

ARTICLE

Governing Climate Adaptation in the Local Arena: Challenges of Risk Management and Planning in Sweden

SOFIE STORBJÖRK

*Department of Water and Environmental Studies/Centre for Climate Science and Policy
Research, Linköping University, Linköping, Sweden*

ABSTRACT This paper directs attention to conditions for climate adaptation as an important part of governing climate change in the local arena. Empirical focus is put on attempts to manage flood risks by means of risk management and planning in two Swedish municipalities. Following the need to widen our understanding of how, when and under what conditions climate adaptation occurs, three challenges are particularly emphasized from the case studies: facing the safety vs. scenery conflict where political priorities and reducing societal vulnerabilities prove difficult; the process of deciding what to adapt to, in which the troublesome role of knowledge is striking; and finally, taking responsibility for measures of flood protection. At the end of the paper, analytical generalizations illustrate the need to give increased attention to institutional challenges and challenges emanating from the science–policy interface in order to come to terms with the implementation deficit in governing climate change in the local arena.

Adaptation as Part of Governing Climate Change

Governing climate change calls for implementation of policies, programmes and strategies at international, national, regional and local levels of society.

Correspondence Address: Sofie Storbjörk, Department of Water and Environmental Studies/
Centre for Climate Science and Policy Research, Linköping University, 581 83 Linköping,
Sweden. Email: sofst@tema.liu.se

In the local arena, municipalities are seen as both part of the problem and the solution to climate change. Evidence shows that local authorities often appear as key actors in coordinating and facilitating action regarding climate change, to various extents cooperating with private actors (Bulkeley & Betsill, 2003; 2005; Kousky & Schneider, 2003; Allman et al., 2004; Lindseth, 2004). It is therefore important to direct attention to the local context and the role cities and municipalities play in climate change policy-making and implementation (Kousky & Schneider, 2003; Willows et al., 2003; Elander et al., 2003; Lorentzoni et al., 2000).

This paper takes official strategies of planning for climate adaptation as a starting point for illustrating challenges in local responses to governing climate change. Climate adaptation appears as a needed policy complement to approaches aimed at mitigating climate change under any scenario produced by the Intergovernmental Panel for Climate Change (IPCC), and is increasingly seen as important in the international and national arenas in both developing and developed countries (IPCC, 2007; IPCC, 2001; Burton, 2004; Pielke, 1998). Adaptation in this sense does not mean passively accepting the problems of climate change and not doing anything about its large-scale structural causes. Instead, adaptation and mitigation are seen as complementary strategies (Pielke, 1998; Brooks, 2003; Dang et al., 2003). Adaptation is here defined as 'adjustments in natural and human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' (IPCC, 2001). It is further assumed that climate adaptation can take place at different societal levels among different actors and be planned or autonomous, short term or long term, take technological, behavioural and/or institutional form (Smithers & Smith, 1997).

Experiences of trying to cope with current extreme weather events such as droughts, floods and storms in different parts of the world reveal that our current level of adaptation has its limits, which indicate that our preparedness for adapting to future climate change is even more limited. It is also shown in recent research that adaptation to current climate variability is more common than concrete initiatives related to climate change (Burton, 2004; Naess et al., 2005, Tompkins, 2005; Lindseth, 2005). At the same time, the former is often seen as being an important starting point for the latter, since managing existing climate variability can create necessary risk awareness in society and improve our general preparedness, for example concerning extreme weather events. Such increased preparedness is expected to be beneficial for managing future climate risks (Smithers & Smith, 1997; Burton, 2004; United Nations Development Programme [UNDP], 2004).

Independent of whether we are speaking in terms of current or future climate, governing climate adaptation at the local level gives rise to questions of implementation. One such regards how to mainstream climate change considerations in societal decision-making processes and what challenges regarding implementation that appear in this process. Risk management and planning are here seen as examples of key activities to govern climate change in the local arena, where climate adaptation is concerned.

Aim of the Paper

Following an identified need to widen our understanding of how, when and under what conditions climate adaptation occurs (Smithers & Smith, 1997; Burton et al., 2002; Adger et al., 2002), the aim of this paper is to discuss challenges for climate adaptation at the local level, related to risk management and planning. What actually facilitates or hinders climate adaptation and the adaptive capacity of particular localities is clearly context dependent. In order to increase our knowledge of climate adaptation, we therefore need to draw lessons from current experiences of adapting to climate impacts in different parts of the world. Here the empirical focus is put on the case of Sweden and the handling of flood risks in the two municipalities of Kristianstad and Falun.

The Case of Sweden

Changed precipitation and high water flows are examples of specific threats and risks influencing our vulnerability both to current climate and to future climate change. Flooding has also been seen as the most problematic natural disaster from a European perspective (Estrela et al., 2001), which the large number of recent floods bear witness to.

In Sweden, responsibility for the practical management of weather-related risks and physical planning rests with the municipalities, following their monopoly on planning. It is stated in the Planning and Building Act of 1987 that municipalities in their physical planning shall account for environmental risks such as floods and landslides. Municipalities determine the appropriateness of different localizations and settlements while the County Administrative Board, operating at the regional level, supervises local planning and supply data and advice. The role of the Board is specifically to safeguard and coordinate state interests in planning. At the national level, authorities such as the Swedish Rescue Services Agency, the Swedish Meteorological and Hydrological Institute, the Swedish Geotechnical Institute, the National Board of Housing, Building and Planning provide knowledge input in risk management and planning and—as in the case of the Rescue Services Agency—state funding for preventive measures. They do not, however, have any formal authority to otherwise directly influence or control specific activities of planning and risk management in the local arena. The Swedish system of governance is often described in terms of having strong traditions of top-down interactions where policy directives, requirements and expectations stemming from the national level entail important demands on municipalities.

The Swedish municipalities of Kristianstad and Falun both have a long history of exposure to flood risks, which to different extents have dictated conditions for their planning and development. Large areas of the two cities would be flooded should water flows rise to critical levels and the various protective measures fail.

Kristianstad is located in the south-east of Sweden, takes up 1300 km² of land area and has a population of about 76,000 inhabitants. The city was

built on a peninsula in 1614 to serve a defensive aim. Between 1859 and 1968, an embankment was constructed to create more agricultural land and the city is today largely built on the bottom of the former Lake Nosaby with bad ground conditions that restrict future settlements. The lowest point in Sweden—2.41 metres below sea level—is found in central Kristianstad. Vital infrastructure such as the city hospital, the local rescue service and fire station, sewage treatment works, settlements, day care centres, schools and eldercare run the risk of being flooded due to their lowland location. The flood risks are related both to rising water levels in lakes and rivers (in turn related to snow-melting etc. in surrounding areas) and to extreme rainfall in the city area. In the more extreme scenarios, 12,000 people run the risk of being flooded. The feeling of safety behind the old embankment was strong until the flood of 2002, when the embankment nearly cracked due to geotechnical problems. Today a large-scale technical project of flood protection is underway, in which a new embankment is combined with areas of planned flooding to manage the risks. The project is highly dependent on state funding, which calls for close interactions between national authorities and local officials in the phases of planning and construction.

Falun is located in the mid-northern parts of Sweden, takes up 228,910 km² of land area and has a population of about 55,000 inhabitants. The city is surrounded by lakes and rivers and the flood risks have three main sources: the river Dalälven south-west of the city, from which increased water levels put stress on lakes nearby Falun, which in turn may lead to city-flooding, the smaller river Faluån running through the city and the watercourse of Svärdsjö, north of the city. The dependence on water regulations and damming to control the water streams around the city is strong and the problems with Dalälven have diminished since its regulation in 1916. Cracking of the dams would, however, be disastrous. In Falun flood protection is currently more of a local process, involving various local and regional actors. The main strategy is planned flooding and temporary embankments to protect existing settlements. When planning future settlements, local officials rely heavily on existing building codes to facilitate sound choices. At the same time there is a strong political pressure to attract new citizens and change former trends of population decline by, for example, providing desired settlements with proximity to water. In the last few decades, several areas built close to water in lowland areas have given rise to increased flood risks, today managed by temporary embankments.

In both municipalities, the exposure to flood risks puts a strain on local activities. The strategies of risk management differ, since Kristianstad is mainly working with permanent and Falun with temporary embankments. Both municipalities, however, work with planned flooding and strongly rely on technical calculations and measures to manage their safety and vulnerability. The process in Falun has currently been more local and regional, while the large-scale project in Kristianstad also involves national authorities. Taken together, challenges found within the two case studies illuminate important conditions for adapting to flood risks at the local level.

Methodological Approach

Methodologically the case-study approach is used (Stake, 1995; Yin, 1994). The empirical material consists of semi-structured interviews with nine local officials in the two municipalities with responsibilities for climate change, physical planning, risk management and flood protection. The local interviews were complemented with seven interviews with representatives of national authorities who have been in a position to provide state funding or act as experts providing knowledge and guidance for municipality representatives. The interviews, all conducted in the spring of 2005, were recorded, transcribed and analysed step-wise to allow for concentration and categorization of meaning. Text analysis of relevant local documents regarding the various processes of climate adaptation was also undertaken to support conclusions, where such documentation existed.

Local Responses to Climate Adaptation in the Swedish Case Studies

From the case studies, three challenges for governing climate adaptation at the local level by risk management and planning are particularly illustrated here. The first concerns *prioritizing climate adaptation* and the key issues of overcoming safety vs. scenery conflicts, event-driven risk management and it-won't-happen-here mentalities. The second focuses on the questions of *what adaptation? what knowledge?* in determining acceptable safety levels and dealing with challenges in knowledge input and communicative gaps regarding what is included or not in risk scenarios, adaptation measures and their uncertainties. The third challenge relates to the much avoided issue of taking responsibility. To guarantee the adequacy of knowledge input and the measures taken always seems to be someone else's responsibility, which touches upon core issues in the current distribution of roles between national and local actors.

Prioritizing Climate Adaptation

This first point illustrates how climate adaptation is conditioned by other politically pressing issues, which calls for sometimes tough priorities related to the safety vs. scenery conflict. This conflict manifests itself in different ways in the two cases, as elaborated below. In Falun the safety vs. scenery conflict relates to the tricky balance of, on the one hand, the need to consider flood risks by avoiding building houses in risky areas and, on the other, the political ambition to build new settlements and facilities with proximity to water. The latter is a part of a political strategy to vitalize the city by improving aesthetic values in areas close to water and thus facilitating recreational and commercial activities, which are believed to give the city an advantage in the general competition of attracting new residents and tax-payers. In this sense it is also a conflict about safety vs. economic incomes. The strategy is however, according to local risk managers, at potential odds with the need to manage and adapt to the flood risks by building in safe places. Despite

intentions, the strategy potentially increases local vulnerability to floods and in the process also creates even larger needs for future risk management. In recent decades, examples of lowland localizations of settlements in Falun have increased the dependency on temporary embankments to avoid flooding, which can be seen as negatively affecting local vulnerability. The general risk management strategy thus strives to minimize risks but does not necessarily lead to a decrease in the overall vulnerability, which stems from the choice of where to build in the first place.

In Kristianstad, the political incentives for new settlements appear smaller than in Falun but, still, the conflict between safety and scenery is present in local planning and decision-making risk management. Approximately 30–40% of the new embankment runs through existing and attractive living environments in the city. In some parts the height of the embankment is not more than a few decimetres but in other parts it amounts to two metres. The lower the height of the embankment, the larger the feeling of contact with water for the citizens, which affects how the legitimacy of the new embankment is currently regarded in the municipality. As one local official explains:

In 2002 and 2003 the understanding of the measures was large from the residents but it's cooling off. Some say they don't believe in the horror scenarios we are working with. The residents do not understand why we have to build such high embankments and there is a constant discussion, since the embankments take a lot of physical space.

It is described as an act of balance of either applying a precautionary principle where a heightened embankment leads to better safety margins or trying to reduce the height as much as possible, which leads to a better city environment, at least when viewing aesthetics, scenery and proximity to water. Officials from national authorities also recognize the seriousness of this safety vs. scenery conflict as a key challenge for Swedish municipalities. Since many cities are localized in lowland areas close to water the awareness of this vulnerability needs to be raised and a number of questions thus explicitly dealt with:

Should we take the risk of flooding every tenth year or build somewhere else? Is it reasonable to invest all this money in protection to be able to place buildings close to water?

As part of the challenge of prioritizing climate adaptation we also find the fact that, as several interviewees indicate, no politician wins an election by investing tax-payers' money in risk management related to dangers that either occurred a few years back or may potentially occur in the future. Political realities mean that to succeed in politics and gain public support, core issues are schools, eldercare and medical services, not risk management. The exception to the rule is of course if flooding has recently occurred. That politics to a large extent is event driven means that specific climate risks run the risk of being too easily forgotten and replaced by other concerns that negatively

affect our preparedness. That there is a corresponding lack of preparedness and sufficient risk management activities to overcome climate vulnerabilities is clear from interviews with representatives of national authorities:

The risks are like ticking bombs that we are aware of but do not cope with or take responsibility for.

At the same time the capacity, means and opportunities regarding knowledge and technical facilities are often believed to exist. The it-won't-happen-in-our-backyard mentality is seen as a hindrance to climate adaptation in this respect.

Governing climate adaptation at the local level also gives rise to the troublesome question of what one is actually adapting to in the two cases climate risks.

What Adaptation? What Knowledge?

If the first challenge is 'to give priority', the second concerns deciding upon 'the priority of what?' and the role knowledge plays in the process. What flood risks one is actually trying to adapt to and what risk levels are seen as reasonable are far from evident and different strategies are chosen in the two municipalities. In neither of them, however, do climate change considerations influence risk management and planning. Regarding current climate variations, ambitions also differ heavily. Falun has chosen to work with managing floods that are experienced every other year, which is seen as a locally reasonable approach. Previous experience and what is known from recent history are made the basis for decisions, not the more severe and unusually occurring floods. It is clearly stated in interviews that the ambition is not to plan for every possible future extreme event, as this is not seen as being either economically defensible or publicly accepted as a base for local action. Climate change is discussed as something that might make current adaptive measures even more acute but not something that calls for stronger measures or changes in current building codes. The County Administrative Board which inspects local plans has, on some occasions, posed the question of whether the proposed local plans are enough when it comes to also managing future climate risks. Their comments have hitherto remained unanswered by the local officials and the Board has chosen not to initiate any further dialogue with the municipalities on the matter. Even if local actors express an awareness of the problems of climate change, local consequences are not believed to be clear enough to support changes in risk management and planning:

There is an awareness of climate change but knowledge of what the concrete problems can be for us and how to tackle them is missing. It is difficult to make a local assessment.

Local officials are thus hesitant about what effects of climate change are valid locally and need to be taken seriously in their daily activities. Besides this uncertainty, a hindrance to include climate change considerations seems to be an experienced lack of capacity and competence:

Municipalities cannot build their own competence around these issues. Knowledge regarding the effects of climate change must come from the national level. Otherwise we are sitting here guessing and fumbling and that can lead us in the wrong direction.

Assistance from regional and national authorities in interpreting and outlining what needs to be done locally is required. Risk managers further claim that they have enough problems to get political priority for the current risks than also try to push for climate change, which is regarded as a future risk issue. Their statements thus illuminate the difficulty of prioritizing future issues here and now.

In Kristianstad, which has chosen to work with the more extreme worst case scenarios of water flows and flood frequency, it is still unclear among officials what is actually included in the calculations used as a basis for risk management and planning. Local officials claim that the planned measures are based on calculations of the worst imaginable scenario, where ‘all devilment’ is assumed to occur at the same time, including future scenarios of climate change with heightened sea levels, increased precipitation and generally bad weather conditions and maximum flows in the watercourse. In interviews with local officials, the figure of 738 m³/second—provided by national authorities—is given an almost magical status in planning and constructing the embankment. The figure is seen as representing the upper limit for what water flows are possible, implying that sticking to it has the potential to save the city throughout the future. Officials from national authorities who have assisted in outlining the worst case scenario, however, state that the figures used in calculating the extension and height of the new embankment are based on knowledge of climate variations over the last 100 years, not any future extreme scenarios. Even if they acknowledge that local officials work with comprehensive measures—the figure of 738 m³/second amounts to water flows three times worse than previously experienced—climate change has not been part of the calculations. Interviews in the case of Kristianstad thus reveal a communicative gap among officials at different levels of society with an apparent lack of clarity regarding what one is actually adapting to in the municipality, illustrating also the problematic nature of knowledge input and interaction between those providing and those using knowledge.

Generally in the two cases there is not very much reflection of uncertainties related to the knowledge and data input used in risk management, and belief that the scenarios represent the truth appear to be strong, except when it comes to believing in and acting upon scenarios for future climate change. The question of certainty vs. uncertainty, however, also raises the question of willingness or unwillingness to take responsibility, should the figures taken as truths prove inadequate.

Knowledge and Responsibility

In both cases there seems to be an unwillingness to touch upon the issue of adequacy in the figures used in risk management and planning, which leaves us with the problem of who takes responsibility if the calculations prove to be insufficient. In Falun, some of the current risk-management projects aimed at protecting existing settlements from floods exemplify how officials choose to interact with various stakeholders such as power companies, house-owners, fishermen and actors seeking to protect the environment and various recreational interests. Their knowledge and engagement are seen as a means to facilitate compromises, common understandings and shared responsibility in the local arena. When it comes to climate adaptation in planning new settlements, activities are instead strongly dependent upon a stringent use of agreed-upon guidelines for where to build. It is, however, unclear who is responsible for the guidelines being enough. Regarding responsibility, interviews also reveal that officials from the local rescue services speak of consciously avoiding showing citizens maps of flood prone areas upon which local guidelines are drawn in order not to end up in the role of determining what is safe or not. The officials thereby avoid selling the scenarios as truths and also the risk of being blamed, should the scenarios prove insufficient. A precautionary approach and awareness of uncertainties in scenarios are thus indicated at the same time as the question of responsibility is left hanging in the air. The question of the adequacy of local plans when it comes to safeguarding against future climate changes has been raised, as discussed above, but no one has yet taken it further. Both the County Administrative Board and the local rescue service do their job in posing the questions ‘Have you considered the risks?’ and ‘Are considerations and proposed measures enough?’, at the same time as the local planners put all their faith in the current building codes as giving legitimacy to their decisions and call for increased national guidance on what to do about climate change. Even if it is easy to understand the request for guidance and knowledge from above and the difficulty of keeping updated regarding the latest knowledge, the incorporation of climate change considerations in risk management and planning risks constantly being seen as someone else’s task.

In Kristianstad the question of responsibility is blurred. National actors see it as a mainly local concern to make decisions regarding climate adaptation and claim that they as experts only provide input advice in the process. One authority in an expert position states,

Our role is that of the natural science advisor. It is important to draw a limit and we do not make the decisions.

According to the national representatives, municipalities themselves must take responsibility for what is to be protected and how. Knowledge input equals advice and guidance, not authoritatively telling municipality representatives what to do. The local actors in their turn claim that they cannot question the national figures handed to them, which is taken as a sign that

they experience a clear dependency on the figures provided by the national experts:

We have not set these limits ourselves. They calculate the flows and we use the figures we get from national authorities. We do not try to set maximum values on our own and we do not discuss future climate scenarios or speculate.

The 'advice' is thus perceived as being non-negotiable and also as a condition to get state funding for the new and expensive embankment. In the views of local officials, national authorities provide clear-cut input in shaping what is considered safe or not and should therefore also have an important role when it comes to safeguarding that the figures are solid. When the interviews are regarded in relation to each other a gap in self-images appears, where the cautious advice intended by national experts instead—in the eyes of local officials—turns into hard-rock and forcing norms. Different explanations are possible for this gap, stretching from traditions of top-down governance structures to, as discussed in one of the local interviews, a potential convenience on behalf of local officials to use the figures provided by national authorities as a protective shield when answering to the sometimes critical local opinion, thus escaping responsibility for what is done. As discussed earlier, the legitimacy of the height and extension of the new embankment is questioned among citizens in the local arena.

Kristianstad with its technical and engineered measure of climate adaptation generally evinces a top-down process of governing climate adaptation in which expert dependency is strong, whereas Falun appears as to have a more horizontal process in which different local and regional stakeholders are engaged and both expert knowledge and lay knowledge are emphasized as being important for the outcomes. In both cases, however, the question of responsibility is left unanswered.

Conclusions on Governing Climate Change in the Local Arena

So what can be said from this Swedish study regarding the more general question of governing climate change? Theories of governance focuses on strategies of policy-making where both structures—institutional arrangements and inclusion of actors—and processes—negotiations and interaction in policy implementation and differences in power and influence—are important to consider (Pierre & Peters, 2000). The governance aspects treated here mainly regard processes and, more specifically, challenges to policy implementation. How to mainstream climate change considerations in societal decision-making processes is an urgent task, concerning both mitigation and adaptation. As indicated by the Swedish case studies, the safety vs. scenery conflict in its different guises reveals the need to safeguard that consciousness of and protection against climate risks are not at odds with willingness to adopt a more generous view of settlements along flood-prone coast- and shorelines. The need to overcome event-driven risk management

and it-won't-happen-here mentalities—prominent in both municipalities—illustrates difficulties in gaining and maintaining political priority in competition with other pressing local issues. Similar difficulties of prioritizing have been pointed out regarding mitigation (Bulkeley & Betsill, 2005; Allman et al., 2004). Managing local tensions thus appears to be a more general problem in governing climate change at the local level.

Further, identifying what strategies of risk management actually reduce vulnerability is an important future challenge. Adaptation studies show that the question of where to build settlements needs to be taken more seriously in order to reduce societal vulnerabilities rather than solely relying on predictive science to calculate what is secure or not in technical and engineered risk management projects (Sarewitz et al., 2003; Rayner, 2000; Willows et al., 2003). This conclusion does not, however, seem to have reached the level of practice in our two Swedish municipalities. Risk management and planning in the two cases reveal a clear dependence on various scenarios aiming to identify limits for what is safe enough and what levels of water flows one should plan for, rather than applying a more general precautionary principle. The practical problem of knowing what the figures stand for and what considerations are actually included in scenarios was a troublesome issue in Kristianstad, showing communicative gaps between knowledge providers and users at national and local levels. Similar conclusions regarding knowledge input have been found in other studies on managing flood risks (Pielke, 1999), which clearly indicate the relevance of analytically considering the interaction between science and policy in order to more fully grasp conditions for governing climate change in the local arena. In Kristianstad the officials believed that climate change considerations were part of the worst-case scenarios used in planning the embankment, whereas local officials in Falun consciously choose to work with floods experienced every other year instead of any future extreme scenarios. Climate change was considered too difficult to grasp and make useful in risk management and planning, without national expert guidance.

The two cases both bring the troublesome question of responsibility to the surface, since there seems to be a general reliance upon someone else in legitimizing decisions and in proposing action for climate adaptation. In Kristianstad the question of responsibility is blurred. National actors refer to their advisory role in combination with decentralized decision-making and the local monopoly on planning. Local actors instead refer to the need to accept the figures provided to them by national authorities as a critical condition to get state funding for the planned measures. Officials in Falun clearly await initiatives from above. That local actors tend to await state guidance, action and subsidies rather than acting themselves has been stated in earlier studies regarding both adaptation and mitigation (Naess et al., 2005; Allman et al., 2004). Regarding mitigation, Allman et al. have noted that the lack of commitment and support from local key actors, lack of funding and lack of appropriate guidance from the government are often emphasized as hindrance to action (Allman et al., 2004). We are left with uncertainties as to who takes the first step in mainstreaming climate change considerations in

risk management and planning and who takes responsibility for measures of risk management being sufficient.

Actually considering climate change also appears to be tricky in the two cases. Previous research has shown that even in the UK, with the activities of the UK Climate Impacts Programme, 68% of local authorities had not considered the effects of climate change and only 4% had developed strategies trying to address them (Demeritt & Langdon, 2004). One difficulty that is evident from the case study in Falun and previous research is that of turning climate change into a local issue, of seeing its local consequences and thus increasing the incentives to act (Tompkins, 2005; Betsill, 2001). Studies instead show that climate change is seldom the main driver behind initiatives but instead a potential positive by-product of activities aimed at addressing other local problems (Kousky & Schneider, 2003; Lindseth, 2004; Bulkeley and Betsill, 2003; Betsill, 2001). A number of studies identify the importance of overcoming institutional barriers related to, for example, unclear distribution of roles and responsibilities among key-actors on national and local levels, an experienced lack of resources, support networks and relevant knowledge-input that could facilitate the process of turning national policy rhetoric to concrete local action regarding climate change (Naess et al., 2005; Tompkins, 2005; Davies, 2005; Demeritt & Langdon, 2004; Betsill, 2001). The Swedish case studies presented here support these conclusions, indicating that in order to come to terms with the implementation deficit in governing climate change in the local arena it is important to give increased attention to challenges of institutional character and challenges emanating from the science-policy interface.

References

- Adger, N. W., Huq, S., Brown, K., Conway, D. & Hulme, M. (2002) Adaptation to climate change. Setting the agenda for development policy and research. Tyndall Centre WP 16, Norwich, University of East Anglia.
- Allman, L., Fleming, P. & Wallace, A. (2004) The progress of English and Welsh local authorities in addressing climate change, *Local Environment*, 9, pp. 271–283.
- Betsill, M. M. (2001) Mitigating climate change in US cities: opportunities and obstacles, *Local Environment*, 6, pp. 393–406.
- Brooks, N. (2003) Vulnerability, risk and adaptation: a conceptual framework. Tyndall Centre WP 38.
- Bulkeley, H. & Betsill, M. M. (2003) *Cities and Climate Change. Urban Sustainability and Global Environmental Governance* (London, Routledge).
- Bulkeley, H. & Betsill, M. M. (2005) Rethinking sustainable cities: multilevel governance and the 'urban' politics of climate change, *Environmental Politics*, 14, pp. 42–63.
- Burton, I. (2004) Climate change and the adaptation deficit, in: A. Fenech, D. Maciver, H. Auld, R.B. Rong, Y. Yin, (Eds) *Climate Change: Building the Adaptive Capacity* (Ministry of Public Works and Government Services, Ontario, Canada).
- Burton, I., Huq, S., Lim, B. & Schipper, E. (2002) From impact assessment to adaptation priorities: the shaping of adaptation policy, *Climate Policy*, 2, pp. 145–159.
- Dang, H. H., Michaelowa, A. & Tuan, D. D. (2003) Synergy of adaptation and mitigation strategies in the context of sustainable development: the case of Vietnam, *Climate Policy*, 3, pp. 81–96.
- Davies, A. R. (2005) Local action for climate change: transnational networks and the Irish experience, *Local Environment*, 10, pp. 21–40.

- Demeritt, D. & Langdon, D. (2004) The UK Climate Change Programme and communication with local authorities, *Global Environmental Change*, 14, pp. 325–336.
- Elander, I., Granberg, M., Gustavsson, E. & Montin, S. (2003) Climate change, mitigation and adaptation. The local arena. Centre for Housing and Urban Research No. 56, Örebro, Sweden.
- Estrela, T. et al. (2001) Sustainable water use in Europe. Part 3. Extreme hydrological events: floods and droughts. European Environment Agency Report No. 21.
- IPCC (2001) *Climate Change 2001. Synthesis Report* (Cambridge Cambridge University Press).
- IPCC (2007) *Changing Climate 2007: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Intergovernmental Panel of Climate Change Fourth Assessment Report. Summary for Policymakers* (Cambridge, Cambridge University Press).
- Kousky, C. & Schneider, S. H. (2003) Global climate policy: will cities lead the way?, *Climate Policy*, 3, pp. 359–372.
- Lindseth, G. (2004) The Cities for Climate Protection Campaign (CCPC) and the framing of local climate policy, *Local Environment*, 9, pp. 325–336.
- Lindseth, G. (2005) Local level adaptation to climate change: discursive strategies in the Norwegian Context, *Journal of Environmental Policy & Planning*, 7, pp. 61–83.
- Lorenzoni, I., Jordan, A., Hulme, M., Turner, R. K. & O’Riordan, T. (2000) A co-evolutionary approach to climate change impact assessment: Part 1. Integrating socio-economic and climate change scenarios, *Global Environmental Change*, 10, pp. 57–68.
- Naess, L.-O., Bang, G., Eriksen, S. & Veatne, J. (2005) Institutional adaptation to climate change: flood responses at the municipal level in Norway, *Global Environmental Change*, 15, pp. 125–138.
- Pielke, R. A., Jr (1998) Rethinking the role of adaptation in climate policy, *Global Environmental Change*, 8, pp. 159–170.
- Pielke, R. A., Jr (1999) Who decides? Forecasts and responsibilities in the 1997 Red River flood, *Applied Behavioural Science Review*, 7, pp. 83–101.
- Pierre, J. & Peters, G. B. (2000) *Governance, Politics and the State* (London, Macmillan).
- Rayner, S. (2000) Prediction and other approaches to climate change, in: D. Sarewitz et al. (Eds) *Prediction. Science, Decision-Making, and the Future of Nature* (Washington/Covelo, CA, Island Press).
- Sarewitz, D., Pielke, R. A., Jr & Keykhah, M. (2003) Vulnerability and risk: some thoughts from a political science perspective, *Risk Analysis*, 23, pp. 805–810.
- Smithers, J. & Smith, B. (1997) Human adaptation to climatic variability and change, *Global Environmental Change*, 7, pp. 129–146.
- Stake, R. E. (1995) *The Art of Case-Study Research* (London, Sage).
- Tompkins, E. L. (2005) Planning for climate change in small islands: insights from national hurricane preparedness in the Cayman Islands, *Global Environmental Change*, 15, pp. 139–149.
- UNDP (2004) *Adaptation Policy Frameworks for Climate Change. Developing Strategies, Policies and Measures* (Cambridge, Cambridge University Press).
- Willows, R., Reynard, N., Meadowcroft, I. & Connell, R. (2003) Climate adaptation: risk, uncertainty and decision-making. UKCIP Technical Report, Oxford.
- Yin, R. K. (1994) *Case Study Research. Design and Methods*, 2nd edn (London, Sage).

Copyright of Local Environment is the property of Routledge and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.