

---

# Overcoming barriers to climate change adaptation—a question of multilevel governance?

---

**Helene Amundsen**

CICERO Centre for International Climate and Environmental Research—Oslo, Pb 1129 Blindern, 0318 Oslo, Norway; e-mail: helene.amundsen@cicero.uio.no

**Frode Berglund**

Statistics Norway, Pb 8131 Dep, 0033 Oslo, Norway; e-mail: Frode.Berglund@ssb.no

**Hege Westskog** ¶

CICERO Centre for International Climate and Environmental Research—Oslo, Pb 1129 Blindern, 0318 Oslo, Norway; e-mail: hege.westskog@cicero.uio.no

Received 24 February 2009; in revised form 29 September 2009; published online 1 March 2010

---

**Abstract.** This paper analyses the results from two surveys which were sent to all Norwegian municipalities in 2007 and gives an overview of adaptation measures undertaken by local governments. Our analyses show that municipalities have more often invested in measures related to extreme precipitation and flooding than in measures for securing buildings and infrastructure against climate change. One key factor explaining their efforts is whether they have experienced extreme events. Hence adaptation efforts are mainly reactive. With a changing climate comes a greater demand for proactive adaptation processes, as well as knowledge of how adaptation policies and measures could be implemented successfully. This paper emphasises the importance of enhancing institutional capacity in order to address the challenges of climate change adaptation at the municipal level; and asserts that a multilevel governance framework is a way of advancing proactive adaptation and overcoming the identified barriers to adaptation.

## 1 Introduction

Climate change adaptation is recognised as unavoidable because the consequences of climate change are being observed in many parts of the world (IPCC, 2007). The latest IPCC report (2007) states that adaptation to climate change is being observed; however, the report also finds that the majority of the adaptation measures taking place are not initiated primarily in response to climate change. Adapting to changing conditions has occurred at all times, but climate change will create new challenges for individuals, communities, and governments, and planned adaptation to climate change will become more and more important.

Despite the need for climate change adaptation, adaptation processes are not easily initiated and implemented, and various factors limit or facilitate adaptation. External shocks might trigger adaptation efforts. Extreme events could be one such trigger and represent a ‘window of opportunity’ to implement adaptation options that have been developed but not yet implemented (Penning-Rowsell et al, 2006). Numerous examples of reactive actions following an extreme event have been identified (eg, IJC, 1997; Levy and Salvadori, 1995; Næss et al, 2005, Zahran et al, 2008). Penning-Rowsell et al (2006) find that policies implemented after a large flooding event in the United Kingdom were ideas that had been developed before the event occurred but had not yet been part of the policy discourse. They argue that adaptation policies are likely to follow the same pattern in some cases: that is, the measures implemented after extreme events include adaptation options that have previously been discussed but are yet to be implemented, and as such are a ‘window of opportunity’.

¶ Corresponding author.

---

Many studies have focused on barriers or triggers to adaptation, and these specifically identify policies and legal requirements (such as institutional frameworks, financial conditions, available technology, information, awareness, and knowledge as well as external shocks) as factors which either motivate or restrain adaptation action (Adger et al, 2005; 2009; Demeritt and Langdon, 2004; Dessai et al, 2005; Penning-Rowsell et al, 2006; Pitt and Randolph, 2009; Smith et al, 2008). These factors are relevant at the local government level, as well as on other institutional scales, and are important in initiating adaptation to climate change.

Budgetary constraints have been put forward as important considerations in the implementation of adaptive measures (eg Dessai et al, 2005; Lorenzoni et al, 2000a; 2000b). Crabbé and Robin (2006) found that municipalities in eastern Ontario, Canada, face financial barriers to climate change adaptation, especially with respect to their responsibilities and the lack of sufficient financial resources to carry these out. Additionally, they argue that Canadian municipalities have access to technological adaptation options but lack both the knowledge of which option to choose and expertise in evaluating different adaptation options. This factor is also underlined by Dessai et al (2005), who argue that the availability of technology and employees' ability to utilise it effectively are important determinants of adaptive capacity. They further argue that access to information and the existence of legal, social, and organisational arrangements are also important factors for adaptation processes.

By combining methods of bottom-up and top-down policy analyses to assess adaptation policies at different scales, Urwin and Jordan (2008) argue that policies at the national scale could constrain adaptation at the local level by limiting the ability of local governments to respond to the challenges. They argue for a combination of local and national level activity, in which the local levels organise their own planning, which is their area of expertise, while the national government prioritise the policy foci (Urwin and Jordan, 2008). Hence they give national governments the role of identifying areas of prioritisation, which the local governments then implement locally. Their findings are consistent with the results from a study in the Oslo region (Vevatne and Westskog, 2007), which points out that, because the national government has not focused on adaptation to climate change, the municipalities have not included it in their work with risk and vulnerability. Adaptation to climate change requires responses at all levels of government, and without national authorities giving clear political signals through designing and facilitating adaptation policies, local governments will find it more difficult to develop effective adaptation policies and implement them.

Thus, a number of barriers and limits to adaptation have been identified, as well as facilitating factors. However, few studies give an overview of adaptation measures undertaken across a large number of local governments and the barriers associated with implementing climate change adaptation. In this paper we present results from two surveys sent to all municipalities in Norway in 2007. The purpose of the surveys was to gain an overview of which adaptation measures they have implemented and the barriers municipalities perceive in their attempts to adapt to climate change.

Our study shows that adaptation in Norwegian municipalities to date is based on historical experience and that there is little evidence of climate change adaptation. The key barriers identified in the surveys are unfamiliarity with and lack of data on climate change, lack of local expertise, and lack of a clear role for local governments when working with adaptation policies and measures. These findings indicate that the lack of focus on adaptation at the national level has in turn led to a lack of attention to these

---

issues at the local level. The need for a multilevel governance framework in which the national government gives a clear role to municipalities through setting goals, creating regulations, and financing adaptation processes for the local governments to implement is identified through our results.

In section 2 we discuss the role of Norwegian municipalities in adaptation policies and their relationship to the national government. In section 3 we then describe the methods we used to gather and analyse the data. In section 4 we present our findings and in particular focus on which measures have been implemented; the importance of extreme events for adaptation; and the barriers municipalities are facing with respect to climate change adaptation. Finally, in section 5, we discuss our findings in light of the literature on climate change adaptation and barriers.

## 2 Adaptation in the Norwegian context

The national government in Norway has recently singled out municipalities as one of the most important arenas for climate change adaptation (Regjeringen, 2008). The reason that the national government has given local governments such an important role with respect to climate change adaptation must be seen in light of the central–local government relationship in Norway. The municipalities in Norway play an important role in implementing state welfare policies (Hovik and Reitan, 2004). Hovik and Reitan argue that the relationship between central and local governments is a model of integration, in which “the various government levels are seen as intertwined, and their relations are described as partnership, building on interdependency, and shared interests” (2004, page 688). The municipalities are responsible for a number of areas, including schools, local roads, waste collection, social services, fire, water provision, and local and spatial planning, and are responsible for organising their activities within these areas. The national government uses regulations and financial support as two means of helping municipalities implement national aims and objectives for those areas which fall under the responsibility of the municipalities.

With respect to preventing damage from weather-related events, the municipalities play a major role in coordinating responses to crises and repairing damage caused by extreme events [see Næss et al (2005) for an overview of how this work is organised]. Municipalities are also legally committed to prohibit new buildings in areas at risk from extreme events, such as landslides or flooding.<sup>(1)</sup> Earlier studies conducted in Norwegian municipalities, focusing on climate change adaptation, showed that few municipalities have prioritised a systematic approach to the challenges of climate change (eg Næss et al, 2005; Vevatne and Westskog, 2007). Interviews conducted in 2007 with representatives of municipalities in the Oslo region showed that climate change adaptation has not yet received political or administrative attention (Vevatne and Westskog, 2007). A main reason could be that the governmental level in Norway has only to a small extent developed clear policies and guidelines or given financial support to municipalities to aid them in this work. In 2007 the national government started its work of developing a national strategy for adapting to climate change. As part of this process it launched a website to advise municipalities on how to address the issue, without, however, combining this with policy recommendations (Regjeringen, 2008).<sup>(2)</sup> In addition, an expert group on climate change adaptation

<sup>(1)</sup> Municipalities are not liable if the risk is not known. Since the survey was conducted, changes have been made to the Planning and Building Act, which regulates municipalities’ planning processes. Municipalities are now legally required to undertake an analysis of the risk and vulnerability of areas suggested for new developments. At the point when the surveys were conducted this was not required.

<sup>(2)</sup> The website can be accessed at <http://www.klimatilpasning.no>

---

consisting of representatives from nongovernmental organisations, researchers, experts, and government bodies was established early in 2009 to suggest ways in which Norway can address the challenges of climate change. The expert group will report to the government by the end of 2010.<sup>(3)</sup>

Hovik and Reitan (2004) make a fundamental distinction between regulations from the national level which set goals and targets to be reached locally on the one hand, and support for institutions and processes on the other. They argue that since the late 1980s major changes have been made in the way in which the national government has developed policies for local governments in Norway. The move has been from a focus on institutions and processes to specific goals and targets; a change which the authors regret because they assert that institutions are important for the successful implementation of policies (Hovik and Reitan, 2004). In the case of adaptation policies for climate change, neither development of institutions or specific targets are developed at the national level.

In Norway designated local-level institutions are responsible for issues such as local planning and extreme weather-related emergencies. However, these are not established for the purpose of adapting to climate change. The work which was initiated at the national level to develop a climate change adaptation strategy in 2007 did not initiate any institutional changes at the local level for that purpose. Furthermore, no specific financial support has been given by the national level to the municipalities for developing their adaptation policies and carrying out measures to prevent future damage. In the case of extreme events those affected are covered through Norwegian national funds for hazards.<sup>(4)</sup> However, no funds have been allocated for the development of climate change adaptation policies and actions.

The low focus on adaptation policies in Norway until recently may have resulted in a substantial knowledge gap, in which the municipalities are not aware of which consequences of climate change they should adapt to, how they should go about it, what the aims of adaptation are, and how they should finance their adaptation efforts. This hypothesis will be studied further below.

### 3 Methods

Two surveys covering both climate change mitigation and adaptation in Norwegian municipalities were carried out in 2007 to gain an overview of the adaptation and mitigation activities taking place in the municipalities. The surveys sought answers to two questions: what is being done at the municipal level in these areas and how do municipalities perceive their role in national climate policy? In this paper we present the responses to the questions about adaptation activities.

Two questionnaires were developed to address both the administrative level and the political level in each municipality. At the administration level, the questionnaire was sent to the chief environmental administrative officers in municipalities.<sup>(5)</sup>

<sup>(3)</sup> Information from the expert group is reported at <http://nou-klimatilpassing.no>

<sup>(4)</sup> It has been argued that the existence of these funds leads to the expectation that the cost of damage from extreme events would be covered fully (Næss et al, 2005). This does pose challenges for climate change adaptation. Even if municipalities are responsible for many adaptation efforts, they expect that their financial responsibility in the case of an extreme event will be covered by these funds. This might affect their willingness to, for instance, sacrifice income from building houses in risky areas for the benefit of reducing the risks of damage from extreme events.

<sup>(5)</sup> The survey was to be answered by the person(s) within the administration of the municipality who works with issues related to environmental issues. In some municipalities this would be a full-time position held by one person or a full team of environmental officers, whereas in other municipalities the responsibilities might be spread across a range of persons and departments.

---

This questionnaire consisted of thirty-two closed questions, of which eleven questions asked the respondents to answer on a graded scale. We asked specifically about the status of the specific planning processes related to climate change adaptation; which measures the municipalities had implemented regarding mitigation and adaptation to climate change; the barriers they face in their work with these issues; and the networks they draw on for information and guidance.

The questionnaire addressing the political level was sent to mayors, with the aim of examining how local politicians perceive their role in implementing climate adaptation policies. This questionnaire consisted of twenty-seven closed questions, and in nine of these respondents answered on a graded scale from very important to not important. We asked the mayors about their perceptions of climate change; their concerns regarding climate change; their perceptions about the appropriate political level that should have the responsibility for climate change adaptation and who should have the responsibility for financing it. At the end of both questionnaires the recipients were asked to give any comments on issues raised in the questionnaires.

The questionnaires were distributed by e-mail to the main e-mail address for each of the 431 Norwegian municipalities. Recipients were asked to forward the questionnaires to the appropriate persons in their municipality. Reaching mayors by this method was quite simple, but reaching the right person became more complicated at the administrative level. Most municipalities have not established a full-time position for an environmental officer, and persons that work with environmental issues are not easily identified by their job titles. The administrative questionnaire covers different environmental issues that are often handled by several individuals and across administrative sections. Therefore the questionnaire would best be answered by more than one person in those municipalities without a dedicated environmental officer. This was explained in the accompanying letter, and the returned questionnaires show that in some municipalities the questionnaire was answered by several persons. In this paper we refer to results from this questionnaire as responses from environmental officers, although several of the respondents carry a different job title and primary responsibilities.

The data were collected electronically through an Internet-based survey programme, and we analysed the data with the SPSS programme MR Dimensions. When we analysed the data in SPSS, we tested for correlation between different answers: for instance, whether municipalities that have discussed the link between extreme events and climate change are those that request regulation from the national level to define roles for climate change adaptation efforts. To test our results in a more comprehensive manner we also tested our survey findings against data from three extreme events.

The response rate among mayors was 46% (196 municipalities), and that from environmental officers was 51% (221 municipalities). In 110 municipalities both mayors and environmental officers responded. We tested for bias in the distribution of responses to see if the responses gave a good representation of the variety of municipalities. The characteristics we tested were size, location, political party support, and municipalities

<sup>(5)</sup> (continued)

Of the environmental officers that answered the survey, 30% work full time as environmental officers; the other 70% work as environmental officers in combination with other responsibilities (their positions based in sections for planning, development, technical, environment, and agriculture, among others). In general, climate change is seen as an environmental issue; hence the questionnaires were sent to persons working with environmental issues. Few, if any, municipalities have an employee whose sole responsibility is issues relating to climate change adaptation.

---

with an Energy and Climate Plan.<sup>(6)</sup> For the distribution of mayors who responded we found that deviations in response rate were only marginal with respect to the characteristics we tested for, indicating that the data collected at the political level are representative for Norwegian municipalities.

The response distribution for the environmental officers was less representative. The response rate increased with the number of inhabitants in a municipality, and municipalities that have developed an Energy and Climate Plan are more likely to have returned the questionnaire than those that have not. These two correlations are connected: larger municipalities are more likely to develop plans because they have more resources than smaller municipalities. It is reasonable to expect that more attention is given to issues regarding energy and climate in municipalities where a plan has been developed. The reason for a difference in distribution between political and administrative respondents could simply be that climate change is a political issue with which political leaders from all political parties and localities are concerned, whereas at the administrative level, the issues that we outlined above—dedicated environmental officer, size, and planning processes—determine the propensity to respond to the survey. Our conclusion from analysis of response rates is that, because respondents to the questionnaire to environmental officers come from municipalities that emphasise environmental issues more than other municipalities; it is likely that our study to some degree overestimates the actions being taken.

Using questionnaires with closed questions has clear limitations where the response options given in the questionnaires determine the answers. However, we chose to use this method in order to survey all municipalities in Norway, which would not be feasible using any other approach. In the questionnaires we gave space for comments, and this was used by the respondents to express their views. The material we present in this paper gives an overview of adaptation processes at the municipal level in Norway, providing a good background for local, qualitative follow-up studies.

#### 4 Findings<sup>(7)</sup>

In order to plan adaptation, local governments are requesting information about what they are expected to adapt to. The projected climate trends for Norway are increased precipitation, especially in autumn and winter; higher temperatures, especially inland and in northern Norway; more intense precipitation events; and stronger winds (Haugen et al, 2008; see also *Tellus A* 2008). These trends are expected to increase the frequency of floods and landslides in some areas, as well as to change flood patterns. Flash floods during heavy rainfall might happen more often, and floods are expected to occur in places where they have not typically occurred and at different times of year than the 'traditional' spring floods. The projected changes in climate indicate that challenges might be different from those experienced in the past. These new challenges are likely to require changes in practices for handling extreme events and the introduction of new adaptive measures in the municipalities. These challenges are starting to be observed in the municipalities and the environmental adviser in Fredrikstad stated:

<sup>(6)</sup> A list of municipalities that have developed Energy and Climate Plans is given in a survey by Enova (<http://www.enova.no/?itemid=4992>). Other relevant factors, such as land-use planning were not used, because there is no overview for all municipalities on these issues that could be easily obtained and added to the survey material. (Enova SF is a public enterprise in Norway established to contribute to environmentally sound and rational use and production of energy. Enova has organised seminars on Energy and Climate Plans and gives financial support to municipalities to develop their Energy and Climate Plans).

<sup>(7)</sup> In Berglund and Nergaard (2008) the statistical data from the questionnaires are presented. They do not present any analyses of the material.

---

“What we have been struggling with thus far has been sudden and heavy rains. ... We have a good drainage system in the town and most of the water runs quickly out to the sea, but the system is not designed to cope with precipitation on this scale” (*Journal of Nordregio* 2008).

In the following discussion we address what the municipalities have done to meet those challenges as well as what barriers they face in this work with adapting to climate changes, and we analyse what might explain their efforts within this area.

#### **4.1 Adaptation measures taken by municipalities**

In the surveys we asked about the municipalities' awareness and familiarity with issues related to climate change. We asked the mayors if they were familiar with the conclusions of the IPCC Report (2007), and if they have confidence in it. We also asked if they were concerned with climate change and saw a need for adaptive measures. The majority of mayors responding to the survey stated that they are familiar with the conclusions of the IPCC Report (2007) and have confidence in its findings. Consequently, 90% of mayors are concerned (to a large and certain degree) about future climate change, and 88% replied that municipalities should do more to adapt to climate change. When asked whether an increase in precipitation, temperature, and extreme events, as projected by climate models and IPCC (2007), would have consequences locally, 11.7% believe that this currently presents a challenge to a large degree, whereas only 0.6% consider climate change to be of no concern for their municipality in the future; 90% perceive climate change to be a challenge for their municipality to a large or certain degree; 63% are concerned to a large or certain degree about their municipalities' ability to deal with the consequences of climate change, whereas 35% are concerned to a small degree about their ability to handle future climate change.

Hence a large percentage of those responsible for handling adaptive measures are concerned and see a need for action. This should clear the way for investments in climate change protection measures. We asked the environmental officers what kinds of measures their municipalities have developed and listed different measures such as flood control; measures to secure existing buildings; and improved treatment of surface water (see table 1 for all alternatives).

Measures against extreme precipitation and flooding were most frequently implemented by municipalities amongst measures included in the surveys (see table 1). Many municipalities have experienced problems with flooding and extreme precipitation, and therefore they have taken steps to prevent future damage from such events. Several Norwegian municipalities to some extent have also implemented measures for better handling of surface water and measures concerning their water and sewage systems. On the other hand, measures for securing homes and other buildings as well as infrastructure against climate change have not been taken in most municipalities. From the study of Vevatne and Westskog (2007), we know that a low level of expertise is still found among Norwegian entrepreneurs in the building sector on how to build more climate-resistant houses, as well as a lack of interest (see also Eriksen et al, 2009; Liso et al, 2007). Table 1 shows the rate of implemented climate change adaptation measures obtained in our surveys.

Our findings indicate that there is a tendency to invest in measures connected to sudden and expensive climate-related events, such as flooding. These events often burden society with high costs that have to be paid over a short period of time. For instance, the extreme precipitation on the 16 and 17 of October 1987 resulted in costs for the region around Oslo of NKr 189 million (Vevatne and Westskog, 2007).

**Table 1.** Survey respondents' answers to the question "To what extent has the municipality implemented measures to adapt to climate change within these areas?"

	Large extent (%)	Certain extent (%)	Little extent (%)	Not at all (%)	Not relevant (%)	<i>N</i> (100%)
Flood control/flood prevention	14.6	31.8	18.2	15.6	19.8	192
Preservation of wetland and marsh areas	7.9	27.2	30.9	23.6	10.5	191
Material used in buildings	1.6	24.2	40.5	28.4	5.3	190
Measures securing existing buildings, including cultural heritage	3.1	20.9	38.2	31.9	5.8	191
Risks of flooding and landslides to planned buildings	15.7	39.3	21.5	13.6	9.9	191
Improved treatment of surface water	6.7	38.9	31.6	19.7	3.1	193
Dimensioning pipes for water supply and sewage	12.5	43.2	26.0	16.1	2.1	192
Adaptation of cultural landscapes	6.4	21.8	36.7	30.9	4.3	188
Securing infrastructure (eg protecting roads from landslides)	4.2	28.9	31.6	22.6	12.6	190

#### 4.2 Extreme events and adaptation

To analyse the data and test whether extreme events play a determining role in motivating investment in adaptation measures, we have combined the findings in our surveys on measures implemented with data from the Naturskadepool (Norwegian Pool of Natural Perils)<sup>(8)</sup> of compensation paid from 1980 to 2007 for flooding, storms, and storm surge events. Three large events were selected to test correlation with the implementation of relevant measures among municipalities hit by these events: the New Year's Eve storm in 1991/92 on the west coast of Norway, the flood in eastern Norway during the spring of 1995, and the autumn 2000 flood in eastern Norway.<sup>(9)</sup> We wanted to see if municipalities that have been exposed to extreme events are the ones that to a greater extent have undertaken measures to prevent future damage from similar events.

In our study we find a clear correlation between municipalities that have experienced the selected extreme events and those that have undertaken measures to prevent future damage from such events, compared with municipalities not affected by these events. After the storm on the west coast of Norway on New Year's Eve 1991/92, the municipalities that were affected are also the ones that have implemented measures to prevent future damage from similar events. The municipalities that had a large amount of storm compensation in 1992 also reported that they have changed the materials used for (new) buildings and that they have implemented several measures to secure current

<sup>(8)</sup> The Norwegian Pool of Natural Perils is a pool of resources, which all insurance companies must be members of and contribute to, for compensation of damage to private property not covered by insurance. There is also a public fund, Naturskadefondet, which is the government equivalent and covers damage to common property not covered by other insurances.

<sup>(9)</sup> The 1995 flood was caused by melting snow combined with rain, etc, whereas the 2000 flood was caused by precipitation.



buildings (including those considered part of the cultural heritage). This result is confirmed by a separate study, which found indications of an increased demand for products to prevent damage by future storm events after the 1991/92 New Year's Eve storm (Teigland, 2002).

If we look at the 1995 flood event on the Glomma River in eastern Norway, the data from the surveys indicate that municipalities hit by the flood have acted to reduce future flood damage. Local governments have developed flood defences and are assessing the risk from flooding when developing new building projects. Næss et al (2005) show an example of reactive adaptation in the Skedsmo municipality after this event, where a flood defence was built around the city of Lillestrøm after the flooding. However, we do not find a significant correlation between this event and handling of surface water or changes in pipe dimensions for water supply and sewage, perhaps because, historically, flood defences, rather than handling of surface water, have been the common response to floods along the Glomma River.

Although flood defences are the most commonly used response to floods in the Glomma River area, the measures most frequently adopted in the urban areas in the Oslo region have been measures for handling surface water and changes in pipe dimensions for water and sewage. In the autumn of 2000 eastern parts of Norway experienced nearly continuous rain over a long period, which led to flooding, especially in smaller rivers and streams. In our study we find a strong correlation between measures for handling surface water and changes in pipe dimensions for water and sewage for municipalities hit by this extreme event compared with other municipalities not hit by it. However, we found no correlation between those municipalities affected by the extreme events and development of flood defences. The reason could be that, in more densely populated areas with hard surfaces, the need for a good water drainage system is urgent to prevent damage from extreme precipitation events. Hence the measures implemented are related to drainage rather than to flood defences.

#### **4.3 Barriers to climate change adaptation at the municipal level**

We also wanted to learn why the municipalities did not do more to adapt to climate change. Hence we asked them what barriers they meet in their work with adapting to climate change. We asked if they needed more concrete data on how climate change would affect their community; if they needed more information about possible effects; if they needed more funding or a clearer defined role for municipalities when it came to work on adaptation to climate change; and if they needed more expertise about these issues in the municipalities.

In the analyses of our results we identified four key barriers to adaptation at the municipal level: unfamiliarity with existing data on climate change; lack of concrete data; lack of local expertise for dealing with effects of climate change; and an unclear role for local governments when working with adaptation policies and measures.

Our surveys show that use of the three main Internet sources of research-based information on adaptation issues in Norway varies significantly among municipalities. The Geological Survey of Norway provides a map-based overview of areas vulnerable to different types of landslides (<http://www.skrednett.no>); the Norwegian Water Resources and Energy Directorate (NVE) has developed flood inundation maps for areas prone to flooding to aid in planning and efforts to prevent flood damage (<http://www.nve.no/flomsonekart>); and climate scenario maps covering the period through 2100 are available from the NVE, Norwegian Meteorological Institute, and Norwegian Mapping Authority (<http://senorge.no>).<sup>(10)</sup> Among the three information databases,

<sup>(10)</sup> Flood maps and landslide maps are based on historical data, whereas the climate scenario maps are based on projections of the future climate.

---

climate maps are the least familiar to the respondents to our surveys (30% answered that they were using this data source), whereas flood maps are used by as many as 55%. This is also confirmed by Vevatne and Westskog (2007), who found none of the municipalities interviewed was familiar with climate map information available on the Internet.

Our study indicates that adaptation strategies are mostly reactive. This implies that municipalities have knowledge about information needed to cope with situations with which they are familiar. Thus municipalities would be expected to be familiar with flood and landslide maps for their region if they are vulnerable to these types of events, but not with climate scenario maps for future climate conditions.

Although resources are available for climate data and projections, municipalities also responded that they lack concrete and comprehensive data on the consequences of climate change. Therefore, they are uncertain about what they should adapt to. Hence there is a need also to focus on communicating knowledge about climate change in such a way that it reaches the municipalities and is found to be useful for them. Moser and Dilling (2007) underline that, to be effective, communication about climate change needs to keep the barriers facing the receiver of the information in mind when communicating. They also point out that a dialogue between the receiver and the sender of information is important for knowledge transmission to be effective. In Norway this has been done to only a small extent. Until now the information about available climate data and projections has not been part of any communication strategy with the involvement of users of this information.<sup>(11)</sup>

Most of the mayors (93%) also said that a greater level of knowledge about effects of climate change is needed in their municipal administration. They argue that the national level should be involved to some extent in financing this increase in competence.

Sygna et al (2004) proposed that the role given to Norwegian municipalities in ensuring the effective implementation of national guidelines for spatial planning and flood preparedness is essential for their ability to handle extreme events. This is confirmed by our surveys. Nearly 90% of mayors believe that the national authorities should define through legislative efforts a clearer role for municipalities in adaptation policies. This might be one important reason why actors at the local level have not done much to adapt to climate change: it is not very clear what they are supposed to do.

We also wanted to investigate whether municipalities that were aware of the climate changes to come had a greater understanding of what was needed to implement an effective adaptation policy in their municipality. Our survey results show a strong correlation between municipalities that have discussed the link between extreme events and climate change and those that request regulation at the national level to define roles for climate change adaptation efforts. Also, there is a clear correlation between municipalities that are concerned about future climate change and those that assert that more concrete data on local climate change, more financial support, more clearly defined roles, and more resources in their municipalities are needed to cope with the adaptation challenges.

<sup>(11)</sup> There are, however, some recent exceptions. In the work initiated by the government to create a website for municipalities on climate change adaptation, a few persons knowing the municipalities' needs were involved (see <http://www.klimatilpasning.no>). Also, scientists are more aware of the need for dialogue on these issues. In a Norwegian research project on adaptation to climate change in municipalities, a website has been launched to communicate knowledge from the project to the municipalities (see <http://www.klimakommune.no>). However, both these websites were launched after the surveys were conducted.

---

We also find a clear trend that municipalities that have discussed whether extreme events could be linked to climate change have to a greater extent than others considered including climate change scenarios in their ROS (risk and vulnerability) analysis. These results show that awareness of the climate change issue creates better understanding of what is needed to achieve an effective adaptation policy at the municipal level. On the other hand, awareness alone is insufficient to trigger successful adaptation by municipalities, as noted by, for example, Potter and Oster (2008) and Demerit and Langdon (2004). Knowledge and information on a subject, such as climate change, do not readily translate into action. This information deficit has been identified as one of many barriers to adaptation (Bulkeley, 2000; Norgaard, 2006).

## 5 Discussion and concluding remarks

Our study shows that there has not been a strong focus on adaptation to climate change in Norwegian municipalities. The analyses show that adaptation efforts that have been undertaken have mostly been reactive—based on historical events—and thus do not incorporate new knowledge on climate change. Our study adds to the literature by basing the analyses on a full sample of adaptation in Norwegian municipalities and it confirms the results from many case-based studies. Næss et al (2005), for instance, show that the 1995 flood event in Norway triggered changes in rules and regulations at the national level. Miller et al (1997) point out that climatic events are an important trigger for institutional change. Penning-Rowsell et al (2006) showed how, in the aftermath of flood crisis, new policies were implemented.

However, with a changing climate reactive adaptation processes may be unreliable because floods and other extreme events may change dramatically in the future, as a consequence of climate change. The current focus on reactive adaptation in municipalities in Norway clearly indicates that more focus and competence are needed on how to face the challenges brought by climate change. A changing climate causes a greater demand for a proactive adaptation policy, as well as knowledge of how such a policy could be implemented successfully. Consequently, information and awareness as limits to adaptation, which have been pointed out by, for instance, Crabbé and Robin (2006), Dessai et al (2005), and Adger et al (2005; 2009), are also identified as important factors in our responses. However, based on our results, the key barrier that needs to be addressed is the relationship between local and national governments. One way in which this barrier could be overcome is through a multilevel governance framework, organised to ensure that processes for proactive adaptation are developed.

Urwin and Jordan (2008) argue that the national government should be setting the policy agenda on adaptation. This is in line with our conclusions. We find that one important reason for the low focus on adaptation to climate change at the municipal level in Norway is the lack of focus on these issues at the national level. The development of a national strategy for adapting to climate change started in 2007 in Norway, and to date policies have not been clearly formulated. In our study this lack of national focus is confirmed by the municipalities. They said that the lack of a clear defined role for municipalities in adaptation policies is a barrier for them in their work on these issues. One respondent (environmental officer) stated it this way:

“I feel that the debate on adaptation to climate change has barely started nationally.

The analysis thus far has been hypothetical and we have not changed our processes based on these.”

Further, the municipalities underline that a barrier to working well with these issues is a lack of competence within the municipalities and a lack of funding to address this shortcoming properly.

---

Hovik and Reitan (2004) suggested that a change has occurred in the role national authorities have given local authorities in Norway from the late 1980s until today. There has been a change from a strong focus on the development of local institutions within the environmental area to delegation of responsibility. Given the weakened institutional capacity, as argued by Hovik and Reitan, the findings in our study point to a clear need for a national framework for proactive adaptation in which the role of municipalities is clearly defined and the basis is created for development of knowledge and expertise within the municipalities. From our point of view, this also includes the establishment of institutional capacity at the municipal level to handle the challenges of climate change adaptation. This could, for instance, imply the funding of officers with the responsibility to manage the climate change adaptation within the municipalities.

Tompkins and Adger (2005) point to a need for integration across different scales of management, as well as across sectors and among government departments, to cope efficiently with climate change. Bulkeley and Betsill (2005) and Bulkeley (2005) also underline that we need to move away from analyses focusing independently on each level of political authority towards a framework of multilevel governance and new network spheres for environmental issues like climate change. The issue of climate change involves different levels of political authorities and new kinds of networks are being shaped (Gustavsson et al, 2009). The potentials for developing more efficient climate policies, including adaptation policies, could be increased when, for instance, cities get involved in transnational municipal networks like the ‘Cities for Climate Protection Programme’ (discussed in Bulkeley, 2005) and efficient multilevel governance structures are established for cross-scale issues. The need for a multilevel governance framework is clearly identified through our results. There has been a lack of focus on climate change adaptation at the national level which consequently has resulted in inaction at the municipal level. Adaptation to climate change involves all levels of governance. National laws and regulations are needed together with day-to-day decisions on where to locate houses and what pipe dimensions to choose. These interlinkages of governance levels signify the importance of a comprehensive approach.

An important issue not touched upon in our paper is the issue of municipal size and capacity to become involved in politics with multilevel dimensions like climate change. With a larger municipality come more resources and diversified capacity to deal with new challenges and multilevel politics (Lundqvist and Borgstede, 2008; Tompkins and Adger, 2005). Also, as Lundqvist and Borgstede (2008)<sup>(12)</sup> point out—the size of the municipality may influence the municipality’s perception of the appropriate level of responsibility for climate change policy. The respondents in the city of Gothenburg in the Lundqvist and Borgstede study (2008) believe that the city has both the capacity and the response space for a strong local engagement in climate policy independent of national action. The smaller suburban areas, on the other hand, seem to have a more defensive attitude. They do to a larger extent put forward the constraints that national requirements place on the room for manoeuvre in local climate politics and prefer to allocate responsibility for climate policies to a higher level of governance (even the international level). Hence scalar constructions are not unambiguous when it comes to analyses of environmental governance (Bulkeley, 2005). Our study does not address the issue of variability in the capacity for adaptation policies between municipalities. However, this is an important question to follow up in further research.

(12) Lundqvist and van Borgstede (2008) are focusing on abatement policies.

Our analyses are based on surveys with closed questions addressed to all municipalities in Norway and the results may form the basis for case studies on adaptation to climate change in Norwegian municipalities. Case studies at the local level may provide knowledge about how an efficient adaptation policy is created and sustained in different municipalities and contexts. In our study we did, for instance, get an overview of the different measures implemented by the municipalities. However, our study did not address the quality of the measures implemented to prevent damage from extreme events. This may vary depending on what different municipalities have invested in and how far they have come in their adaptation policies. With our study we have gained an overview of the state of adaptation to climate change in Norwegian municipalities. This knowledge is important in order to develop a more effective policy for municipalities on adaptation to climate change.

From our point of view a multilevel governance framework advancing proactive adaptation and the establishment of institutional capacity at the municipal level is of great importance to handle the challenges of climate change adaptation. In that regard, there is a need for more research to increase the understanding of how different levels of governance influence and interact with each other and of the processes leading to efficient networks and interactions between and across governance levels.

**Acknowledgements.** We thank Grete Hovelsrud, Ilan Kelman, Sjur Kasa, Jonas Vevatne, and two anonymous reviewers for helpful comments and suggestions. Funding from the Norwegian Research Council is gratefully acknowledged.

## References

- Adger W N, Arnell N W, Tompkins E L, 2005, "Successful adaptation to climate change across scales" *Global Environmental Change* **15** 77–86
- Adger W N, Dessai S, Goulden M, Hulme M, Lorenzoni I, Nelson D, Næss L O, Wolf J, Wreford A, 2009, "Are there social limits to adaptation to climate change?" *Climatic Change* **93** 335–354
- Berglund F, Nergaard E, 2008, "Utslippsreduksjoner og tilpasninger", Notat 2008:13, NIBR (Norwegian Institute for Urban and Regional Research) Oslo
- Bulkeley H, 2000, "Common knowledge? Public understanding of climate change in Newcastle, Australia" *Public Understanding of Science* **9** 313–333
- Bulkeley H, 2005, "Reconfiguring environmental governance: towards a politics of scales and networks" *Political Geography* **24** 875–902
- Bulkeley H, Betsill M M, 2005, "Rethinking sustainable cities: multilevel governance and the 'urban politics of climate change'" *Environmental Politics* **14** 42–63
- Crabbé P, Robin M, 2006, "Institutional adaptation of water resource infrastructures to climate change in Eastern Ontario" *Climatic Change* **78** 103–133
- Demeritt D, Langdon D, 2004, "The UK Climate Change Programme and communication with local authorities" *Global Environmental Change—Human and Policy Dimensions* **14** 325–336
- Dessai S, Lu X, Risbey J S, 2005, "On the role of climate scenarios for adaptation planning" *Global Environmental Change* **15** 87–97
- Eriksen S, Øyen C, Kasa S, Underthun A, 2009, "Weakening adaptive capacity? Effects of organizational and institutional change on the housing sector in Norway" *Climate and Development* **1** 111–129
- Gustavsson E, Elander I, Lundmark M, 2009, "Multilevel governance, networking cities, and the geography of climate-change mitigation: two Swedish examples" *Environment and Planning C: Government and Policy* **27** 59–74
- Haugen J, Keltzow M, Iversen T, 2008, "Mer ekstrem nedbør og vind i Norge" *Klima* **2** 36–38
- Hovik S, Reitan M, 2004, "National environmental goals in search of local institutions" *Environment and Planning C: Government and Policy* **22** 687–699
- IJC, 1997, "Red River flooding: short term measures", Interim report of the International Red River Basin Task Force to the International Joint Commission, Ottawa/Washington, DC
- IPCC, 2007 *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, Cambridge)
- Journal of Nordregio* 2008, "Warmer, wetter and wilder!" **8**(4) 10

- Levy M, Salvadori M, 1995 *Why the Earth Quakes: The Story of Earthquakes and Volcanoes* (W W W Norton, New York)
- Liso K R, Myhre L, Kvande T, Thue J V, Nordvik V, 2007, "A Norwegian perspective on buildings and climate change" *Building Research and Information* **35** 437–449
- Lorenzoni I, Jordan A, Hulme M, Turner R K, O'Riordan T, 2000a, "A co-evolutionary approach to climate change impact assessment: Part I. Integrating socio-economic and climate change scenarios" *Global Environmental Change—Human and Policy Dimensions* **10** 57–68
- Lorenzoni I, Jordan A, O'Riordan T, Turner R K, Hulme M, 2000b, "A co-evolutionary approach to climate change impact assessment: Part II. A scenario-based case study in East Anglia (UK)" *Global Environmental Change—Human and Policy Dimensions* **10** 145–155
- Lundqvist L J, von Borgstede C, 2008, "Whose responsibility? Swedish local decision makers and the scale of climate change abatement" *Urban Affairs Review* **43** 299–324
- Miller K A, Rhodes S L, Macdonnell L J, 1997, "Water allocation in a changing climate: institutions and adaptation" *Climatic Change* **35** 157–177
- Moser S C, Dilling L (Eds) 2007 *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change* (Cambridge University Press, Cambridge)
- Næss 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, Part A* **15** 125–138
- Norgaard K M, 2006, "‘We don't really want to know’: environmental justice and socially organized denial of global warming in Norway" *Organization Environment* **19** 347–370
- Penning-Rowsell E, Johnson C, Tunstall S, 2006, "‘Signals’ from pre-crisis discourse: lessons from UK flooding for global environmental policy change?" *Global Environmental Change* **16** 323–339
- Pitt D, Randolph J, 2009, "Identifying obstacles to community climate protection planning" *Environment and Planning C: Government and Policy* **27** 841–857
- Potter E, Oster C, 2008, "Communicating climate change: public responsiveness and matters of concern" *Media International Australia* number 127, 116–126
- Regjeringen, 2008, "Klimatilpasning i Norge. Regjeringens arbeid med tilpasning til klimaendringene", [http://www.regjeringen.no/upload/MD/Vedlegg/Klima/Klimatilpasning/Klimatilpasning\\_redegjorelse150508.pdf](http://www.regjeringen.no/upload/MD/Vedlegg/Klima/Klimatilpasning/Klimatilpasning_redegjorelse150508.pdf)
- Smith T F, Preston B, Gorddard R, Brooke C, Measham T G, Withycombe G, Beveridge B, Morrison C, 2008, "Regional workshops synthesis report: Sydney Coastal Councils' vulnerability to climate change", Sydney Coastal Councils Group Inc., Sydney
- Sygnaa L, Eriksen S, O'Brien K, Næss L O, 2004, "Climate change in Norway: analysis of economic and social impacts and adaptations", report 2004:12, CICERO, Centre for International Climate and Environmental Research, Oslo
- Teigland J, 2002, "Sosioøkonomiske effekter av ekstremt vær i Norge—en studie av effekter i tid og rom av nyttårsorkanen 1992", Vestlandsforskning report 07-2002, Sogndal
- Tellus A 2008, "Special issue presenting results from the project RegClim (Regional climate development under global warming)" **60** 395–586
- Tompkins E L, Adger W N, 2005, "Defining response capacity to enhance climate change policy" *Environmental Science and Policy* **8** 562–571
- Urwin K, Jordan A, 2008, "Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance" *Global Environmental Change* **18** 180–191
- Veatne J, Westskog H (Eds), 2007 *Tilpasninger til klimaendringer i Osloregionen. Rapport til Klimasamarbeidet i Osloregionen. Utredning på oppdrag fra Akershus fylkeskommune, Buskerud fylkeskommune og Oslo kommune* CIENS (Centre for Interdisciplinary Environmental Social Research) Oslo
- Zahran S, Brody S D, Vedlitz A, Grover H, Miller C, 2008, "Vulnerability and capacity: explaining local commitment to climate-change policy" *Environment and Planning C: Government and Policy* **26** 544–562

**Conditions of use.** This article may be downloaded from the E&P website for personal research by members of subscribing organisations. This PDF may not be placed on any website (or other online distribution system) without permission of the publisher.