



## Stakeholder Perceptions of Climate Change in the Baltic Sea Region

Klaus Eisenack<sup>1</sup>, Vera Tekken<sup>1</sup> and Jürgen P. Kropp<sup>1</sup>

<sup>1</sup> Potsdam Institute for Climate Impact Research, Germany

### Abstract

The project “Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region” (ASTRA) assesses regional vulnerabilities to climate change and aims for developing adaptation options. To determine whether the participating municipalities are prepared to climate change, this study investigates stakeholder perspectives and knowledge in multiple case studies. Based on a qualitative survey, institutions perceived to be relevant as well as climate change impacts and exposure units were collected. Institutional failures are identified. While factors constraining adaptation are found more on the local level, enabling factors are seen at higher levels. Most importantly, climate change is not a priority issue on the municipal level. Respondents have difficulties in identifying concrete susceptibilities and response options, leaving the impression that many municipalities are not prepared to climate change. This is due to uncertainties, but also to missing frames of reference, indicating that many municipalities are at an early stage of awareness. Current priorities should be given to knowledge transfer and communication processes. The study further indicates that most actions happen on the mitigation part. This contradicts state-of-the art theory on adaptation such that the study gives impulses for future research.

### 1. Introduction

Climate change is a global problem with varying regional impacts. It is widely accepted that anthropogenic climate change is a fact and that even strict mitigation efforts will not be sufficient to avoid significant impacts of climate change (cf. IPCC 2007a). It is therefore urgent to complement measures against the causes of climate change with measures to cope with its adverse effects (cf. STERN 2006, PIELKE ET AL. 2007). Coherent adaptation measures are yet of minor importance in the global context of climate change, e.g. in the Kyoto Protocol. Strong difficulties exist in the attribution of specific weather related events to climate change. Yet river floods, storm surges, and droughts are in the main focus of decision makers and it is very likely that their intensity and frequency will increase further. The capacity to cope with damages depends on administration and infrastructure, economic prosperity, and further factors as e.g. already institutionalised management structures to adapt to those singular events. Every country has particular experience with natural hazards and therewith different emphasis on impacts and action, but adaptation strategies to climate change are weak due to several obstacles.

The INTERREG III B project “Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region” (ASTRA, cf. SCHMIDT-THOMÉ ET AL. 2007)<sup>1</sup> represents the background for the study presented in this paper. It involves local case study regions in Finland, Latvia, Estonia, Lithuania, Poland and Germany. The aim of the ASTRA project is to raise awareness on climate change, and to develop transboundary and coherent adaptation policies. Based on the distinction between *mitigation* and *adaptation* this paper intends to find answers on the current state of adaptation to climate change in municipalities in the Baltic Sea Region (BSR). According to the definitions of the Intergovernmental Panel on Climate Change (IPCC), *mitigation* means all efforts to reduce or avoid climate change from its causes, in particular by reducing greenhouse gas (GHG) emissions. In

<sup>1</sup> Project co-financed by the European Union within the BSR INTERREG III B programme. See: <http://www.bsrinterreg.net/> and <http://www.astra-project.org>

contrast, *adaptation* refers to adjustments in social behaviour (e.g. improvement of flood defence infrastructure) to reduce adverse consequences associated with climate change (SMIT ET AL. 2000).

Consequently, the study explores whether municipalities in the BSR and local responsible actors are prepared to adapt to climate change. Knowing to what extent municipalities in the BSR's coastal zones are capable to face this challenge is essential to understand the dimension of the climate change problem. The most vulnerable settlements are generally those in coastal plains, which are exposed to land loss and coastal erosion. In Europe, anticipated future impacts include more frequent coastal flooding due to sea-level rise and storminess (IPCC 2007B). For the North Sea coast an intensification of storm surges is expected by the end of this century: scenarios and models show "*that extreme wave heights may increase by up to 30 cm [...] by 2085*" (WEISSE & GRABEMANN 2007).<sup>2</sup> Previous projections on global mean sea level rise (IPCC 2001) were lower than the actual observed rise and therefore "*a rise of over 1 m by 2100 for strong warming scenarios cannot be ruled out*" (RAHMSTORF 2007). The coastal zone deserves special attention, also because of its density of urban areas and its economic and social functions. Worldwide 352 million people live in coastal urban areas less than ten metres above sea level (McGRANAHAN ET AL. 2007). This knowledge alone does not at all imply solutions. Vulnerability assessments are often performed to inform policy makers where potential hot spots of action might be in the future (e.g. KROPP ET AL. 2006). They link impacts and adaptation, but they do not provide adaptation strategies per se. The building of coastal protection infrastructure, population retreat from the coastal area, or other strategies are conceivable, but their usefulness and implementation depend on the specific local characteristics as well as the preparedness and knowledge of the responsible actors. In particular, policy and decision makers often argue that scientific information is insufficient to set up adequate interventions. From the very beginning of the project there was a strong demand for more concrete information. To provide adequate information and to identify potential knowledge gaps, we want to evaluate stakeholder demands from science and their ability to process such information, being a crucial component of the preparedness to adapt.

This study presents a qualitative assessment of local and regional stakeholder perceptions and frames on climate change adaptation, including impacts, exposure units, actual or potential responses as well as constraining and supporting factors for adaptation policies. It is aimed to reveal priorities of the respondents, their problem framing and knowledge level concerning climate change, all being a pre-requisite for adequate adaptation. Theories of learning suggest that the interpretation of perceptions, being closely linked to stakeholder frames, is the entry for adaptation to climate change (e.g. BERKHOUT ET AL. 2006). The local and regional focus is considered important here, since adaptation strategies evolve from regional experience - their implementation and feasibility crucially depends on the regional level. While other studies focus on structural obstacles to local policy processes and on public participation for developing adaptation options (e.g. BROWN ET AL. 2007), we concentrate on assessing the perceptions that form the basis for local discourse. BEHRINGER ET AL. (2000) make a representative survey on reactions of stakeholders to proposed climate impacts. In contrast to that our approach is qualitative and refrains from proposing certain scenarios. This is necessary to determine e.g. the degree of awareness and whether climate change is framed as mitigation or adaptation problem.

The next section introduces the methodology. Then the results on stakeholder knowledge and framing are presented. This provides the basis for a discussion where the results are contrasted with expectations from theory. We conclude with suggestions for action on the municipal level.

---

<sup>2</sup> To our knowledge there exist no comparable studies for the BSR.

## 2. Methodology

The qualitative research design of the study took advantage of a modified grounded theory approach (e.g. STRAUSS AND CORBIN 1990) and was created for multiple purposes. The main objective is to establish a basis for the development of adaptation strategies by assessing the state-of-the-art in local climate protection, stakeholder problem framing and knowledge on climate change. It should identify basic adaptation needs in the BSR in an explorative style and aims to formulate working hypotheses and entry points for further scientific work and for planning and development of new instruments. More basically, revealing how stakeholders perceive climate change is deeply related to problem awareness, being necessary condition for municipalities to adapt.

The study objectives aim at discovering views of participating stakeholders that cannot be hypothesized by theorists from the onset. We had to expect that there is a very diverse knowledge about climate change impacts, about adaptation and mitigation strategies, and about the (un)certainty of climate projections. The method consequently needs to capture a broad range of different cases but not to discover general features common to all cases. Instead of drawing conclusions from the frequency of certain responses, it is meant to generate hypotheses which lead to further research; hence a qualitative approach is indicated. Therefore, a semi-structured questionnaire was developed comprising a set of seven thematic subject categories. The conceptual base of the questionnaire was developed following the Environmental Impact Assessment (EIA) and the DPSIR (Driver – Pressure – State – Impact – Response) framework (OECD 1993, EEA 1999). This approach offers a relatively easy accessible and established terminology. Put into this framework, climate change refers to changes of the *state* of average meteorological properties (e.g. temperature, precipitation). This is distinguished from *impacts*, being the consequences of a changing climate state influencing society and the environment (people, species, institutions, firms etc.). All potentially affected objects, systems or beings are subsumed under the term *exposure unit*. *Responses* refer to planning procedures, policy options and other societal reactions to impacts and climate change. The terms ‘adaptation’ and ‘mitigation’ were only mentioned in the cover letter as we were interested whether respondents are aware of this distinction. The first section of questions concentrates on the impacts stakeholders find likely to occur, and on potentially affected exposure units. The second section focussed on already existing (or potential) responses. This was complemented by questions related to more general policy objectives, to supporting and to constraining factors. The latter concepts are modified versions from the SWOT method in policy analysis (HOUBEN ET AL. 1999), which establishes opportunities and threats for proposed policy instruments. Questions on constraints and supporters aim at identifying basic strategic conditions that have to be taken into account for the development of adaptation strategies. Further questions were related to knowledge demands from science. A final section gave the opportunity to deliver background information on the case study areas<sup>3</sup>.

Due to the qualitative approach and the embedding of the study in the ASTRA project, the case selection included all participating stakeholders. The questionnaire was distributed among 34 project partners (scientists and stakeholders from various institutional levels). Finally, 15 answers were retrieved. The respondents are located in cities (Gdansk, Espoo, Riga, Hamburg, Klaipeda, Kokkola, Neringa, Pärnu, Tallinn, Warnemünde), regional (Salaca River Basin, Pirkanmaa) or national institutions (Sweden, Estonia).

The grounded theory approach was used to make the variety of problem patterns and responses comparable at an adequate level of abstraction (EISENACK ET AL. 2006, 2007). The coding procedure was modified not to be completely open, in particular because the semi-structured questions gave first structural pre-qualifications. To cluster the large number of codes we use the following abstract categories: built environment, natural environment, economic sectors, actors and institutions, impacts and states.

---

<sup>3</sup>See EISENACK AND KROPP (2006) for the questionnaire and the email letter to the interviewees.

### 3. Results

#### Institutions, Impacts and Exposure Units

The foci of the partners and the particularities of the case studies are very diverse.<sup>4</sup> The responses provide a broad set of institutions somehow relevant for climate change. From the theoretical viewpoint, institutions are the social rules governing the behaviour of multiple actors, such that e.g. a planning office (an actor) has to be distinguished from the planning regulations. However, when we speak of institutions in this section, we also mean actors, since it was not always possible to make this distinction from the responses. The variety of institutions can be systematized along several dimensions. One obvious dimension is the scale, to distinguish local, regional, national, European and international level institutions.

Exposure units are roughly characterized in *Tab. 1*. Compared to institutions, the heterogeneity of terms is smaller. Most exposure units are presented in a general way not making reference to local particularities. The view on the economic sectors is mostly generalized, e.g. particular companies were not mentioned. In many cases, they are only provided in a very unspecific way (e.g. “ecosystems”, “economy”, “economic losses”, “companies”, etc.), one extreme example being “all sectors and activities”. This leaves the impression that exposure units were not derived from particular local problems or experience, but from causal reasoning or lay knowledge. We hypothesize that stakeholder intuitions about exposure units are not well-developed in many cases.

*Table 1: Selected exposure units collected from the responses.*

	<b>Exposure Unit</b>
<b>Built environment</b>	Buildings and urban area in general, in particular buildings near the shore, cultural heritage, heating (energy demand depending on temperatures and housing conditions), infrastructure (shore infrastructure, water supply systems, coastal protection, communication, transportation and technical infrastructure, waste dumps)
<b>Natural environment</b>	Ecosystems in general, in particular coastal ecosystems, beaches, shore meadows, municipal parks, rivers
<b>Economic sectors</b>	Economic and material losses in general, tourism, forestry, transportation (roads, sea transport, ports, airports), energy utilities (transmission lines, hydro power, renewable energies, demand for heating energy), agriculture, fishery, industry, water utilities (groundwater, water supply)
<b>Institutions and further actors</b>	Inhabitants and private households, public health, coastal management authorities, local administration (and local budgets), spatial planning authorities

The list of impacts collected from the questionnaires is relatively small compared to the other lists. This may be caused by a relatively limited amount of distinguishable weather events of climatic stresses. However, some of them refer to very specific impacts, indicating that respondents might have concrete ideas or experience in mind. On the other hand, not all mentioned impacts are related to climate change. It is also not straightforward to disentangle impacts from changes in the climatic conditions. Many respondents phrased them in a way that does not allow for separate categories. We distinguish the impacts by their relation to climatic or physical variables (see *Tab. 2*).

The collected institutions were more closely refined by distinguishing those which are estimated as constraining or supporting adaptation policies (see *Tab. 3* and *Tab. 4*). Some constraints point to local interactions between various actors which may hinder the implementation of adaptation policies (e.g. “opposition against building restrictions”, “interest of buildings near streams”, “unions of industry, agriculture and employees”). Others confirm the observation that climate change is currently not a priority issue on the local or regional level (e.g. “climate change is not a priority”, “lack of human resources and knowledge”, “stained municipal budgets”). Finally, some constraints seem to be related to the specific situation of new EU member states.

<sup>4</sup>

For a complete list of codes and quotes see EISENACK AND KROPP (2006).

Table 2: Climate change impacts collected from the responses.

Climatic condition	Selected impacts	
<b>Temperature</b>	Increasing temperatures, e.g.: Less frequency of winter frost, mild weather in winter, less cold winters, winter is shorter, increasing of summer temperature	Extreme temperature events, e.g.: Heat waves, increasing temperature of sea water, decrease in sea ice cover
<b>Precipitation</b>	Overall increase, e.g.: more water in reservoirs, changed water supply, heavy rainfall, increase of precipitation in winter, decrease in summer	
<b>Temperature and precipitation</b>	Droughts, changing growth conditions, e.g.: lengthening of growing season, hibernating of plants is harder; less snow	
<b>Temperature, wind and precipitation</b>	Changes in winter humidity and summer aridity; eutrophication, e.g.: shift in nutrient loads, public health	
<b>Wind</b>	Storms, e.g.: more frequent and stronger storms, thunderstorms, hurricanes	
<b>Sea level</b>	Loss of land	
<b>Sea level and precipitation</b>	River floods, e.g.: flash floods, changes of [groundwater] salinity	
<b>Sea level, wind and waves</b>	Storm surges, e.g.: height and frequency of storm tides	
<b>Sea level, wind, precipitation and waves</b>	Erosion, e.g. costal erosion, land slides	

Table 3: Selected constraining factors collected from the responses.

Level	Selected constraints
<b>Local</b>	Local interests are more important than global
<b>Local and/or regional</b>	It is necessary to work out recommendations on building, measures and recommendations on construction of buildings to prevent heavy consequences of storm, deficiencies and mistakes of operating of crisis-committee and its divisions
<b>National</b>	National policies [...] inadequate responses to the threats of climate change, gaps in legislation [...] different interpretation of what is allowed or what is not
<b>Local to national</b>	Lack of finances (climate change is not a priority in many cases), lack of human resources and knowledge, weak integrated coastal zone management
<b>Informal</b>	Lack of relevant information, uncertainty of research results on the issue of climate change provides uncertainties in the discussions for investments in better infrastructure, vulnerability of different economy sectors, social sectors, ecosystems for climate change is not fully evaluated
<b>Economic sectors</b>	Business on county and local authority level (i.e. opposition against building restrictions), interest of buildings near streams and lakes, fishers, insufficient insurances, unions of industry, agriculture and employees
<b>Further</b>	Problems related to development of democratic society, spatial development planning system itself is at the development phase that means frequent alterations in legislation, missing strategy of development

Additionally, compared to formal institutions, more diverse informal institutions were mentioned. This may be attributed to the current state of local adaptation policies, namely that they are in most cases not yet in an implementation phase, but at a stage at which the mere necessity of such policies has to be established. It may also be more deeply rooted as a kind of non-explicit barrier to communicate about adaptation options. This hypothesis is confirmed by the fact that also formal institutions are often only described in a vague way (e.g. *“national policies [...] inadequate responses to the threats of climate change”*).

We made similar observations on the supporting side. Many vague or general statements were made and many informal institutions were mentioned, for example related to knowledge transfer. The latter result is in line with a strong demand from climate research to provide a huge amount of information that was expressed by the respondents. On the other hand, there are also some exceptions of relatively concrete (strategic) supporters (e.g. *“coastal protection authorities”*), in particular on the economic side (e.g. *“Swiss Re, Shell”*), which are partially related to sectors that could be potential exposure units (e.g. tourism, transport, *“refinery”*). Many of the more explicit institutions are related to mitigation measures (e.g. *“the objective to reduce the emissions”*, *“supra-national pressure”*). In contrast to that, more concrete adaptation-related supporters are integrated in other policy sectors (hazard management, coastal protection, spatial planning, and environmental objectives).

Table 4: Selected supporting factors collected from the responses.

Level	Selected supporters
<b>Local</b>	City of [...] office
<b>Local and/or regional</b>	Local planning instruments, compilation of territorial planning process [...] reducing conflicts between different interest groups, upgrading of meteorological, hydrological, rescue etc. services, the status of the National Park helps to release the environmental initiatives
<b>National</b>	state government, national environmental objectives, adaptation: support (financial, information) from the federal level, the objective to reduce the emissions
<b>Local to national</b>	Political parties in national level, coastal protection authorities
<b>Informal</b>	Academic and research institutions, international recognition of climate change impact importance and need of its mitigation, visible and tangible impact of climate change can strengthen public attention and pressure on decision-makers, improvement of education system, particularly for the people involved in planning and making decisions, efficient regional and global cooperation
<b>Economic sectors</b>	High oil prices, engagement of multinational companies (Swiss Re, Shell), tourist sector, fishers, possibility to minimise losses caused by storms stimulates investments of harbour.
<b>Further</b>	Active work of NGOs, financial support on the same [EU] level, mitigation: supra-national pressure.

The comparison of constraining and supporting factors indicates that problems are rather found on the local scale, while concrete enabling forces are more biased to higher levels. It is likely that there is a shift of responsibilities to higher institutional scales. Several reasons may explain this: (1) Since most respondents are situated at the local level, they are more familiar with the local problems while from higher level preferably positive influences are noticed. (2) Constrained municipal budgets, limited human resources on the local level and the high degree of capacity needed for climate related issues hinder implementation, while resources, framework legislation and information from the national or European level have a positive impact. (3) Local conflicts of interest and a closer relation between local administration and their electorates favour myopic compromises over long-term goals. It can be observed that the diversity of answers is lower in the case of “supporters” than for “constraints”. And as supporters (on higher institutional levels) are defined more concretely, this could also be interpreted as a pessimistic view on the chances to implement climate change policies on local levels.

### Problem Framing

Problem awareness about climate change is primarily framed by the potential impacts that may affect the case study regions. However, on the local level only little attention has been paid to vulnerable exposure units and for policy responses. This conclusion is supported by the observation that many institutions mentioned were not specifically aligned (e.g. “local government”), rather vague (e.g. “politicians”) or informal (e.g. “necessity of cooperation on the regional or national level”) and is well confirmed by the generalized notions of exposure units used by the interviewees (e.g. “economy”). In this regard we assume that stakeholder intuitions are still very vague concerning local exposure units, while there is enough tacit knowledge and attention to formulate vulnerable sectors in an abstract way. In other words, there seems to be little concrete knowledge about whom or what is potentially affected by climate change impacts.

Climate change is mainly seen as mitigation problem, while adaptation issues are vague, unclear or difficult to structure. Questions on constraints and supporters typically provide informal institutions - responses on rather formal institutions relate to mitigation measures (e.g. “promotion of renewable energies”) and to the national level (e.g. “the objective to reduce the emissions”). The latter is, again, associated with renewable energies and international commitments. Adaptation strategies are mainly put in less concrete terms or are integrated into other policy sectors. There seems to be little strategic knowledge on actors and institutions that support or constrain adaptation to climate change. To sum up, next to the problem awareness framed in terms of mitigation measures, primal attention is paid to

climate change in the form of expected impacts and in the form of “soft factors” such as missing knowledge, inaction and bad coordination of various actors.

#### 4 Discussion

This paper started from the question whether current institutional capacities of local communities are adequate for adaptation to climate change. Standard economic considerations suggest that local institutions are better prepared to adapt to climate change than to mitigate. This expectation is rooted in the argument that mitigation is a contribution to a global public good, such that there are incentives to be more reluctant due to the free-rider problem. This is different for adaptation where both costs and benefits are local. If this were true, there should be a broader knowledge about exposure units than on mitigation responses or at least well-developed communication and learning processes for adaptation.

The results of our qualitative analysis show the opposite: most concrete options to react to climate change mentioned by the respondents refer to *mitigation* of future climate change. This shows that there is already a “kernel” of basic problem awareness and a feeling for the need to take action, but mainly related to potential impacts and international mitigation policies. Knowledge about exposure units and adaptation responses is not very distinctive. Many interviewees point only vaguely towards soft instruments, e.g. education or communication. Little has been done in concrete terms. The difficulties in describing concrete supporting and constraining factors underline that adaptation options currently are not framed clearly. Since this contradicts theoretical expectations it is worth speculating about potential causes in order to provide insights about political consequences and necessary future research. In the following we formulate three hypotheses about obstacles and chances for the development and implementation of adaptation policies on the local level.

(1) Adaptation is more difficult and more complex than mitigation. Standard economic analysis may ignore subtleties such as the fact that also mitigation measures have to be implemented locally (e.g. thermal insulation of public buildings), that adaptation can be a public good (e.g. improving road infrastructure safety against extreme events), and that strong adaptation efforts of one actor may strategically increase the need for adaptation of other actors. Moreover, there may be higher (social) entry costs for adaptation to climate change, involving extensive efforts in capacity building, as the following argument suggests. Mitigation is associated with, e.g. techniques for low-emission energy production - such options are quite common and there is wide-spread knowledge. The network of involved actors in mitigation, in particular energy utilities, is more simply structured than that of involved actors in adaptation, since the latter is (to more or less degree) relevant in all social, political and economic sectors. While many actors relevant for GHG mitigation are able to make qualified or expensive organizational and engineering investments, a lot of small and heterogeneous actors which have to decide on adaptation do not have this capacity (KLEIN ET AL. 2005). Finding adequate solutions or coping strategies for multiple interconnected sectors on different scales or spatial units entails heterogeneous targets. More generally, impacts of climate change potentially cause a wide range of concomitant effects which are not always connected with particular impacts in an obvious way. Finally, due to the inertia of the earth’s climate system mitigation doesn’t have a short-term effect on atmospheric concentration of GHG’s, hence long-term strategies are essential. This is usually provided as an argument in favour of adaptation strategies, when it is claimed that short-term reactions to extreme weather events as well as mid-term reactions when it comes to, e.g. sea level rise, are needed. However, short-term decisions require strong commitments, while for long-term targets actions can be easily postponed.

(2) The current structure of local institutions relevant for climate change adaptation hinders adequate learning. “*Solving growing global environmental problems [...] requires institutional changes*” (BREIT AND TROJA 2003). So far institutional structures and functions are based on experiences already made. Knowledge might be adopted from other organizations or institutions and knowledge accumulation is learning (CHAKRAVARTHY ET AL. 2003). But adequate learning may be hindered by unknown vulnerabilities and exposure units as well as by the lack of cooperation and communication between

fields of institutional activities and responsibilities. Current structures are not cooperatively aligned to the challenges of climate change which is a cross-sectoral phenomenon. As far as adaptation on the local or regional scale is concerned, many sectoral policies and institutions are affected by changing climatic conditions, e.g. when spatial planning considers risk levels for certain areas and other administrative bodies are responsible for flood protection. Private organizations may observe current or future impacts of climate change, such that there is a need for adequate learning in the sense that they need to adjust institutionalized decision-making and information-providing procedures in an appropriate way. If this is not the case, it may be caused by inflexible institutional structures or communication failures. For example, certain fields of adaptation can stay beyond established responsibilities, and for changed requirements new responsibilities might become necessary. This is hindered if their establishment contradicts other existing procedures (e.g. legal constraints) or invites for shifting them between different organizations. There also might be the case that although the need for change is clearly perceived on the lowest level (e.g. by harbour officials or farmers), there are no communication channels to those institutional levels that could take action, as the latter do not perceive the problem.

(3) The current framing of climate protection hinders adaptation. Political communication about the need of an adequate adaptive management depends inter alia on the willingness and credibility of political actors and the availability of comprehensive and tangible options. Agenda-setting for adaptation requires decision makers to frame the issue in a way that addresses vulnerabilities to climate change. However, the public discourse on climate change in the recent years concentrated mainly on the causes of atmospheric concentration of greenhouse gases and their impacts for the earth's climate system. Further reasons may have shaped this framing: first, the difficulties of adaptation outlined in hypothesis (1), and that the media informs comprehensively about mitigation options. This eases the communication of targets and decision-making with respect to mitigation due to a positive public image. In contrast, established regional scenarios and estimates of potential impacts and losses are not easily available. Second, giving mitigation a higher priority may be more close to the public expression of justice that those who cause damages are responsible for actions to hinder further harm (as the success of the "polluter pays principle" shows). Third, all countries have more or less well-rehearsed institutions to deal with the impacts of climatic or weather-related events (e.g. flood protection). Although there are strong clues that central procedures in these institutions need to be changed under an accelerated global warming (e.g. extensions of extreme value statistics, KALLACHE ET AL. 2008), organizations dealing with the impacts and responsible for e.g. compensatory measures are embedded in national policies. In this respect, reducing damages from extreme weather events is not captured by a climate frame, but a hazard frame. Adaptation therewith is not new, but confronted with new exposures and the need of bundling functions and to generalize adaptation options for more effectiveness and exchange of experiences. Fourth, the need to discuss adaptation to climate change is more difficult to establish when other structural problems are urgent (e.g. high rate of unemployment). Finally, urban actor networks may hinder adequate urban planning (cf. RECKIEN AND EISENACK 2007), and power elites may be able to prevent adaptation from being put on the agenda (HARDING 1995).

#### 4. Conclusion

All three hypotheses outlined in the discussion confirm the perception of many stakeholders in our study: *currently* there is a major need for "soft" instruments related to awareness raising, education and communication efforts, to provide local actors with the capacity to structure their perceptions, to clearly talk about the challenge and to set the agenda (3), to assign adequate responsibilities and to make relevant knowledge available (2), and to disentangle the complexities of adaptation (1). This supports the conclusion of ETKIN & Ho (2007) that adaptation also requires collective action on higher institutional levels. On the institutional level, BROWN ET AL. (2007) found more constraints to strategic coastal management than examples of good practice, which resembles our results about stakeholder perceptions on constraining and supporting factors. While such studies focus on potential adaptation

options for specified climate change impacts and on general obstacles (e.g. uncertainties, limited resources and misfit of timescales, see also BEHRINGER ET AL. 2000), we extend the perspective by explicitly focussing on the problem framing as a precondition for adequate adaptation. Based on the identified obstacles, we feel that it is a popular fallacy that policy making should mainly be based on quantitative findings from science, a fallacy that hinders adequate action. It might be of higher priority that stakeholders are enabled to apprehend coherences and the scope of the problem instead of science fulfilling demands for more concrete quantitative data or climate change scenarios. A precondition to “*shoulder responsibility for acting, take decisions*” are capacities of “*individual actors to identify environmental problems*” (ENGELS & MOSS 2003). The current situation may be characterized as being on the threshold between stakeholders’ basic awareness of climate change and a learning phase of the involved institutions - an intermediate period between recognition of the scope of the problem, the restructuring of current institutional structures and steps towards more concrete policy frames. Nevertheless this stage provides good opportunities to define entry points for concrete planning and adaptation in the BSR.

The study suggests that besides awareness raising and coordinative efforts for adaptation, it may be important how local and national institutional levels interact such that the supportive capacity of higher levels is complemented with detailed knowledge from lower levels. Due to local capacity limits it might be helpful to enhance adaptive capacity by supplying regional and local authorities with an appropriate mix of information, education, obligations and resources. For the coastal zone in the BSR and the North Sea, exemplary efforts in this direction are made in projects like ASTRA, SEAREG, ICZM-Oder and safecoast<sup>5</sup>, since they explicitly contribute to a clearer view on essential issues for decision-making. In addition it would be valuable to enhance the strategic awareness of local actors on how to overcome reservations against adaptation measures. Actual or potential links to key players who could be activated to promote adaptation should be identified. This could change the situation by providing new strategies and opportunities. Based on an increasing general awareness among stakeholders, joint work of scientists and stakeholders can help to put attention to exposure units and adaptation issues, contributing to a shift in thinking and to deal adequately with uncertainties.

## Acknowledgements

This work is supported by the European Commission through the EU INTERREG IIIB project „Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region” (ASTRA).

## References

- Behringer, J., R. Buerki & J. Fuhrer (2000): Participatory integrated assessment of adaptation to climate change in Alpine tourism and mountain agriculture, *Integrated Assessment* 1: 331-338.
- Berkhout, F., J. Hertin & D.M. Gann (2006): Learning to adapt: organisational adaptation to climate change impacts, *Climatic Change* 78(1): 135-156.
- Breit, H. & M. Troja (2003): Institutional change and social learning in environmental contexts: an introduction, In: H. Breit, A. Engels, T. Moss & M. Troja (eds.): *How Institutions Change – Perspectives on Social Learning in Global and Local Environmental Contexts*, Leske & Budrich, Opladen.
- Brown, K., R. Few, E.L. Tompkins (2007): Climate change and coastal management decisions: insights from Christchurch Bay, *Coastal Management* 35(2-3): 255-270.
- Chakravarthy, B., S. McEvily, Y. Doz & D. Rau (2003): Knowledge management and competitive advantage, In: M. Easterby-Smith & M.A. Lyles (eds.): *The Blackwell handbook of organizational learning and knowledge management*, Blackwell Publishing, Cornwall, UK.
- EEA European Environment Agency (1999): *Environmental indicators: Typology and overview*, Technical Report No. 25, Copenhagen, Denmark.
- Eisenack, K. & J.P. Kropp (2006): Regional stakeholder perceptions of climate change: Baltic case study screening, ASTRA technical report, available from <http://www.pik-potsdam.de/~eisenack/downloads/CSSreport-fd.pdf> (accessed August 2007).
- Eisenack, K., M. Lüdeke & J.P. Kropp (2006): Construction of archetypes as a formal method to analyze social-ecological systems, *Proceedings of the Institutional Dimensions of Global Environmental Change Syn-*

<sup>5</sup> <http://www.gtk.fi/slr/>, <http://www.ikzm-oder.de>, <http://www.safecoast.org> <http://www.safecoast.org>

- thesis Conference, Bali, Indonesia December 06-09, 2006, [http://www2.bren.ucsb.edu/~idgce/papers/Klaus\\_Eisenack.pdf](http://www2.bren.ucsb.edu/~idgce/papers/Klaus_Eisenack.pdf) (accessed August 2007).
- Eisenack, K., M. Lüdeke, G. Petschel-Held, J. Scheffran & J.P. Kropp (2007): Qualitative modelling techniques to assess patterns of global change, In: J.P. Kropp and J. Scheffran (eds.): *Advanced Methods for Decision Making and Risk Management in Sustainability Science*, NOVA Science Publishers, New York: 83-127.
- Engels, A. & T. Moss (2003): Institutional change in environmental contexts, In: H. Breit, A. Engels, T. Moss & M. Troja (eds.): *How Institutions Change – Perspectives on Social Learning in Global and Local Environmental Contexts*, Leske & Budrich, Opladen: 355-375.
- Etkin, D. & E. Ho (2007): Climate change: perceptions and discourses of risk, *Journal of Risk Research* 10(5): 623-641.
- Harding, A. (1995): Elite theory and growth machines. In: Judge, D., G. Stoker & H. Wolman H (eds.): *Theories of Urban Politics*, Sage, London: 35-53.
- Houben, G., K. Lenie & K. Vanhoof (1999): A knowledge-based SWOT-analysis system as an instrument for strategic planning in small and medium sized enterprises, *Decision Support Systems* 26: 125-135.
- IPCC (1997): *IPCC Special Report on the Regional Impacts of Climate Change - An Assessment of Vulnerability*, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- IPCC (2001): *Climate Change 2001: The Scientific Basis*, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- IPCC (2007a): *Climate Change 2007: The Physical Science Basis*, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- IPCC (2007b): *Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability, Summary for Policymakers*, Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- Klein, R.J.T., E.L.F. Schipper & S. Dessai (2005): Integrating mitigation and adaptation into climate and development policy: three research questions. *Environmental Science and Policy*, 8(6): 579-588.
- Kallache, M., H. Rust, H. Lange & J.P. Kropp (2008): Extreme value analysis considering trends, In: J.P. Kropp & H.J. Schellnhuber (eds.): *In Extremis: Extremes, Trends, and Correlations in Hydrology and Climate*, Springer, Berlin, forthcoming, Chapter 5.
- Kropp, J.P., A. Block, F. Reusswig, K. Zickfeld & H.J. Schellnhuber (2006): Semiquantitative assessment of regional climate vulnerability: the North-Rhine Westphalia study, *Climatic Change* 76: 265-290.
- McGranahan, G., D. Balk & B. Anderson (2007): The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones, *Environment and Urbanization* 19(1): 17-37.
- OECD (1993): *OECD core set of indicators for environmental performance reviews*, Environment Monographs No. 83, OCDE/GD (93) 179, Paris, see <http://lead.virtualcentre.org/en/dec/toolbox/Refer/gd93179.pdf> (accessed August 2007).
- Pielke, R., G. Prins, S. Rayner & D. Sarewitz (2007): Lifting the taboo on adaptation. *Nature* 445(7128): 597-598.
- Rahmstorf, S. (2007): A semi-empirical approach to projecting future sea-level rise, *Science* 315(5810): 368-370.
- Reckien, D. & K. Eisenack (2007): Urban sprawl processes: using QuAG to sensitize stakeholders for the interdependencies between actors, accepted for publication in *Simulation & Gaming*.
- Schmidt-Thomé, P., J.P. Kropp & E. Talockaite (2007): Climate Change affecting the Baltic Sea region. *Balt-info*, March/April: 6-8.
- Smit, B., I. Burton, R.J.T. Klein & J. Wandel (2000): An anatomy of adaptation to climate change and variability, *Climatic Change* 45: 223-251.
- Stern, N. (2006) (ed.): *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge.
- Strauss, A. & J. Corbin (1990): *Basics of Qualitative Research. Grounded Theory Procedures and Techniques*, Sage, Newbury Park.
- Weisse & Grabemann (2007), in prep., cited in: von Storch, H. & R. Weisse (2007): Storm climate and related marine hazards in the Northeast Atlantic and the North Sea, [http://w3g.gkss.de/staff/storch/pdf/weisse/ices\\_full\\_paper.2006.pdf](http://w3g.gkss.de/staff/storch/pdf/weisse/ices_full_paper.2006.pdf) (accessed July 2007).

Dr. Klaus Eisenack  
 Potsdam Institute for Climate Impact Research  
 Telegrafenberg A51  
 14473 Potsdam, Germany  
 E-mail: [eisenack@pik-potsdam.de](mailto:eisenack@pik-potsdam.de)