Franz 1997; IPCC 2004; Nilsson 2007; Weart 2003). It can be roughly divided into three time phases: 1) pre-regime knowledge networking, 2) negotiating initial climate change mitigation, and 3) implementation of mitigation and refocusing on impacts/adaptation. Each phase has its own dynamics in relation to social learning and climate adaptation.

3.1 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. From a social learning point of view, the WMO can be seen as an early boundary organization. It was not immediately relevant to climate adaptation but set the stage for climate-relevant international research, for example in connection with the International Geophysical Year in 1957/58 and its focus on global biogeochemical dynamics, including the carbon cycle (Miller 2001b; Weart 2003).

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 climate 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 1998a; 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 perspectives of 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 by the wayside and instead led to the creation of the Intergovernmental Panel on Climate Change (IPCC) in 1988 (Agrawala 1998a). 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 cli-

mate 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 and Jacob 2005; Selin and 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 Framework Convention on Climate Change (UNFCCC) (Miller 2006).

Adaptation was not a major issue in the first phase of climate change policy and was framed mainly in relation to impacts and the limits of ecological tolerance, that is, 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 the 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). With the start of negotiations for a convention, the issue of adaptation fell away, 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.

3.2 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 was 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, *ibid.*), the first meeting of the Conference of the Parties, in 1995, requested the UNFCCC’s Subsidiary Body for Scientific and Technological Advice (SBSTA) to seek advice from IPCC on the development, improvement and refinement of methodologies on a number of specific topics. They included regional impacts of climate change and adaptation responses (IPCC 2004).

After the UNFCCC came 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 how the experts had very limited knowledge about farming practices. Even if recommendations from the IPCC brought growing 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 knowledge 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 (*ibid*), 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 and 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 (*ibid*) 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. It is an example of how social learning is also relevant for scientific knowledge production, especially in broadening the knowledge base and perspective.

Another probable impetus for the reframing of adaptation was a growing recognition that it would become necessary to adapt to climate change as the difficulties of reducing emissions of greenhouse gases became more apparent (Schipper 2006). Shortly after the IPCC’s 2001 report, adaptation emerged on the political agenda when 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.

3.3 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 policy discussions 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 climate mitigation grew rapidly, including cities and states setting emission targets that were more stringent than the international agreements (Bulkeley and Betsill 2005; Selin and 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 more dense map of actors and actor coalitions comes 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. Here, tensions exist between two views: the first sees adaptation funding as compensation for damage by emitters of greenhouse gases, the second as an integrated or mainstreamed component in official development aid (Klein and Persson 2008). The international negotiations thus still harbour many elements of a malign problem where conflicting interests are at stake.

What future arenas for social learning could the increasing international emphasis on adaptation open up? Some arenas may develop in connection with a line of research that Füssel and Klein (2006) have labelled “adaptation policy assessment” which aims at meeting the needs of planners and policymakers. A review of European national adaptation strategies is a case in point (Schwart *et al.* 2009). A related trend, also focusing on Europe, was evident at the Circle ERA-net Final and Outlook conference in September 2009. This research funding network activity is shifting its emphasis from impact studies to creating adaptation support for planners, including increased involvement of various stakeholders in the process of knowledge production (<http://www.circle-era.net/results/circle-final-and-outlook-conference/>). Another set of arenas will no doubt be created in the surge of capacity-building initiatives that have emerged 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 recent 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 (Keski-talo 2008; Smit and 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 researchers (Smit and 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. An example is an emerging Nordic network among adaptation researchers, based on Circle ERA-Net initiatives. The participatory methods in many current research efforts may help build legitimacy for climate science towards audiences at the local level and possibly also change the direction of scientific inquiry. 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.

4. 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 relatively low adaptive capacity (Smith *et al.* 2003), adaptation will also become necessary in the developed world. In order to understand the opportunities for social learning about climate adaptation on the local level from the 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.

4.1 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, and the national level in Sweden, local climate-related activities have primarily been associated with mitigation, for example efficient transport and sustainable energy. At the national scale, some attention to adaptation needs came in connection with flooding events in 2000 and 2001 but the major shift came after extensive damage from two severe storms in 2005–2006. They provided strong impetus for a government-appointed commission on climate and vulnerability,

which finalized its assessment in the autumn 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 appeared at a time of increased attention to climate change in 2007, for example in connection with the IPCC reconfirming the 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 planners and decision makers in their efforts to adapt to climate change (Climatools, www.climatools.se).

The growing 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 ongoing 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 central parts of Stockholm. Sea-level rise may therefore influence flooding risks in the long run and could also affect Mälaren’s water quality through salt-water intrusion. Because Mälaren is the major drinking water reservoir for the Stockholm region, this is a major concern. Increased demands on water supply would compound pressures from the growing population in the region (Rudberg 2009).

4.2 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, see <http://www.mistra-swecia.se/>) has conducted a case study of adaptation in the Stockholm region. This 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; that is, actors that are likely to become affected by adaptation as well as those who determine adaptation efforts in the urban region. The issue in focus in the study 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 with 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. In the final meeting, all four stakeholder groups gathered to share their experiences and perspectives on climate adaptation efforts and propose future action on regional adaptation.

4.3 Preliminary results

The results from the participatory exercises (transcripts, questionnaires, stakeholder-produced material) show that, over the course of the process, stakeholders changed how they “framed” climate change and gained greater insight into the complexity of the factors affecting adaptation needs and options. For example, at the first meeting, most stakeholders only had vague notions of ongoing adaptation activities in the region and how these could become more effective. Prior to the case study, it appears that climate change discussions in the organizations represented by the stakeholders tended to focus on mitigation strategies, and many of them did not have formalized adaptation policies. However, most participants did clearly recognise that their work relates to adaptation strategies. They also viewed climate adaptation as an issue of immediate importance and one which their organisations should pursue.

The results from the final workshop indicate a sophisticated and pragmatic awareness of adaptation needs, barriers and opportunities that had not been apparent in the early sessions. In break-out groups, participants described how the urban region was performing on adaptation efforts, as well as what would be required to strengthen ongoing adaptation initiatives over the next 10 years. Another difference over time was a wider understanding of the organisational landscape concerning local climate adaptation efforts. At the beginning of the process, participants focused on their own organisations and those with which they already had close collaborations (e.g. neighbour municipalities). Towards the end of the process, mapping exercises revealed 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.

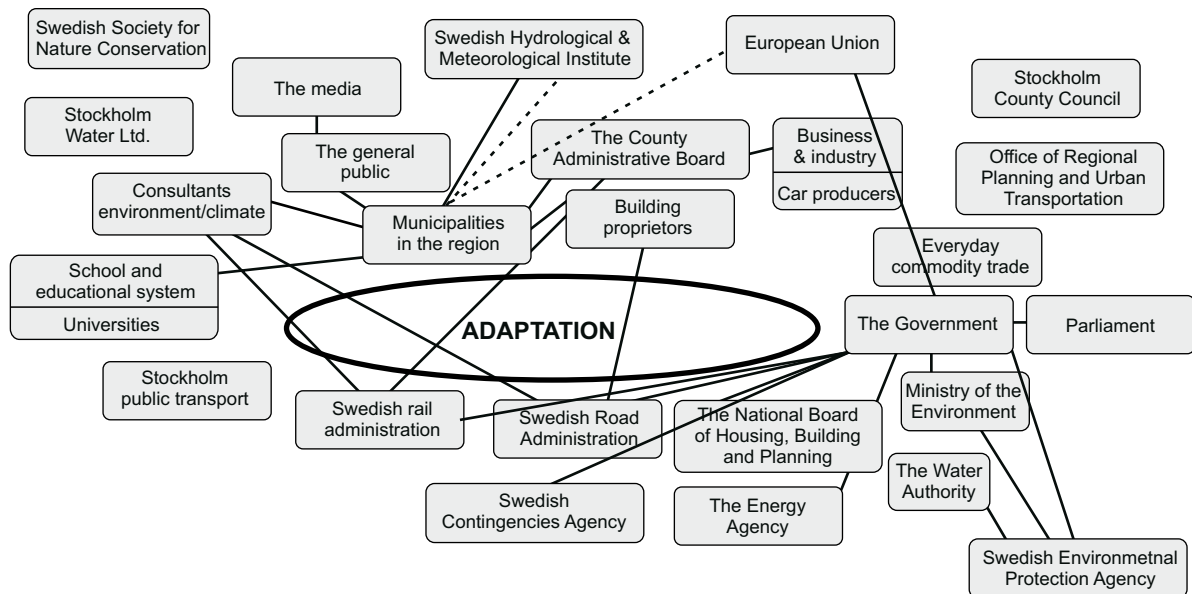


Figure 1: Map of stakeholder groups identified by Group A as relevant for the adaptation work in the Stockholm region. The proximity to the “Adaptation circle” corresponds to the perceived level of importance of actors for future adaptation efforts. The actors are also clustered on the basis of their 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).

One outcome relevant to horizontal and vertical integration of knowledge was a widely perceived need for a strong regional policy arena, where stakeholders could meet to exchange ideas and experiences and establish links across sectors and municipalities. Mapping exercises in the focus groups showed that links between local practitioners and regional organizations were very weak. Participants strongly expressed a desire for the regional governance level, i.e. County Administrative Board, to take responsibility for the overall coordination of climate adaptation in Stockholm County.

Most participants claimed that, to a greater or lesser degree, they had benefited from the scientific input provided during the process (i.e. results from climate, land use and hydrology models) and had suggestions for how such knowledge could be better adjusted to local planning processes. However, many respondents claimed they already had access to similar scientific data, and they typically remarked that such data would be of more practical use if it were given over shorter time scales, if the scenarios and diagrams were of a higher resolution, and if the data were explained more clearly.

Overall, the results from this process – along with the participants' wish that such meetings should continue – indicate that social learning opportunities at the local level can help to encourage stakeholder engagement in local adaptation to climate change. The process also helped to raise awareness about the need for adaptation action in the private and public spheres, as well as what kind of action should be taken. It also appears that such participatory learning exercises can enhance network building among municipal actors simply by providing a space for sharing knowledge and perspectives about ongoing and planned activities.

Each group consisted of participants with similar professional roles and organizations at the same governance level. Calls for more engagement at the regional governance level may indicate a void in the current governance system. 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 many 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. In response, a government bill presented in March 2009 included new roles for regional level government (Swedish Government Bill 2008/09:162). The next Regional Development Plan for the Stockholm Region (according to a version of the plan under consultation from June 30 October 2009), does include a focus on adaptation to climate change. It places particular emphasis on avoiding further risks when making long-term infrastructure investment; mapping risks and enhanced risk management; and using municipal planning processes to prevent new housing in flood-prone areas. The plan highlights the responsibilities of municipalities in ensuring that further risks are not “built in” to society (Office of Regional Planning and Urban Transportation 2009). The fact that the plan clarifies the roles of various actors and calls for increased awareness paves the way for new arenas for social learning among local actors in the Stockholm region. The positive outcomes of the Mistra-SWECIA case study point to a potential for these arenas to help increase stakeholder awareness about and commitment to climate adaptation in the Stockholm region in coming years.

In contrast to the discussions in the international climate regime (see above), the preliminary results from the Stockholm region case study show that there was no shadow system at the local level that has brought climate adaptation work forward to compensate for the lack of national and regional recognition of the need to plan for adaptation. In Sweden, the municipalities have power over many questions that are relevant to adaptation, 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 revealed at the outset of the Stockholm case study. However, lack of ownership and power over specific decisions was raised in the group discussions. For example, planners claimed that they cannot steer building design and other adaptation-related decisions where the power rests with businesses or individuals.

The role of conflicting goals among the various actors is difficult to judge from the participatory process because the groups were rather homogeneous. However, comments from participants highlighted that “short-term economic growth thinking” often conflicts with long-term adaptation goals.

Moreover, in rating the factors that affect adaptation action, short-term thinking and political priorities, along with the economy, were often listed as barriers to adapting to climate change. (Here the term “barrier” refers to a problem that the participants saw as impossible to overcome.) This highlights a perceived conflict between economic development and climate adaptation in the context of a highly developed country, as well as a need for local social learning arenas in which they can be addressed.

5. CONCLUSIONS

Below we summarize and discuss the main findings of the global and local case studies by applying the three analytical themes: bridging and boundary organizations, shadow systems, and conflicting goals.

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 co-production of science and knowledge. Rather, the international discourse cemented a framing of climate change as mainly a global concern, and there appears to have been a substantial inertia before local perspectives have entered the knowledge base. The IPCC’s work on linking vulnerability and adaptation, especially its 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 has not carried over to the local level in Sweden. In fact, concerns about adaptation needs did not emerge in the national public debate in Sweden until 2007, with the publication of the the government-commissioned assessment on climate and vulnerability. . The Stockholm case study instead shows that there is 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’ mapping of actors that are relevant in the local adaptation work, links to scientists are very weak. Moreover, the stakeholders did not view the global governance level (i.e. IPCC and UNFCCC) as relevant to them. Rather, it seems that local action mainly depends on national priorities, activities and incentives, and that the lack of a clear signal from the national government, or its regional representation in the County Administrative Board, partly explains the inertia in the local adaptation process. The main connection between local level actors and international discourse appeared to be via the media and the issues it chooses to highlight (e.g. high attention to climate change in 2007).

Shadow systems: In relation to the politicized discussion in the UNFCCC the IPCC appears to have served as a shadow system for developing knowledge about adaptation. In contrast, the Stockholm case study suggests that the Swedish governance system has not created space for a shadow system that enables local actors 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 case study suggests that the general lack of awareness in the population and among politicians, along with a perceived need to prioritize other tasks, 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 and Betsill 2005; Selin and 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 stemming from the early stages of international climate policy discussions has played a major role in delaying discussions about adaptation at the international level. Even if there is no equivalent political dispute at the local

level in Stockholm, a strong emphasis on mitigation at the national level (following the international discourse) appears to have cemented mitigation as the primary climate change concern. The Stockholm case study, and surveys of other Swedish actors, show that it is only recently that adaptation has gained a place in the Swedish policy debate.

The case study revealed a demand for networking opportunities and more locally relevant information about climate change. However, the study also indicates that support for such initiatives alone is not likely to be sufficient for future adaptation planning and action, because conflicting goals are likely to remain a major barrier. 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 conflicts at both the global and local levels is the difficulty in handling short-term and long-term time perspectives simultaneously. The perception of competing goals as a barrier suggest that there is also a need at the local level to create opportunities for social learning that include actors with diverging interests and different perspectives. These opportunities would need to involve much more heterogeneous groups than those who participated in the Stockholm regional case study (e.g. private actors and local politicians along with local planners).

In summary, the case study shows that there is a need for arenas for social learning about *local* climate adaptation that embrace more than knowledge sharing 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 priority is to find ways that would make local progress less vulnerable to national and international dynamics, for example by promoting shadow systems. Such shadow systems would be a way of providing diversity in the governance systems, which is important for the resilience of social-ecological systems (Norberg *et al.* 2008).

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