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## **Grappling with the uncertain**

*Climate change in SEA*

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Grappling with the uncertain  
Climate change in SEA

Doctoral thesis

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October 2010

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*Grappling with the uncertain – Climate change in SEA*

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# Preface

This thesis is the result of a three-year Ph.D. fellowship at the Department of Development and Planning at Aalborg University. The project was co-financed by and produced in close cooperation with Rambøll A/S, mainly in Copenhagen. The main subjects of the research project are strategic environmental assessment, climate change, river basin management plans and sociological risk theory. Working with these subjects has provided me with ample opportunity both to expand my knowledge about subjects I had already studied and found interesting and to explore new and contemporary issues.

The cooperation with Rambøll has had a considerable impact on the last three years. Without their financial support and engagement, the project would never have been initiated. I would like to thank my co-supervisor, Head of Department Helle Vang Andersen, for her support, especially her open mind both towards the project and her great insight into practice. At Rambøll I have had the great pleasure of being part of Department 406, Environment and Planning, and I thank all my colleagues in the department for the time I spent with you.

At Aalborg University I have been part of the Department of Development and Planning in Aalborg and Ballerup, the research group Environmental Assessment and Governance, and, during the last months of the project, the Danish Centre for Environmental Assessment. I would like to thank all my colleagues for competent sparring and a great group dynamic – both professionally and socially. I especially thank my main supervisor Professor Lone Kørnøv, for her enthusiasm,

engagement and overview.

As part of the research project, I spent three months as a visiting fellow at Griffith University in Brisbane, Australia. Here I was affiliated with the Urban Research Programme, and I thank Professor Lex Brown and everyone at the programme for giving me the opportunity to visit.

The data collection for this research project could not have been completed without the help of the staff in the Danish municipalities who participated in the survey and in interviews. Thus I thank all the staff from the municipalities that participated, and especially the respondents from Aalborg, Egedal, Favrskov, Guldborgsund, Hillerød, Hørsholm, Næstved, Ringsted and Roskilde who took time to participate in interviews.

Lastly I would like to thank my family and friends for unconditional support and for being the secure basis that gave me confidence to push boundaries. Especially I thank my parents and my sister for all their help, and for the time I have spent with them in Aalborg during the past three years.

*I hope you enjoy the thesis!*



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# Summary

This research project takes its point of departure from an ongoing process of preparing river basin management plans (RBMPs) in Denmark. In this process the Ministry of the Environment has decided that climate change will not be included as a factor in preparing the plans, because of lack of knowledge about the consequences of climate change. It is argued in this thesis that climate change is an important factor, and the potential of integrating climate change in strategic environmental assessments (SEA) of the RBMPs is discussed. On this basis the goal of this research project is to:

*Develop an understanding of the current practice of integrating climate change in SEA, with the Danish RBMPs as a case and focus on uncertainty, and to discuss paths for further development based on this understanding.*

In pursuit of this goal a conceptual model of approaches to integrating climate change in SEA is established on the basis of reflections about the interrelations between climate change and water. The model points to three distinct approaches to integrating climate change in SEA:

- Mitigation: assessment of GHG emissions resulting from a plan, and how these may be reduced
- Adaptation: the impacts of climate change on the plan and how the plan may be adapted to these
- Baseline adaptation: the impacts of climate change on the environmental baseline for the SEA, and how these might influence targets and assessments.

The level of focus on climate change and on the three approaches both in RBMPs and in SEA is investigated. The investigation of RBMPs is based on a document study of submissions for an initial hearing and a survey among municipalities, both carried out as part of this research project. The investigations show that the actors in the initial hearing are divided in their focus on climate change in the RBMPs. The majority of the actors do not mention climate change in their submissions, but 22% do encourage integration of climate change in RBMPs in spite of the Ministry's decision. The regions and municipalities are the actors most often suggesting integration, the latter largely because it is necessary in order to produce good-quality RBMPs. Regarding the three approaches the focus is clearly on adaptation and baseline adaptation. In SEA, the issue of climate change is investigated by carrying out a documentary study of Danish environmental reports. This shows that 58% of the investigated environmental reports integrate climate change, and there is an emphasis on mitigation. Subsequent interviews point towards a lack of systemacy and overview in the approach to integrating climate change.

A theoretical perspective is added to the research, wherein theoretical challenges and focus points for development are derived from Ulrich Beck's theory of risk society, which is presented in "*Risk Society - Towards a new modernity*". It is hypothesised that one challenge of integrating climate change in SEA is delivering assessments and predictions under conditions of uncertainty, complexity and magnitude regarding the consequences



## SUMMARY

of climate change, combined with the fact that science is becoming increasingly unable to determine risk. Another challenge relates to handling differences of opinion and debate because climate change is perceived to increase and spread struggles over risk definitions. The theory of risk society supplemented with notions of post-normal science points to focus points for handling the challenges. These are compared with the understanding gained from empirical investigations and a final set of focus points is presented as suggestions for further paths for development. The focus points are:

- Systematic approach to climate change
- Inclusion of local knowledge
- Inclusion of values
- Addressing uncertainty.

One of the main reflections regarding the theoretical framework is that the struggles over risk definitions which are theoretically prominent have not so far presented themselves in practice. An issue which does appear challenging in practice is uncertainty related to climate change. This is reflected in:

- The decision of the state to exclude climate change
- The survey and interviews with municipalities about future challenges
- The fact that uncertainty is rarely addressed in SEA in Denmark.

It is hypothesised that there are several strategies for avoiding uncertainty, namely denying, ignoring or postponing dealing with it, and that several mechanisms could underlie a decision to avoid it. In many ways the case of climate change in RBMPs and SEA seems to reflect the mindset of modern society. Technical arguments and tangible experiences are dominant, and the exclusion of climate change from the RBMPs is an example of a clash between reliance on

exact scientific knowledge characteristic of the modern society and challenges in terms of uncertainty and complexity characteristic of risk society. Perhaps this indicates that in this case the mindset of the modern society has so far prevailed.

# Dansk resumé

Dette forskningsprojekt tager udgangspunkt i en aktuel planproces med at udarbejde danske vandplaner. I denne proces har Miljøministeriet fastlagt, at klimaændringer ikke vil blive indarbejdet som en faktor i udarbejdelse af planerne på grund af manglende viden om konsekvenserne af klimaændringer. Der argumenteres i dette forskningsprojekt for at klimaændringer er en væsentlig faktor, og potentialerne for at integrere klimaændringer i strategisk miljøvurdering af vandplanerne diskuteres. På denne baggrund er målet med forskningen at:

*Opnå forståelse for nuværende praksis for integration af klimaændringer i strategisk miljøvurdering med de danske vandplaner som case og fokus på usikkerhed, samt at diskutere retninger for videreudvikling baseret på den opnåede forståelse.*

For at forfølge dette mål, opstilles en konceptuel model for tilgange til integration af klimaændringer i strategisk miljøvurdering, på basis af refleksioner over sammenhænge mellem klimaændringer og vand. Modellen peger på tre forskellige tilgange til integration af klimaændringer i strategisk miljøvurdering:

- Forebyggelse: Vurdere og afbøde emissioner af drivhusgasser der resulterer fra planen.
- Tilpasning: Tilpasse planen til konsekvenserne af klimaændringer.
- Tilpasning af baseline: Inkludere konsekvenser af klimaændringer i miljøstatus eller miljømæssig baseline.

Spørgsmålet om, hvor meget fokus der

er på klimaændringer og de tre tilgange, undersøges både i forbindelse med vandplanerne og strategisk miljøvurdering. Undersøgelsen af vandplanerne baseres på et dokumentstudie af indlæg til en indledende høring, samt en spørgeskemaundersøgelse blandt de danske kommuner. Begge er udført i forbindelse med dette forskningsprojekt. Undersøgelserne viser, at aktørerne i den indledende høring er delte i deres syn på, hvorvidt klimaændringer bør integreres i vandplanerne. Størstedelen af aktørerne nævner ikke klimaændringer i deres indlæg, men 22% opfordrer til, på trods af Miljøministeriets beslutning, at klimaændringer integreres i vandplanerne. Regionerne og kommunerne er de aktører, der oftest opfordrer til en integration, og for kommunerne er den væsentligste grund at en integreret tilgang er nødvendig for at kvalificere vandplanerne. Vedrørende de tre tilgange er der mest fokus på tilpasning og tilpasning af baseline. For at undersøge fokus på klimaændringer i strategisk miljøvurdering, gennemføres i dette forskningsprojekt et dokumentstudie af danske miljøvurderingsrapporter. Undersøgelsen viser, at klimaændringer er integrerede i 58% af rapporterne og at der lægges vægt på forebyggelse. Opfølgende interviews peger på manglende systematik og overblik i forhold til tilgange til integration af klimaændringer.

Et teoretisk perspektiv anlægges på forskningen, hvor teoretiske udfordringer og fokuspunkter for udvikling af integration af klimaændringer i strategisk miljøvurdering er opbygget. Dette er baseret på Ulrich Becks teori om risikosamfundet, fremsat i *"Risikosamfundet og det andet moderne"*. Der opstilles i forskn-

## DANSK RESUMÉ

ingsprojektet en hypotese om, at det er en udfordring at gennemføre vurderinger og forudsigelser under påvirkning af usikkerhed, kompleksitet og potentielle katastrofale konsekvenser af klimaændringer, kombineret med at videnskaben i stigende grad ikke er i stand til at fastlægge risici. En anden udfordring for integration af klimaændringer i strategisk miljøvurdering ses i at håndtere uenigheder og debat, idet klimaændringer forventes at forøge og sprede kampe om risikodefinitioner. Teorien om risikosamfundet, suppleret med idéen om post-normal videnskab, peger også på fokuspunkter for håndtering af udfordringerne. Disse fokuspunkter sammenlignes med forståelsen for praksis, og der opstilles et endeligt sæt af fokuspunkter, der udgør dette forskningsprojekts forslag til retninger for videre udvikling. Fokuspunkterne er:

- Systematisk tilgang til klimaændringer
- Integration af lokal viden
- Integration af værdier
- Håndtere usikkerhed

En af de væsentligste refleksioner over den teoretiske ramme er at de kampe om risikodefinitioner, som er fremtrædende i teorien, indtil videre ikke lader til at slå igennem i praksis. Et emne, som til gengæld lader til at være udfordrende i praksis, er usikkerhed relateret til klimaændringer. Dette afspejles i:

- Statens beslutning om at ekskludere klimaændringer fra de danske vandplaner.
- Spørgeskemaundersøgelsen hos kommunerne omkring fremtidige udfordringer.
- Det faktum at usikkerheder sjældent er håndteret i miljøvurderingsrapporter.

Der opstilles en hypotese om, at der er flere forskellige strategier for at undgå at

tage hånd om usikkerhed - at benægte, ignorere eller udsætte usikkerhed - samt at der kan ligge en række forskellige mekanismer bag beslutningen om at undgå usikkerhed. På flere måder lader problematikken omkring klimaændringer i vandplaner og strategisk miljøvurdering til at afspejle det moderne samfund. Tekniske argumenter og håndgribelige erfaringer dominerer, og ekskluderingen af klimaændringer fra vandplanerne er et eksempel på et sammenstød mellem afhængigheden af den eksakte videnskab, som er karakteristisk for det moderne samfund, og udfordringerne i form af usikkerhed og kompleksitet i risikosamfundet. Så tilsyneladende dominerer det moderne samfunds tankegang stadig denne case.

# Introduction

# 1

*This chapter constitutes the introduction to the overall background and purpose of the thesis. These issues are all elaborated in the following chapters.*

The research project behind this thesis originated from a challenge in the field of strategic environmental assessment (SEA) in Denmark. As shown in figure 1.1, the challenge lies in the intersection between three current issues in Danish planning: river basin management plans (RBMPs), climate change and SEA.

SEA is to be prepared for new Danish RBMPs, and since this is a new type of plan in the Danish context, it poses a challenge. At the same time, climate change is presenting itself as a key issue for the RBMPs. However, in spite of this climate change has been formally excluded from the national planning process because of argued uncertainty in the form of lack of knowledge. The exclusion is debatable and it poses the problem of inaction by planners and decision-makers confronted

with uncertainty. The exclusion of climate change from the RBMPs causes a need to look at the potential for SEA to integrate climate change in the process of preparing RBMPs.

My own professional point of departure and main interests are SEA and the integration of climate change in SEA. Added to this is puzzlement about developments in practice, where climate change is omitted from Danish RBMPs despite the fact that it seems an obvious factor to include. This has sharpened my focus on SEA as a means of handling climate change in relation to the RBMPs. At the same time, the situation in Denmark has caused me to question the lack of action in situations characterised by uncertainty as well as the dependence on scientifically based numbers and models which the

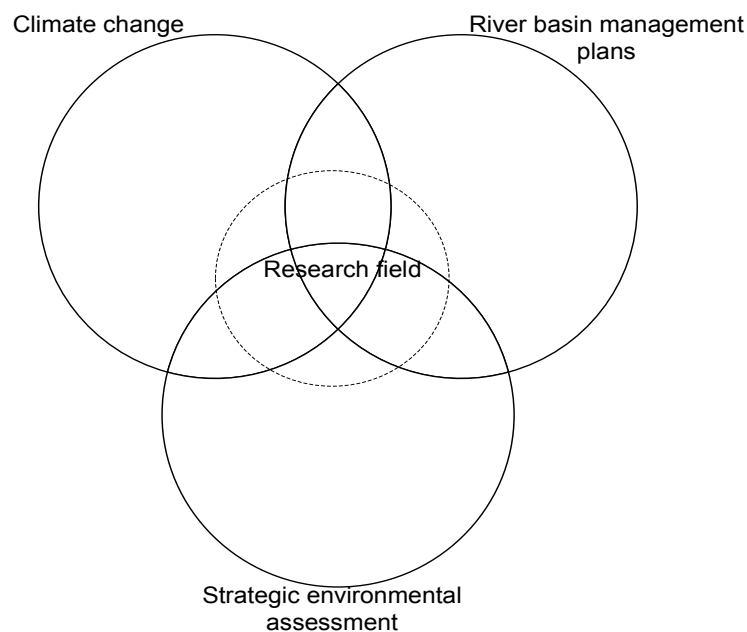


Figure 1.1 Research field

## INTRODUCTION

exclusion of climate change could reflect. My focus on uncertainty and risk derives from this situation, which is a challenge to SEA.

There is little experience of working with climate change in SEA in Denmark, and on the national level no methodology or guidance has been developed. Against this background it is the goal of the research to investigate and discuss SEA practice in the light of the current challenge.

### **Research goal:**

*To develop an understanding of the current practice of integrating climate change in SEA, with the Danish RBMPs as a case and focus on uncertainty, and to discuss paths for further development based on this understanding.*

The understanding of further development in terms of integrating climate change in SEA is broad, and encompasses both the overall design of the process and more specific tools. To provide the basis first the relevance of and experiences with integrating climate change in SEA and RBMPs in Denmark are explored, guided by the following research questions.

### **Research questions:**

1. What is the level of focus on climate change in SEA and RBMPs in Denmark?
2. How can climate change conceptually be integrated in SEA, and how is this concept reflected in practice in relation to SEA and RBMPs?

The question of why or why not climate change is integrated in SEA in Denmark is posed and a theoretical framework is derived from sociological risk theory. This is used to understand the observations from practice and also helps to direct discussion of further development. The theoretical framework is chosen because

it provides a frame for understanding the empirical developments regarding climate change in RBMPs and SEA, and sparks interesting questions and perspectives. Thus this contributes to the understanding of uncertainty and risk and what this means to SEA and decision-making. The following research question is posed.

### **Research question:**

3. What are the theoretical challenges and focus points which are relevant in integration of climate change in SEA and how are these reflected in practice?

Based on the analysis of the research questions, a more forward-looking approach is taken when discussing paths of development for the integration of climate change in SEA.

In the introductory chapters of the thesis, the background to the research questions is explored further.

## **1.1 Reading guide**

The thesis is structured in three overall parts: *introduction*, *analysis*, and *discussion and conclusion*.

*Introduction* contains a more detailed presentation of the research project, including further discussion of the main issues: SEA, climate change, and RBMPs and the cross-sections between these. The research goals and questions are also readdressed. The section concludes with a chapter on the overall methodology of the research project. Part of this is in the form of an article:

- Kørnøv, Lone; Lyhne, Ivar; Larsen, Sanne Vammen and Hansen, Anne Merrild. 2010. *Change agents in the field of strategic environmental assessment: What does it involve and what potentials does it have for research and practice?* Under review at Journal of Environmental Assessment

Policy and Management. It contains reflections with regard to the set-up of the research project and the implications of this for research and practice.

*Analysis* contains analysis of specific issues in the form of four articles:

- Larsen, Sanne Vammen and Kørnøv, Lone. 2009. *SEA of river basin management plans: Incorporating climate change*. Published in *Impact Assessment and Project Appraisal* 27(4): 291-99. It focuses on the issues of how to integrate climate change in SEA of RBMPs, based on considerations of the linkages between climate change and water. The main result is a conceptual framework for how to integrate climate change in SEA.
- Larsen, Sanne Vammen. 2010. *Risk as a Challenge in Practice: Investigating Climate Change in Water Management*. Published online in Regional Environmental Change DOI 10.1007/s10113-010-0123-7. It focuses on the role of climate change in the RBMPs and the related planning process. The theoretical framework is used as a frame for analysing how climate change is handled in practice and which aspects of climate change are important in the RBMPs. This also leads to reflections regarding the applicability of the theory.
- Larsen, Sanne Vammen and Kørnøv, Lone. 2010. *Integrated approach to climate change: Is SEA responding to the challenge?* Submitted to Environmental Impacts Assessment Review. It is focused on the issues of climate change in SEA. Reviews experiences of integrating different approaches to climate change and the potential consequences of current practice.
- Kørnøv, Lone and Larsen, Sanne

Vammen. 2010. *The non-handling of climate change uncertainties in strategic environmental assessment*. Final draft. It concludes that climate change uncertainties are not addressed in Danish SEA and explores the underlying reasons for this.

The main results of the analysis are summarised and discussed in a preliminary conclusion, where the three research questions are answered and the first part of the research goal addressed.

*Discussion and conclusion* examines possibilities for further development of the integration of climate change in SEA against the backdrop of previous analysis, thus allowing the second part of the research goal to be addressed. Conclusions are drawn on the project as a whole.

References in this thesis follow the Harvard style. In the text, references before a full stop refers to the sentence, and references after a full stop refers to the paragraph above. Because many of the sources used for this research project are in Danish, quotes have been translated from Danish to English. Where the source of a quotation is in Danish the translation has been made by the author of this thesis. Figures are numbered with chapter number followed by a consecutive number.



# Part 1

## Introduction





# New challenges

## in Danish planning

# 2

*This chapter contains further presentation of the three issues: RBMPs, SEA and climate change. As described in chapter 1, these issues and the connections between them constitute the field of research for this thesis. Thus the review in this chapter forms a framework for understanding the origin, problem and design of the research. It further contains the state of the art and the contributions of the thesis.*

The chapter begins with a short separate introduction to the RBMPs, SEA and climate change in sections 2.1, 2.2, and 2.3. The review of legislation in sections 2.1 and 2.2 is mainly based on the Danish legislation rather than the European directives, because this research project is focused on the Danish context. In section 2.4 the connections between the main issues are discussed, and a summary is given in section 2.5.

### **2.1 River basin management plans**

In 2000 the EU passed *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*, also known as the Water Framework Directive (WFD) (Directive 2000/60/EC 2000; Ministry of the Environment and Coun-

ties in Denmark n.d., p. 3). The directive was implemented in Danish legislation in 2003 through the *Law on environmental goals* (Anker 2006, p. 453). Regarding water, the purpose of the law is to "establish frames for protection of surface and ground water" (LBK nr 1756 2006, §1). The frames are meant to secure fulfilment of the overall goal of the WFD, which is to achieve "good status" for all water bodies in the EU in 2015 (Directive 2000/60/EC 2000, Article 4; Anker 2006, p. 419).

The law prescribes the preparation of state RBMPs and municipal action plans covering the whole of the country (an overview of the Danish public authorities is provided in box 1). Every RBMP contains environmental goals for all surface and ground water in the area covered by the plan, as well as a programme of meas-

#### **Box 1: The Danish public authorities**

There are three levels of public authority in Denmark: state, regional and municipal.

- State: The overall authority is the Danish state: the area of planning and environmental assessment is represented by the Ministry of Environment and the Agency for Spatial and Environmental Planning. The Ministry has established five environmental centres in five different locations to act on its behalf.
- Regions: The level of authority below the state is the five regions of North Denmark, Central Denmark, South Denmark, Zealand and the Capital.
- Municipalities: The most local authorities in Denmark are the 98 municipalities. They range in size from 500.000 inhabitants in the municipality of Copenhagen to 2000 in the municipality of Læsø, on average numbering 55.000 inhabitants per municipality.

(Ministry of the Interior and Health 2005; Ministry of the Environment n.d.a)

## NEW CHALLENGES

ures with instruments to reach the goals in a cost-effective way. The municipal action plans are intended to determine how these measures are utilised at the local level in order to achieve the environmental goals of the state RBMPs, and thus the implementation of the RBMPs is the responsibility of the municipalities. (LBK nr 1756 2006) Examples of environmental goals and measures can be seen in box 2.

Overall, the goals are to prevent a deterioration in the status of surface and ground water, both from natural and human-made causes, as well as to prevent any increased pollution with dangerous chemicals (LBK nr 1756 2006, §11). Further, the goal is to improve the status of all surface and ground water to the point where all water bodies have achieved "good status" in 2015, as prescribed in the WFD. The understanding of good status includes ecological, chemical and quantitative status. (LBK nr 1756 2006, §12; Ministry of the Environment and Counties in Denmark n.d., p. 4)

The preparatory work for the state RBMPs has included preparing basis analyses, which were published in 2005 and 2006. Subsequently preparation of the RBMPs began following the schedule shown in figure 2.1.

As shown in figure 2.1 the process in-

cludes three hearings, among these an initial hearing regarding the RBMPs and subsequent SEA. After the initial hearing, the planning process was delayed, and the first draft for RBMPs was released for a pre-hearing in the municipalities in January 2010, more than a year later than planned. The reason given for this is that the RBMPs needed to be coordinated with the *Green Growth* strategy of the Danish Government (Agency for Spatial and Environmental Planning 2009). *Green Growth* is a political agreement and the Danish Government's strategy for a green growth economy "where a high level of environmental, climate and nature protection goes hand in hand with a modern and competitive agriculture and food production" (Government 2009, p. 3). Furthermore, in *Green Growth* it is established that it is the government's intention that the environmental goals should be reached through "a cost-effective effort which secures an actual effect on the environment" (Government 2009, p. 5). In *Green Growth* the Government sets overall goals for a water environment of good quality as well as concrete goals, for example a 19.000 ton reduction in leaching of nitrogen by 2015. Also, concrete measures for obtaining the goals are presented, for example establishing 13.000 hectares of wetlands, and the overall financing of the instruments is laid out. The RBMPs are part

### **Box 2: Examples of environmental goals and measures**

Environmental goals:

- Ecological status of lakes: content of chlorophyll A
- Chemical status coastal waters: content of chemical substances, for example lead and mercury

Measures:

- Aftercrops
- Establishing wetlands
- Improved sewage treatment

(Environmental Centre Aalborg and Environmental Centre Ringkøbing 2010)

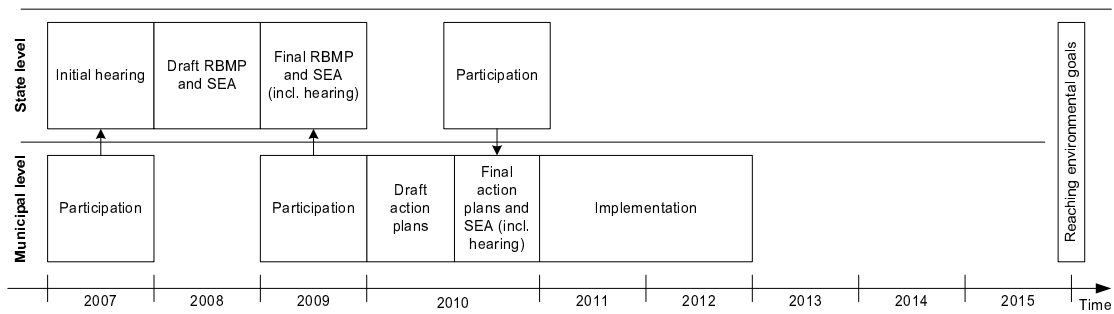


Figure 2.1 Process and time schedule for implementation of the new water planning in Denmark. Based on (Ministry of the Environment n.d.b; Ministry of the Environment and Counties in Denmark n.d.)

of the programmes established in *Green Growth* and thus needed to be coordinated with it. (Government 2009) In June 2010 Denmark along with 12 other EU Member States received a letter of notice pointing out the lacking RBMPs and thus lacking compliance with the WFD (Danish Parliament 2010). The Danish Government has not yet answered the letter of notice. (Danish Parliament 2010) However, according to Danish media, it seems that there is still much political disagreement about the RBMPs; specifically there is much discussion about negative consequences of interventions in relation to agriculture. It seems that the RBMPs and the agreements made in *Green Growth* are still very much open for political discussion. (Jerking 2010) Thus at the time of completing this thesis, the final RBMPs have not yet been published, the planning process is contested, and there is no deadline for finalising the plans.

What influence the delay of the RBMPs will have on the time schedule for the rest of the planning process is yet to be seen. After final approval the RBMPs are valid for six years, after which they will then be revised. The preparation of the second generation of RBMPs will begin in 2015. The state and regional authorities as well as the municipalities will ensure fulfilment of the outlined environmental goals and advance them through their daily administration. (LBK 1756 2006, §3) Part of such a planning process is a strategic environmental assessment.

## 2.2 Strategic environmental assessment

In 2001 the *Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment* was passed by the EU (Directive 2001/42/EC 2001). The Directive was implemented in Danish legislation in 2004 through the *Law on environmental assessment of plans and programmes*. The law has been amended since, the last time in 2009. (LBK nr 1398 2007; LOV nr 250 2009) The purpose of the law, and subsequently of SEA, is to "secure a high level of environmental protection and to contribute to the integration of environmental considerations during the preparation and approval of plans and programmes with a view to promoting sustainable development through securing preparation of an environmental assessment of plans and programmes which have potentially significant impacts on the environment" (LOV nr 250 2009). According to the law, an environmental report is to be prepared for certain plans and programmes (for the sake of simplicity the different forms of strategic actions covered by SEA are from now on referred to as plans). The report should describe and assess the likely environmental impacts of the plan and reasonable alternatives, with the purpose of improving the possibilities of assessing which solutions are most expedient in a sustainability framework. (LBK

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nr 1398 2007, §7; VEJ nr 9664 2006, p. 3) SEA is thus a systematic assessment of the environmental consequences of plans based on a broad concept of the environment, with the purpose of supporting more sustainable decisions at a strategic level, through integrating environmental issues in decision-making (Kørnøv 2001, pp. 3-6; Kørnøv and Christensen 2005, pp. 345-6; Therivel 2004, p. 7). Thus, one of the possible results of SEA is delivering information to decision-makers, allowing them to use this when making their decisions (Therivel 2004, p. 15).

As a result of the law an environmental report has to be produced in relation to certain plans. Which plans are covered by the law is determined through a screening process, the first step in SEA as illustrated in figure 2.2. Overall it encompasses plans which establish frameworks for future project approvals and have significant impacts on the environment, meaning that an initial exploration of possible significant impacts on the en-

vironment takes place in the screening (LBK nr 1398 2007, §2-3). The environmental impacts which are investigated in SEA are impacts on "*biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape, and the interrelationship between the above factors*" (LBK nr 1398 2007, §1 stk.2). The exact focus and content of an SEA is determined in the scoping stage. Here a delimitation is made with a point of departure in the above-mentioned issues, through further exploration of the possible significant impacts of the specific plan. (VEJ nr 9664 2006, p. 16) The content of the environmental report includes identifying, describing and assessing environmental impacts in accordance with fixed demands (LBK nr 1398 2007, §7). The impacts assessed should include secondary, cumulative, synergistic, short-, medium- and long-term, permanent and temporary, positive and negative impacts. Beyond the

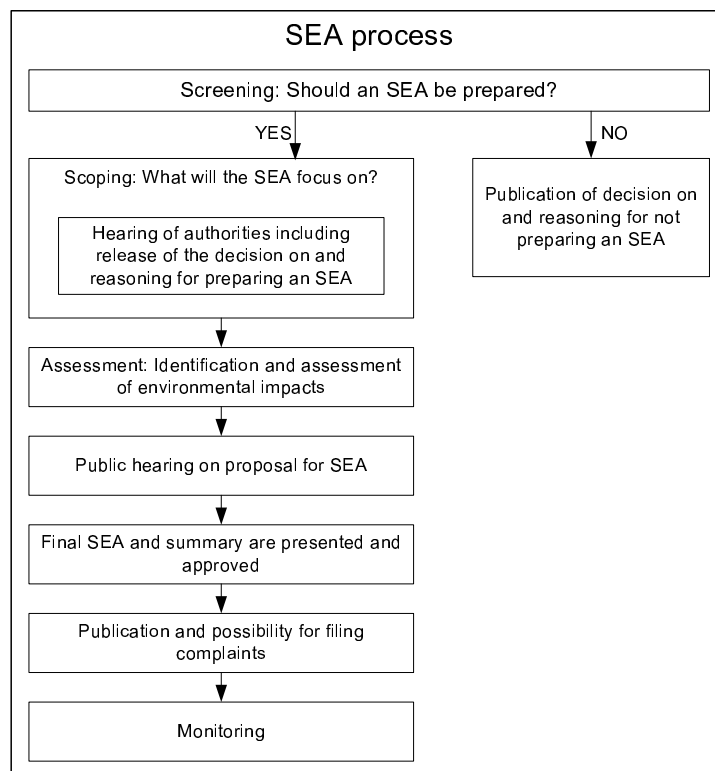


Figure 2.2 The SEA process (LBK nr 1398 2007)

potential impacts of the plan on the environment, the assessment should also contain information about “any existing environmental problem of relevance for the plan or programme”. (LBK nr 1398 2007, appendix 1) Thus SEA both covers the impacts of the plan on the environment and the impacts of the environment on the plan.

Figure 2.2 shows that hearings and right of complaint are embedded in the process. This is closely connected to the fact that SEA is perceived as an instrument for providing more transparency and public participation in an otherwise often closed and complex political decision-making process (Kørnøv 2001, p. 7; Therivel 2004, p. 17). The process is completed with the approval and release of the final plan and environmental report followed by monitoring.

The basic SEA process described in figure 2.2 is modelled on a rational decision-making process. Questions have, however, been raised by among others Kørnøv and Thissen (2000) and Nilsson and Dalkmann (2001) about the assumption of a rational decision-making process. Some of the issues pointed out as contradicting it are the multiplicity of stakeholders, problem definitions, solutions, norms and values as well as issues of power and social interaction, uncertainty, lack of knowledge and limited cognitive resources. Thus it is suggested that actual decision-making processes are complex, and that SEA should take this into consideration. (Kørnøv and Thissen 2000; Nilsson and Dalkmann 2001) One of the issues currently attracting much political attention and controversy is climate change.

### 2.3 Climate change

In the fourth assessment by the IPCC climate change is defined as “a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variabil-

ity of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity” (Bernstein et al. 2007, p. 30). Present and future climate change is currently assessed by the IPCC as real and probably caused by society’s increasing emissions of GHGs. Global emissions of GHGs increased by 70% from 1970 to 2004, and are mainly related to use of fossil fuels. Most stem from energy supply, transport, industry, agriculture and forestry. (Barker et al. 2007)

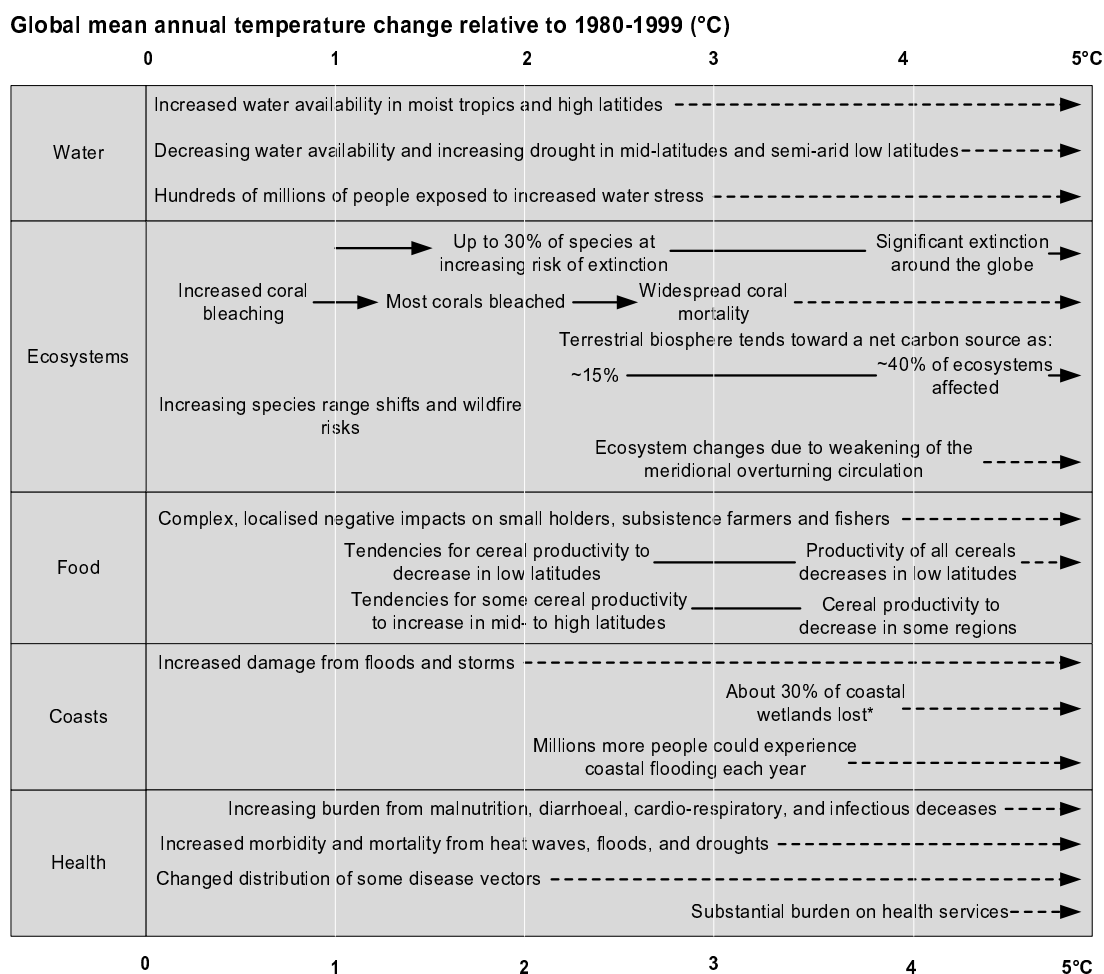
The IPCC has drawn up figure 2.3, which shows several examples of potential consequences of climate change on a global scale.

Among the consequences are, for example, lack of water and increasing pressure on specific species. It is noticeable that the consequences of climate change vary between regions. For example, precipitation is predicted to increase in some regions and decrease in others, causing variations in water availability between regions. (Bernstein et al. 2007)

Predictions of future climate change specific to Denmark in 2100 compared with 1990 include a rise in average yearly temperature of 0.7 to 4.6 °C. The rise in temperature is followed by an increase in precipitation in winter and a decrease in precipitation in summer, as well as more extreme events in the shape of extreme precipitation or drought. With increased temperature come increased evaporation, increased water temperature, and a minor increase in storms. On the basis of predictions of global sea level rise and the change in wind patterns a sea level rise of 0.6 to 0.9 metres is predicted for the west coast of Denmark. (Meteorological Institute of Denmark n.d.a; Bates et al. 2008)

There are two overall approaches which

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\* Significant is defined here as more than 40% \* Based on average rate of sea level rise of 4,2 mm/year from 2000 to 2080

Figure 2.3 Examples of possible consequences of changes in average global temperature (Bernstein et al. 2007, p. 51)

society could adopt to counter the negative effects of climate change. As Bernstein et al. (2007, p. 56) describe it: "Societies can respond to climate change by adapting to its impacts and by reducing GHG emissions (mitigation), thereby reducing the rate and magnitude of change". Previously the focus has primarily been on reduction of GHG emissions, but in recent years more attention has been paid to the necessity of adaptation: "adaptation measures will be required at regional and local levels to reduce the adverse impacts of projected climate change and variability, regardless of the scale of mitigation undertaken over the next two to three decades" (Bernstein et al. 2007, p. 56).

It is important to be aware of the un-

certainities connected with determining both present and future climate change. The Meteorological Institute of Denmark (n.d.b) state that "in practice it is a very difficult task since the climate models are not nearly detailed enough to describe all elements of the real world". The IPCC explicitly addresses and categorises uncertainty. In relation to climate changes there is a focus on scientific uncertainty, for example in relation to feedback mechanisms in the carbon cycle or changes in ice flow. In relation to responses to climate change the IPCC also delves into the uncertainties related to how planners will integrate knowledge of climate change in their decision, and what the institutional, political and financial constraints for adaptation will be. (Bernstein

et al. 2007)

## 2.4 Cross-fields

After the three issues of RMPS, SEA, and climate change the following sections 2.4.1, 2.4.2 and 2.4.3 deal with the cross-fields between these issues, as illustrated in figure 2.4.

### 2.4.1 RBMPs and SEA

The two planning instruments RBMPs and SEA have the overall purpose of supporting sustainable development. They promote this development in different ways: the legislation on SEA demands a process with a certain content to promote the overall goal of sustainable development, whereas the legislation on RBMPs demands the fulfilment of concrete environmental goals to promote sustainable development.

There are different connections between RBMPs and SEA. The most immediate connection between the two planning instruments is that SEA is to be carried out for both the state RBMPs and the municipal action plans. This is based on the fact that water management is one of the sectors covered by the legislation on SEA, as well as the fact that RBMPs and action plans set frames for future project approvals and potentially have sig-

nificant environmental impacts (LBK nr 1398 2007, §3a; Carter and Howe 2006, p. 288). On different occasions I have heard practitioners ask why SEA is necessary when the RBMPs are fundamentally beneficial for the environment. The role of SEA in this context is to assess from a more holistic perspective the environmental consequences of the measures put in place to improve the water environment. Consequently SEA is an instrument for identifying interactions such as environmental suboptimisation in implementation of the RBMPs.

Another connection between the two is present in connection to other plans, which might affect the environmental goals of the RBMPs, for example spatial plans and waste water plans. As an example, a spatial plan for a new residential area might lead to emission of waste water, which can affect the quality of nearby water bodies and thus jeopardise fulfilment of the environmental goals in the RBMPs. In the Danish legislation on RBMPs it is stated that *"when exercising powers pursuant to legislation, state authorities, regional and municipal councils are bound by the RBMP and the municipal action plan and shall inter alia secure the implementation of the programme of measures and the municipal action plan"*

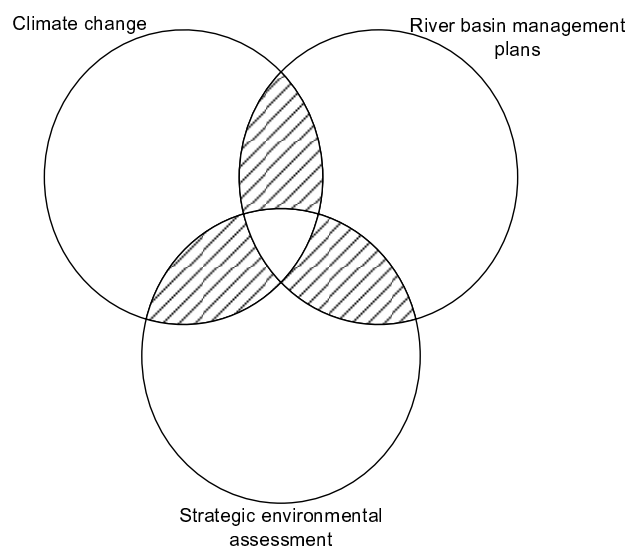


Figure 2.4 Illustration of the cross-fields between the three main issues.



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(LBK nr 1756 2006, §3). Thus, as also stated in section 2.1, the authorities are obliged to further the implementation of the RBMPs when performing other duties, and other plans are not allowed to counteract the RBMPs. In a case where a plan might have the potential to influence the implementation of the RBMPs, SEA of the plan can be used to identify, assess and prevent negative impacts on the goals and measures of the RBMPs (Carter and Howe 2006, p. 288).

Besides these connections the WFD and the directive on SEA have several convergent procedural demands, for example regarding collection of baseline data, assessment of alternatives, and identification of mitigation measures (Carter and Howe 2006, p. 292). Carter and Howe (2006, p. 292) argue that these convergences can lead to a beneficial coordinated process, whereby synergies can be obtained along with a more holistic perspective on the planning. For example, monitoring data from the RBMPs can be used in SEA of other plans and vice versa.

It is important to note that RBMPs are sector plans, and that there are not many experiences with SEA of this type of plan in Denmark. Thus in the Danish collection of examples of SEA from 2007 only one SEA of a sector plan is included (Kørnøv, Østergård and Steen 2007, p. 4). Further, the analysis of the initial hearing prepared for this research project shows that out of the 365 actors who were included in the analysis, only twelve refer to the SEA, so even though the hearing included both the RBMPs and the SEAs of these, there was not much focus on SEA.

### 2.4.2 Climate change and SEA

In the legislation on SEA climate change is included (cf. section 2.2) in the concept of environment in the form of "*climatic factors*" and therefore the impacts of the plan on these is included (LBK nr 1398

2007, §1 stk. 2). Climatic factors are not defined in more detail in the Danish legislation. In the guidance local climatic changes related to construction are mentioned as an example of climatic factors (VEJ nr 9664 2006, p. 6). Later in the guidance climate change is mentioned as an example of a cumulative environmental impact (VEJ nr 9664 2006, p. 48), and an example of environmental goals is reducing the risk of damage to buildings caused by sea level rise (VEJ nr 9664 2006, p. 58). As regards whether or not climate change is currently integrated in environmental assessments in Denmark, an analysis of 153 environmental reports shows that 58% integrate climate change (Larsen and Kørnøv 2010). Thus climate change is not prominent in the Danish legislation on SEA or practice of SEA.

Internationally, a report prepared for the European Commission in 2009 shows that in SEA "*specific attention to climate change issues appears still to be limited in many Member States*" but there now seems to be increasing attention paid to the issue (COWI 2009, p. 116). There are examples of more systematic work with climate change in environmental assessment. In the UK a guidance paper is available on how to include climate change in SEA. The guidance points out the need to consider mitigation of and adaptation to climate change and gives specific instructions on how to include these issues at the various stages of the SEA process. (Levett-Therivel Sustainability Consultants 2007) Both OECD and the Vietnam-Sweden Cooperation Programme have worked specifically on integration of climate change in SEA in relation to development work (Risse and Brooks 2008; Vietnam-Sweden Cooperation Programme 2008). The OECD guidance aims to advise development professionals working with strategic planning on a national or sectoral level on how to assess the resilience of planning under different climate change scenarios and identify

adaptation measures (Risse and Brooks 2008). The guidance from the Vietnam-Sweden Cooperation Programme aims at investigating the climate change-related activities of the programme more broadly and mentions SEA as an opportunity to consider climate change mitigation and adaptation in relation to policies, plans and programmes. The guidance suggests accounting for how climate change will influence the environmental baseline and using this as the basis of the assessments. (Vietnam-Sweden Cooperation Programme 2008)

Also, in Denmark, examples of statements on the expedience of integrating climate change in environmental assessment are found. For example Danida (2005, p. 30) in their Danish Climate and Development Action Programme mention that climate change should be handled in both SEA and EIA in relation to development work. It is further mentioned that not only development's impact on climate change should be in focus but also the impacts of climate change on development. (Danida 2005, p. 10) In the climate adaptation strategy of the Danish government, climate change and SEA are also mentioned, since it asks for "an assessment of whether the existing arrangements for impact assessment, for instance SEA (*Strategic Environmental Assessment*) and EIA (*Environmental Impact Assessment*) are sufficient from a climate change adaptation point of view or if changes are required" (Government 2008, p. 30). Thus both guidance on and experiences with integration of climate change in SEA are lacking in Denmark, but there is also evidence of the need to consider this.

### 2.4.3 Climate change and RBMPs

Several of the potential climate changes mentioned in section 2.3 are related to water. Likewise climate change in Denmark has many possible consequences with relation to water, inter alia (Ministry

of Finance et al. 2007; Bates et al 2008; Sonnenborg et al. 2006; Bouraoui et al. 2004; Eisenreich 2005):

- Ground water intrusion into sewers
- Flooding
- Leaching of pesticides and nutrients
- Drought
- Coastal erosion
- Changes in bacteria in water
- Changes in flow to water reservoirs
- Salt water intrusion into ground water
- Oxygen depletion
- Changes in ecology and biodiversity

There are many investigations of how and why climate change is dealt with in the water sector (see for example Eisenack, Tekken and Kropp 2007; Moser and Tribbia 2007; Næss et al. 2005; Arnell and Delaney 2006; Subak 2000) The potential consequences of climate change for water point to the relevance of dealing with climate change in the RBMPs. Climate change is not mentioned specifically in the WFD, however. *The Common Implementation Strategy for the Water Framework Directive* (2005, p. 14) touches on the relevance of climate change for RBMPs, since mitigation of impacts of climate change are mentioned as one of the benefits of implementing the WFD. Likewise it is mentioned in a document from the European Commission (2007, p. 41) that "as climate change impacts could enhance the risk of non-attainment of the objectives of the WFD, further steps are also needed to include climate change as an additional pressure on the EU waters. Already now, it is clear that all hydrological processes are affected by climate change". In the EU White Book on climate change adaptation the same issue is touched upon, as it is stated that "the River Basin Management Plans due in 2009 under the Directive will take into account the impacts of climate change and the next generation of plans...should be fully climate-proofed" (European Commission 2009, p. 11). Thus there are

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indications of the relevance of addressing climate change in relation to RBMPs.

### 2.5 State of the art

This research project contributes in two areas. The primary contribution is the analysis and work on climate change in SEA, with a focus on uncertainty and using sociological theory on risk. The other contribution consists of the analysis of climate change in RBMPs. State of the art for these areas is summed up below.

#### *Climate change in SEA*

This field includes research on climate change in environmental impact assessment of projects (EIA) and impact assessment more broadly, such as (Byer and Yeomans 2007; Duinker and Greig 2007; Wilson and Piper 2008). Wilson and Piper (2008) call for an integration of climate change in EIA and SEA to promote mitigation of and adaptation to climate change, whereas Byer and Yeomans (2007) and Duinker and Greig (2007) specifically address the use of different tools to integrate the consequences of climate change in EIA. The Federal-Provincial-Territorial Committee on Climate Change (2003) in Canada has published guidance on integration of climate change in impact assessment of projects, covering both greenhouse gas (GHG) emissions from projects and the impacts of climate change on projects.

Specifically regarding climate change and SEA, Wilson (2010) has problematised the lack of integrated work on climate change adaptation and mitigation in SEA of UK regional spatial plans. Also, as reviewed in section 2.4.2, different forms of guidance have been published. OECD and the Vietnam-Sweden Cooperation Programme have published guidance on integration of climate change adaptation in SEA (Risse and Brooks 2008; Vietnam-Sweden Cooperation Programme 2008, 4). Guidance on climate change in SEA developed for the UK by Levett-Therivel

Sustainability Consultants (2007).

Regarding uncertainty, Tennøy, Kværner and Gjerstad (2006) have investigated the handling of uncertainty in EIA, and emphasise a need to address and communicate uncertainty. Regarding risk and uncertainty specifically in SEA, Thisen and Agusdinata (2008) has worked with handling deep uncertainties in impact assessment in general. They discuss different approaches to uncertainty and suggest a specific analytical approach. The state of the art also includes Elling (2008), who discusses impact assessment from a theoretical perspective using sociological theory focused on reflexive modernisation. He is critical of Beck's thesis on risk society and bases his work on the theories of Habermas, calling for a focus on public deliberation and going beyond the cognitive-instrumental rationality which he believes dominates impact assessment.

Compared with the state of the art, the contribution of this research project is first of all that it is targeted at researching and developing the work on climate change specifically in SEA. Furthermore, it has a broad scope regarding climate change which is e.g. not limited to adaptation to climate change. In general there is not an abundance of research to be found on climate change, uncertainty and SEA, so a contribution is made to a developing field of research. Also this research project contributes in a different context, since it is primarily focused on Denmark and takes its point of departure in the new case of RBMPs. Further, it differs in its use of Beck's theory on risk society as a theoretical framework relatively untested in the field of impact assessment.

#### *Climate change in RBMPs*

Beyond a contribution to SEA, this research project also seeks to offer a modest contribution to research into the is-

sue of climate change in RBMPs in terms of the relevance of climate change as an issue, and the challenges of integration. In this regard much research has been done in relation to how and why climate change has been integrated in planning and practices both in general and in the water sector (see e.g. Berkhout, Hertin and Gann 2004; O'Brien et al. 2006; Blennow and Persson 2008; Adger et al. 2009; Battaglini et al. 2009; Eisenack, Tekken and Kropp 2007; Moser and Tribbia 2007; Næss et al. 2005; Arnell and Delaney 2006; Subak 2000).

Here, compared to the state of the art, this research project contributes by investigating the relevance and challenges of climate change as regards the new case of Danish RBMPs and using the theoretical framework of risk theory in this connection.

*Contributions*

Figure 2.5 summarises the contributions of this research project.

As the figure illustrates, the most important contribution is made to the field of SEA, more specifically through work with integration of climate change in SEA, the new case of RBMPs and the framework of uncertainty and risk theory. The second, and minor, contribution is made in relation to RBMPs. Here, considerations about issues of climate change and their relevance in RBMPs, as well as the framework of risk theory is considered a contribution to this new case.

**2.6 Summary**

On the basis of the review in this chapter it is clear that a range of new challenges are emerging in the area of SEA in Denmark. First are the new RBMPs, which have not previously been subject to SEA. The global problem of climate change has appeared on the agenda, and has been acknowledged as one of the most significant environmental issues facing society. Thus climate change is not one of the traditional issues of focus in SEA, but one of the issues which is likely to gain focus in

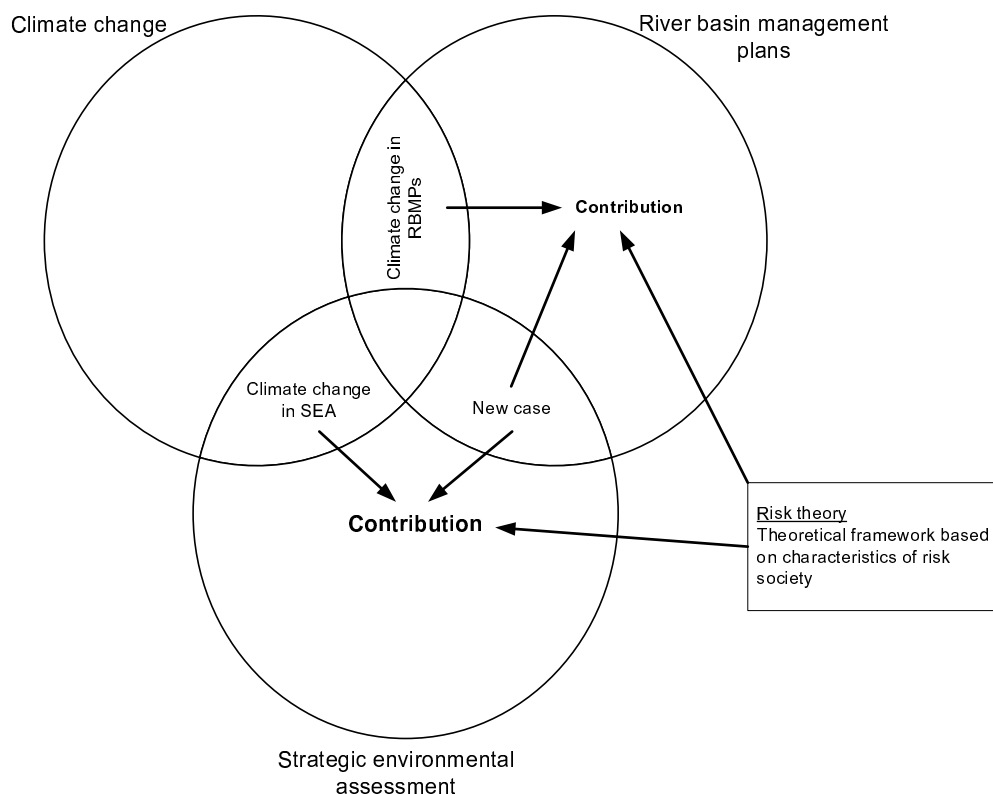


Figure 2.5 Contributions of the research project

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the future. One of the significant issues is water, on which climate change is expected to impact. Experience of integrating climate change in SEA is limited in Denmark, however, as is the guidance. This is not necessarily a problem unique to Denmark, as it is pointed out in other relations (see for example Risse and Brooks 2008, p. 6). Integrating climate change in SEA can be viewed as challenging also because of its inherent uncertainty, as mentioned in section 2.3. The challenge is greater because of the complexity of the process of preparing RBMPs, which cover large areas, have ambitious goals and involve many stakeholders. These issues are further unfolded in chapter 3, where the actual situation in practice in Denmark is analysed.

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# The Danish status

## RBMPs, climate change and SEA

# 3

*In this chapter the current role of climate change in the process of preparing Danish RBMPs is described. This gives rise to a discussion on uncertainty and decision-making, and the relation between these considerations and SEA. The chapter presents the empirical motivation for the research project and contributes to an understanding of the basis of the research goal.*

*"Climate change has already significantly changed our water environment. To pretend this is not happening is to bury one's head in the sand."*

Professor Jørgen E. Olesen,  
University of Århus (Rothenborg 2010)

The chapter begins with an account of the role of climate change in RBMPs in section 3.1 and a discussion of this in section 3.1.1. Uncertainty and decision-making are discussed in section 3.2, and their relation to SEA in section 3.3.

### **3.1 The role of climate change in river basin management planning**

As described in section 2.1 the Danish RBMPs have been under way since the initial hearing in the autumn of 2007, and a draft was published for a municipal pre-hearing in January 2010. Throughout the process statements have been made by the Ministry of the Environment regarding the role which climate change should play in the new RBMPs.

During the initial hearing in August 2007 the Minister of the Environment answered a question from the Committee for Environment and Planning in the Danish Parliament. The question was *"how is adaptation to climate change included in the implementation of the Water Framework Directive?"* The answer from the Minister was that *"the Environmental Protection Agency and the Forest and Nature Agen-*

*cy state that the present technical basis for such assessments is not adequate to determine a need for measures in the first RBMP in 2009"*. Furthermore, the knowledge base is expected to improve before the next planning cycle of RBMPs starts in 2015. (Ministry of the Environment 2007) I interpret this statement as a dismissal of the issue of climate change in the first generation of RBMPs.

In March 2008 the Committee for Environment and Planning in the Danish Parliament again asked the Minister of the Environment about the role of climate change in the RBMPs. The answer from the Minister started with the statement that *"new knowledge about the effects of climate change on the state of water and Natura 2000 areas will be continuously integrated in relation to assessing the need for measures to reach the environmental goals"*. (Ministry of the Environment 2008) This is interpreted as a softening of the dismissal of climate change in the RBMPs.

As a follow-up to the initial hearing the Ministry of the Environment produced an overview of the general issues that the participating actors had pointed to. Among these is the issue of integrating climate change in RBMPs, especially regarding the risk of flooding, which seems to resonate with the actors. The response from the Ministry of the Environment was to refer to the two previous statements and state that *"to the extent pos-*

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*sible climate change will be integrated in river basin management planning, and it is significant when new measures are determined in the RBMPs that it is assessed whether these are 'working in the right direction' also in relation to climate change".* (Ministry of the Environment n.d.)

In connection with the publication of the draft RBMPs in January 2010 the Agency for Spatial and Environmental Planning made an online statement about climate change in the RBMPs. On the home page the question of whether climate change is factored into the RBMPs receives a negative answer because *"There is not yet sufficient knowledge of how climate change will affect the water environment. As soon as we know this, it will be incorporated"*. This statement is repeated in the draft RBMPs, where it is specified that the knowledge base is not sufficient to deal with climate change in relation to the environmental goals and changes in run-off and leaching. It is argued that the improvement of the water environment which the RBMPs are expected to result in will make it more robust in relation to handling climate change. It is also pointed out that certain measures such as constructing wetlands along streams will have positive effects in relation to adaptation to climate change. It is established that the Agency for Spatial and Environmental Planning will work towards an integration of climate change in the next generation of RBMPs, which will be initiated in 2015. (Agency for Spatial and Environmental Planning 2010; Environmental Centre Roskilde 2010, p. 4; Environmental Centre Limfjorden 2010, p. 6) Tony Christensen, Head of Office at Environmental Centre Roskilde, said in a radio interview that *"climate change will be a significant challenge in the next generation of RBMPs. We must recognise that here and now we do not have the tool to add in climate change, not with regard to the change in crops that might happen or*

*the change in precipitation etc. However, all things being equal, there are instructions in the RBMPs that you should be aware especially of precipitation in cities and sewers etc. - that here you should take into account that we will probably see more severe precipitation events in the future."* (Christensen 2010)

My interpretation of the various statements made by the Ministry of the Environment and the environmental centres is that what is articulated is a technical-scientific form of rationality and a reliance on quantification. This is based on the expressed need for tools and scientific knowledge as well as the basis in *Green Growth* and cost-effectiveness (cf. section 2.1). When uncertainty makes it impossible to continue down this path in relation to climate change, this issue is omitted or postponed.

Whether or not climate change is integrated in SEA of RBMPs has not been communicated by the Ministry of the Environment. There does not seem to have been very much focus on SEA of RBMPs for example, in the initial hearing on the RBMPs which also called for input for SEA, only 3% of the 365 participants mentioned SEA. Surprisingly, when the RBMPs were published in the spring of 2010 for a pre-hearing in the municipalities, the SEA was not published along with them.

Thus it has been decided by the Ministry of the Environment that climate change is not integrated in the Danish RBMPs, and integration of climate change in SEA is an unresolved issue. In section 3.1.1 the appropriateness of this failure to integrate climate change in the RBMPs is discussed.

### **3.1.1 The failure to integrate climate change in RBMPs**

I argue that the lack of integration of climate change in RBMPs is problematic.

This is partly because of the statements which, cf. section 2.4.3, have been made by the EU in relation to the WFD. These statements emphasise the fact that climate change can threaten the goal attainment for RBMPs. Also it is possible that the RBMPs will overlook benefits in the form of reduction of CO<sub>2</sub> emissions, for instance from nature restoration.

According to the Ministry of the Environment, the most significant barrier to integrating climate change in the RBMPs is uncertainty in the form of lack of knowledge about the consequences of climate change. The strategy of the Ministry in this regard is to wait until later generations of RBMPs before integrating climate change. The expediency of this can be criticised on at least three counts:

- RBMPs can contain measures which are irreversible in practice. Measures may be impossible, difficult or expensive to change even if later generations of RBMPs show that in the light of climate change they are not expedient or sufficient. For example, restoration of wetlands: a new wetland which turns out to be in a less optimal location because of climate change is difficult to move. This point of view is supported by Jørgen E. Olesen, Professor of Climate Change and Agriculture at Aarhus University. He told the Danish newspaper Politiken that *"you risk making wrong investments, and that it will subsequently be more expensive to correct the situation"* (Rothenborg 2010). Olesen cited the case of wrong investments with environmental approvals being given to farmers, which must later be withdrawn when climate change is integrated in the RBMPs (Rothenborg 2010). This is not to say that the state environmental centres have not thought of these issues at all in their planning, but without systematic consideration the risk of problems occurring can increase. Also any considerations would not necessarily be communicated and thus the process is not transparent in this regard.
- There may be a certain delimitation in the first generation of RBMPs. When there is a draft plan available which following revisions build upon, there can be a lack of inclination to view a broad spectre of alternatives to the plan and diverge from the given basis. Lindblom (1959) calls this incremental planning, whereby one of the issues is a delimitation of alternative policies to those similar to the ones already in place as a pragmatic and realistic simplification of the planning process. In the case of RBMPs, however, this approach raises questions of whether problems can arise later in the planning process with expansion of the range of alternatives to those relevant to new challenges from climate change.
- We will never have full knowledge of the future. The future is by definition unknown, and thus predictions uncertain. Of course science is continuously developing climate change models etc., but at the same time as new knowledge is attained, further needed knowledge will also be identified and there are uncertainties that are irreducible. (Adger et al. 2009, pp. 343-4; Briesbroek et al. 2009; Walker et al. 2003) Furthermore, improved knowledge does not automatically lead to action. For example, warnings from researchers that important climate trends such as sea level rise and ocean acidification are developing faster than expected (see for example Richardson et al. 2009, p. 8) does not seem to be compatible with the perceptions that the results of the IPCC negotiation processes in Copenhagen in 2009 were weak (see for example Averchenkova 2010). The question remains whether we will ever feel we have sufficient certainty

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about climate change to act.

Thus there is a problem because society in the form of the Ministry of the Environment, owing to the lack of certainty about climate change and the ensuing lack of ability to prepare certain plans, choose to close its eyes to the risk of failed measures. It should be noted that the possible consequences mentioned here do not include ethical and democratic issues; for example, lack of transparency for those who might be negatively affected. Uncertainty and its relation to decision-making processes are discussed in section 3.2.

### 3.2 Uncertainty and decision-making

As indicated in section 3.1.1 the issue of uncertainty can be viewed as a result of a tendency for decision-makers to consider themselves dependent on scientific information as a basis for their decisions (Dessai et al. 2008). This aspect is also touched upon in section 4.1.1.

Uncertainty has been defined in many ways (Lipshitz and Strauss 1997). In relation to the context of this thesis, the definition put forward by Willows and Connell (2003, p. 49) that "*uncertainty describes a condition where we lack certain knowledge that we think may be important to making a decision*" is deemed useful. Beyond a generic definition of uncertainty it is important to be aware that there are different types or levels of uncertainty. Walker et al. (2003, p. 12) and Dessai and Sluijs (2007, p. 12) suggest the following categories of uncertainty:

- Statistical uncertainty: can be expressed in statistical terms, and both outcomes and the probabilities of these outcomes are known. Implies understanding of how the system works.
- Scenario uncertainty: outcomes are known, but the mechanisms leading to outcomes are not well understood

and thus probabilities are unknown.

- Recognised ignorance: where an uncertainty is realised but neither outcomes nor probabilities are known.
- Total ignorance: unknown unknowns, uncertainties which we know nothing about yet, developments that are unforeseeable and which are therefore not articulated.

This categorisation underpins that there can be uncertainty about both outcomes and their attached probabilities (Willows and Connell 2003, pp. 43-5; Petersen 2002). The types of uncertainty show the levels of uncertainty, from statistical uncertainty, which is easier to deal with in decisions, to the deeper uncertainty of total ignorance at the other end of the spectrum.

Another aspect of uncertainty is that it has multiple sources. According to Petersen (2002, p. 11) the basic source of uncertainty is a "*lack of knowledge of how a system behaves*" and he suggests that such lack of knowledge has two sources, namely the behaviour of a system and scientific limitations. Similarly Walker et al. (2003) distinguish between **epistemic uncertainty** related to imperfect knowledge, and **variability uncertainty** related to inherent variability. Linked to epistemic uncertainty are, for example data uncertainty, stemming from the limitations as to which data we can collect and have available, and model uncertainty, stemming from not having enough knowledge to produce a satisfactory model (Willows and Connell 2003). As regards variability uncertainty, Walker et al. (2003) specify that it can relate to inherent randomness of nature, unpredictable and non-rational human behaviour, social, economic and cultural processes and surprising technological developments. An example of variability uncertainty related to climate change outcomes are the choice of mitigation measures, which in turn relies on issues

such as risk perceptions and preferences. This leads to another aspect of uncertainty, namely the conflicts which uncertainty opens up (Jaeger et al. 2001). Lipshitz and Strauss (2007, p. 151) state that *"decision makers are sometimes unable to act not because they lack information but because they are overwhelmed by the abundance of conflicting meanings that it conveys"*. This issue is also dealt with in the theory presented in chapter 4.

It is worth noting that categorising uncertainty is not always straightforward. As noted in section 3.1.1 some uncertainties can be reduced whereas others remain irreducible (Walker et al. 2003). Petersen (2002) and Walker et al. (2003) agree that although there is no clear-cut distinction, there is a tendency for uncertainties related to variability uncertainty to be irreducible, whereas epistemic uncertainty is more often reducible through further research and data collection.

When decision-makers are faced with uncertainty in decision-making processes, one of several possible reactions is inaction, according to Thissen and Agusdinata (2008). This is the case with climate change in the Danish RBMPs. Specifically Adger et al. (2009) point to the lack of action in relation to strategies for climate change adaptation, and Gagnon-Lebrun and Agrawala (2006, p. 36) observe that uncertainty is sometimes used to *"justify slow progress in implementing adaptation"*. Zehr (2000, p. 87) in a literature study also comments on the fact that uncertainty whether substantiated or constructed can be used as an argument for lack of action: *"The science is uncertain so we better wait"*. In a survey of perceptions of climate change among actors in the Baltic Sea Region one of the conclusions is that *"it is a popular fallacy that policy making should mainly be based on quantitative findings from science, a fallacy that hinders adequate action"* (Eisenack, Tekken and Kropp 2007, p. 9).

Part of the strategy when faced with uncertainty in decision-making processes regarding climate change is often a focus on attaining more knowledge, among other things in the form of additional models (Adger et al. 2009; Briesbroek et al. 2009). Beyond the issue of irreducible uncertainty, Briesbroek et al. (2009, p. 232) argue that improved knowledge usually does not lead to improved decisions, but instead to a need for further knowledge.

As a reaction to this, Adger et al. (2009) argue that uncertainty should not be considered a barrier to adaptation. Instead, no-regret measures for adaptation can be implemented in the short term, which are beneficial regardless of the developments in climate change (Gagnon-Lebrun and Agrawala 2006, p. 36). Similarly, Dessai et al. (2008, p. 55) point to the fact that successful adaptation to climate change is not necessarily attached to precise predictions of climate change, but rather *"successful adaptation strategies can be developed in the face of deep uncertainty"* by utilising robust decision-making strategies. Moss (2007) focuses on how decision-makers do not always have the possibility of postponing decisions to wait for more information, but that it can be beneficial for them to work with solutions which are robust to different outcomes of the uncertain parameters. More specifically it is pointed out that in situations where uncertainties cannot immediately be reduced, *"it may be advisable to accept uncertainties, and spend efforts on identifying and assessing them and on developing appropriate approaches to act in light of (irreducible) uncertainties"* (Thissen and Agusdinata 2008, p. 1).

Thus it appears that uncertainty is a common barrier to action in relation to climate change. In (Kørnøv and Larsen 2010) approaches to uncertainty in decision-making in general are discussed.

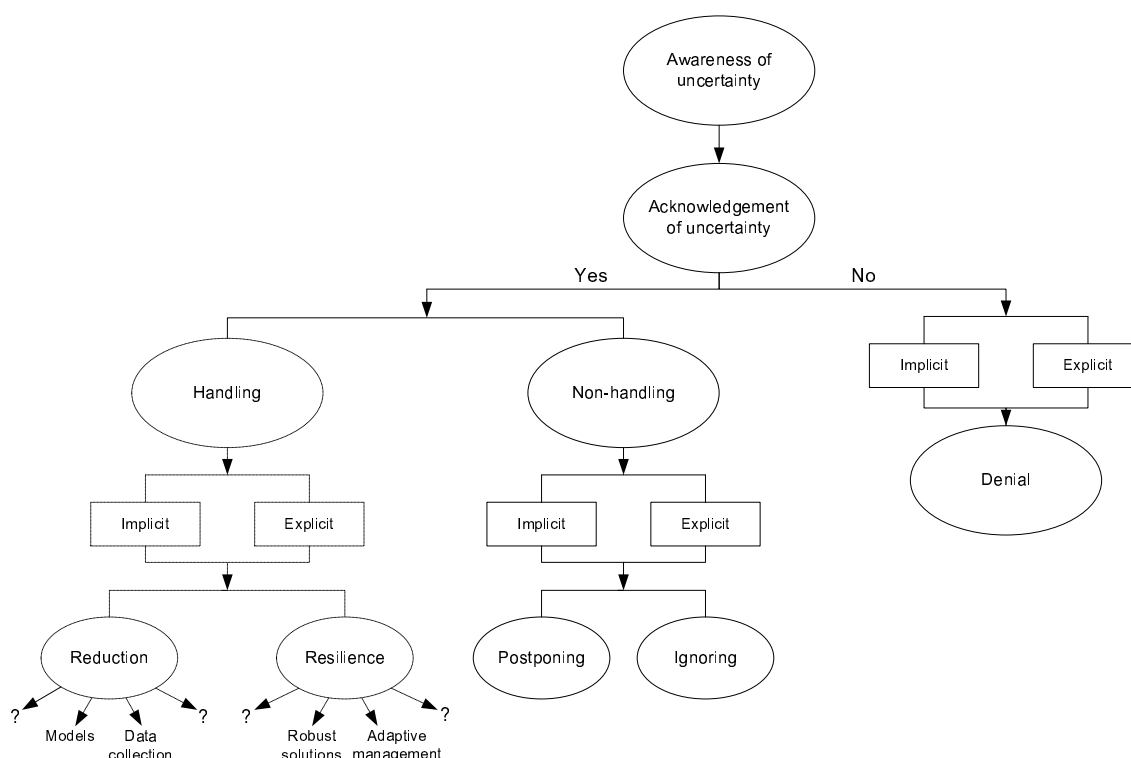


Figure 3.1 Hypothesis about handling uncertainty

Figure 3.1 illustrates a hypothesis about uncertainty in decision-making such as that related to SEA.

As figure 3.1 shows, the first step is whether or not a decision-maker is aware of uncertainty and acknowledges it. If uncertainty is not acknowledged it suggests implicit or explicit denial. If on the other hand uncertainty is acknowledged, there is a choice of either handling it not handling it. In (Kørnøv and Larsen 2010) a range of possible mechanisms behind not handling uncertainty are suggested: uncertainty itself, cognitive limitations, conflict avoidance, instilling trust and reliance on quantification. It is further suggested that non-handling can result in postponing the consideration of uncertainty or ignoring it. Figure 3.1 also shows preliminary reflections about handling uncertainty. Much in line with the discussions in this section, it is suggested that handling uncertainty – implicitly or explicitly – can be done following strategies of reduction or resilience. The reduction strategy seeks to reduce uncertain-

ty, for example by using climate change models. The resilience strategy can be linked to the issues mentioned in relation to robust solutions, where uncertainty is not reduced but still dealt with.

It is clear that uncertainty can be an issue in a decision-making process, and that sometimes it becomes a barrier to action. It does not necessarily have to be so, however, and in section 3.3 the possible potentials of SEA in this connection are discussed.

### 3.3 Potential of SEA

Uncertainties are connected with climate change (cf. section 2.3). This is (cf. section 3.1) the argument for not handling climate change in the RBMPs, which might be questionable. At the same time researchers argue that uncertainty does not need to stand in the way of action in relation to climate change. Thus it is perceived as inexpedient that climate change is not handled in the RBMPs and the question of the possible contribution of SEA arises.

Part of the motivation for this research is my perception that SEA has a number of potential opportunities to integrate climate change in spite of the inherent uncertainty:

- Relevance: climate change (cf. section 2.4.2) is included in the environmental scope of SEA and thus it is compulsory to integrate it in assessments. This is also supported by an increasing international focus on climate change in impact assessment research and practice. For example the International Association for Impact Assessment is organising two symposiums on climate change in impact assessment in 2010 and 2011 (IAIA n.d.).
- Methodological breadth: in SEA, unlike the RBMPs, there is not necessarily a demand for quantitative and precise calculations, which according to Christensen (2010) seem to be part of the difficulty of integrating uncertain climate change. The legislation on SEA states that environmental reports "*shall include the information that may reasonably be required taking into account current knowledge and methods of assessment*" and "*the contents and level of detail in the plan or programme*" (LBK nr 1398 2007, §7). This relates to the focus of SEA on delivering information that is useful to decision-makers and indicates that qualitative methods are sometimes appropriate for this (Therivel 2004, 135).
- Space: SEA is prepared under a different framework from the RBMPs, and has the purpose of reflecting more broadly and holistically the content of the plans, and integrating these perspectives in the plans and decision. That being so, SEA potentially provides a space for freer reflections on the issue of climate change independently of the demands and frameworks of the RBMPs.

- Openness: it is required in the SEA legislation that the environmental report should contain information about any difficulties encountered during the assessment in the form of "*an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information*" (LBK nr 1398 2007, Appendix 1). This signals openness, an acceptance that difficulties occur during assessment, for example uncertainty, and a demand to address it. As stated by Therivel (2004, p.146), "*the aim of SEA is to reduce uncertainty where it makes sense to, and otherwise to record it, and cope with it*". It furthermore signals the importance of communicating uncertainty to decision-makers and the public.

Therefore it may be meaningful to analyse and improve the use of SEA as a tool to integrate the uncertain issue of climate change in planning. This is in line with the basic purpose of SEA presented in section 2.2 as the integration of environmental issues in decision-making. There are examples of integration of climate change in SEA. Notably, SEA in relation to RBMPs in the UK addresses issues such as whether the effectiveness of proposed actions could be affected by climate change or whether proposed actions could cause or mitigate GHG emissions (Environment Agency 2008).

The discussions in this chapter form the basis for putting forward the research goal presented in chapter 1:

*To develop an understanding of the current practice of integrating climate change in SEA, with the Danish RBMPs as a case and focus on uncertainty, and to discuss paths for further development*



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*based on this understanding.*

The research goal is driven by the challenge posed by the issues presented about climate change in RBMPs, a challenge which, in the case of the Danish RBMPs, is being handled in a questionable manner. This is coupled with the notion that integration of climate change can be part of dealing with this challenge.

In pursuit of the goal of understanding current practice, the following research questions are pertinent:

- What is the level of focus on climate change in SEA and RBMPs in Denmark?
- How can climate change conceptually be integrated in SEA, and how is this concept reflected in practice?

In the following chapter 4 a theoretical framework is added to the focus of the research.

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# Theoretical framework

## Risk society

# 4

*In this chapter, the overall theoretical frame for the research project is presented. This is done by accounting for the choice of theory, presenting the theory itself, and discussing it in relation to integration of climate change. In Chapter 5, this is followed up by a description of how the theoretical framework is utilised.*

There are many perspectives on risk, which has been on the agenda since the advent of industrialism and modernity, and the concept as well as practice has developed over time. Until the seventies, the conceptualisation of risk was characterised by the aim of objectivity and was based on technique and economics, with an emphasis on natural science. The goal was to establish an acceptable level of risk through an objective and structured decision-making process, based among other things on the precondition that everyone perceives risk the same way. During the seventies and eighties another view of risk became more prominent: risk was viewed as subjectively experienced, and thus psychology and sociology were emphasised. (Breck 2001; Nielsen et al. 1999)

Risk has many definitions. Examples include "a possibility that something unfortunate or unwanted will happen" (Pallesen and Becker-Christensen 2002, p. 1017) or "a danger with an uncertain outcome" (Bang et al. 1999, p. 831). Risk is oriented towards the future, because it relates to potential future effects which we can foresee and so, according to Beck (1992, p. 52), risk is "a threatening possibility" but also "a fact in abeyance". According to Giddens, risk is not solely a negative thing, because it always comes with an integrated possibility: risk is something you run, when you take a chance, and without risk no chance (Nielsen et al. 1999, p. 51). Beck concurs that risk is "the inescapable flipside of opportunity.

*Each time you choose one, you get the other as well" (Willms and Beck 2002, p. 110). That being so, our decisions are also attached to a risk, a negative event, which could possibly result from our decisions; however the future is always connected to uncertainty, because the future by definition is something that has not yet happened. As Luhmann (1997, p. 161) writes: "The future is always and will always be a horizon of uncertainty. It is not yet fixed and can always turn out differently than expected". Jaeger et al. (2001, p. 17) state that risk encompasses both "the possibility that an event or outcome can happen" and "the denial that either occurs with predetermined certainty". These deliberations emphasise the link between risk and uncertainty, which makes the theory of risk relevant in relation to the discussions in chapter 3. In accordance with this, risk can be defined as a negative future development of which we are not certain. For example, climate change consisting of future events, some negative, where we are uncertain of the outcome or probability, can be defined as a risk. The definition of climate change as a risk is discussed further in section 4.2.1.*

### 4.1 Ulrich Beck's thesis

A theoretical framework of sociological risk theory has been chosen for this thesis. This is mainly based on the macrosociological theory of risk society put forward by Ulrich Beck in his book *Risk Society: Towards a New Modernity*, which was first published in German in 1986.

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The theory of risk society is part of the research focused on subjectively and socially framed risk which emerged during the seventies and eighties. Beck's work has proven to be influential both in terms of reaching a broad audience and as a basis for discussions and further scientific work, especially within sociology. It has also been taken up by others, notably Anthony Giddens. (Hinchcliffe 1997; Nielsen et al. 1999) Other influential perspectives are offered by Mary Douglas, who has a cultural and anthropological focus, and researchers building on Michel Foucault's work on governmentality. Common to the perspectives they offer are a view of risk as socially embedded and more or less socially constructed. (Lupton 2006)

The theory of risk society has been used in research, and also within planning and environment (see for example Eden 1996; Hinchcliffe 1997; Matten 2004; Gow and Leahy 2005; Cebulla 2007; Olofsson and Öhman 2007), often with the goal of analysing its applicability in specific situations or cases. At the same time others have discussed the lack of empirical underpinning of Beck's work (see for example Matten 2004; Lupton 2006; Cebulla 2007; Olofsson and Öhman 2007). For me, this lack of underpinning is part of the motivation for using the theory of risk society to reflect over on its empirical applicability.

The decision to base the theoretical framework on Beck's thesis has been taken because it provides a theoretically based explanation for some of the situations that can be observed in practice in the case of RBMPs and climate change. Thus the framework can help to understand the empirical issues and provide suggestions for future development. This implies the notion that one purpose of theory is *"to explain the meaning, nature, and challenges of a phenomenon, often experienced but unexplained in the world in which we live, so that we may use that*

*knowledge and understanding to act in more informed and effective ways"* (Lynham 2002, p. 222). The theory of risk society through its perspectives on the nature of risk and uncertainty is useful for characterising both climate change and SEA, and provides an angle from which climate change and SEA can be viewed and understood. The decision is thus based on the expectation that the theory can contribute interesting perspectives partly through analysing climate change as a risk and partly through viewing SEA as an assessment of such risks. Regarding the aspect of using theory to guide development, the theory of risk society has been criticised for remaining descriptive rather than prescriptive (Elling 2008, 117). I subscribe to the point of view that the theory of risk society is mainly descriptive and that the prescriptive parts are fairly vague. This has led me to supplement the theory of risk society with writings on post-normal science, as described in section 4.2.

Of course, the choice of one theory rather than others means that a certain perspective on climate change and SEA is chosen rather than other possible perspectives, because the theoretical frame emphasises certain aspects. Specifically, the choice of theory involves a focus on risk and uncertainty in connection with climate change and SEA, which is in accord with the empirical motivation. Other theoretical frames could have emphasised, for example, institutional or organisational aspects, issues of power or deliberation. This affects the analysis and results of the research; the specific discussions on further development will focus on aspects of risk and uncertainty and could be supplemented with other perspectives.

Ulrich Beck's theory on risk society encompasses many aspects; however, three major themes have been pointed out (Elliott 2002):

- Risk society
- Reflexive modernisation
- Individualisation

In this thesis the emphasis is on the theme of risk society and to a lesser extent on reflexive modernisation. Individualisation has not been in focus. More specifically the use of the theory in this thesis has an emphasis on:

- Characteristics of risk society with an emphasis on environmental risks, in order to gain an understanding of Beck's theory.
- The role of science and knowledge, because it is the basis of prediction and assessment in SEA.
- Politics and decision-making, which relate to SEA as a tool for decision-making.

Overall, Beck divides the development of society into three phases: pre-industrial society (the traditional), industrial society (the first modernity), and risk society (the second/reflexive modernity) (Beck 1992). The three phases are examined in the following, the two first as a short introduction to the elaborated presentation of risk society and the perspectives: reflexive modernity, new risks, a perplexed science, risk definitions and politics and sub-politics. Finally the theory is summarised and discussed in relation to the subjects of the research in section 4.2.

### **4.1.1 Prior to risk society: pre-industrial and industrial society**

In pre-industrial society dangers were mainly attributed to external factors such as natural disasters or interventions by gods. Dangers were perceived as beyond control: *"rather than being experienced as decision-dependent, they are interpreted as being unleashed by natural catastrophe or as punishments from the gods. They are experienced as unalterable collective destiny"* (Willms and Beck 2002, pp. 110-11). Dangers or risks were

often personal and thus limited, for instance; going on an explorative expedition or not. (Beck 1992; Willms and Beck 2002)

Conversely, industrial society tends to be oriented towards controlling risk through application of quantitative knowledge. As Ben-Haim (2006, p. 9) puts it, *"we are an age of number-givers, and the first advice to a novice in the modern world would be: if it stands still, measure it; if it moves, clock its speed"*. Science and numbers are used to understand a chaotic world and to reduce uncertainty through gaining more knowledge and controlling nature and the environment (Ben-Haim 2006; Beck 1992). Part of the modern project is precisely controlling the dangers and threats from nature; for instance, through dykes, dams and penicillin in order to suppress nature and secure welfare and wealth (Breck 2001).

The type of risks which characterise industrial society most often have a limited extent; they are limited to a certain location, a certain time, and a certain group of people (Willms and Beck 2002; Mythen 2004). They are viewed as visible, tangible dangers, which can be handled and controlled through development of knowledge and technology (Beck 1992).

### **4.1.2 Risk society: reflexive modernity**

According to Beck, we no longer live exclusively in an industrial society, but at the same time we do not live exclusively in a risk society. In risk society, the efforts of industrial society to control dangers through science and technology lead to the creation of a new form of risks for society. (Beck 1992) For instance, nuclear energy is one of the great technological breakthroughs, but it is also filled with risk both regarding the operation and handling of waste. Thus modernity is still in existence, but it is increasingly becoming problematic, since it continuously

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creates more risks through development and technology. The products of industry or modernity are, in some parts of the world, no longer in short supply, which means that in these parts of the world there is an increasing capacity to question the negative side-effects or risks produced by progress and whether they are acceptable or not. (Beck 1992; Willms and Beck 2002) This can be argued to reflect a focus on the western world not taking into consideration the situation in other parts of the world, something for which Beck has been criticised (see for example Mythen 2004, p. 182).

These issues entail a transition to risk society, which is characterised by a different form of risk and awareness of risk. Increasingly, risk is created by modernisation, technology and progress, and thus by human actions and decisions. That risk is created primarily by society itself according to Beck leads to society undermining itself, which is basically what Beck terms reflexive modernity. (Beck 1992; Willms and Beck 2002) According to Beck (1992, p. 183), modernisation which has the goal of controlling danger and risk has *"taken over the role of its counterpart – the tradition to be overcome, the natural constraint to be mastered"*: in its attempt to protect it has itself become the threat.

Anthony Giddens also writes about reflexive modernity, but from a slightly different perspective from Beck. For Giddens reflexivity refers to the fact that currently great volumes of knowledge are gathered in society, and used constantly to reorganise and change society and social practice. This also means that there is a constant uncertainty regarding the knowledge gathered. The stable connection between increased knowledge and increased certainty is, according to Giddens (1990, p. 39), no longer valid: *"We are abroad in a world which is thoroughly constituted through reflexively applied*

*knowledge, but where at the same time we can never be sure that any given element of that knowledge will not be revised"*. This theoretically underpins the relevance of the question asked in section 3.1.1 regarding whether there will ever be enough knowledge to act. The paradox is also pointed out by Beck (cf. section 4.1.8). Giddens emphasises society's increased reflection about risk: a *"greater awareness of risk as risk"*, which has a broad base in the public (Nielsen et al. 1999, p. 50). The difference between Beck and Giddens in the definition of reflexive modernisation is emphasised by Beck's statement that *"reflexive does not mean that people today lead more conscious lives. On the contrary, reflexive does not describe a greater mastery and consciousness, but a greater awareness that mastery is impossible. Simple modernisation becomes reflexive modernisation as it removes the spell from and afterwards dissolves its own natural premises"* (Willms and Beck 2002, p. 23).

Beck emphasises unconscious processes and is critical towards the first modernity (Willms and Beck 2002). The first modernity is characterised by a great degree of confidence in the positive effects of technological progress and its ability to solve problems. In the second modernity, the conviction that technological progress is always a good thing is challenged by the increased risks, which appear as negative side effects. (Beck 1992) Despite its contested nature, progress is not halted: *"one can say 'no' to progress, but that does not change its course at all"* (Beck 1992, p. 203). Beck's critical opinion of the first modernity is not shared by everyone. For instance, Giddens is less critical and emphasises that modernity has remedied many of the risks that characterised traditional society, for instance through development of hospital services and medicine (Nielsen et al. 1999). The new risks have different characteristics from the risks which marked the two

previous phases of society. This is examined in the following section.

#### 4.1.3 The new risks

As mentioned in section 4.1.2, the new risks are predominantly tied to our decisions and therefore they are self-inflicted. Risks in the second modernity transgress former categories of time and space. Where risk was formerly limited to specific groups, places and times, this is not the case with the new risks; for example, forests in Norway and Sweden are being spoiled by air pollution, even though these countries do not have very much heavy industry. Likewise, nuclear accidents affect people within a very large radius and also future generations. (Beck 1992; Willms and Beck 2002) Regarding climate change, developing countries are the most exposed to the negative consequences of climate change, even though they have historically contributed the least to GHG emissions (Richardson et al. 2009). Beck claims that risks are universal in the sense that no one is safe: "*Even the rich and powerful are not safe from them*" and sooner or later everyone will be affected (Beck 1992, p. 23). This argumentation however seems to lack proper consideration of the possibilities of people with resources and power to protect themselves, and at least postpone their exposure to risk. Beck also recognises this stating that "*the wealthy (in income, power or education) can purchase safety and freedom from risk*" (Beck 1992, p. 35). In this way Beck seems to contradict himself, however, his argument is that eventually as risks worsen and spread, these means of protection will be useless. He states with reference to pollution that "*in these circumstances, only not eating, not drinking and not breathing could provide effective protection. And even this only helps to a degree. After all, we know what is happening to the stone in the buildings and the lichens on the ground*" (Beck 1992, 36).

This means that the new risks, because of the many actors involved and their separation in time and space, have complex and non-transparent causal mechanisms. This also complicates the issue of deciding who is responsible for creating risks: there is a general lack of responsibility. The complex causal mechanisms make it possible to argue for a certain causality depending on what we stand to lose or gain. (Beck 1992; Willms and Beck 2002)

Beck writes of the new risks that "*in a fundamental sense they are both real and unreal*" (Beck 1992, p. 33). They are directed towards future expected events and thus can be said to exist only because of our knowledge of these expected events (cf. section 4.1.2) (Beck 1992). Another characteristic of risks in the risk society is that they cannot be observed directly: "*many of the newer risks (nuclear or chemical contaminations, pollutants in foodstuffs, deceases of civilisation) completely escape human powers of direct perception*" (Beck 1992, p. 27). Thus Beck defines risk as second-hand non-experience, partly because knowledge of risk is not based on specific experience, partly because knowledge of risk is external and comes from science. Since risks cannot be perceived through the senses, society is dependent on science to obtain knowledge and evidence. This gives scientists and experts extensive power to define what is dangerous and it declares the general public incapable of defining for themselves how to act. (Willms and Beck 2002; Beck 1992) In relation to climate change, extreme weather events in the summer of 2010, such as the flooding in Pakistan and extreme temperatures in Russia, have been linked to climate change. Climate change researchers cited in Danish news media, however, state that even though they are convinced that these events are caused by climate change, this is currently under investigation and they expect to have proof in a year. (Jensen 2010) This is an



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example in part of the complexity of causal relations of risks and in part of a situation where, even though consequences of risk could be materialising, we are still dependent on science to prove this.

According to Beck, the new risks which dominate risk society thus differ from the risks and dangers which have previously dominated. Questions have been raised about this; for example, Elliott (2002, p. 299) asks whether *"life in society has become more risky"* and Elling (2008, p. 109) criticises Beck for focusing only on risk no longer being latent, *"making previously invisible hazards visible"*. I would argue that Beck sees the change not necessarily as a question of more or less risk, but that the focus on as well as the causes and nature of risk have changed. The changed characteristics which are described here have a range of consequences, which are described in the following.

### 4.1.4 Science perplexed

As also described above, in the industrial society, science has had a monopoly on rationality and on objectively assessing risk, a status which it has been able to uphold because of *"its success, with promises of liberation from constraints not yet understood"* (Beck 1992, p. 155). This also includes an opposition between lay people and experts, where researchers refer to science as being superior to handed-down knowledge, tradition and lay practice (Beck 1992).

Today, however, science is confronted with the consequences of its own enterprise and success (cf. section 4.1.2): *"they are targeted not only as a source of solutions to problems, but also as a cause of problems"* (Beck 1992, p. 156). At the same time, science has problems in delivering certainty and knowledge regarding risks. This is part of an opening up for processes of definition and different perceptions of risk (cf. section 4.1.5).

Thus it is legitimate that there is more than one perception of whether or not a certain risk is significant or not, which according to Beck (1992, p. 29) means that *"the sciences' monopoly on rationality is broken"*. Risk is thus no longer defined solely by science; rather it is affected by *"competing and conflicting claims, interests and viewpoints of the various agents of modernity and affected groups, which are forced together in defining risks"* (Beck 1992, p. 29). The public is increasingly critical towards science and its results, and *"more and more people are able to play the role of assessors of science"* and act as critical counter experts (Beck 1992, p. 168). Science is no longer capable of being as convincing as in the past, and faith in science, experts or others becomes an increasingly important factor in judging the validity of knowledge about risk (Beck 1992). Yet Beck points out that the public is dependent on the scientific rationality and using scientific language because *"the worst-case scenarios of scientific and technological development can only be understood in terms of scientific and technical categories. In a hypercivilized world, even the critique of scientific and technical rationality from the perspective of a broader lay rationality must avail itself of scientific methods, terminology and evidence if that critique is ever to be successful"* (Willms and Beck 2002, p. 196).

The definition of risk influences decisions and actions related to risk, and thus in the end has significant implications for society, economy and politics. The influence on politics and action means that nature and natural science becomes a societal issue and politicised. (Beck 1992) According to Beck (1992, p. 82) this increasingly directs the work of natural and engineering scientists, who have become *"a branch office of politics, ethics, business and judicial practice in the garb of numbers, despite the external preservation of all their objectivity"*. At the same

time there is increasing focus on the dependence of research results on circumstances, preconditions and decisions: *"Thus 'facts' – the former centerpieces of reality - are nothing but answers to questions that could just as well have been asked differently, products of rules for gathering and omitting"* (Beck 1992, p. 166).

In summary, science according to Beck (1992, p. 166) has become both *"indispensable to and incapable of truth"*. A problematic paradox exists because society is strongly dependent on science in relation to risk at the same time as science is increasingly incapable of offering the required assistance, and the public becomes increasingly critical. In risk society, science and society, in spite of the problems mentioned, are still attempting to control the negative side-effects of technological progress and maintain the monopoly on rationality. The combination of risk and uncertainty and the fact that decisions are necessary means that they are often presented as certain and infallible in spite of associated uncertainty. The dependence on science and the extent and severity of risk also mean that scientists are subject to a demand for infallibility in their predictions of risk. (Beck 1992; Willms and Beck 2002) In this line of thinking, risk management is used to control risk and the perception is that we just need to gain more knowledge: *"all we need is more information and better knowledge, and then we'll be able to predict and control it just like we used to"* (Willms and Beck 2002, p. 127). The argument for excluding climate change, as described in section 3.1, is a practical example of this line of thought. Beck argues, however, that this is not expedient, since uncertainties are manufactured, and more knowledge often just causes more uncertainty. Beyond this, Beck claims that it is not possible to control risk, since the control mechanisms are designed for the industrial society and

not for handling the new risks of risk society. (Willms and Beck 2002)

#### **4.1.5 Societal processes of definition**

A consequence of science's monopoly on rationality is that science perceives the public as ignorant. The solution to any disagreement between the public and science is that the public is informed properly, after which it will see reason. As described in section 4.1.4, however, risk society leads to science losing its monopoly on rationality, and thus *"as the uncertainties of scientific judgement grows, so does the grey area of unrecognised suspected risks"* (Beck 1992, p. 71). On the other hand this creates a perplexed public, because if science cannot demonstrate an unequivocal truth regarding risk, then what should one relate to? (Beck 1992)

Such confusion or openness creates space for societal processes of definition, and thus for the broad public to get involved in risk definition. Risk definitions are for instance clarification of the causality behind risk, and thus who causes risk and what should be done; for example, forest decline, where some will define motoring as the cause, whereas others will define power plants as the cause, depending on their own interest. (Beck 1992) In the processes of definition actors are brought together because they are involved or affected by risk in different ways and, because of the *"competing and conflicting claims, interests and viewpoints"*, struggles over definitions occur (Beck 1992, p. 29). Engaging with issues such as this, Beck comes close to touching upon issues of power, but does not explicitly comment on this.

According to Beck, the utilisation of objective natural science, regardless of its failing status, is not enough in the processes of risk definition, because *"it ignores the significance of cultural perceptions and intercultural conflict and dialogue"* (Beck

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1996, p. 3). Given the “*competing and conflicting demands, interests and viewpoints*” there are many different perceptions of, for instance, what represents a significant risk and which risks we are willing to accept to gain an advantage (Beck 1992). According to Beck science cannot answer these questions: “*All kinds of experts can never answer the question: How do we want to live?*” (Beck 1996, p. 4; Beck 1992; Willms and Beck 2002). Instead, these questions should be “*the object of a global dialogue between cultures*” and rather than only the question of technical and scientific investigations there is a need for normative input in the definition processes (Beck 1996, p. 4; Beck 1992). Thus, the participation of the public becomes relevant in relation to the definition of risk: “*in their implicit cultural value notions of a life worth living, statements on risks contain a bit of codetermination*” (Beck 1992, p. 58). Beck writes about a scientific and a societal rationality which are divided yet co-dependent (Beck 1992).

The mechanisms which lie behind the construction of these definitions and perceptions of risk which Beck calls for have been the focus of much research within the field of risk (see for example Etkin and Ho 2007; Lorenzoni, Lowe and Pidgeon 2005; Lowe 2006). However, Beck does not deal with this but sticks with the macro level of theory. Further, Beck’s original theory of risk society has been criticised for being unclear regarding whether or not risks are real or constructed. Beck emphasises that risk is defined in society and exists because of our scientific knowledge of it, but at the same time he indicates a real increase in risk. (Nielsen et al. 1999) In later work, Beck rejects both the naïve realism which only sees risks as real and objective, and the naïve constructivism, which sees risk only as socially and subjectively constructed (Beck 1996; Nielsen et al. 1999). Instead Beck refers to what

he calls reflexive realism, where risks are partly constructed, because they can be defined and articulated differently, but in the end can have real and severe consequences (Nielsen et al. 1999; Beck 1996; Beck 1992). On the basis that risks are partly constructed, the increased risk in society can be ascribed both to the fact that there are really more risks and to the fact that there is an increased focus on risk by the public: “*It is not clear whether it is the risks that have intensified, or our view of them*” (Beck 1992, p. 55).

### 4.1.6 Politics and sub-politics

Struggles over risk definitions have political and economical consequences such as political pressure, control of businesses, compensation, lawsuits, etc. (Beck 1992; Willms and Beck 2002). Beck points out that when risks are acknowledged they “*develop an incredible political dynamic*” (Beck 1992, p. 77). At the same time these consequences are somehow independent of discussions about whether risk is constructed or objective because “*if people experience risks as real, they are real as a consequence*” in the sense that their recognition gives them effect in society (Beck 1992, p. 77). The significance of risk definitions means that it becomes urgent for the actors to affect and control this struggle of everyone against everyone for the most beneficial risk definition (Beck 1992).

The opening of the discussion on risk definitions means that there is a possibility that different actors can construct or even manipulate risk, defining it in a way that fits their needs. Scientists are isolated from the use of their results, and thus the actors have greater opportunity to use them in a way that serves their particular interest. Furthermore there are numerous experts to choose from for, e.g., involvement in political processes, and there is therefore an opportunity to affect input and results. (Beck 1992) As touched upon previously, risk defini-

tions are often called into question and among other things the need for more knowledge and more research is emphasised “*before one can be sure what the situation is and take the appropriate measures*” (Beck 1992, p. 45). In society, decisions are constantly made which because of the level of risk can have serious consequences, and we are forced to make these decisions on the basis of uncertain knowledge. (Willms and Beck 2002) Based on experiences with the RBMPs the questions about what decision-makers do when faced with uncertainty and what they base this choice on are discussed in chapter 3. Beck’s theory, however, does not go into issues of how uncertainty is handled in decision-making processes, and thus models for explaining these choices cannot be based on the theory of risk society but must be sought elsewhere.

The new risks in risk society pose a problem for the nation state. It can no longer guarantee security for its citizens or base its rule on certain knowledge, and thus the confidence of the citizens in the state and its legitimacy is weakened. In risk society processes of definition and decisions regarding risk increasingly take place outside the formal democratic political frames and are instead handled in more informal arenas with the participation of e.g. businesses and the public. In this way the political sphere is expanded to what Beck terms the sub-political. (Beck 1992) According to Beck, the term sub-politics refers to “*politics outside and beyond the representative institutions in the political systems of nation states*” and therefore means direct individual participation in political decision-making rather than solely representative democracy (Beck 1996, p. 18). Sub-politics can for example result in more influence for public movements, organisations, lobbyists, experts and public officials. Regarding public movements and organisations, the presence of risk can make people

gather in grassroots organisations with the purpose of avoiding a specific risk. These groups use their democratic rights, for instance through media, to advocate their idea of how they want to live. (Beck 1992)

When decisions about risk are no longer made within the traditional political frames, it becomes increasingly difficult to determine where decisions have been made and thus again who is responsible. It also becomes increasingly difficult to control risk and maintain the legitimacy of decisions; for instance, businesses, where the control mechanisms of the state cannot keep up with the technological development. The state only knows about the development after it has taken place and thus cannot control it, but rather has to try to legitimise the development and take responsibility for possible consequences that are really outside its control. (Beck 1992)

#### 4.2 Summary and discussion

According to Beck’s theory of risk society, we see a new type of risk in society, which has a range of consequences regarding inter alia science, societal processes of risk definition, and politics. Figure 4.1 summarises the characteristics of the new risks and the consequences that are deemed relevant for this research project.

Others have also dealt with the issues of risk and its consequences, and among these the discussion about post-normal science as a way of handling complex science-related issues is of interest. The discussions are mainly initiated by Silvio Funtowicz and Jerome Ravetz. As in the theory of risk society, Funtowicz and Ravetz (2005) describe how science and progress have created new problems and risks, and how these risks are characterised by uncertainty. The new risks are described as more intense, rapid, uncertain, complex, value-loaded and global

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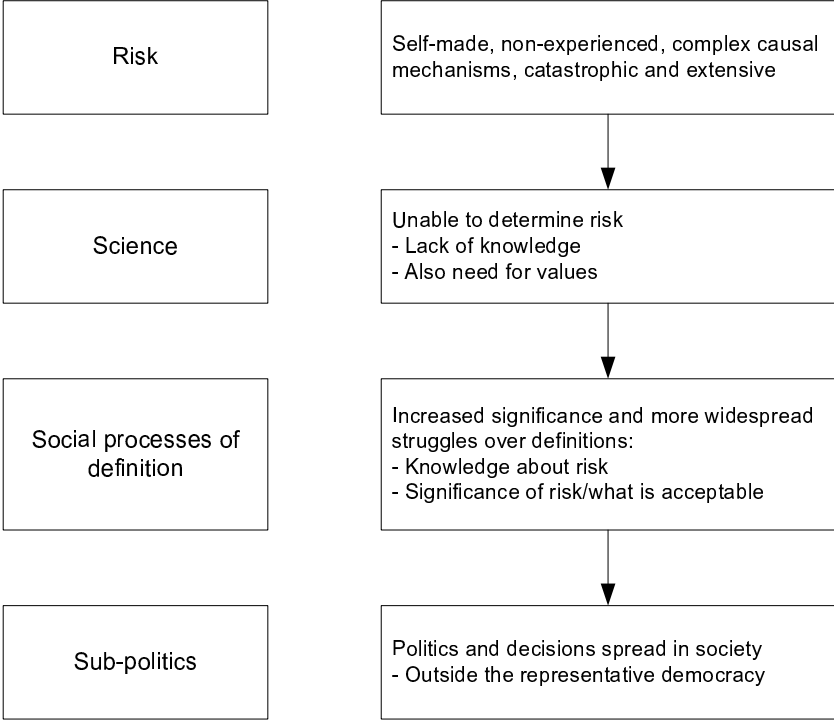


Figure 4.1 Summary of the characteristics of the new risks and consequences according to the theory of risk society

(Marchi and Ravetz 1999). Funtowicz and Ravetz (2005, p. 371) describe how, when it comes to risk and environment, *"facts are uncertain, values in dispute, stakes high and decisions urgent"*, and thus, like Beck, they emphasise the societal struggles over definitions in relation to decisions. As an example they use the struggle over whether or not GMO corn is acceptable or not, and how in this case it is not just *"a question of different ways of conceiving a danger; some participants say that there is no danger at all"* (Marchi and Ravetz 1999, pp. 753-4). In writings on post-normal science, as in the theory of risk society, it is described how it is increasingly problematic for science to deliver certain answers and certain knowledge (Marchi and Ravetz 1999; Funtowicz and Ravetz 1990). Researchers are increasingly questioned and their statements are more often debated: *"We may say that the triumphs of science-based technology have now produced problems which science cannot solve unaided. The simple idea of progress through scientific conquest no longer commands assent"*

(Marchi and Ravetz 1999, p. 755).

Thus Beck's theory about changes in society as a consequence of new risks is supported by the concept of post-normal science – they are basically perceived to describe very similar situations albeit within different frameworks. Beyond the description of the current situation, the discussions about post-normal science also touch upon a range of ideas about how science could be reformed in this new situation. These ideas will be utilised in chapter 5. Using the work of Funtowicz and Ravetz in relation to Beck's theory can be discussed in terms of consistency, because Beck opposes the idea of *"post"* as an expression of a complete break with modernity instead of a redefinition of it (Willms and Beck 2002). In spite of this it has been decided to use the work of Funtowicz and Ravetz, because it is solely the content and prescriptive part of the discussions relating to what to do in a situation of post-normal science (on which there is agreement between the work of Beck and Funtowicz and Ravetz)

which is utilised and not the issues of how this situation came about. As will be shown in chapter 4, the prescriptive parts complement each other well in spite of the different backgrounds.

#### 4.2.1 Climate change: a new risk

In this research project, climate change is regarded as an example of the new form of risks described by Beck, because climate change possesses many of the characteristics Beck ascribes to these risks.

Climate change is probably self-inflicted, since it is seen as a result of emission of greenhouse gases. This is supported by the IPCC in their fourth assessment, where it is stated that "*most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropogenic GHG emissions*" (Bernstein et al. 2007, p. 39). However, the causes and significance of climate change are still debated by researchers and politicians (see for example Ramskov 2008; Andersen 2009; Nielsen 2009).

Climate changes are also to a certain degree not based on direct experience. Some climate changes can be observed already today, but many predictions of consequences have long time horizons. For example, the IPCC operates with a time horizon until 2100 (IPCC Working Group III 2000; Bernstein et al. 2007). Likewise climate change and its consequences are global (Bernstein et al. 2007). The lack of firsthand experience is reflected in the many different perceptions of climate change (see for example Etkin and Ho 2007; Lorenzoni, Lowe and Pidgeon 2005; Risbey 2008; Zehr 2000) as well as in the perceived dependence on science (cf. section 3.2). The different perceptions are also reflected in surveys of the Danish population. In a survey from 2009 of 1019 Danish citizens, 28% answered that they were not con-

cerned about climate change, whereas 40% answered that they were; 56% believed that climate change is anthropogenic, whereas 40% believe that climate change is completely or partly a natural phenomenon (Capacent 2009).

Uncertainty and complexity are also connected to the predictions of emissions of GHGs, climate change and their consequences (Willows and Connell 2003; Erhard 2008; Bernstein et al. 2007). In the report *Impacts of Europe's Changing Climate* from the European Environment Agency, the uncertainties regarding climate change are expressed, for instance, in relation to how the climate system functions and how the driving forces of society will develop and affect climate change (Erhard 2008). The IPCC also describes uncertainties in relation to climate change; for instance, how "*uncertainty in the carbon cycle feedback creates uncertainty in the emissions trajectory required to achieve a particular stabilisation level*" (Bernstein et al. 2007, p.73). The question of responsibility for climate change is also debatable, since GHG emissions are connected with such widespread activities as motor vehicle transport, use of electricity and farming (cf. section 2.3). However, in the *Copenhagen Accord* which was the result of the UN COP15 negotiations on climate change, developed countries have agreed to provide "*adequate, predictable and sustainable financial resources, technology and capacity-building to support the implementation of adaptation action in developing countries*", something which can be perceived as an acceptance of a certain responsibility on behalf of the developed nations (UNFCCC 2009).

Furthermore, climate change has potentially significant negative effects globally and long-term, as described in section 2.3. As a result of a scientific climate change congress held in Copenhagen in 2009 a synthesis report was produced, in

## THEORETICAL FRAMEWORK

which it is concluded that "Temperature rises above 2°C will be difficult for contemporary societies to cope with, and are likely to cause major societal and environmental disruptions through the rest of the century and beyond" (Richardson et al. 2009, p. 6). Thus, climate change potentially has far-reaching consequences, and all in all the points brought up here suggest viewing climate change as a new risk. In chapter 5, the use of the theory of risk society with regard to climate change and SEA is discussed.

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# Climate change in SEA 5

With risk society in tow

*In this chapter the theoretical frame from chapter 4 is discussed in relation to SEA. From this theoretical challenges and focus points for the integration of climate change in SEA are derived and discussed to form the answer to part of the theoretically aimed research question presented in chapter 1.*

In chapter 4 it is argued that climate change can be seen as one of the new risks encompassed by the theory of risk society. This gives rise to a nuanced discussion of the relations between SEA, climate change and risk. In the following section 5.1 first the connections between SEA and risk are discussed, and in section 5.2 the connections between SEA and climate change as a risk are discussed. The chapter concludes with a brief summary in section 5.3.

## 5.1 SEA and risk

When carrying out SEA the aim is to predict the consequences of a decision more or less precisely and deliver information to decision-makers for them to make an informed decision (Directive 2001/42/EC 2001; Kørnøv and Christensen 2005, p. 345; Anker 2006, p. 154; Therivel 2004, pp. 7-8). Consequently risk can be viewed as incorporated in SEA, because it is about potential future consequences, and the purpose of SEA is to predict and mitigate risk. It follows that SEA can be perceived as a reflection of modern society wishing scientifically to measure and predict the consequences of our actions in order to reduce and manage risk arising from decisions. This is supported by analysis from Elling (2008). He emphasises inter alia the perception of environmental assessment as “*composed of scientific knowledge*” and “*capable of achieving full information on the likely environmental effect of implementing a proposal or an activity*” and generally as being based on a cognitive-instrumental

rationality (Elling 2008, pp. 229-31).

Giddens argues, cf. section 4.1.5, that the seemingly increasing risk and increasing focus on risk are really a product of an increasing self-reflection in society. That means that increasingly society is searching for risk and thus also increasingly finding it. This argument is also present in Beck’s writings: “*it is not clear whether it is the risks that have intensified, or our view of them*” (Beck 1992, pp. 55). Beck argues that this is really two sides of the same coin, since risks exist through our predictions of them (Beck 1992, p. 74). Because SEA is a tool for reflection on the decisions made in society, it can be seen as part of reflexive modernity in Giddens’s definition and as part of the increasing focus on and management of risk.

Therefore SEA as well as climate change is related to the theoretical framework. The question posed in this context is what effects occur when climate change, as representative of the risks of a risk society, enters SEA?

- What are the theoretical challenges and focus points which are relevant in integrating climate change in SEA, and how are these reflected in practice?

This question is discussed in the following section 5.2.

## CLIMATE CHANGE IN SEA

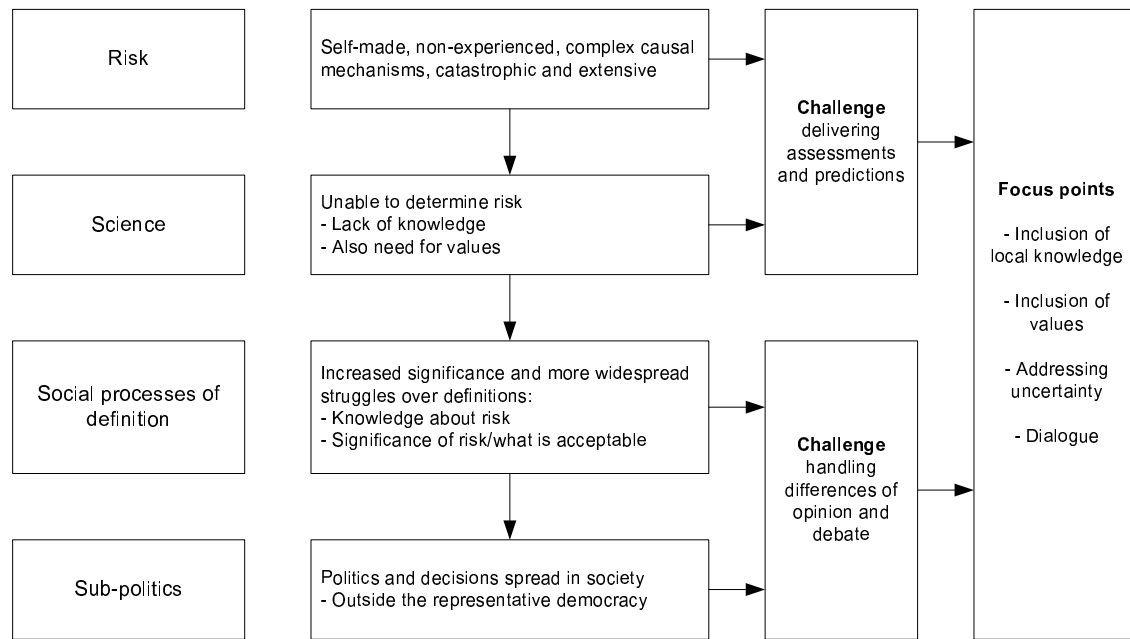


Figure 5.1 The theory of risk society and the challenges and focus points it points towards.

### 5.2 SEA and the risk of climate change

When climate change as a new risk is integrated into SEA the characteristics of risk society follow it into the process. This can have consequences for the process and methodology in the form of challenges, which can be approached through focusing on issues that gain importance if climate change is to be integrated. Figure 5.1 shows my hypothesis, based on the theory of risk society about what these challenges and focus points could be.

As figure 5.1 shows, the theory of risk society outlines that the new risks have a range of characteristics such as complexity, increased lack of knowledge, etc. This means that when climate change as a new risk is integrated in SEA these characteristics follow it into the process. At the same time figure 5.1 shows that science according to the theory of risk society cannot necessarily deliver answers and predictions as a basis for assessments. Consequently the SEA theoretically becomes increasingly characterised by uncertainty which, cf. section 3.1 and 3.2, is a challenge for delivering assessments and predictions. This is particularly chal-

lenging in the light of Beck's statements about the increasing dependence on science and the demand for infallibility, cf. section 4.1.8.

Figure 5.1 also shows that risk society is characterised by struggles over definitions of risk regarding both facts and values, and that politics and decisions are increasingly dispersed in society as sub-politics. In relation to SEA this means that, theoretically, the public will increasingly have an opinion about risks such as climate change and that increasingly there will be disagreement about it. Such disagreement could be regarding facts, for example how common future flooding will be, or regarding values, for example the importance attached to a certain piece of land which might be designated for flooding. Handling these opinions and disagreements presents a challenge.

The theories of risk society and post-normal science also assist in pointing to possible focus points for tackling such challenges.

In relation to the challenge of delivering assessments and predictions, Beck em-

phasises the need for dialogue and critique of science, experts and technology. This is both in the form of internal critique from science itself but also cross-disciplinary sections of society: *"The hope remains that reason, which was silenced in science, can be activated and mobilised against it"* (Beck 1992, p. 180). The emphasis on openness is also, according to Elling (2008, p. 23), reflected in Beck's notion of sub-politics, where the established definitions of knowledge are challenged. Beck is criticised for focusing on experts, and scientific aspects of critique (see e.g. Bulkeley 2000; Elling 2008, p. 141). He claims, however, that risks are socially constructed and dependent on the circumstances under which they are defined, as well as normativity and cites examples. What is an acceptable burden? Who decides what is valid when knowledge is uncertain? Which norms and values are the bases of decisions? Which assumptions about causality are considered valid? (Beck 1992; Willms and Beck 2002, p. 132)

Similarly to Beck, it is suggested in the discussions of post-normal science that part of a solution is to include all actors, decision-makers, researchers and others, in dialogue. This would mean an extended peer review, in which the local knowledge and values of all actors are included, going beyond the notions of experts and scientific knowledge. (Marchi and Ravetz 1999, pp. 743-4, 755; Funtowicz and Ravetz 2005, p. 371) The rationale for this is that *"when stakeholders in a case, either counter-experts or lay, are treated as potential equals, and the definition and handling of an issue is shared, they can mobilise resources of local knowledge and understanding, which complements the generalised knowledge of researchers or official experts"* (Marchi and Ravetz 1999, p. 756). It is proposed that extended peer communities can contribute with local knowledge in the form of *"extended facts"* based on for example

*"craft wisdom and community knowledge of places and their histories, as well as anecdotal evidence, neighbourhood surveys, investigative journalism and leaked documents"* (Funtowicz and Ravetz 2003, p. 7).

On this, basis I suggest a focus on two issues when integrating climate change in SEA. First, a more flexible understanding of knowledge that goes beyond strictly scientific knowledge and recognises **local knowledge** in the form of relevant, contextual knowledge from local actors. Second, some form of **inclusion of values**, which is to be understood broadly as values, perceptions, worldviews and consequently prioritisations of actors.

The relevance of focusing on values as part of environmental assessment is part of the ongoing debate. Richardson (2005, p. 348) argues that SEA is inherently value-laden and that *"one of the issues that the EA community must sort out is how it deals with the presence of multiple and often conflicting values and ways of valuing"*. A need to deal with values is also stressed by Nilsson and Dalkmann (2001, p. 323), among others, who state that *"SEA must accept and handle explicitly the presence of values in decision making"*. Elling (2008, p. 26) argues that even though such questions of value in his view are increasingly important for impact assessment, *"it is characteristic, however, that such questions are rarely posed"*, essentially because they do not fit with the modern scientific mode of thinking. A further challenge lies in the issue that when knowledge and science improve, they become increasingly complex, and this in turn affects the possibilities of public participation and criticism.

Funtowicz and Ravetz (2005, pp. 369-371) emphasise a need to focus on securing quality in science through management of uncertainty, by being explicit and systematic in accounting for uncer-

tainty in science. As Ravetz (2004, p. 352) states: "*The great lesson of post-normal science is that the quality of results does not depend on the elimination of uncertainty. Rather, the skilled management of uncertainty, along with the recognition of decision stakes, is the key to quality, especially in the precautionary fields*". It is argued that trust in the validity and truth of quantitative data needs to be re-evaluated, as well as the belief that problems of uncertainty and risk can be remedied by finding more quantitative data (Funtowicz and Ravetz 1990, p. 10). Beck adds that it can be appropriate to accept that decisions are a learning process and to provide room for continuous revision as a reaction to possible negative effects (Beck 1992). In relation to SEA, the relevance of openly addressing uncertainty is pointed out in section 3.3 as a demand for and potential of SEA. Tennøy, Kværner and Gjerstad (2006) as well as Byer and Yeomans (2007) have worked with uncertainty in environmental assessment and concluded that uncertainty, both in relation to environmental assessment in general and in relation to climate change specifically, is not handled satisfactorily. Thissen and Agusdinata (2008, p. 1) support this, when they write that "*uncertainties abound in impact assessment, not just because of lack of knowledge or theory, but also because impact assessment is about the future. Yet little attention is given to this very important aspect...*". This all suggests a focus on **addressing uncertainty** and working with it in SEA in an open and explicit fashion.

According to the theoretical framework, disagreements between stakeholders on issues of definition of risk have become more dominant, in science and elsewhere. As Beck writes: "*If three scientists get together, fifteen opinions clash*" (Beck 1992, p. 167). This points to increasing conflict and debate. Funtowicz and Ravetz (2003, p. 4) propose an

open dialogue regarding the different viewpoints, stating that "*the plurality of legitimate perspectives on any problem leads to a focus on dialogue, and on mutual respect and learning, wherever possible*". Ravetz (2004, pp. 351-352) adds that debates involving different actors and their different "*agendas and perspectives*" if successful can foster mutual learning among the actors. This suggests a focus on dialogue. Elling (2008) calls specifically for dialogue among the different actors in SEA which seeks a possible consensus among different positions and reports discrepancies.

### 5.3 Summary

There is a range of theoretical challenges in integrating climate change in SEA, and focus points which could be part of meeting this challenge. These should of course not be considered as an exhaustive list but rather as my suggestions for what can be derived from Ulrich Beck's theory of risk society. The deliberations in this chapter only answer part of the research question, and thus reflection on the challenges and focus points in practice needs further investigation. This discussion of theory in practice is especially relevant in the light of the criticism that Beck's theory lacks empirical underpinning, cf. chapter 4. The question of whether the theoretical challenges are relevant in practice also forms the basis for discussing the relevance of the derived focus points in practice. These discussions are found in part 2 of this thesis.

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*In this chapter the research design is presented and reflected upon. This includes both overall thoughts about the purpose and practice of research and the more detailed content and methodology. The chapter contributes to the understanding of the research and the point of departure for the researcher.*

*Science is not an intellectual computing-machine: it is a slice of life*

*of connections in terms of which we can make sense of the flux of events”.*

(Toulmin 1961, p. 70)

In the following section 6.1 the role of the researcher is discussed in terms of both the approach to research and practice. This is supplemented by the article *Change Agents in the Field of Strategic Environmental Assessment: What does it involve and what potentials does it have for research and practice?* in the end of the chapter. The lines drawn up in section 6.1 form the background for the approach to research described in section 6.2 and the specific content and methods applied, as described in sections 6.3 and 6.4. For all of the choices made in research design and methodology it is important to be aware that they are very much dependent on the circumstances of this specific research project and my own approach to research.

## **6.1 The role as researcher**

The point of departure for my research has been the case of climate change in SEA, specifically motivated by the RBMPs, the formal exclusion of climate change and the influence of uncertainty. I have first of all sought an understanding of how this area of study is developing and why it is developing in this way. The focus on understanding is much in line with Toulmin (1961, p. 70) in that *“The central aims of science is, rather, concerned with a search for understanding...and this has meant looking for rational patterns*

I partly share a constructivist point of view with Stærdahl (2004, p. 85): *“A point of departure which obviously does not reject the existence of the material world, but finds that it is interpreted and perceived differently”.* That being so, the material world is interpreted differently by different researchers depending on things such as background and worldviews and thus different researchers have different approaches. One way of viewing this is that of Toulmin (1961), who argues that researchers have preconceived notions which shape the questions they pose. He stresses that *“we must recognize that ‘preconceptions’ of this kind are both inevitable and proper – if suitably tentative and subject to reshaping in the light of our experience”* (Toulmin 1961, p. 71) and therefore a critical and open-minded approach to our preconceptions is called for. In this thesis, the constructivist point of view is for example reflected in an interest in the statements and opinions of the actors related to the RBMPs and SEA. Further, this view has played a role in the choice of theory, because I can relate to Beck’s point about risks being socially constructed but still essentially real threats. I would not have been inclined to work with a theory that perceived risk as solely a socially constructed phenomenon nor one that perceived it as a purely objective phenomenon.

My approach is also influenced by the



## RESEARCH DESIGN

pragmatist way of thinking described by Creswell (1998, p. 22): *"the important aspect of research is the problem being studied and the questions asked about this problem."* The problem and an understanding or solution to it is in focus: *"Individual researchers have a freedom of choice. They are free to choose the methods, techniques, and procedures of research that best meet their needs and purposes"* (Creswell 1998, p. 23). In this research, for example, the point of departure in SEA and the ongoing process of preparing RBMPs has meant that collection of data has been guided by what was available in relation to this. Thus, when the process of preparing RBMPs was delayed, the focus and data collection shifted slightly to focus more on climate change in SEA in general, although the problem remained the same. A further point related to these considerations is that I have a background as an engineer within the field of environmental planning and management, and have been trained at a technical faculty. This means that with my explorations into sociology I have been breaking new personal ground and developed an understanding of a field which was not my original core area.

Another facet characteristic of my role as a researcher is the objective of being close to and engaging with practice. This is partly owed to my engagement in a problem in practice and the point of departure in a case. Also, the close connection is related to cooperation with the Danish consultancy Rambøll, which has co-financed the research project. The main driver has been a sense of purpose in terms of contributing something to an important issue in practice and this has been adopted as a shared goal in the collaboration. Practically, cooperation with Rambøll has meant being based at the office of the consultancy for the duration of the project, working on projects as a consultant and holding continuous dialogue with the practitioners.

The relation to practice in this research project is described in (Kørnøv et al. 2010) in terms of conducting Mode 3 research and acting as a change agent. Essentially a framework of three modes of research has been set up:

- Mode 1 research is characterised by high organisational autonomy and low strategic interdependence with the surrounding milieu. This mode of research is generally discipline-based and intra-scientific and the researcher is free to conduct research independently of the context (Gibbons et al. 1994). This form of research is named *"ivory tower research"* by critics and it is berated among other things for its inability to affect practice.
- Mode 2 research is characterised by low organisational autonomy and high strategic interdependence with the surrounding milieu. This mode of research is cooperative, transdisciplinary and has a close connection to the context. This provides possibilities for change-oriented research with high relevance for practice. (Gibbons et al. 1994; Huff 2000) Mode 2 research is criticised among other things for being too pragmatic and commercialised and for lacking a real ability to promote change (Huff 2000; Jamison 2001).
- Mode 3 research is characterised by high organisational autonomy and high strategic interdependence with the surrounding milieu. This mode of research is transdisciplinary, closely connected to the context and driven by a shared goal and engagement. Thus there is a constant negotiation between the researcher and the milieu on the frames for research and the research and cooperation are both oriented towards change. (Huff and Huff 2001; Kurek 2008)

For a more detailed presentation of the three research modes see (Kørnøv et al.

Organisational autonomy	Strategic interdependence
Joint decision on research goal	Co-financed project
Right of the researcher to decide on theory and data collection	
Right of the researcher to decide on publication	

Figure 6.1 Main characteristics of the collaboration

2010) in the end of this chapter.

In the case of this research project, the milieu which Mode 3 research is oriented towards is mainly Rambøll. The main determinants of relevance for characterisation of the cooperation are presented in figure 6.1.

The set-up of Mode 3 research has led to a number of advantages for this research project. First is the retention of focus on the specific problems in practice, which stems from the ongoing discussions with practitioners at Rambøll and the joint research goal. Also, this means that there is a direct access to practitioners in terms of having results exposed to and implemented in practice. For example, the results of the study have continuously been presented to my colleagues at Rambøll for feedback. Likewise the set-up has contributed to the focus on a continuous communication of results also aimed at practitioners who are largely situated in the Danish municipalities. This has resulted in the publication of an article in a non-scientific journal, which can be viewed in appendix C. Another advantage is the possibility of building bridges between different organisations, in this case between Rambøll, Aalborg University, and the Danish municipalities. On the other hand, the close connection to Rambøll has sometimes been a disadvantage in terms of access to other organisations. For example, SEA of the Danish RBMPs is prepared by a competing consultancy, which has limited my possibilities of access. The main challenge of Mode 3 research is perceived to be maintaining autonomy and the ability to be critical of the cooperating organisation. In this case, however, the problem is partly remedied

by the fact that the object of study has not been specifically Rambøll but other actors. The practice of Mode 3 research is perceived to have the potential to influence practice positively and contribute to attaining the set goals in terms of enhancing practice.

Attention should be paid to the fact that even though Mode 3 research has characterised the research project, this does not mean that Mode 1 and Mode 2 and the strengths they represent have not been applied when the situation has called for it. The choice of working mainly with Mode 3 research has been a result of the goal and set-up of the research but is also a personal choice to do with motivation.

The article in the end of this chapter presents a more detailed study of the issues of Mode 3 research. The perception of the role a researcher plays is reflected in the further approach to research, which is the subject of the following section 6.2.

## 6.2 Approach

The point of departure – the Danish RBMPs – is used as a case to study climate change in SEA. As previously stated it is this case that sparked the research project to begin with, because it was found relevant and interesting owing to the exclusion of climate change. Yin (2003, p. 13) provides a definition of a case study as: “*An empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*”. As this research project deals with the contemporary phenomenon of the process of preparing RBMPs and its context

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in the form of actors, for example, it is perceived as a form of case study. The case is used to study climate change in SEA which is also studied specifically. Flyvbjerg (2009, p. 87-8) stresses the context dependency of case studies and the importance of context-dependent knowledge to gain an understanding of contemporary issues. According to Yin (2003, p. 9), case studies are a relevant choice of research strategy when "a 'how' or 'why' question is being asked about a contemporary set of events, over which the investigator has little or no control", as is the case in this research project. The case of RBMPs is viewed as an extreme case, which according to Flyvbjerg (2009, p. 96) is characterised by the intent to "generate information about unusual instances, which can be particularly problematic or particularly desirable in a more precisely defined sense". The case of RBMPs is perceived to be particularly problematic because of the exclusion of climate change and thus interesting and relevant. It is important to note that the goal of the research is to develop an understanding of climate change in SEA in general - beyond the case of RBMPs - and thus this is also part of the research.

The point of departure in the current case, where the planning process is taking place simultaneously with the project, is considered a benefit, partly because it is a motivating factor, partly because

it enables the collection of new data. At the same time it has posed a challenge, because the planning process, cf. section 2.1, has been delayed and it has thus been necessary to be flexible regarding the design of the research. Notably SEA of the RBMPs has not been publicly accessible during the research project, and thus analysis of SEA of the RBMPs has not played a central role.

Further elements in the approach are the theory of risk society and the discussion of further development. In this regard the purpose is to understand the case as well as to reflect on the applicability of the theory, cf. section 6.1. In general, this means that the interaction between case, theory and development is as illustrated in figure 6.2.

As illustrated in figure 6.2, theory is used as an analytical framework in relation to analysing and understanding the case. On the other hand, it serves as an analysis of the applicability of selected theoretical hypotheses in the case of SEA and RBMPs. Beyond this, theory contributes the focus points for future development (cf. chapter 5), and thus it adds to the discussion on further development. The case also contributes to the discussions on development, partly with knowledge about experiences, partly with inspiration.

This interaction between theory and em-

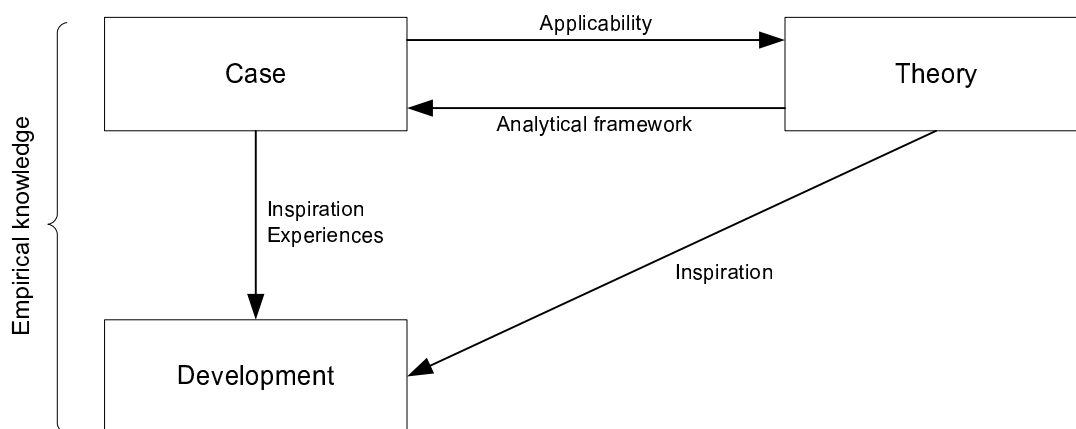


Figure 6.2 Interaction between case, theory and development

empirical knowledge as described goes beyond the notions of deduction and induction defined by Alvesson and Skjöldberg (1994):

- Deduction: Takes point of departure in a general rule or theory which is tested to see if it applies to separate cases.
- Induction: Takes point of departure in a number of empirical cases and derives from this general rules or theories.

The interaction can be illuminated by the notion of abduction defined by Alvesson and Skjöldberg (1994):

- Abduction: Takes point of departure in one or more empirical cases and uses existing knowledge or theory to analyse these in order to obtain an understanding of the empirical cases as well as adding to the theory.

As stated, in this research project the empirical point of departure is SEA of the Danish RBMPs, and this background to the case includes theoretical reflections about risk and uncertainty in order to offer a deeper understanding of the case and spark development as well as reflect on the applicability of the theoretical issues. Consequently, "*facts serve to prompt theory and at the same time play the role of a critical instrument for tuning and a maker of new ideas for theory*" (Alvesson and Skjöldberg 1994, p. 43). Mac (2004) describes the process as an open process, where theory determines what is examined but the field leads to a clarification or revision. This way of working has the potential advantage of reaching the deeper structures of understanding compared with induction, which generates empirically-based rules. Also, abduction has the advantage of being defined by an empirical situation, whereas deduction can at the outset be more disconnected from the empirical issues.

(Alvesson and Skjöldberg 1994) This way of working is applicable in the case of this research project, where the reflection of Stegmüller (1973 cited in Alvesson and Skjöldberg 1994, p. 30), that theories are not something to be tested but rather to be used, makes sense. A final feature of the research project is that the understanding achieved is used for a discussion of further development of working with climate change in SEA and therefore it perhaps goes beyond the definition of abduction.

### 6.3 Content

To answer the research questions four articles are produced which are based on different analyses. This is in addition to the article about the role as a researcher: Change Agents in the Field of Strategic Environmental Assessment, which is presented in section 6.5. The articles and the relationship between them and with theory and development can be viewed in figure 6.3.

Figure 6.3 also illustrates how the articles cover the three central subjects, RBMPs, climate change and SEA, according to their vertical position. The emphasis of the articles is on SEA and climate change, since this is where the focus of the research goal is. Also, the choice of topics for the articles is influenced by the previously mentioned fact that the SEA of RBMPs was not accessible during the project period, which has influenced focus on the RBMPs. This is also one of the issues which influenced the possibilities for data collection.

### 6.4 Methods of data collection

The methods of data collection are described on an overall level in this section and supplemented with more detailed methodology sections in the separate articles included in the thesis.

**Literature studies** are used throughout the research project to obtain inter alia

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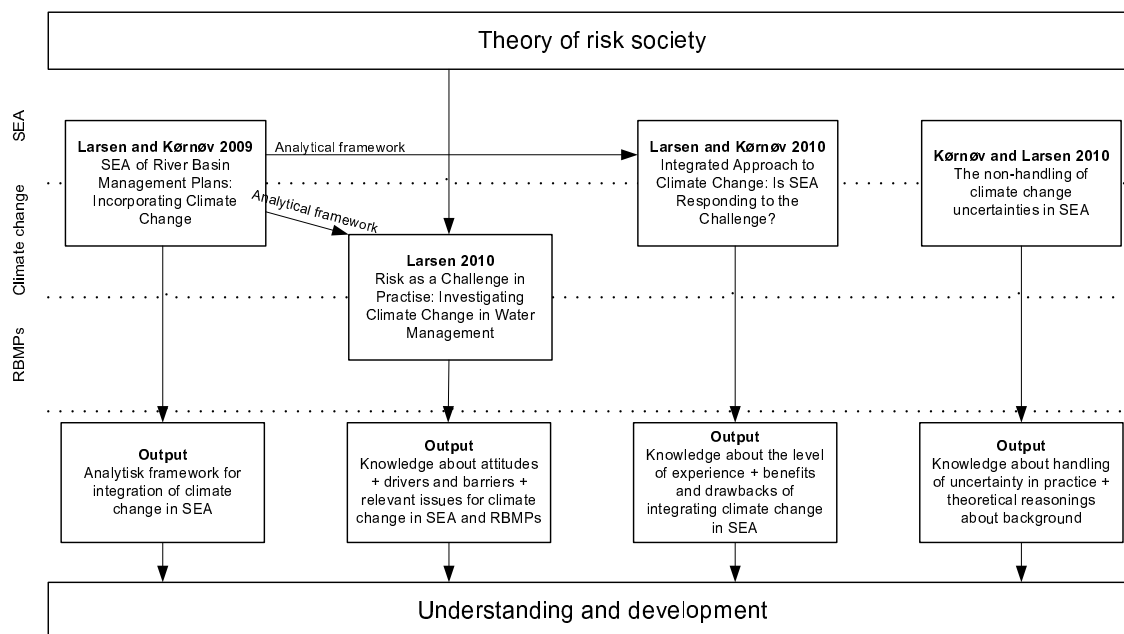


Figure 6.3 Overview of content of the research

knowledge about issues that are not covered by my own professional background. Thus literature is used particularly for obtaining knowledge about RBMPs, climate change and risk theory. Specifically in the use of Ulrich Beck's work on risk theory, attention has been paid to the fact that it was first put forward in 1986, and that parts of it may no longer be entirely relevant today. For example, Beck (1992) urges a development from ex post control of pollution to a more preventative practice, which to some extent has already taken place in the industrialised world in the past decades.

**Document analyses** are used in two instances:

- In analysis of the process of preparing Danish RBMPs, whereby written submissions for a hearing are analysed. A total of 670 submissions from 365 different actors are examined with a view to establishing whether they mention climate change or SEA, and, if they do, what the detailed content is. The analysis took place in the spring of 2008 and is used in (Larsen 2010).
- In an analysis of how climate change

is integrated in SEA in Denmark today, the content of 153 environmental reports of regional plans, municipal plans, local plans and sector plans was examined. These were reviewed to establish whether and how they integrate climate change. The analysis took place in the autumn of 2009 and is used in (Larsen and Kørnøv 2010) and (Kørnøv and Larsen 2010).

**Interviews** are also used in two instances:

- To investigate the motives of the Danish municipalities in relation to whether or not they have encouraged an integration of climate change in the RBMPs. Interviews are carried out with four heads of department in municipalities and the results are subsequently tested in a survey in the Danish municipalities. The interviews were carried out in the autumn of 2008 and used in (Larsen 2010).
- To investigate the motivation behind and the consequences of an integration of climate change in SEA, interviews with key employees are conducted in six municipalities that work with climate change in SEA. The mu-

municipalities are chosen on the basis of the document analysis of environmental reports. The interviews were conducted in the spring of 2010 and some of them used in (Larsen and Kørnøv 2010).

Thus interviews are used partly in an exploratory way to define subsequent analysis and partly to clarify and deepen obtained knowledge.

**Surveys** are used in an analysis of the motives of the municipalities in relation to whether they have encouraged integration of climate change in the RBMPs. This constitutes a test of support for a range of hypotheses based on the aforementioned interviews. Also tested are a range of hypotheses on what challenges the municipalities expect if they choose to integrate climate change in their action plans. The survey was sent to all 98 Danish municipalities, producing 58 respondents from 50 municipalities. The analysis was performed in the spring of 2009 and used in (Larsen 2010).

The choice of methods for data collection has partly been based on what was current and accessible in the light of the fact that the process of preparing RBMPs has been ongoing. An example of this is the decision to analyse the submissions for the hearing which the Ministry of the Environment has published online.

The analyses utilise both qualitative and quantitative data. Quantitative data in the form of statistics are used, and are continuously analysed, interpreted and clarified by means of qualitative data. In this way data are triangulated: for instance, when the analysis of the submissions for the hearing is supplemented by interviews and by a survey, or when the analysis of environmental reports is supplemented by interviews. This method is approved by Alvesson and Skjöldberg (1994, p. 11), who argue that whether

qualitative or quantitative data are preferable depends on the situation and that they can sometimes supplement each other to advantage.

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# Change agents in the field of strategic environmental assessment: What does it involve and what potentials does it have for research and practice?

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## **Abstract**

One of the challenges facing strategic environmental assessment (SEA) is finding ways to work in research and practice allowing critical interrogation and appropriate action to support sustainability. The point of departure for this article is the hypotheses that cooperative knowledge-production, where SEA researchers interact with the societal milieu as change agents, increases the potentials of SEA research and practice to further sustainability. Based on literature and three cases, the paper is focussed on the question: 'what does acting as a change agent within the field of SEA involve and what potentials and relevance does it have for research and practice? The cases illustrate how SEA research and practice have complementary perspectives, and used together can support reflective SEA practice and practice-based SEA research. Theoretically the current understanding and discussion on change agents is sharpened through the focus on real-life linkages, putting forward the contextual influence and the unpredictability related hereto.

**Keywords:** Change agent, Mode 3 research, strategic environmental assessment, knowledge production.

## **1 Introduction**

The point of departure and underlying assumption behind this paper is that to make knowledge through SEA and impact decision-making, science and practice needs to be connected.

During the last decade science and technology have increasingly been harnessed in the quest for a transitioning towards sustainability, among other things grounded in the belief that for knowledge to be useful from a sustainability perspective, it generally needs to be co-produced through close cooperation between scholars and practitioners (Clark, 2003). The important scholarly discussion about the role and effectiveness of environmental assessment (EA) as a tool to promote sustainable development has simultaneously increased over the last years and it has been questioned if EA has the wanted impact on the planning and decision making process. The dis-

cussion involves questioning whether EA tools are too often developed from an expert-driven perspective without sufficient attention to contextual circumstances including the practitioners' needs and capacities (Emmelin, 2006) and without sufficient understanding and recognition of the actual non-linear decision making processes (Richardson, 2005; Kørnøv and Thissen, 2000; Lawrence, 2000; Nilsson and Dalkmann, 2001; Bina, 2001). The reasons for the experienced gap between the science of EA and the practice of EA can be found in these arguments, and can be due to a scientific non- or low collaborative knowledge production, with a clear demarcation between science and practice.

The practice of connecting theoretical knowledge with practical problems, including a high personal engagement, is by Andrew Jamison (2001; 2008), called 'change-oriented research' and refers to a knowledge making which is problem-



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based with the aim "...to intervene creatively and constructively in an ongoing social or political process: to contribute to change. Rather than the traditional notion of enlightenment, by which is usually meant that the role of the scientist is to provide insights for the broader society, derived from a 'disinterested' pursuit of the truth, change-oriented research is about empowerment, where the researcher applies knowledge gained from experience to processes of social learning, carried out together with those being 'studied'" (Jamison, 2010: 9). This engagement of the researcher as a change agent is in different fields of research referred to by other names like e.g. participatory planning, empowerment and action research.

This situated form of knowledge making can from the authors' point of view be seen as help to reconnect science and SEA practice to serve the needs and concerns of society in relation to sustainability. Research, which is closely linked to current societal needs and is undertaken in cooperation between science and practice, is termed 'Mode 3' (Huff and Huff, 2001; Kurek, 2007). Kurek (2007) provides an analytical framework for studying the strategic positioning of the researcher, which makes it possible to distinguish between modes of research. The paper is inspired by both Jamison's normative framework and argument about the need for change-oriented research, and by the analytical framework developed by Kurek (2007). These frameworks are used for discussing how to connect science and practice, and thereby approach the mentioned insufficiencies in the field of SEA. The hypothesis is that combining the frameworks so that the researcher acts as a change agent within a Mode 3 positioning is a relevant setup for improving the connection and promoting sustainable development.

At Aalborg University's Department of

Development and Planning, three research projects on SEA are conducted by researchers acting as change agents. This paper builds upon the experiences from these cases. Focus is on the potentials of conducting Mode 3 research, seen from the perspective of the researcher and from the perspective of the organisation, which is the base for the researcher and the study object at the same time. The objective of the paper is to identify if and how this specific setup of research provides potentials in terms of practice in the organisation and in terms of the research.

The analytical framework is developed through a discussion of different research modes. This framework is then used for presenting and analysing the three cases, in terms of what it involves to conduct Mode 3 research within the field of SEA. This covers discussions of strategic positioning in relation to the formal and informal frames for the research projects. This is followed by an analysis of the potentials unfolded by the authors' and collaborating organisations' observations and assessments of the research projects.

## 2 The Discussion of Research Modes

When discussing the different modes of research with focus on the connection of research and practice, the contribution of Gibbons and colleagues in '*The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*' from 1994 is found very relevant and inspiring. This work is an influential contribution to the ongoing discussion of the need to improve research relevance and knowledge flows from science to practice. Gibbons et al. distinguish between two modes of knowledge production.

Mode 1, typically produced in universities and named 'ivory tower research' by

critics, has the characteristics of largely being discipline-based, intra-scientifically produced and not related to a specific context for application (Gibbons et al., 1994). In Gibbons words *"This structure provides the guidelines for researchers about what the important problems are, how they should be tackled, who should tackle them, and what should be regarded as a contribution to the field. In its social dimensions, it also prescribes the rules for accrediting new researchers, procedures for selecting new university faculty, and criteria for their advancement within academic life"* (Gibbons, 1999: 9).

The strength of the structured research in Mode 1 is widely acknowledged. However, when it comes to research aiming at changing practice, Mode 1 research meets criticism, e.g. the risk of limited relevance of research for society. Mode 1 research on SEA does not necessarily take point of departure in experienced problems in certain contexts, and therefore it may not be relevant and it may not be applied. In line with this criticism, Gibbons (1999) point at a need for knowledge production, which is 'socially robust', ensured through a new social contract between research and society. It becomes not just a matter of how knowledge is produced but also what knowledge is produced. Here Mode 2 research offers a different approach.

In Mode 2 the relationship between science and practice is characterised by interaction and cooperation, which according to Gibbons and colleagues leads to change-oriented science in which *"the boundaries between the intellectual world and its environment have become blurred"* (Gibbons et al., 1994: 81). The characteristics are knowledge produced trans-disciplinarily, jointly and bound to a specific context. Therefore, Mode 2 research is validated by its relevance for practice. Compared to mode 1, mode 2 is

argued to be *"more timely, more practical, more democratic"* (Huff, 2000: 291) Huff (2000) criticizes Mode 2 research for having limitations *"especially as it moves away from science and technology into management"* (Huff, 2000: 291). According to Huff (2000: 292), Mode 2 research is too pragmatic and tends to make *"big bets on the basis of limited evidence"*. Another criticism of Mode 2 is the commercialisation of research, e.g. raised by Jamison in *'The Making of Green Knowledge'*. Research is defined by market interests in funding organisations rather than by the interest among researchers (Jamison, 2001). Furthermore, Jamison (2001: 124) criticizes Mode 2 for limited change *"...many of the actual practices of the companies they run and/or represent all too often continue to follow 'business as usual'"*.

The discussion of research modes and trends in knowledge production has received considerably scholarly attention (Nowotny, Scott and Gibbons, 2001). In the midst of these discussions the concept of Mode 3 arose.

### **Strategic positioning and Mode 3**

In line with Jamison's discussion of the need for a 'change-oriented research', the limitations of Mode 2 lead Huff and Huff to suggest Mode 3 knowledge production with the purpose *"...to assure survival and promote the common good, at various levels of social aggregation"* triggered by *"...appreciation and critiques of the human conditions, as it has been, is, and might become"* (Huff and Huff, 2001: 53). The researcher within this Mode 3 is closely linked to societal needs and compared to Mode 2 is capable of influencing his milieu by creating demand for the scientific knowledge instead of supplying on an external demand (Kurek, Geurts and Roosendaal, 2007).

Some characteristics, used in the literature on Mode 3, are multiple stakeholder

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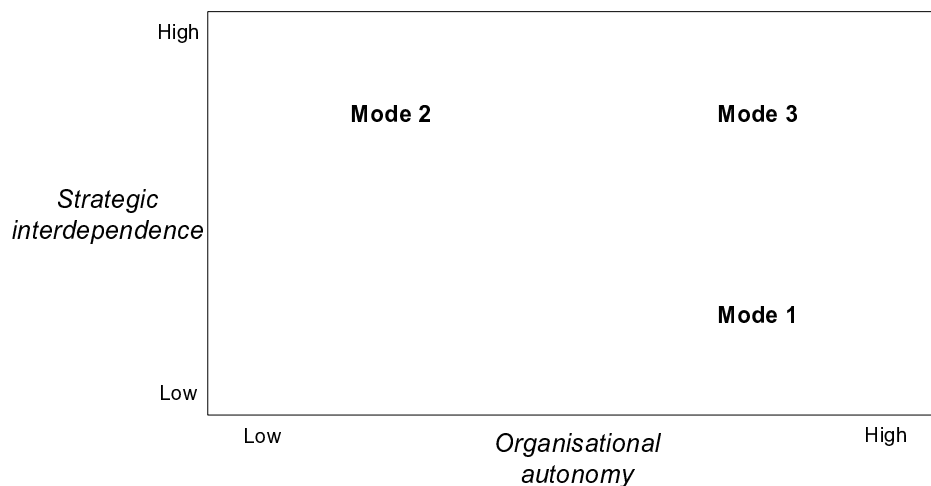


Figure 1 Three modes of strategic positioning. (Based on Kurek, Geurts and Roosendaal, 2007: 503)

involvement and interdisciplinarity, conversation and cooperation, community driven, engagement in study field, high organisational autonomy and strategic interdependence (Huff and Huff, 2001; Kurek, 2008). The normative element of Mode 3 is explicated by the goal of a 'future good' (Huff and Huff, 2001) and 'giving voice' through science as social advocacy (Jamison, 2009b).

Whereas in Mode 1 the researcher mainly is accountable to oneself, and in Mode 2 accountable to the milieu and financing organisation, the researcher in Mode 3 is mainly accountable to the people and/or environment affected both in the research process and the research outcome. Mode 3 involves not only personal, active engagement and intervention in on-going processes, but also a normative framework within which the researcher works.

The relationship between the change agent and the milieu (researchers, government, industry and NGO) is established through negotiation, and the researcher in Mode 3 must make on-going choices of how much he is willing to let others influence the research. An analytical model of the strategic positioning of the researcher within the milieu is de-

veloped by Kurek and colleagues (Kurek, Geurts and Roosendaal, 2008). The model is based upon two dimensions – organisational autonomy and strategic interdependence – and provides a typology with the different modes of researchers positioning, see figure 1.

We understand Mode 3 as being characterised by high organisational autonomy and strategic interdependence, and at the same time attributed a normativity guiding the ongoing knowledge making and negotiation process taking place between the researcher and the milieu. Mode 3 is building on and incorporating both Mode 1 and Mode 2 research in the process a researcher within a project and time period often will choose interplay between the different modes. A pure choice of one mode seems unrealistic or unfavourable.

In Mode 3, like in Mode 2, the researcher and milieu share resources (money, time, knowledge) but at the same time the researcher "...autonomously determine directions of research. He retains his responsibility for directing a project" (Kurek, Geurts and Roosendaal, 2007: 504). So in Mode 3 both the researcher and the milieu are strong enough to sanction each other, and both the strategic interdependence and organisational

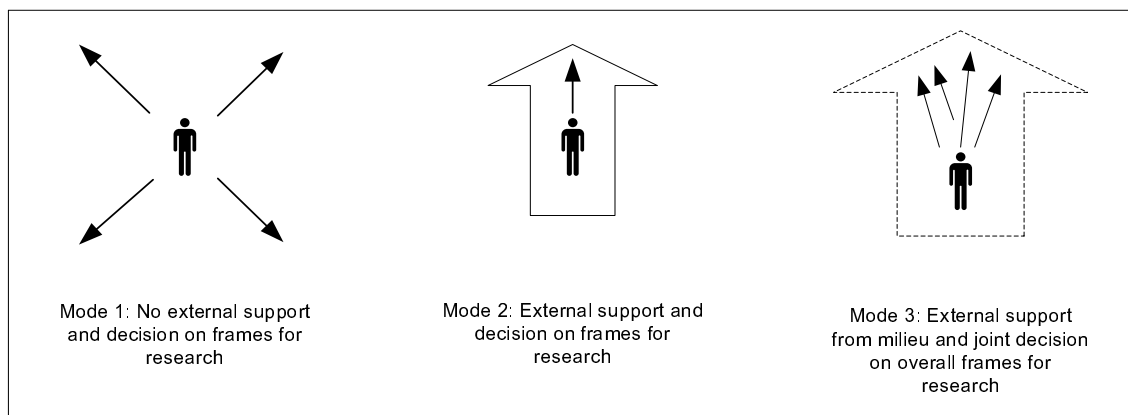


Figure 2 The relation between the researcher and external milieu in the three modes of research.

autonomy is high. This also means that the normative framework, guiding Mode 3 research, is developed by and acceptable to both the researcher and the milieu. The difference is visualised in figure 2.

Before turning to answering the questions of what Mode 3 within SEA research involves and why it matters, the cases and methods applied are presented in the following section.

### 3 Cases and Methods

The analysis in this paper is based upon case studies, from which experiences with Mode 3 research is drawn. In the following the three cases are introduced, and the methods applied in the two analyses are presented. Further information about the three cases is presented continuously in the paper, where it is included in the analysis. The analyses deal with the strategic positioning of the researchers and the potentials for SEA research and practise. The empirical basis for the analyses is document analysis, the researcher's personal observations, and subjective assessments by the researchers as well as the contact person in the organisations.

#### Cases studied

The study comprises three cases, where PhD researchers are working on their projects in close cooperation with an organisation outside the university. The three research projects have different

foci in relation to SEA and different reasoning for the cooperation between SEA research and practice. In all three cases the organisations have co-financed the research projects.

#### Case 1

Case 1 concerns the first generation of SEA of plans and programmes in relation to the national energy infrastructure in Denmark (gas and electricity). In this case, Energinet.dk faced implementation of SEA and without sufficient internal professional resources, they initiated cooperation with AAU that ended up with the project aiming for developing and implementing SEA in the energy sector, including SEA methodology targeted the strategic decision making processes in the sector. The project is organised with an AAU-based professor as supervisor and the head of Research and Environment section as main contact person at Energinet.dk. The project has theoretical basis in decision-making theory and sense-making theory, which are used to understand practice and develop methodology. The project is based on an interactive research approach, in which the researcher is situated at Energinet.dk for a year, participating in meetings and planning processes. To maintain a critical distance, the remaining two years of the project is carried out at AAU, however, still with periodical participation in meetings at Energinet.dk. The research

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conducted from AAU is widely based on document analysis and interviews.

### *Case 2*

Case 2 concerns SEA of mega industry in Greenland in a system having no legislation or guidelines in place. This case is rooted in the environmental and democratic challenge of planning and assessing an aluminium smelter in Greenland (Hansen and Kørnøv, 2009). The aim of the research project was to secure a critical and independent view upon the processes and effect of carrying out SEA. Besides being funded by the Greenlandic Self Government the project is co-funded by the independent Alcoa Foundation. The project commenced in November 2007 and is set to finish in November 2010. It is organised with an AAU-based professor as main supervisor and the head of the department of physical planning from the Greenlandic Self Government as co-supervisor. The project is conducted as a case study of the SEA and the planning process of an aluminium reduction plant in Greenland. A theoretical approach is taken, combining power theory with impact assessment theory on the concept of effectiveness. These theories are used to setup an analytical frame for the case study. Document analysis is used to determine the chronology, and thus the backbone of the mapping of decisions in the project. Participant observation and statements are collected primarily by qualitative interviews with key persons from the central actor groups, and by attending meetings as an observant. The interviews are supplementing the document review in covering the case activities and behaviour, also regarding identification of interests among the actor groups and in relation to their access to resources. Based on this, reflections regarding effectiveness and power structures relating to the use of SEA as a decision making tool when planning new industries in Greenland will be

made in terms of development of process and methodology.

### *Case 3*

Finally, the project in case 3 is carried out in cooperation between AAU and the major Danish engineering consultancy Rambøll. It commenced in September 2007 and set to finish in September 2010 and is organised with an AAU-based professor as main supervisor and a head of department from Rambøll as co-supervisor and main contact-person within the consultancy. The research takes point of departure in the current Danish process of preparing river basin management plans (RBMPs), implementing the EUs Water Framework Directive, and preparing SEAs of these plans. Currently, climate change as an environmental factor has been excluded from the planning process, with the reasoning that there is not enough knowledge about climate change to assess its consequences for the water environment and the RBMPs. On this background, the project is aimed at developing the work with climate change in SEA of the RBMPs. A theoretical approach is taken, using sociological risk theory as a framework for research. Document analysis, interviews, and a survey is utilised to uncover the attitudes of different actors towards inclusion of climate change in the RBMPs, while a document analysis and interviews are used to assess the experiences with climate change in SEA in Denmark. Based on this, reflections regarding integration of climate change in SEA will be made in terms of development of process and methodology.

### **Analysing what it involves to be a change agent within the SEA field**

The conclusion upon the formal strategic positioning of the researchers in the three cases, and thus whether and how they conduct Mode 3 research, is first and foremost reached by analysing the

content of contracts. The standard issues like e.g. time schedule is not perceived interesting and relevant for this paper, but the non-standard and unique issues are more interesting and symbolise the negotiated parts of the cooperation. The analysis of the contracts is focused on the explicated objectives and the clauses. Both are used to indicate the strategic interdependence and organisational autonomy and thereby map the research mode. In addition informal positioning and negotiation takes places in an ongoing dialogue between the SEA researcher, the university and the collaborating organisation. The analysis of the informal process, influencing the research intention, the methods applied, and the output of research, is based upon the researchers observations and experience.

#### **Analysing what Mode 3 research matters to SEA research and practise?**

The hypothesis of this paper, that Mode 3 research can support SEA and sustainable change via its potentials for connecting research and practise, constitutes the point of departure for the analysis of what potentials Mode 3 research has. Two sources form the basis for the analysis: The first part is assessments from the researchers that point at potentials for research. These assessments are substantiated by examples from the projects. The second part is based upon open questions related to the potentials for influencing practise. The questions are answered by the contact persons at the organisations. The questions formulated are: 1) How has the involvement of NN and his/her research influenced the organisation? 2) How has the involvement influenced the broader society?, and 3) In which way has the involvement and cooperation influenced the strategic environmental assessment (understanding of SEA, the SEA process, the documents)? and 4) How would you characterise the strengths and weaknesses of the setup of

the cooperation between your organisation and the researcher?

In respect to the premature concept of Mode 3 research, the sources are (intentionally) not constrained by mode classifications or characteristics. The sources are in stead held open to any impact of the research and this inductive approach may support a refinement of the Mode 3 concept. Following the analysis of potentials, these are mapped in terms of the modes of research in the discussion in order to clarify the potentials of Mode 3 research.

As the three cases are ongoing research projects, the analysis is primarily focused on the process rather than the outputs. The cases do, however, outline a picture of the potentials of the research mode. This evidence is related to other empirical investigations of change agents and research modes in the discussion.

#### **4 What Does Mode 3 Research within SEA Involve?**

The Mode 3 research is analysed in terms of the strategic positioning of the researchers in the three cases, and thus whether and how they carry out Mode 3 research. Focus is both on formal and informal frames for the research, and these frames will show what it involves to do Mode 3 research.

The analysis begins with the strategic interdependence and the organisational autonomy in accordance with the model of strategic positioning proposed by Kurek et al. The analysis presented in table 1 and 2 are inspired and to a large extent developed upon the work of Kurek, Geurts and Roosendaal (2007; 2008) who build upon Parsons' theories on social systems. Table 1 gives an overview of the parameters chosen to describe and analyse the strategic interdependence and organisational autonomy. These parameters are inspired by Parsons' model

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<p><b>Strategic interdependence</b></p> <ul style="list-style-type: none"> <li>Understood as the deliberate sharing of heterogeneously distributed resources, assets and capabilities between the partners in order to achieve a joint goal.</li> </ul>	<p><b>Organisational autonomy</b></p> <ul style="list-style-type: none"> <li>Understood as the researcher's degree of self-governing the research. It is analysed in relation to the researchers autonomy to decide upon:</li> </ul>
<p>Economic interdependence</p> <p>Interdependence on exchange of information sources</p> <p>Interdependence on engagement</p>	<p>Research goals</p> <p>Acquiring information</p> <p>Working place and working balance</p> <p>What to write in publications</p> <p>Where and when to submit research results</p>

Table 1 Parameters chosen as basis for describing and analysing modes of research.

of social systems in which four media can function as exchange means: Inducement (e.g. money), deterrence (negative sanctions), commitment and persuasion (Parsons, 1963).

Common for the research projects is that most of the strategic positioning is happening in an on-going and informal process between the researcher and the cooperating organisation. This will be analysed and discussed in the following.

### Formal and informal strategic interdependence

Table 2 shows the analysis of whether and how the researchers and organisations have strategic interdependence. The analysis shows an economic interdependence in all three cases. This is partly evident from the contracts and partly evident from the informal negotiations, and the economic interdependence gives both parties a possibility for sanctioning. The second parameter, dependence on exchange of information sources, reveals some differences. Only case 1 is really highly dependent upon the collaborator. This has to do with the nature of the SEA research: This project has a focus

	High interdependence	Low interdependence
<b>Economy</b>	Researcher is either fully or partly funded by the organisation and the organisation must get return of their investment in the project	Researcher is economic independent and the organisation is not dependent on return of their investment.
Formal	Case 1, 2 and 3	
<b>Exchange of information sources</b>	The organisation is an essential source of information for the researcher and the organisation needs information from the research society	Researcher is not dependent on information from the organisation and opposite
Informal	Case 1	Case 2 and 3
<b>Engagement</b>	The researcher and the organisation are mutually dependent on the other parts' engagement in the project	Neither the researcher nor the organisation is dependent on engagement from the other part in the project.
Informal	Case 1 and 2	Case 3

Table 2 Analysis of the SEA researcher's strategic interdependence in relation to the collaborating organisation. Whether the dependence is explicated formally (in the contract) or informally in the process is indicated in the left column.

of getting the right environmental information to the right people at the early stage in decision making, and to do so the researcher is very dependent on understanding the processes within the collaborating organisation. The contract in case 1 is a standard contract added restrictions on confidential data that may only be used after approval by Energinet.dk. However, both case 2 and 3 do experience some dependence upon information from other actors in the milieu, which the collaborating organisation either informally hinders or supports access to.

engagement of the collaborating organisation developing its SEA system, since this is the object of study and change. At the same time, the company relies on engagement from the research in this process of development, e.g. by securing adequacy in terms of regulation. In case 2 the interdependence is similar, since it also revolves around change in the collaborating organisation. Case 3 is different from this, because the change, which is aimed for, is not restricted to the collaborating organisation, but a wider range of actors.

Another kind of interdependence is engagement in the project. The researcher is dependent on engagement from the organisation, since it is necessary that the organisation continues internal activities relating to the research and is able and willing to consider and use the research to achieve change in these activities. If the organisation is not engaged, the researcher cannot change anything. The organisation is likewise dependent on the engagement of the researcher to fulfil the expectations of changes. In case 1, the researcher is dependent on the

**Formal and informal organisational autonomy**

Table 3 shows the analysis of whether and how the researchers in the cases have organisational autonomy. Regarding to what extent the researchers set research goals autonomously, the analysis shows both high and medium organisational autonomy for all cases. Formally, based upon the contracts, the autonomy is assessed as high/medium as all cases include a loosely formulated goal for the research. In case 2, the contract emphasises the need for an autonomous

	High autonomy	Medium autonomy	Low autonomy
<b>Autonomy to decide on research goals</b>	Researcher sets research goals within a negotiated overall frame.	Research goals are based upon the problems of the organisation involving the researcher.	The organisation set specific research goals.
Informal and formal	Case 1, 2 and 3		
<b>Autonomy in the acquisition of scientific knowledge</b>	Researcher decides on how and what data is collected	Joint decisions are made	Decisions on data collection are made by the organisation.
Informal	Case 1, 2 and 3		
<b>Autonomy to decide on working place and working balance</b>	Researcher decides upon where to work and to what extent he will do research related work with the organisation.	Joint decisions are made continuously.	The organisation decides upon the working conditions.
Informal and formal	Case 2	Case 1 and 3	
<b>Writing autonomy</b>	Researcher suggests the content of publications and gives argument why certain theories etc. are chosen.	Researcher edits or re-writes publications partly or fully.	Researcher comment on drafts.
Informal	Case 1, 2 and 3		

Table 3 Analysis of the SEA researcher’s organisational autonomy in relation to the cooperating organisation. Whether the dependence is explicated formally (in the contract) or informally in the process is indicated in the left column.



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researcher, providing critical and independent guidance based on 'insider' knowledge/understanding. It is furthermore emphasised that the researcher must work independently and with high validity in relation to the second co-funder Alcoa Foundation. Differing from this, in case 3 the consultancy expects the PhD-study to "*enter directly into Rambøll's work with developing services and having dialogue with costumers*", which is limiting the autonomy for setting research goals. Within the broadly stated research goals, the researcher informally decides on the research in negotiation with the collaborating organisation.

The contracts do not mention methods of data collection, besides the data collected through interaction between researcher and collaborating organisation. In all cases the researchers thus have a high autonomy in the acquisition of scientific knowledge.

For case 1 and 3, the organisational autonomy regarding working place and working balance is assessed as medium. For both cases this is due to informal negotiation between the collaborating organisation and the researcher, but also due to the researchers own interest in being close to what is being studied. Additionally, for case 3, the contract is more explicit and includes the expectation that the researcher "*...spends the main part of the time at our office in Virum.*" For case 2, the organisational autonomy is assessed as high, as there are no restrictions or expectations from the collaborating organisation regarding working place and working balance.

Writing autonomy is high in all cases, as the researchers decide on what should be included in publications, and in which journals to publish their results. In all cases, the milieu has interests in certain media, however, which media to use, remains the researchers' decision.

The two analysis presented in table 2 and 3 show predominantly Mode 3 research with the researchers having high and/or medium strategic autonomy, and primarily high organisational autonomy. The SEA research is carried out with high engagement in the study field and characterised by cooperation with exchange of sources and views. At the same time the researchers retains the responsibility for directing the SEA research and freedom to be critical. For the researcher it means freedom to govern the project within a broadly given frame, which differs from the other modes of research, as shown in Figure 2 and discussed in the following.

Despite the categorisation of all three projects as predominantly Mode 3, differences exists in practice. The differences observed are e.g. different levels of how much the researcher at a personal level identifies with the study field and different levels of critical participation in the processes studied. These differences indicate that within Mode 3 many nuances exist, and that Mode 3 research does not lead to one specific research design and practice. Mode 3 can be undertaken in various ways, depending upon the specific context including personal preferences, timing, resources etc.

### **5 Potentials for Research and Practice in Mode 3**

The objective of this paper is to investigate 1) if and how the research and cooperation influence the organisation and the work with SEA and 2) if and how being a change agent in relation to SEA influences the research process and content. These two questions are treated in the following by interpreting the Mode 3 research cases in terms of influences enabled by the combination of high autonomy and high interdependence. The interpretation is based on experiences and observations of the researchers and contact persons.

### **Influence on research: The researchers' experience**

The influence on research of the Mode 3 research is based on the researchers' experiences from the three cases. This section is organised around main issues of access, dialogue on direction and ownership of the research.

#### *Access to people, processes and information*

The researchers point at the importance of access in the close association with the organisations: Access to the right person at the right time and place makes it possible for the researcher to make suggestions that test hypotheses or theories. With high strategic interdependence, the researcher is provided with insight and access to follow processes in the organisation. At the same time, the researcher has high autonomy, which means that the researcher potentially can make suggestions that are relevant for practice and at the same time tests hypotheses or theories as part of the research process. An example of this potential is from case 1, where the researcher has continuously taken part in organisational processes, which has given possibilities for testing hypotheses, e.g. about the timing of decision aid put forward in theories of organisational decision-making.

At the same time the researcher is allowed to use the information independently, which may improve the research, e.g. by getting feedback on the research from a wider research community. An example of this potential is from case 2, in which the researcher was allowed to use confidential documents on assessment practice as basis for research. The confidential data was a key source for research, which included recommendations for how to improve practice. These recommendations would not otherwise be made, as no one else has interest in using this material for this purpose. The combination of interdependence and au-

tonomy thus made it possible to publish research with a highly relevant content.

The close association with the cooperating organisation through the high strategic interdependence has also been experienced as limiting the research, when the researcher is trying to gain access in areas with opposition towards the associated organisation. For example in case study 3, the task of performing SEA of the river basin management plans, which is the topic of the research project, was tendered and won by a competing consultancy. This meant that the researcher being closely associated with a competing consultancy was excluded from studying the process. In other situations, the high organisational autonomy may make it possible for the researcher to go beyond the organisation and interact with competing organisations. Such an act may be validated by a belief that the result of it is (more) beneficial for the research project and the collaboration. This has been possible in case 2, in which the researcher has experienced being excluded from access because of her association with the respective organisations. The researcher used her autonomy and built her own relationships beyond the cooperating organisation, and emphasised her relative independence from it.

#### *Dialogue on direction of research*

The researchers point at dialogue about the direction of the research as an important influence of the Mode 3 setup. The dialogue is seen as an opportunity for enhancing the relevance to practise and society.

The high interdependence in the cases is likely to ensure a dialogue with the organisation as the organisation has interest in the output of the research. In the three cases, the dialogue has given valuable input from a practical angle to keep the project relevant to practise. The organisational autonomy means that the

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researcher is still free to develop the research design and secure a scientific rigour independently of the practical wishes of the organisation. In case 1 and 3 this influence has been experienced through the fact that the research results are continuously being 'reality-checked' by practitioners from the organisation. In this way the researcher gets a valuable input on whether suggestions are relevant for practice.

This dialogue also poses a challenge for researchers because the researcher constantly has to balance between the interests of the organisation, scientific demands and the researcher's own interest. In case 3, for example, the organisation has clear wishes for immediately usable methodology, while the scientific community expects more time to be spent on issues such as theoretical angle and research methodology.

### *Ownership of outputs of autonomous research*

The last influence identified by the researchers is connected to the utilisation of the results of the research projects. The Mode 3 setup is experienced to give the organisations ownership of the output of the autonomous research, meaning that the output is more likely to be used in the organisations. This support is especially relevant as the researcher - retaining the organisational autonomy - may have chosen approaches and theories that the organisation would not have preferred at first although the researcher found these more beneficial. The combinations of interdependence and autonomy may in such situations make it possible to improve research and practice by double-loop learning processes (Argyris, 1977) in the organisations. For example, case 1 is aiming at this by using theory that is not previously related to the field, and the organisation has supported the researcher's choice.

The experience from the case studies is that for the organisations, the sense of ownership is related to getting a return for their investment, cf. table 2. The organisations have invested in the research projects and have had influence on the direction of the research, so that it has relevance, and they will, if at all possible, try to benefit from it in their organisations. The organisations may even work as platforms for disseminating the research results to society and other practitioners. Case 3 is an example of this, because Rambøll will strive to implement any methodology developed, in their subsequent consultancy work, thus communicating it to their clients. The ownership and backing from the collaborating organisation is in case 2 furthermore experienced to give the output of the research a higher status among related institutions.

### **The organisations experience with influence of Mode 3**

The organisations' responses to the questions of influence shed light on the cooperative mode of research seen from practitioners' experiences. This section is organised around main issues arising in the written response: The importance of linking research and practice closely; the influence observed and assessed; and the risk and weaknesses.

#### *The importance of close linkages between SEA research and SEA practice*

The respondents in general stress the importance of a close relationship between research and practice. The respondents from Energinet.dk and Rambøll e.g. express the value for SEA research as:

*"The strength is that SEA theory is challenged by reality's diversity of asymmetrical courses and sudden political and strategic changes."* (Head of Section, Energinet.dk)

*"Sanne gets input for understanding eve-*

*ryday life and problems of the practitioners. Thereby the research study adjusts to a more societal beneficial approach."* (Head of Department, Rambøll)

The contextual aspects of practice are hereby put forward as important for enhancing relevancy of SEA research. The importance for SEA practise is also raised and related to the organisations' motivation for entering a Mode 3 setup. Energinet.dk chose to initiate the cooperation with Aalborg University because they wanted research input to how to practice SEA, on which plans and especially how to integrate SEA into decision making:

*"It has always been – and still is – the attitude in Energinet.dk, that SEA shall not be a shallow paper exercise. SEA shall enter the decision making processes at a time and with content that makes SEA an active element".* (Head of Section, Energinet.dk)

The same line of motivation is found in the Self Rule who puts it this way:

*"I like to see the units' cooperation with Anne as an expression of a greater openness to external challenges than some other units' ...Whether it can be said to be evidence that we to a higher degree operate with 'governance' administration principles, I will leave for others to objectively assess – but it is what I as manager of the unit strive for as a principle."* (Head of Department, The Greenlandic Self-Rule)

While Energinet.dk and the Self Rule emphasise both the short and long term perspectives in their views upon the importance of a close relationship between SEA practice and SEA research, Rambøll especially stresses the motivation as short-term business expansion through a competency development. On the long term Rambøll views the importance of cooperation with research for the SEA

practice in general:

*"Rambøll gets access to Aalborg University on a more personal level and thereby easier access to future sparring and development of other cooperations."* (Head of Department, Rambøll)

The researchers' high engagement in practice is by two respondents underlined as important for the cooperative mode and the content of the research. The following statements from Energinet.dk and the Greenlandic Self Rule exemplify this and point to the importance of grounding research in an understanding of specific contextual circumstances:

*"Ivar has from the first day shown genuine interest in the dilemmas of Energinet.dk, and has very thoroughly acquainted himself with the atypical decision processes behind a decision on large scale infrastructure projects."* (Head of Section, Energinet.dk)

*"In relation to the societal perspective, it has been an unconditioned benefit – supposedly a precondition – for Anne, that she is an integrated part of the Greenlandic society."* (Head of Department, The Greenlandic Self-Rule)

The physical affiliation, involving staying in the environment for periods, is part of the high engagement by the researchers and is stressed as an important basis for the influence their SEA work. The first-hand acquaintance of the actual projects and issues are mentioned as a positive consequence of physical affiliation – in addition to the possibility of involving the SEA knowledge in the processes and to challenge the work undertaken continuously. The researcher becomes integrated and *"...not just an external consultant or observant"*. (Head of Section, Energinet.dk)

*The influence observed and assessed*

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A general observation in the answers from the respondents is the conclusion that the close cooperation has influenced the respondents' competences through the developed understanding and actual work on SEA:

*"On the concrete and praxis-related level, it have had great impact for progress and development of the specific SEA, that Anne has 'wafted over the water' in different matters. Anne has through the whole process been a really good sparring partner for me being responsible for the SEA."* (Head of Department, The Greenlandic Self-Rule)

Rambøll who also refers to the personal competency development, but finds it difficult to assess the direct competency development for others and the company in general supports this. The reason put forward is, that the application-oriented part of the research is not yet finished. This may have to do with the character of the company being a consultancy, and the expressed need for tool making. Energinet.dk raises the influence on the competences on a more institutional level:

*"It has qualified the research project and brought valuable knowledge on SEA from Ivar. Several internal workshops have been held to qualify key employers within SEA. Ivar has participated in the development of internal and external minutes on SEA to be used for establishing a proper SEA policy".* (Head of Section, Energinet.dk)

And continues to stress the influence for other actors and society in general:

*"Energinet.dk and other authorities have a need to get the SEA processes defined and coordinated properly – in that case the project has already been of great importance".* (Head of Section, Energinet.dk)

The hidden influence, or indirect influence, for which it is difficult to establish a clear causal relationship between the research and changes in practice, is discussed as important. The respondent from Greenland explains this indirect influence - due to publication, involvement of informants and just general presence by the researcher - through examples like these:

*"In relation to The Bureau of Minerals and Petroleum (BMP) and Anne's insistence on getting access to the (so-called) SEA's written by BMP, I think that this insistence has had an impact on the decision that BMP in January 2010 for the first time has started to publish their SEA's."*

*"It is difficult to express but it has to do with a small society, and here Anne's contribution to the debate has made the media image a bit more nuanced – not on the axis advocate versus opponent, but on the axis unreflective versus reflective."*

These influences are from the authors' perspective related to Mode 3 research, with the normative sight on e.g. democratic SEA processes, supplemented at times with a Mode 1 research to secure the necessary distance to keep a critical stance.

### *Risks and weaknesses*

Working as closely as it has been the case in the three research projects can also be associated with different risks. One is that researchers do not use the synergies between the three modes of research and get too involved in the specific contextual setting with a risk of not keeping enough distance to be critical. The respondent from Energinet.dk raises this risk:

*"A potential weakness in the cooperation model is if Ivar is not capable of getting the necessary distance to the experiences in Energinet.dk. If he becomes part of*

*the processes because they are interesting, it might be difficult to keep the appropriate academic distance to the experiences... Energinet.dk has in general not experienced these weaknesses...more to consider as observation points".* (Head of Section, Energinet.dk)

Another risk put forward by the respondents is the unpredictability in the research process and thereby the actual possibilities of creating synergies between practice and research. Rambøll experienced a lower degree of synergies due to lack of jobs of relevance to the research project:

*"We tried to get jobs within the core of the research field, but unfortunately failed. Had we won just one of these jobs, and especially the environmental assessment of the river basin management plans, it would presumably have meant a greater involvement of Sanne in the production."* (Head of Department, Rambøll)

The opposite situation was the case for Energinet.dk, since they during the research period experienced massive intake of large projects, which has given a large empirical base for the research project. These experiences raise the need to acknowledge the unpredictability in having cooperative processes, and that the benefits for SEA and the organisation as such might appear later than assumed. For Rambøll it was also an unexpected experience that the close cooperation between Rambøll and Aalborg University limited the access to the process of preparing SEA of the new RBMPs:

*"We were very surprised to experience, that the process was so closed, and that Rambøll's cooperation with the university and Sanne in that respect was hindering the openness of the authorities".* (Head of Department, Rambøll)

Still the research has a role to play, but the influence is more on the societal level

than for the company as such:

*"...the research project can give the Danish approach to integration of climate in environmental assessments a lift..."* (Head of Department, Rambøll)

Another risk mentioned, is the lack of engagement from the organisation in general. It is experienced by the respondents that a risk with the cooperative model is that only the key person is fully engaged in bridging SEA research and practice:

*"Rambøll only benefits from the cooperation, if individuals in Rambøll have time/interest/will in getting involved in the cooperation – our conditions for this has actually not been the best."* (Head of Department, Rambøll)

In the Self Rule the cooperation has also been solely coupled to the key person, which has not given beneficial and automatic access to other parts of the organisation:

*"Some specific conditions have meant that I have right of disposal over necessary resources and at the same time taken the necessary decision competence for the cooperation to become a reality, but I do not hold a sufficiently high position to personally spread 'the happy message' to other parts of the Self Rule. This work should have been done by others, but unfortunately no one else has taken on this task."* (Head of Department, The Greenlandic Self-Rule)

Trough examples as above it are stressed by the respondents that the members of the organisations need to be open and accessible to make a bigger difference. This is in line with the emphasis on interdependence in the Mode 3 setup.

## **6. Conclusion and Discussion**

The article has raised the need for SEA research to get involved in engaged knowl-

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edge making starting with the environmental problem. The point of departure has been the international questioning whether SEA is effective in influencing planning and decision-making processes in the quest for sustainable development. The authors further question whether the experienced gap between SEA research and SEA practice can be due to a scientific non- or low cooperative knowledge production. The article, based upon theories on knowledge production and empirical analysis of three cases of SEA research intervention in ongoing processes, reveals results presented and discussed in the following.

### **There are different ways of doing SEA research as Mode 3**

The cases show that doing SEA research can be done in different ways with different degrees of involvement. Borrowing terminology from Andrew Jamison (2009a), three roles for SEA researchers in the process of inclusiveness are shown:

1. *"Taking side"*: The researcher identifies with the field of study (The Greenlandic case in which the researcher develops a kind of partisanship with the Greenlandic society possibly impacted by the drive for implementing new mega industries).
2. *"Helping out"*: The researcher becomes a 'critical friend' (The Energinet.dk case in which the researcher critically participates in the processes in the organisation to find ways for SEA to influence decision making).
3. *"Giving advice"*: The researcher keeps an academic distance in advising the organisation (The Rambøll case in which the researcher gives professional input to the development of SEA of water plans and incorporation of climate change in SEA).

The three cases indicate that Mode 3 re-

searchers work in a variety of ways. This variety may be triggered by different situations that the researchers adapt to in the process of doing research.

### **Mode 3 influences SEA research and SEA practice**

The empirical analysis, based upon the experience and reflection of both the researcher and the key person in the cooperating organisations, shows that Mode 3 influences SEA research and practice in ways that Mode 1 and 2 do not.

The engagement and involvement in what is being studied has developed a timely and real-life correlated understanding of the processes in which we are trying to integrate and use SEA as a means for sustainable development. The context is being brought to the forefront, which is assessed by all parties in the three cases as positive and important for research to increase relevance for SEA practice and influence this. The increased relevance and influence is e.g. realised by:

- Critical review of planning and decision making processes, and review of assessments undertaken
- Development of attitudes towards SEA and development of specific assessment skills within the organisations.
- Bridge building among actors within the organisation, and between the organisation and external actors.
- Communication of SEA results to e.g. the public.

By cooperating on knowledge making, the researchers have also gained benefits by getting increased access to information and processes. This is assessed as improving both the quality of research, and ongoing dissemination of knowledge and research results in non-academic forum. The high autonomy in Mode 3 means that the suggestions of the researcher are likely to go beyond the assumptions and

rules that govern practice in the milieu.

The overall conclusion from the study is that a researcher, with high autonomy and interdependence, functions as a change agent for more environmentally sustainable decisions by being part of and influencing the field studied – without devaluing or compromising the traditional scholarship.

### **Mode 3 is rewarding – though challenging for SEA researchers and the organisations involved**

Being part of Mode 3 knowledge making is experienced as challenging in different aspects. First, the researcher is putting him 'in game'. One needs to know and recognise own knowledge, values and delimitations - and at the same time recognise others'. Second, Mode 3 research is, and needs to be, personally driven, based upon a high engagement and clarification of own values. An overall pitfall of Mode 3 research is also the balance of having a close cooperation and at the same time retaining the critical approach of a researcher. It is a challenge to have a high interdependence and at the same time maintain high autonomy, i.e. without compromising slightly with your ability or willingness to be critical to the organisation with which you are associated. For the organisation the study especially shows challenges in getting a broader organisational engagement and commitment in the SEA research.

Despite the focus on Mode 3, the analysis also shows Mode 2 and 1 characteristic in some parts of the Mode 3 research: From time to time, the researcher's work resembles a consultancy for the benefit of the cooperation and in other periods the researcher's efforts resemble traditional science in detailed studies of a specific. In addition to autonomy and interdependence, what distinguishes the Mode 3 researcher from these other modes is also the reflexivity that precedes and fol-

lows the efforts resembling other modes. In this way Mode 3 is by the authors seen as a complementary mode to doing research: Incorporating to a certain extent Mode 2 and 1 and thereby combining the benefits of modes.

The point of departure for the article is that if the SEA research society is to make a difference for practice, we need a wide and deep form of cooperation between researchers and practitioners. This cooperation can be achieved through Mode 3 research entailing co-funding, co-formulation of research questions and co-production of results. We as SEA researchers can choose to be close to the SEA practitioners, decision makers and affected parties and at the same time create temporary space of distance to the relevance demands coming from the co-operators to safeguard rigour. The contextually based Mode 3 research, and the appertaining critical pragmatism, can give us one way to minimise the gap between SEA research and SEA practice. Preconditions for this to happen prove to be personal engagement, shared wish for research to make a difference for SEA practice and dialogue with a confrontation of own research intention listening to the intentions of the society.

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# Part 2

## Analysis



# SEA of river basin management plans: incorporating climate change

Sanne Vammen Larsen and Lone Kørnøv

In 2000 the European Parliament and the European Council passed the Water Framework Directive (WFD) to be implemented in all Member States. The consequence of the directive is that river basin management plans (RBMPs) shall be prepared which are legally subject to a strategic environmental assessment (SEA). An important environmental factor for the water sector is climate change, especially the changes it causes to the water environment. However, based on an argument of an inadequate knowledge base regarding climate change impacts, the prospect of Danish authorities including climate change in their SEAs of RBMPs is weak. In this paper the connections between climate change and water are reviewed. As a result, it is suggested that climate change needs to be considered in three ways: mitigation, adaptation and baseline adaptation.

Keywords: strategic environmental assessment, river basin management plans, water framework directive, climate change, mitigation, adaptation

**T**HE FOCUS ON climate change and its potentially significant consequences for nature and human beings is increasing. Today we attempt to counter climate change both through mitigation of any further releases of greenhouse gases and through adaptation to the changes already happening. According to the report of Working Group II in the third assessment from the Intergovernmental Panel on Climate Change (IPCC), mitigation is defined as ‘an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases’ and adaptation as ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities’ (McCarthy *et al.*, 2001: 982, 990).

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The need for adaptation is widely acknowledged. Adaptation as a strategy complements the mitigation strategy and, as stated by the IPCC in the summary for policymakers of their Fourth Assessment Report; ‘adaptation will be necessary to address impacts resulting from the warming which is already unavoidable due to past emissions’ (IPCC, 2007: 19). The European Commission, in its white paper on climate change adaptation, states that ... ‘we must take adaptation action to deal with the unavoidable impacts,’ and emphasises among others the water sector (Commission of the European Communities, 2009).

There is international consensus that mitigation and adaptation of climate change is relevant in impact assessment processes at both project and strategic levels in different sectors (Byer and Yeomans, 2007; Duinker and Greig, 2007, Wilson and Piper, 2008). The Organisation for Economic Co-operation and Development (OECD) states that climate change adaptation needs to be better integrated in development, and that environmental assessment is an appropriate entry point for information on climate change mitigation and adaptation, at both planning and project level (OECD, 2006). The OECD (2006) claims that guidelines for impact assessment need to be broader and also to consider the impacts of the

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## **There is international consensus that mitigation and adaptation of climate change is relevant in impact assessment processes**

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environment on the project. The EU also focuses on the need for developing guidelines and best practice on how to integrate climate change in EIA, SEA and spatial policies (Commission of the European Communities, 2009). Internationally there are more and more examples of national practical guidance on how to incorporate climate change into EIA and SEA, for instance in the UK and Canada (Levett-Therivel Sustainability Consultants, 2007; The Federal-Provincial-Territorial Committee, 2003). In Denmark, the Danish International Development Agency emphasises the importance of screening climate change impacts in both developed and developing countries, and that one of the necessary activities would be addressing climate change impacts in SEAs and in EIAs (DANIDA, 2005). Further, the Danish climate change adaptation strategy outlines a need to assess whether the current regime for environmental assessment, including SEA and EIA, is sufficient, seen from a climate change perspective, or whether changes should be made. At the same time a need for guidance for practitioners on incorporating climate change in SEA and EIA is underlined (Danish Government, 2008: 30).

There is growing awareness of the need to mainstream both climate change mitigation and climate change adaptation in EIA and SEA. The awareness also covers the SEAs performed within the water sector, and this article aims to contribute with reflections on how to include climate change in the specific case of SEA of RBMPs in the Danish context.

### **Research methodology and scope**

The following two sections present the European WFD and SEA, as well as their interconnections, and discuss the issue of incorporation of climate change in SEA of RBMPs; the reasoning for the focus on Denmark is also discussed. In January 2008 telephone interviews were carried out with representatives of each of the seven Danish state environmental centres who were either responsible for the SEA or working on the RBMP. The interviewees were appointed by the centres themselves, as those they considered best capable of answering the relevant questions. The fifth section presents an analysis of the connections between climate change and the water environment; this analysis is then used to draw up a framework for the inclusion of climate

change in SEA of the RBMPs. Finally, in the last section conclusions are drawn.

There exists extensive research into barriers and motivation for climate change considerations, hereafter referred to as climate change adaptation (Smit and Pilifosova, 2001; Næss *et al*, 2005; Adger *et al*, 2009; Blennow and Persson, 2009). Smit and Pilifosova, in the IPCC report on climate change from 2001, state that 'Adaptation to climate change and risks takes place in a dynamic social, economic, technological, biophysical, and political context that varies over time, location, and sector' (2001: 895). The capacity for adaptation therefore depends upon a range of interrelated factors, e.g. economic resources, technology, infrastructure, knowledge, institutions etc. The scope of this article does not cover in-depth analysis of the whether or not climate change is incorporated in the RBMPs and SEAs, and the factors that determine this. Rather, the scope is limited to dealing with how climate change can be considered in the SEAs.

### **The Water Framework Directive and SEA**

In 2000 the EU issued Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, also known as the Water Framework Directive. The purpose of the directive is 'to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater,' through setting up a framework for river basin management planning in Member States. The directive dictates preparation of RBMPs containing environmental goals for all surface and groundwater within the water district, and a programme of measures to reach these goals. The ultimate goals are to prevent deterioration of water quality and to achieve good water quality by 2015 (Directive 2000/60/EC, 2000).

The WFD was implemented in Denmark through national legislation (*Miljømålsloven*) in 2003. According to this legislation, the Danish state is obliged to prepare the RBMPs for the Danish water districts (LBK nr 316, 2004). In practice the work is divided so that the overall RBMPs will be prepared by the state's seven national environmental centres; the 98 Danish municipalities will prepare action plans containing specific directions for the implementation of the RBMPs within their geographical area (Danish Ministry of the Environment, n.d. 5, 10).

SEA in accordance with Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the Assessment of the Effects of Certain Plans and Programmes on the Environment (SEAD) and the resulting Danish Law on Environmental Assessment of Plans and Programmes from 2001, applies to both the state RBMPs and the municipal action plans. In the WFD it is also stated by the Commission that the SEAD needs to be taken

into account during implementation (Directive 2000/60/EC). The purpose of the Danish law on SEA is to 'secure a high level of environmental protection, and contribute to the integration of environmental considerations during the preparation and adoption of plans and programs, with a view to advancing sustainable development, by ensuring that an environmental assessment is performed for plans and programmes that may result in significant environmental impacts'. The SEA is performed by public authorities with participation by the public, and forms part of the decision process concerning the plan or programme (LBK nr 316, 2004; LOV nr 250, 2009).

Research into the connections between SEA and the WFD has been made by Carter and Howe (2006), who point out a range of linkages between the directives. They point to the fact that SEA has to be applied to the RBMPs, and that the RBMPs should be used in making SEAs in other areas (Carter and Howe, 2006). They further find common requirements between the two directives, including the collection of baseline data, assessment, mitigation, monitoring and consultation, reporting processes and public participation. That both directives share a common goal of sustainable development and have overlapping procedures, is a reason for growing consensus that an integrated approach when applying SEA to RBMPs is beneficial (Deasly and Preston, 2007; Carter and Howe, 2006). Integration as a strategy is also in line with the SEAD, which aims to avoid duplication (Directive 2001/42/EC, Art. 4(1), 5(2) and 5(3)).

An RBMP is a type of plan likely to have significant effects on the environment, which are assessed in an SEA, including impacts on flora, fauna, surface water, groundwater etc. Climate change is also relevant in this regard, because it can be characterised as a potentially significant effect on the environment stemming from human actions. Screening and scoping within SEA, though, is not only based on an assessment of how the RBMP may affect the environment: how the environment affects the plan is also a matter which determines whether a plan is subject to SEA or not, and what should be within the scope of assessment.

According to the SEAD, one of the 'criteria for determining the likely significance of effects referred to in Article 3(5)' is 'environmental problems relevant to the plan or programme' (Directive 2001/42/EC, Annex 2). In other words, it can be judged that an RBMP in itself might not have significant impacts on climatic factors; rather, it is climate change that has significant impacts on the RBMP, for example extremely wet or dry years may significantly affect the hydrological and aquatic systems and thereby be a determining factor in the achievement of environmental objectives laid down in the RBMPs.

These couplings are explored further below.

### SEA, RBMPs and climate change in Denmark

In spite of the above-mentioned issues, the Danish Ministry of the Environment has decided that climate change will not be taken into consideration in the first generation of RBMPs. The Environment and Planning Committee of the Danish Parliament asked the Danish Minister for the Environment how adaptation to climate change was incorporated in the implementation of the WFD. In August 2007 the answer was given that climate change was not to be a specific issue in implementing the WFD because 'the present technical basis for such assessments is not sufficient' (Danish Ministry of Environment, 2007). The lack of knowledge about climate change is one of the barriers specific to climate change adaptation, and it is argued that limited knowledge need not be a barrier to adaptation, although it is often presented as such (Adger *et al.*, 2009). Whether insufficient knowledge has been the only barrier for the Ministry of Environment to exclude climate change in the RBMPs can not be assessed here.

In Denmark work with the RBMPs has begun. Basic analyses have been published by the state environmental centres, and the planning process has started with an initial public hearing, in order to gather ideas and input from the public and other authorities (Danish Ministry of the Environment n.d.). The state environmental centres are also performing the SEA of RBMPs, but this work is only just beginning and it has not yet been decided how climate change will be handled. The SEA of state RBMPs might prove to be a driver for including climate change despite the announcement from the Ministry of Environment. The state environmental centres have published an overview of the issues that were brought up in the initial public hearing. From this it can be seen that during the period of public hearing these centres received input concerning climate change. It is also stated in the overview that this does not change the decision to not include climate change in the RBMPs (Danish Ministry of the Environment, 2008). However, the state has not officially excluded climate change from the SEA of RBMPs, and it appears from telephone interviews with the national environmental centres that four of the seven interviewees believe that climate change will in be included some form.

This context of the exclusion of climate change as an issue in the RBMPs in Denmark stresses the

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### The lack of knowledge about climate change is one of the barriers specific to climate change adaptation

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importance of addressing climate change in SEA of the RBMPs. This makes Denmark an interesting case, and provides the motivation for this article. The question is therefore how climate change should be taken into account in the forthcoming SEA of RBMPs in Denmark? To address this question a framework of ways in which climate changes should be considered in the SEAs of RBMPs is proposed.

### Connections between climate change and the water environment

It was stated above that SEA not only covers the effects of a given plan on the environment, but also any effects of the environment on the plan. Following from this, both the contributions of RBMPs to climate change and the influence of climate change on the RBMPs should be taken into consideration in SEA. This paper focuses on the impacts of climate change on hydrology, water resources and water environment. The influence of climate change on plans is an area not previously covered either in the Danish context or in connection with the water environment in SEA. In order to understand how climate change influences RBMPs, an overview of the influences of climate change on the water environment is required.

It is stressed, among others by UNEP (2007: 120), that 'Climate change is expected to exacerbate pressure, directly or indirectly, on all aquatic ecosystems.' For example, the fourth assessment by the IPCC stated that 'There is high confidence that some hydrological systems have also been affected through increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers, and effects on thermal structure and water quality of warming rivers and lakes' (IPCC, 2007: 2). The linkages are further emphasized in the IPCC Technical Paper VI Climate change and water from 2008: 'Observational records and climate projections provide abundant evidence that freshwater resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystem' (Bates *et al*, 2008: 3). There are several research publications on the effects of climate change on water in the Danish context, for instance Sonnenborg *et al* (2006), and Danish Ministry of Finance *et al* (2007).

Figure 1 is a simple causal model of the probable negative effects of climate change on the water environment in Denmark and in northern Europe in general. The model shows the temperature increase and other climate changes, the implications of this for water, consequences for the water environment, and effects on the environmental baseline represented by the environmental factors included in the European SEAD.

It should be noted that water and climate change are interconnected in complex ways and do not exist in isolation, but must be seen in the context of

socioeconomic and environmental conditions (Bates *et al*, 2008). Furthermore, global differences exist and are observed, in parameters such as surface temperature and precipitation impacting the hydrological cycle and hydrological systems differently between continents and regions and within regions (Bates *et al*, 2008; Eisenreich, 2005: 30). The observations of climate change also varies within Europe, e.g. showing significant variations between northern and southern Europe, indicating that the southern part will be more negatively affected by a warmer and drier climate (EEA, 2004; McCarthy *et al*, 2001). The model presented does not provide a comprehensive picture of the climate change processes affecting the water environment but illustrates some important couplings between climate change and water relevant for impact assessment through SEA. The model is based on a literature study of predictions of climate change in Europe, relying primarily on the contribution of Working Group II to the Third Assessment Report of the IPCC (McCarthy *et al*, 2001) and the Technical Paper of the IPCC on Climate Change and Water (Bates *et al*, 2008). Further, a European study on climate change and water adaptation prepared for the European Environment Agency by Footit and McKenzie (2007) is used, as well as Danish studies such as those by Sonnenborg *et al* (2006) and the Danish Ministry of Finance *et al* (2007). The effects on the environmental baseline are not based on the literature study and should be regarded as illustrative examples rather than an exhaustive survey.

In the following paragraphs, the four steps of Figure 1 will be reviewed.

The model illustrates different climatic factors, and how climate change makes these factors vary. Precipitation, as the main driver of variability in the water balance, is affected by climate change through variations in its patterns of occurrence and by changing the state in which it produces (Arnell and Lui, 2001). A warmer climate is expected to increase extreme precipitation compared to the mean (Bates *et al*, 2008) and heavy precipitation has already been observed across Europe (Klein Tank and Können, 2003). Evaporation is the other major influencing factor. Based on observations, it is found that global land evaporation closely follows variation in land precipitation (Qian *et al*, 2006). Evaporation is expected to increase almost everywhere (Bates *et al*, 2008) due to higher temperatures (Eisenreich, 2005). Further sea-level rise is projected for the coming decades, with substantial uncertainties and geographical variability (Bates *et al*, 2008: 28).

As shown in Figure 1, projected changes in climate lead to changes in water. Those changes in Denmark and northern Europe in general cover changes in both surface and groundwater systems, with, for example:

- An annual increase in runoff for surface waters of approximately 5–15 % up to the 2020s and by

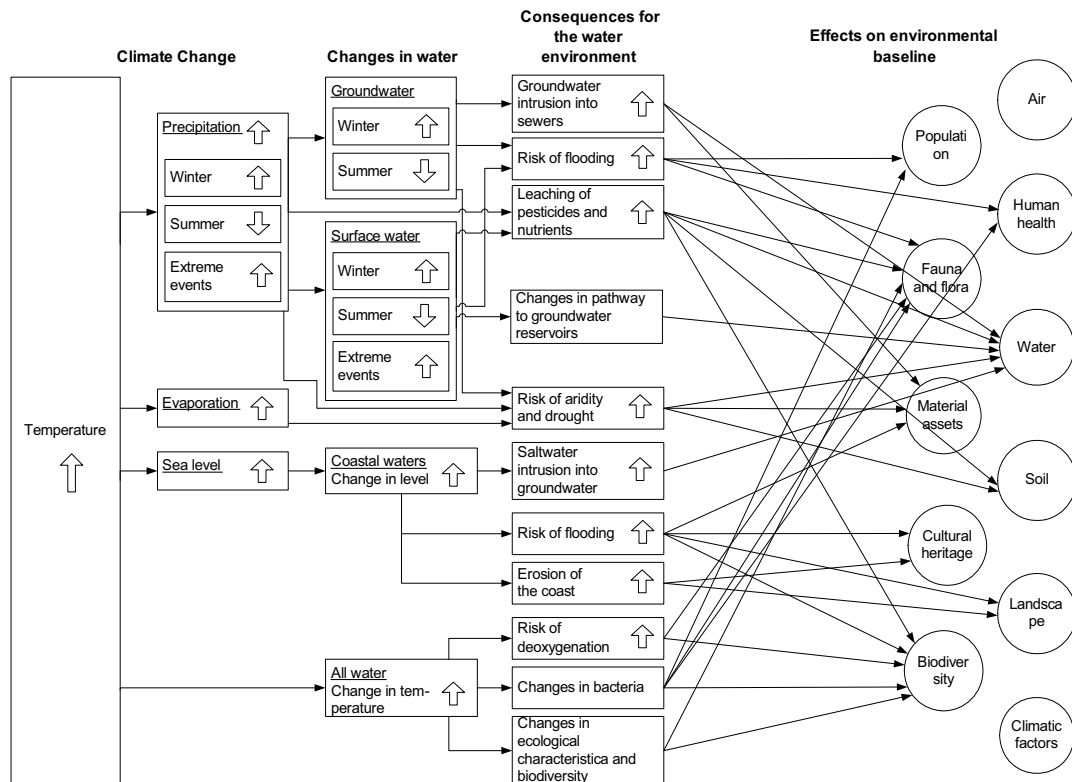


Figure 1. Model of the effects of climate change on the water environment

9–22 % up to the 2070s (Alcamo *et al*, 2007), and increases in flow seasonality (Arnell, 2003) and extreme events (Sonnenborg *et al*, 2006: 67).

- Changes in the level of groundwater, with significant geographical and seasonal variation. In Denmark an overall higher groundwater production and level is predicted (Sonnenborg *et al*, 2006: 67).
- A rise in the level of coastal water as a result of the rise in sea level (Danish Ministry of Finance, 2007: 11).
- Higher temperatures in all waters (Bates *et al*, 2008).

The projected changes all have potential consequences for the water environment, as illustrated in Figure 1. The consequences of the higher level of groundwater include increased risk of groundwater intrusion into sewers (Danish Ministry of Finance, 2007: 31). The seasonal increase in surface water and groundwater as well as the increase in extreme events also increases the risk of flooding, northern Europe being one of the regions most prone to a rise in flood frequencies (Bates *et al*, 2008; Sonnenborg *et al*, 2006). The consequences also cover a risk of aridity and drought due to the seasonal low water levels combined with the increase in evaporation, and more extreme events (Sonnenborg *et al*, 2006; Danish Ministry of Finance, 2007). The higher precipitation and increase in surface run-off,

combined with reduced frost, may increase the leaching of pesticides and nutrients from cultivated fields (Bouraoui *et al*, 2004; Sonnenborg *et al*, 2006: 70; Danish Ministry of Finance *et al*, 2007: 30). Changes regarding groundwater may cause the water to flow differently to the groundwater reservoirs (Sonnenborg *et al*, 2006: 70). The higher level of coastal waters can lead to an increased risk of saltwater intrusion into groundwater, and together with an increase in flooding and storms to further coastal erosion (Eisenreich, 2005: 33). The higher temperatures might increase the risk of deoxygenation (Danish Ministry of Finance *et al*, 2007: 10; Footit and McKenzie, 2007: 16). It might also change the bacterial environment, with an increase of toxic cyanobacteria in lakes (Eisenreich, 2005) as well as bacteria in drinking water (Danish Ministry of Finance, 2007: 30), and change the ecological characteristics and biodiversity with, for example, increased species richness in northern Europe freshwaters (Bates *et al*, 2008).

All the consequences for the water environment can affect the environmental baseline of an SEA. The model in Figure 1 illustrates the environmental parameters included in the SEADs environmental concept and baseline. As shown, climate change impacts on the water environment potentially affect almost all environmental parameters.

It should be noted that the simple model in Figure 1 has a number of limitations, as follows:



- It does not include reasons for temperature rise.
- It does not depict geographical variations.
- It does not show complexity of multiple stresses.
- It does not include human interference.
- It does not represent a course of time.
- It does not include feedback mechanisms.

The model shows that climate change can have a number of consequences for the water environment, and in turn a number of effects on issues such as population or biodiversity, which are part of the baseline for SEA. As stated earlier, any effects of climate change on water environment are relevant for consideration in SEA of the RBMPs, and when coupled with the information in Figure 1 it appears that the effects of climate change are important factors to consider.

**Including climate change in SEA of RBMPs**

Figure 2 summarises the issues regarding climate change in relation to SEA of RBMPs. In the following section, adaptation refers to the planned type of adaptation taken in advance to either minimise or offset negative climate change effects.

*Mitigation*

As stated earlier, SEA assesses the effects on the environment from implementing a plan, and hence the effects on climate change. Implementation of the RBMPs will be in the form of water management activities that should lead to an improved water environment. This means that SEA of RBMPs should include any contribution from these proposed activities to climate change by assessing the resulting greenhouse gas emissions. On the basis of this assessment, mitigation measures can be suggested to prevent further climate change.

This way of considering climate change is illustrated in the first horizontal line of Figure 2. Examples of issues where mitigation could be relevant for the RBMPs include (Madsen *et al*, 2007):

- Reduction in greenhouse gas emissions related to hydro dams (location, power density, flow rate etc.);
- Reduction in greenhouse gas emissions due to less energy consumption for pumping water;
- Reduction in greenhouse gas emissions in connection with changes in waste water treatment.

Climate change mitigation does not immediately appear to be essential in relation to the measures relevant for the RBMPs, when viewing the suggestions made in the Danish pilot study from Odense (Madsen *et al*, 2007: 61). However, it is of course relevant to consider possible effects on climate change.

*Adaptation*

SEA should also assess the impacts of climate change on the plan. Climate change can have multiple effects on the water environment, and because water is the issue dealt with in the RBMPs, it is clearly relevant to assess how climate change will affect the issues dealt with in the RBMPs. Consequently, the plan, and hence the water management activities, can be adapted to any unavoidable effects of climate change, through adaptation measures. Examples of adaptation measures relevant for inclusion in the RBMPs are (Madsen *et al*, 2007):

- Reservoirs and dykes, emergency flood reservoirs, preserved areas for flood water, coastal protection infrastructure etc. to protect against floods;
- Tending of water bodies, e.g. crop cutting in streams and restocking of fish spawn;

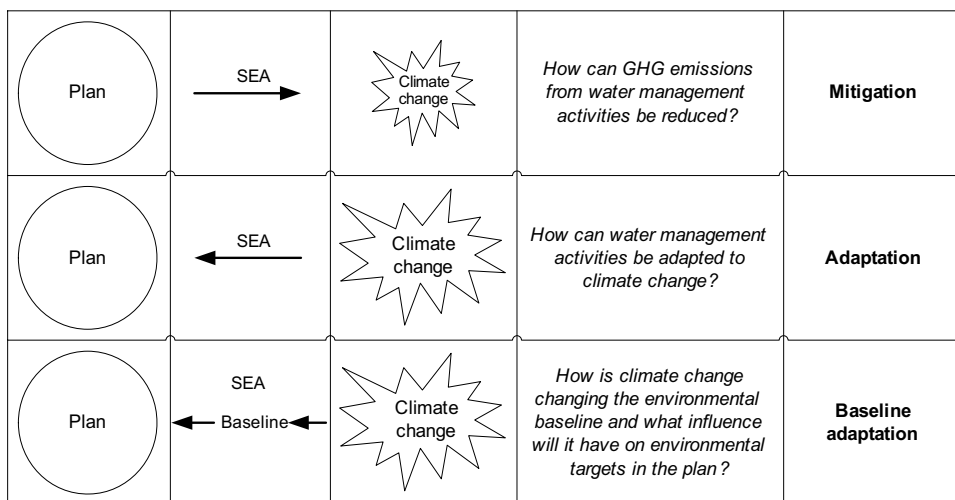


Figure 2. Framework for considering climate change in SEA of RBMPs

- Buffers around streams in urban areas to reduce the potential negative consequences of future heavier runoff;
- Constraints on activities, e.g. agricultural and industrial procedures;
- Increased capacity, e.g. in wastewater treatment;
- On the supply side, e.g. impound rivers to form in-stream reservoirs, wastewater reuse etc.;
- On the demand side, e.g. water conservation, reduction in leaky water systems, water pricing etc.

These are much the same as the measures relevant for the RBMP itself, used to adapt to a changing climate. Such integration of adaptation measures can help to improve society's resilience to climate change. This is illustrated in the second horizontal line of Figure 2.

#### Baseline adaptation

As shown in Figure 1, climate change results in effects on almost all of the environmental factors in the baseline. This has implications for SEA of RBMPs because it makes the baseline, to which we are comparing the effects of the plan, change independently of the implementation of the plan. This should be taken into consideration, because the baseline according to the SEAD should include 'the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme' (Directive 2001/42/EC, 2001, Annex 1). Examples of how climate change changes the baseline, or the ecological status, and makes this dynamic and uncertain, for example, are changes in the water temperature and dissolved oxygen or changes in the aquatic fauna and flora (Wilby *et al.*, 2006; Footitt and McKenzie, 2007). This means that when setting the baseline, the changes caused by climate change should be included. This makes setting the baseline a challenging task. The effects on the baseline also influence the setting and achievement of the environmental targets of the plan. Goals are ideally set to be ambitious yet realistic based on the predictions of the baseline; thus if the baseline is very unpredictable, the goals might prove to be either unrealistic or not ambitious enough. This issue is illustrated by the third horizontal line in Figure 2. This third approach is termed by the authors baseline adaptation.

The issues of adaptation and baseline adaptation are closely linked. Baseline adaptation is a precondition for adaptation: if no predictions are made about future climate changes then it does not make sense to talk about adapting to them. An assessment of the literature on this subject indicates that most experience is gathered in the field of mitigation of greenhouse gases, with less stemming from adaptation and baseline adaptation. This is supported by Levett-Therivel Sustainability Consultants (2007: 5), focusing on mitigation and adaptation, but stating that 'Adaptation measures are unusual in that they

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### If no predictions are made about future climate changes, it does not make sense to talk about adapting to them

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require consideration of how climate changes are likely to impact on plans and programmes'. The actual experience with adaptation and baseline adaptation in Denmark is not investigated in this paper but could be the subject of further research.

#### Conclusion

This paper discusses the upcoming SEA of RBMPs in Denmark, with a focus on incorporation of climate change. It is shown that climate change can have a range of impacts on the water environment, ultimately influencing the environmental parameters in the baseline for SEA. The main contribution of the paper is a framework consisting of three ways in which climate change should be considered in SEA of RBMPs:

- Mitigation of climate change;
- Adaptation to climate change;
- Adaptation of the baseline.

This is intended to help authorities in their work with SEA of the plans stemming from the WFD.

It is expedient for the Danish municipalities to consider climate change in the SEA of RBMPs. However, even when the benefits of adapting to climate change are obvious, it is not certain to lead to actual consideration of climate change in planning and action (O'Brien *et al.*, 2006). A range of issues can act as barriers, one example being a lack of certain knowledge about climate change, which is highlighted by the Danish state in the case of the RBMPs. Other examples of potential barriers are unfavourable economic conditions, diverse values, beliefs and perceptions about climate change, lack of awareness of climate change, lack of resources or skills, technical feasibility and innovation, regulatory and institutional context and the presence of other important pressures (O'Brien *et al.*, 2006; Adger *et al.*, 2009; Arnell and Delaney, 2006).

Another challenge relates to the assessment of climate change, which is a cumulative effect. Assessment of cumulative effects is an obligatory and important part of the SEA process. However, building on earlier experience with SEA tackling cumulative effects, this might be a challenging task. The literature on cumulative effects shows limited cumulative assessment and management in IA practice

(Baxter *et al*, 2001; Ross, 1998; Duinker and Greig, 2007; Therivel and Ross, 2007). Ecosystems, such as those assessed in the SEA of RBMPs, are complex and adaptive to climate change. To be manageable, such complex systems must be described in a reducible way (Costanza, 2000), for example as in the Danish case, without scoping climate change due to lack of knowledge. According to post-normal science, complex systems must not be described in such reducible way (Funtowicz and Ravetz, 1993, 1994).

This argument is also found in a general critique of environmental assessment, relying on a reductionism paradigm that builds upon measurable indicators such as simple time horizons, quantification and aggregating (Gasparatos *et al*, 2008). Including climate change in a non-reducible way and thereby acknowledging the complexity surrounding RBMPs calls for a shift in scoping. The scoping undertaken by the Ministry of Environment builds upon a technical model of scoping, whereas the complexity as presented in the article calls for a supplementing social model of scoping with stakeholder involvement in the decision-making process – acknowledging the legitimacy of stakeholder attitudes towards climate change risk. Stakeholders may have many different perceptions, values, beliefs and attitudes towards climate change, e.g. different perceptions of its seriousness, the certainty of predictions, the control that society has over climate change and the time horizon for climate change to occur (Etkin and Ho, 2007; Dessai *et al*, 2003; Lorenzoni *et al*, 2005). These different perceptions may influence whether and how climate change is considered in the SEA process. This adds to the complexity of the SEA and stresses the need for a broad inclusion of stakeholders in the process, in order to prevent a too narrow consideration of climate change. Based on this, there are prospects for further research into whether and why the Danish municipalities will consider climate change in their forthcoming action plans.

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## Risk as a challenge in practice: investigating climate change in water management

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**Abstract** Climate change is one of the risks that society faces today. Among other things, it has the potential to interfere with the water environment, and thus it can be a relevant factor in current work with river basin management plans (RBMPs) in Denmark. At the same time, climate change in theory has characteristics that can pose challenges, if included in such a planning process. In this article, it is investigated what the attitudes towards climate change are among actors in the planning process, and what the main drivers, barriers and challenges related to including climate change in the RBMPs are, compared to the theoretical challenges. The investigation consists of a document study of hearing responses, interviews, and a survey among Danish municipalities. The overall results are that there are many attitudes towards the inclusion of climate change as a factor in RBMPs and that this diversity theoretically can be a challenge in the planning process. The main theoretical and practical barriers and challenges in connection with inclusion of climate change in RBMPs relate to lacking knowledge and uncertainty.

**Keywords** Climate change · Risk · Actors · Water framework directive · River basin management plans

### Introduction

Risk has many definitions and is studied in many contexts. Generic definitions are for example that risk is “a possibility that something unfortunate or unwanted will happen”

(Politiken 2002) or that risk is “a danger with an uncertain outcome” (Bang et al. 1999, 831). In accordance with this, risk can be defined as a negative future development. Risk can be viewed on a personal level and an action oriented level, where “to take a risk normally means that one deliberately exposes oneself to a possible danger in order to gain something” (Breck 2001), and as such risk is a negative side-effect. Risk can also be viewed at a societal level, which is the case in this article.

One of the risks that concern society today is climate change and its possible negative consequences. Water is one of the issues on which climate change potentially has a range of effects. The linkages between climate change and water are emphasised in the IPCC Technical Paper VI on climate change and water: “Observational records and climate projections provide abundant evidence that fresh-water resources are vulnerable and have the potential to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems” (Bates et al. 2008, p. 3). Some of the possible global effects of climate change on water are pointed out in the fourth assessment by the IPCC. The effects include for example rising sea levels, decreasing snow and ice cover, changes in the amount of precipitation and number of extreme events, changes in river flows, increased flooding, and changes in available water resources (Bernstein et al. 2007a). Changes are already occurring: for instance, it is stated in the fourth IPCC assessment that “There is high confidence that some hydrological systems have also been affected through increased runoff and earlier spring peak discharge in many glacier- and snow-fed rivers, and effects on thermal structure and water quality of warming rivers and lakes” (Bernstein et al. 2007a, p. 2). In the Danish context, the effects of climate change on water are predicted to include for example increased precipitation and extreme events,

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increased run-off, increased flooding, more leaching of nutrients, and a rising sea level (Sonnenborg et al. 2006; Danish Ministry of Finance et al. 2007). These facts point to the relevance of handling the risks posed by climate change through planning and actions in the water sector.

Many studies have been carried out to investigate how and why the effects of climate change are taken into consideration in planning and practice both in general (see e.g. Berkhout et al. 2004; O'Brien et al. 2006; Blennow and Persson 2008; Adger et al. 2009; Battaglini et al. 2009) and in the water sector (see e.g. Eisenack et al. 2007; Moser and Tribbia 2007; Næss et al. 2005; Arnell and Delaney 2006; Subak 2000). The study presented in this article aims to add to the previous research a case study of how climate change is dealt with in another context. In the water sector, Denmark and the rest of the EU member states are currently implementing the EU Water Framework Directive by preparing river basin management plans (RBMPs). Denmark is an interesting case, because the Danish state has chosen to exclude climate change as a factor in the plans, even though from an overall perspective it seems like an obvious factor to include. The purpose of this article is to shed light on the attitudes towards an integration of climate change among other actors in the planning process and what influences these attitudes. Specifically, which factors are perceived as drivers, barriers, and challenges in integrating climate change in the RBMPs? In this way, the article seeks to provide a more nuanced picture of the attitudes towards integration of climate change in RBMPs in Denmark, instead of leaving it up to the state alone to define the problem.

The findings in this article are analysed and discussed in the light of the theory of risk society put forward by Ulrich Beck. Beck's work is useful for describing the nature of climate change as a risk and suggests a theoretical interpretation of some of the developments that can be seen in practice in the case of RBMPs in Denmark. Thus, the theory of risk society is used for forming hypotheses about the challenges posed by an integration of climate change in RBMPs, which are tested in practice. The theory of risk society has also been utilised in similar ways in other research (see e.g. Hinchcliffe 1997; Matten 2004; Gow and Leahy 2005; Cebulla 2007; Olofsson and Öhman 2007). It is often used to investigate whether or not the theoretical hypotheses are corroborated by empirical data, as well as to interpret collected empirical data. The testing of Beck's theory of risk society with empirical data has special interest, since this has not been a focal point in Beck's work itself (see e.g. Matten 2004; Cebulla 2007; Olofsson and Öhman 2007).

The theory of risk society is presented in "[Beck's risk society: a view on the risk posed by climate change](#)", and the Danish case of RBMPs is presented in "[Case: the](#)

[Danish RBMPs](#)". The methodology is presented in "[Methodology](#)", followed by the analysis in "[Actor attitudes towards climate change in RBMPs](#)", "[Drivers and barriers in encouraging integration of climate change in the RBMPs](#)", and "[Future challenges to integrating climate change in municipal action plans](#)". Finally, conclusions are drawn in "[Conclusion and discussion](#)".

### **Beck's risk society: a view on the risk posed by climate change**

Beck describes the transition from traditional society to a risk society, which is increasingly dominated by awareness of risk. As opposed to traditional society, the risks present in a risk society are produced by modernisation, technology, and progress, in other words by human action and decisions. Beck describes this as part of reflexive modernism, where modernisation undermines itself through risks. This is in opposition to traditional society, where risks were to a greater extent external and imposed upon society by nature. It should be noted that Beck does not claim that we live entirely in a risk society or in a traditional society. Rather modernity still exists, but it is becoming reflexive (Beck 1997; Beck and Willms 2004).

The risks in risk society are described as global, complex, self-inflicted, and irreversible. They also transcend the time scales within which society used to operate, as they have long time horizons and cross generations. Risks are unobservable by our senses and thus not based on concrete firsthand experience. Rather they are partly constructed, and until they materialise they exist only due to our awareness and scientific knowledge of them. The knowledge of risks is based on knowledge of their causal relations, but in risk society it is becoming increasingly difficult to establish these relations with certainty because of high complexity. This also means that it is increasingly difficult to establish who is responsible for the risks and who will be affected by their consequences (Beck 1997; Beck and Willms 2004).

Traditional society is focused on obtaining concrete knowledge about nature in order to be able to control and exploit it. In this regime, science and scientists play an important role as providers of knowledge, and the notion that science knows best prevails. In risk society, however, science has problems providing certainty and knowledge regarding risks and also in relation to the uncertain causal relations mentioned earlier. This means that issues are open to different risk definitions and perceptions, and consequently there can be different opinions of for example whether a risk is substantial or not. Because of this, Beck (1997, p. 40) states that science is losing its "monopoly on rationality"—risks are defined no longer only by



knowledge produced by science, but also by things such as competing demands and different interests, values, and opinions. Risk thus becomes more contested. The risk definitions, in turn, influence decisions regarding risk, for example about whether and how risk should be handled. Another issue regarding decisions and risk is what Beck terms “subpolitics”. According to Beck (1996, p. 18), “The concept of subpolitics refers to politics outside and beyond the representative institutions of the political system of nation-states”. In subpolitics, business and the public gain influence over decisions regarding risk, and therefore the decision-making competence moves slightly from the appointed political field into the subpolitical field. This can for instance happen through public movements, grassroots organisations, and lobbying (Beck 1997).

#### The challenging characteristics of climate change

Climate change is viewed as an example of the new risks that society faces today, because climate change has many of the characteristics of the new risks. Climate change potentially has significant negative impacts on a global and long-term scale (Bernstein et al. 2007a). It is arguably a result of progress, technology, and the actions of society, namely greenhouse gas emissions. This is supported by the IPCC in its fourth assessment, where it is stated that “*Most of the observed increase in globally averaged temperatures since the mid-twentieth century is very likely due to the observed increase in anthropogenic GHG emissions*” (Bernstein et al. 2007a). At the same time, climate change is uncertain and disputed, as illustrated for instance by the existence of different perceptions of risk (see e.g. Etkin and Ho 2007; Lorenzoni et al. 2005; Risbey 2008; Zehr 2000). Also, there are still uncertainties and a lack of scientific knowledge about climate change and its consequences, notably on a regional and local level (see e.g. key uncertainties in Bernstein et al. 2007b).

The characteristics of the new risks, as described by Beck, can be viewed as hypotheses of what the challenges of integrating climate change in planning and decision-making processes are. The fact that climate change has the features of lack of knowledge and data, complexity, non-transparent consequences, and causal mechanisms and that it is contested and has long time horizons can make it difficult for planners and decision makers to handle. Possible challenges stemming from the characteristics of climate change are summarised in Fig. 1. The challenges are divided into those that mainly concern planners, understood as the administrative professionals who prepare plans, and those that mainly concern decision makers, understood as those who have decision powers regarding the plans.

The challenges proposed in Fig. 1 are based on some implicit preconditions, such as the necessity of considering

the views of the public and a demand for a certain knowledge and rational decision-making. These preconditions can undoubtedly be discussed; this is, however, outside the scope of this article.

Some of the issues in Fig. 1 have been discussed in contemporary literature. Both Adger et al. (2009) and Eisenack et al. (2007) discuss the issue of lack of knowledge and data in relation to climate change and how this perceived lack of knowledge is often used in decision-making as an argument for inaction. Difficulties with prioritising climate change because it can seem distant and non-pressing are also discussed (Lorenzoni et al. 2005). These theoretical characteristics and the proposed challenges are used as hypotheses for investigating the challenges of integrating climate change in the Danish RBMPs. This can lead to new insights into the practical challenges of integrating climate change in water management and planning and can be discussed in relation to both theory and other research.

#### Case: the Danish RBMPs

In 2000, the EU issued Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, also known as the Water Framework Directive (WFD). Its purpose is “to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater”. This purpose is pursued through setting up a framework for implementation of river basin management planning in the Member States. According to the directive, RBMPs should contain environmental goals for all surface waters and groundwater within the water district and a programme of measures for reaching these goals. The ultimate environmental goals of the directive are to prevent deterioration of water quality and to achieve good water quality by 2015 (Directive 2000/60/EC 2000).

In 2003, the WFD was implemented in Denmark through national legislation. According to this, the Danish state is responsible for preparing overall RBMPs for the Danish water districts. These plans contain, among other things, an overview of the state of each water body, the environmental goals for each water body, and the programme of measures to reach the goals. (Danish Ministry of the Environment 2010a; Law on Environmental Goals 2006) On the basis of the RBMPs, the 98 Danish municipalities, which are the local authorities in Denmark, will prepare action plans. These plans will contain specific directions for the implementation of the RBMPs within the geographical area of each municipality. (Danish Ministry of the Environment 2010a; Law on Environmental Goals



**Fig. 1** Characteristics of climate change as a risk and how the characteristics can pose challenges to planners and decision makers

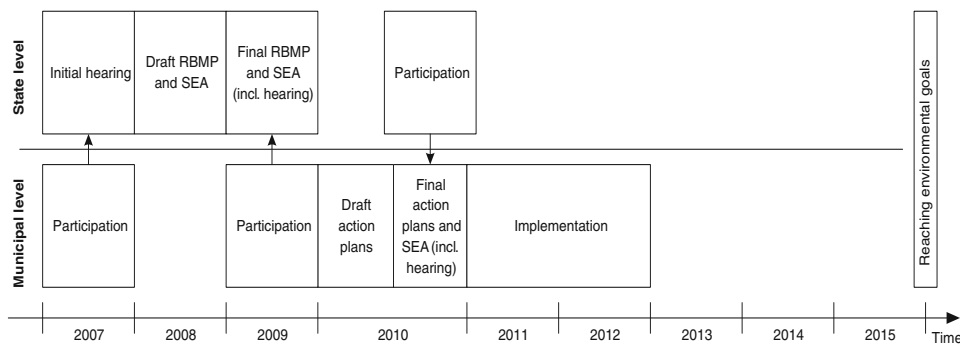
Characteristics	Challenges	
<b>Lack of knowledge and accessible data</b>	For planners	To calculate and factor climate change into their plans To provide decision makers with unequivocal answers regarding climate change
	For decision makers	To assess the plans and make a decision
<b>Complexity, non-transparent consequences and non-transparent causal mechanisms</b>	For planners	To calculate and factor climate change into their plans
		To provide decision makers with unequivocal answers regarding climate change
		To communicate knowledge to decision makers and the public in an understandable way
	For decision makers	To secure the necessary cross-disciplinarity
<b>Contested</b>	For planners	To prioritise against immediately visible and pressing issues
	For decision makers	To assess the plans and make a decision
	For both	To secure agreement among actors to take action in the implementation of the plan To agree on plan and decision To handle the differing views of the public
<b>Long time horizons</b>	For planners	To provide decision makers with justification to prioritise against immediately visible and pressing issues
	For decision makers	To prioritise against immediately visible and pressing issues

2006) Fig. 2 illustrates the planned process as well as the division of tasks between the state and the municipalities.

The initial hearing, which is shown in Fig. 2, was held by the state from June to December 2007. The purpose of the hearing was to have a broad involvement of the public and to provide the possibility for actors with an interest in the RBMPs “to give input to the state water planning at the earliest possible point in the process” (Danish Ministry of the Environment 2010a, 7). Prior to the hearing, background material was published, and a web page was established with information about the WFD, RBMPs, and hearing (Danish Ministry of the Environment 2010a; Danish Ministry of the Environment 2010b). Actors were invited to submit their ideas and suggestions for the planning process and the RBMPs. The hearing was a written

hearing where the actors sent their input either via the web page or by mail directly to the state’s environmental centres (Danish Ministry of the Environment 2010b).

Since the initial hearing, the planning process in Denmark has been delayed compared to the plan in Fig. 2. In January 2010, the Danish state released draft RBMPs for a technical pre-hearing in the municipalities. This is more than a year later than planned. The reasoning for the delay is that the government wanted to coordinate the efforts in the RBMPs with other up-coming state environmental initiatives. The pre-hearing and public hearing are set to finish in January 2011; no new deadline for finishing the state RBMPs has been communicated (Danish Agency for Spatial and Environmental Planning 2008; Danish Agency for Spatial and Environmental Planning 2010a).



**Fig. 2** The planned process of preparing RBMPs in Denmark (based on Danish Ministry of the Environment 2010a, c)

Climate change in the Danish RBMPs

It has previously been stated that due to the potential of climate change to influence the water environment, climate change is a seemingly relevant factor in the RBMPs. This is supported by the Common Implementation Strategy for the Water Framework Directive (2005, p. 14), where it is stated that one of the benefits from implementing the Directive is “Mitigation of impacts from climate change ...”. Further, in an EU Commission Staff Working Document reporting on the first stages of implementation of the WFD, it is stated that “As climate change impacts could enhance the risk of non-attainment of the objectives of the WFD, further steps are also needed to include climate change as an additional pressure on the EU waters” (Commission of the European Communities 2007, p. 41). In the EU white paper on adaptation, the same point is stressed with the statement that the RBMPs stemming from the WFD “will take into account the impacts of climate change and the next generation of plans due in 2015 should be fully climate-proofed” (Commission of the European Communities 2009, p. 11).

In spite of the above-mentioned linkages between climate change and river basin management planning, the Danish Minister for the Environment has decided that climate change will not be taken into consideration in the first generation of RBMPs in Denmark. This has been announced on several occasions and also at the release of the draft RBMPs in January 2010. According to the Danish Agency for Spatial and Environmental Planning, the reason for the exclusion is that “there is not yet sufficient knowledge of how climate change will affect the water environment”. It is further stated that “as soon as we know, it will be incorporated” (Danish Agency for Spatial and Environmental Planning 2010b).

The exclusion of climate change reflects one of the theoretical challenges suggested in Fig. 1, because the argument about lack of knowledge is used. This means that in the Danish case, in accordance with theory, uncertainty and lack of knowledge are perceived as challenges and as a barrier to deal with climate change in the RBMPs. This barrier is also recognised by Adger et al. (2009) and Eisenack et al. (2007). Further, on the basis of theory, it can be speculated that integrating climate change in the planning process on a weak knowledge base might open the process up for a larger degree of debate about risk definitions, uncertainty, values, and perceptions. As stated in Fig. 1, this contested nature of climate change as a risk can be a challenge, and it can make the planning process increasingly complex, something that is perhaps not in the interest of the state.

So, the attitude of the Danish state concerning climate change in the RBMPs is clear. The methodology for

investigating the attitudes of other actors in the planning process is outlined in “Methodology”.

**Methodology**

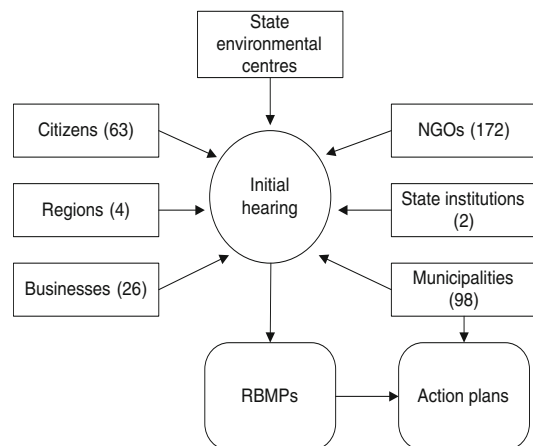
The study consists of three parts: a document study, interviews, and a survey.

Document study

Initially, the attitudes of the actors were investigated through a document study of their submissions to the initial hearing held in 2007. The study was carried out in May 2008 after the end of the hearing, by gathering and examining all written input submitted by all actors. The submissions were retrieved from the web page [www.vandognatur.dk](http://www.vandognatur.dk), where they were made publicly available after the end of the initial hearing. In total, 670 documents submitted by 365 different actors were retrieved and analysed.

The submissions analysed came from various types of actors. Figure 3 shows that the state initiated the hearing, as part of the process of preparing RBMPs, and that a number of citizens, regions (authorities on the administrative level between the state and the local municipalities), businesses, NGOs, other state agencies, and municipalities participated in the hearing.

Figure 3 illustrates that the municipalities have a special status compared to the other actors, because they will be preparing action plans and thus play an important role in the implementation of the RBMPs. The hearing was open to anyone wishing to participate, and all the submissions are included in the analysis. Of course, this means that the analysis is based on the opinions of those who chose to participate rather than a representative segment of possible



**Fig. 3** Overview of the actor groups, and numbers of actors that participated in the initial hearing

actors, and as such is not completely unbiased. However, in this case, it is relevant to analyse the opinions of those who are interested and intend to take an active part in the process. There are 98 municipalities in Denmark, and it can be seen from Fig. 3 that they all participated in the hearing. There are five regions in Denmark and, according to Fig. 3, four of these participated. Few state institutions participated, possibly because the plans were prepared by the state in the first place. Also, fairly few businesses participated, possibly because few business sectors will be affected by the plans besides agriculture, which is largely represented by NGOs.

The written submissions were analysed in terms of whether or not the actors encourage the state to integrate climate change as a factor in the planning process. The results are shown in Fig. 5.

### Interviews

As stated in relation to Fig. 3, the municipalities are important actors, because they will be preparing the local action plans implementing the state RBMPs. Because of this, the choice was made to focus on the municipalities and carry out interviews to investigate what influenced their attitudes towards climate change in the RBMPs.

The purpose of the interviews was to form hypotheses about the drivers and barriers for suggesting an integration of climate change in the RBMPs, and about the possible challenges of integrating climate change in the municipal action plans. However, it was clear from the interviews that the municipalities had not yet begun preparing the action plans, nor had they reflected much upon the possible challenges of integrating climate change. Thus, the interviews were used to hypothesise about drivers and barriers for suggesting climate change in the RBMPs, while the hypotheses on challenges of integrating climate change in the action plans were based solely on the theory presented in “Beck’s risk society: a view on the risk posed by climate change”, and particularly Fig. 1.

Four interviews were conducted in autumn 2008. For the interviews, four municipalities were chosen so that two of them had encouraged the integration of climate change in RBMPs and two had not. The interviewees comprise both municipalities that are characterised by urban areas and municipalities that are characterised by rural areas, as well as municipalities located on the coast and inland, respectively. The respondents were all heads of department in the municipalities. This was the choice of the municipalities, and for the purpose of uncovering the official position of the municipalities, heads of department are also viewed as a good choice by the author. The interviews were open, explorative, and unrelated to the theory. The respondents were asked about what the drivers and barriers were for

suggesting an integration of climate change in the RBMPs. Also, the respondents were asked about future challenges of integrating climate change in their action plans. However, as stated, the municipalities were not able to answer these questions.

### Survey

The purpose of the survey was to test the hypotheses developed on:

- drivers and barriers for the municipalities in relation to encouraging an integration of climate change;
- the main challenges they could be facing if they integrate climate change in their own action plans.

Specifically, much support each of the hypotheses found in interviews and theory have among the municipalities was tested. A similar methodology was used by Moser and Tribbia (2007) in their study of the coastal managers of California and by Gow and Leahy (2005) in their study of perceptions of environmental risks in the Hunter region in Australia. In each of these studies, interviews were conducted and used as inspiration for a more extensive survey. The survey consisted of a questionnaire, with multiple choice questions. The questions were based on the interviews and theory as illustrated in Fig. 4.

All possible drivers and barriers, which were mentioned by one or more of the interviewees, were included in the questionnaire. The questionnaire was sent in spring 2009 via email to employees in the 98 Danish municipalities. The employees were chosen on the basis of an examination of the homepages of the municipalities, and included directors, heads of department, team leaders, and ordinary employees in the areas of environment, planning, and water. The municipalities chose which employees were most appropriate for answering the survey, and some chose to forward it to more relevant colleagues. Fifty-eight respondents from 50 of the 98 Danish municipalities filled

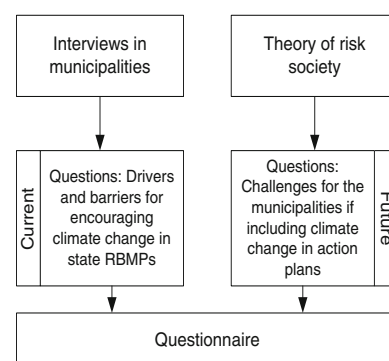


Fig. 4 Overview of the input to and the structure of the questionnaire

in and returned the questionnaire, giving a response rate of around 50%. The municipalities that have answered have a good geographical distribution with a response rate of around 50% within the five geographical regions in Denmark. Almost 100% of the large municipalities (>100,000 inhabitants) answered, while about 50% of the mid-sized municipalities (25,000–5,000 inhabitants) and 30% of the small municipalities (<25,000 inhabitants) participated. In the light of these numbers, only simple analyses are carried out. The relatively small numbers of respondents in total, and thus for each of the different groupings of municipalities, do not warrant more detailed statistical analysis comparing the groups.

**Actor attitudes towards climate change in RBMPs**

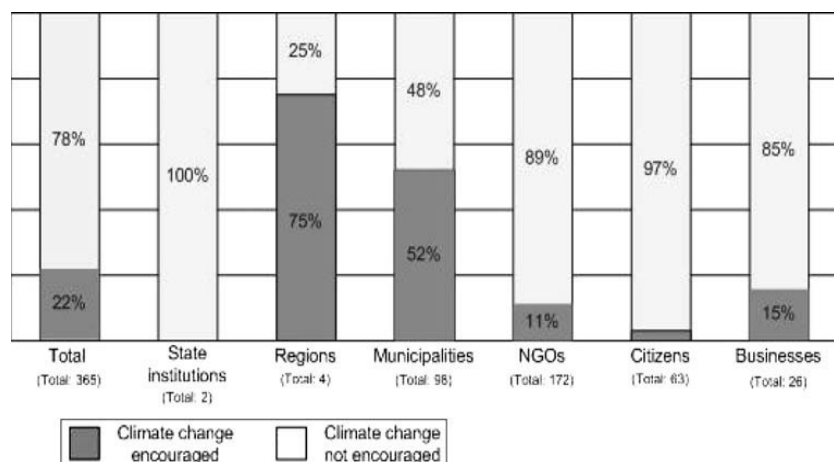
Figure 5 shows the percentage of the actors participating in the initial hearing who encourage an integration of climate change in the RBMPs.

The results show that in total, 22% of the actors participating in the hearing point to climate change as an issue to be dealt with in the RBMPs. This corresponds to 79 out of the 365 actors. So, some of the actors do encourage an integration of climate change in the RBMPs, in spite of the state’s decision to exclude it, and thus they disagree with the state. At the same time, 78% of the participating actors do not encourage an integration of climate change. This also shows that there is a discrepancy among the participating actors. These circumstances can be interpreted as being in support of the theoretically based notion that climate change is a contested issue and that decisions and statements on climate change can be challenged: cf. “Case: the Danish RBMPs”. Apparently, there are many views and perceptions when it comes to climate change and whether or not it is a relevant and important factor.

It can also be seen from Fig. 5 that especially the state institutions, NGOs, citizens, and businesses do not encourage a focus on climate change. The reason why the state institutions do not encourage the integration of climate change can perhaps be that they do not want to contradict the Ministry of the Environment. Also as stated in “Document study”, only two state institutions participated in the hearing, making it difficult to draw conclusions on this basis. Especially, the NGOs might have been expected to raise the issue of climate change. However, the NGOs, citizens, and businesses immediately appear to be focused on specific and local issues of interest. This is in contrast to the global nature of climate change, as pointed out in theory and practice in “Beck’s risk society: a view on the risk posed by climate change” and “Case: the Danish RBMPs”, and thus the local focus might be part of the reason for the lack of interest in climate change. This reflection is supported by Eisenack et al. (2007), who conclude that the perception that local interests are more important than global can act as a barrier to climate change adaptation.

Among the regions and the municipalities, more than half of the actors encourage integration of climate change in RBMPs. From this, it appears that the local authorities are relatively actively encouraging the state to integrate climate change. As an example, the municipality of Aalborg states in its input to the hearing that “it is the municipality of Aalborg’s recommendation for the RBMPs... that the consequences of climate change should be incorporated in the RBMPs”. Another example is the municipality of Struer, which states in its input that “the state is encouraged to take climate change into account when preparing the RBMPs, both when providing the baseline, goals and measures”. It is interesting that the municipalities are so positive towards an integration of climate change in RBMPs, because they will be continuing

**Fig. 5** The percentage of actors (total number of actors 365) encouraging and not encouraging integration of climate change in RBMPs in total and for each group of actors (based on document study)



the planning process and thus have the opportunity to integrate climate change in their action plans. There appears to be a bottom-up pressure from the municipalities who are more ambitious than the state in this regard. There are examples from other cases of municipalities acting as driving forces in relation to other environmental issues. For instance, Lindahl and Söderqvist (2004) show this in the case of Swedish water management.

It is clear from the earlier discussions that the municipalities in Denmark are among the actors who are most positive towards an integration of climate change in RBMPs. This implies that climate change might have a more dominant role to play later in the planning process when the municipalities prepare their action plans. However, the municipalities also have different attitudes towards climate change as a factor in the RBMPs, since 48% of them do not encourage an integration of climate change. In the following, an understanding of the background to these attitudes is sought.

#### Drivers and barriers in encouraging integration of climate change in the RBMPs

In the survey, the municipalities were asked which of a range of factors had been the main drivers for those encouraging integration of climate change in RBMPs. The possible drivers used in the survey were derived from interviews, as stated in “Document study”. The results can be seen in Fig. 6.

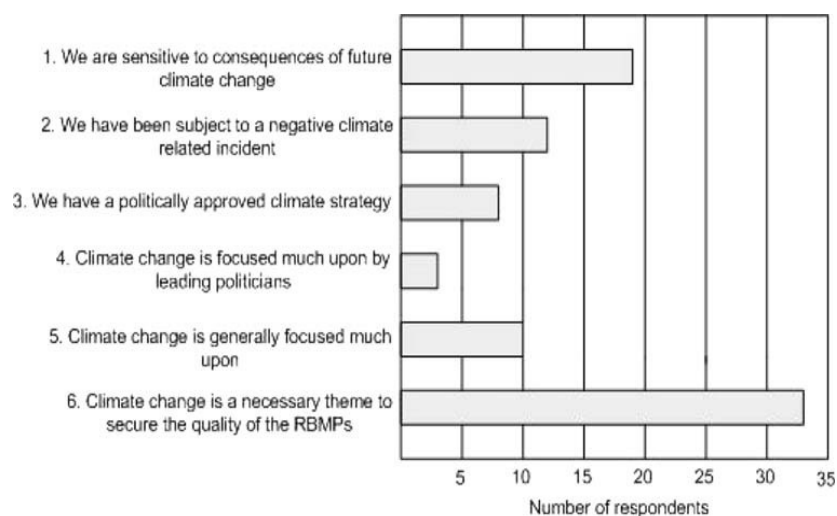
It can be seen from Fig. 6 that the perception that integration of climate change will improve the quality of the RBMPs has been a main driver for the municipalities (item 6). In this regard, the survey also shows that 67% of the respondents consider their technical staff the main driving

force behind encouraging integration of climate change in the RBMPs. In addition to this, being exposed to present and future negative consequences of climate change is a key driver for the municipalities (items 1 and 2). Eisenack et al. (2007) also regard this barrier as probable, by pointing to visible and tangible impacts of climate change as drivers for climate change adaptation.

The factors of the least importance to the municipalities are those concerned with the general and political focus on climate change (items 3, 4, and 5). The fact that the focus of leading politicians is not an important driver for the municipalities can seem puzzling, because the survey also shows that 26% of the respondents point to their politicians as the main driving force behind encouraging integration of climate change in RBMPs. It should be noticed that the respondents in the survey are the technical staff in the municipalities. Other results with more focus on the political issues might have been obtained if the politicians had been asked the same questions. The survey also shows that only 2% of the respondents consider the citizens a driving force behind encouraging integration of climate change in the RBMPs. This might reflect that the submission for the initial hearing was prepared as an administrative exercise without public participation. Theoretically, it is interesting that the technical arguments and the tangible experiences are important drivers. This does not correspond to the theory of Beck that climate change sparks off a more open process with inclusion of different perceptions and values. On the contrary, it reflects the traditional line of thinking, which is very dependent upon science.

In the survey conducted, the municipalities which have not encouraged integration of climate change as a factor in RBMPs were asked which of a range of factors had been barriers to this. The possible barriers are derived from

**Fig. 6** The number of respondents (total number: 58) in the survey that considered each factor a driver for their encouragement of integration of climate change in the RBMPs. The respondents could choose more than one factor (based on survey)

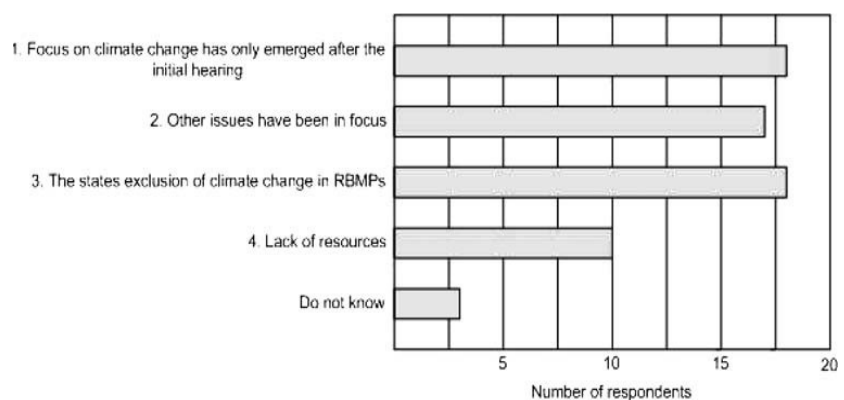


interviews, as stated in “Document study”. The results can be seen in Fig. 7.

It is noticeable that relatively few of the respondents consider a lack of resources a barrier to encouraging an integration of climate change in RBMPs (item 4). Rather the issues of lacking focus on climate change are considered key barriers by respondents (items 1 and 2). This is either because issues other than climate change are in focus (item 2) or because climate change has only gained focus after the initial hearing (item 1). In the theory of risk society, it is described how risks such as climate change are dependent on our focus on and awareness of them, something which is reflected in the fact that a lack of awareness or focus acts as a barrier to addressing climate change. This argument is supported by the work of Moser and Tribbia (2007), who find that other issues overshadowing that of climate change act as barriers to addressing climate change. It is interesting that the political focus was not among the important drivers, while a lack of political focus apparently is an important barrier.

Finally, the state’s exclusion of climate change as a part of the RBMPs is a key barrier for municipalities (item 3). The decision of the state is perhaps considered by some municipalities to be final, or the municipalities do not want to go against the state and challenge its decision. The fact that the decision by the state is a main barrier to encouraging integration of climate change counters the previously discussed issue of climate change being contested and open for interpretation. Apparently, the municipalities see this issue very differently. Other researchers have had similar results. Moser and Tribbia (2007) conclude that a lack of legal mandate can be a constraint on climate change adaptation, and Eisenack et al. (2007) mention an inadequate response at national level as a constraint on adaptation to climate change. Næss et al. (2005) emphasise the need for collaboration between the national and local levels of authorities in handling climate change. All these aspects support the empirical finding of this article that the state decision can act as a significant barrier.

**Fig. 7** The number of respondents (total number: 58) in the survey that considered each factor a barrier to their encouragement of integrating climate change in the RBMPs. The respondents could choose more than one factor (based on survey)



### Future challenges to integrating climate change in municipal action plans

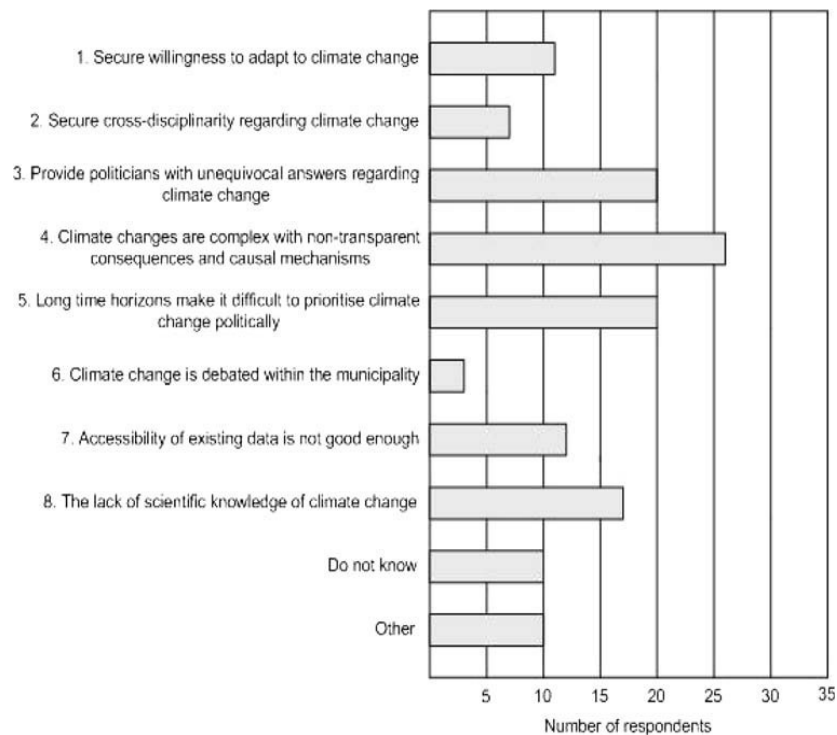
The respondents in the survey were asked which of the theoretical challenges from Fig. 1 they considered to be the main challenges for the municipalities if they integrate climate change in their own action plans. The results are shown in Fig. 8.

It can be seen from Fig. 8 that the respondents perceive the complexity and non-transparency of climate change (item 4) as the main challenge. Other key challenges are the political difficulties posed by climate change because of the long time horizons and the lack of unequivocal answers (items 3 and 5). The lack of scientific knowledge is also pointed out as a challenge by a fair amount of respondents (item 8). At the lower end of the spectrum, some of the more practical matters are found, such as the accessibility of data and securing cross-disciplinary cooperation (items 2 and 7). Eisenack et al. (2007) in their study also point to uncertainties in the form of lack of information and knowledge, uncertainty in research, and lack of full evaluation of vulnerability as barriers to adaptation. Arnell and Delaney (2006) mention issues of short planning horizons as a barrier to adaptation, because they do not fit the long time horizons of climate change. It can also be seen that the issue of securing willingness to adapt and the issue of climate change being debated internally within the municipalities are not major concerns for the respondents (items 1 and 6). In the light of the previous finding that climate change is contested among the different actors, it is interesting that even if this is so, the municipalities do not see it as a potential challenge.

In this case, the challenges posed by the theoretical characteristics of new risks are tested as possible challenges of addressing climate change in municipal action plans. The survey shows that characteristics related to uncertainty are those most often considered significant challenges by the respondents.



**Fig. 8** The number of respondents (total number: 58) in the survey that considered each factor a challenge if climate change was integrated in the municipal action plans. The respondents could choose more than one factor (based on survey)



## Conclusion and discussion

This article investigates the attitudes towards an integration of climate change among actors involved in the process of preparing RBMPs in Denmark, specifically which factors are perceived as drivers, barriers, and challenges. For this purpose, the support for different hypotheses derived from either theory or practice is tested.

The analysis in Chap. 5 shows that some of the actors have positive attitudes towards integrating climate change in RBMPs, especially municipalities and regional authorities. In contrast, NGOs, citizens, and businesses do not encourage an integration of climate change very actively. This can possibly be attributed to a focus on specific and local issues rather than the global ones such as climate change. In accordance with the theory of risk society, risk such as climate change is contested and debatable. The analysis of attitudes supports this, since the actors apparently do not agree on the importance and relevance of integrating climate change. This contested nature of climate change can be interpreted as a challenge when integrating climate change in a planning process, in accordance with the theoretical issues raised in Fig. 1. Theoretically, this challenge complicates the planning process and means that the disputes and, in the terminology of Beck, struggles of risk definitions between the actors need to be handled. However, the analysis of challenges shows that the contested nature of climate

change is not actually perceived as an important challenge by the municipalities. As such, the analysis only supports part of the theoretical contemplation.

The participation of the public in decision-making, through the initial hearing, can be discussed in relation to Beck's thesis on subpolitics in risk society. The fact that the public attempts to gain influence in the planning process and attempts to define climate change as a relevant risk despite the decision from the appointed decision maker can be seen as an example of subpolitics. However, the public has not been successful in actually affecting the planning process and having climate change integrated in the state RBMPs. Also, relatively few private citizens participated in the process, and as such it does not resemble the public movement that subpolitics can be interpreted as.

Regarding the main drivers and barriers for the municipalities that encourage an integration of climate change in the state RBMPs, a range of issues are pointed out by the respondents in the survey. The main driver for the municipalities encouraging the integration of climate change in the RBMPs is that they consider it necessary for preparing qualified RBMPs. This driver is obvious and not dealt with in the other studies mentioned in this article. Other important issues for the municipalities are their exposure to present and future possible consequences of climate. The main barriers for the municipalities are the state decision to exclude climate change from the RBMPs and a lack of focus on climate change.

The question of what the municipalities consider the main challenges of integrating climate change in their own action plans is also dealt within the survey. The respondents point to the main challenges of handling the complexity and non-transparency of climate change in the planning process. Also, a lack of knowledge, the availability of clear answers to inform decision makers, and issues of handling the long time horizons politically are significant challenges. This supports the theoretical hypotheses that the uncertainty of risks such as climate change becomes integrated in the planning process and constitutes a challenge.

In the case of climate change in Danish RBMPs and municipal action plans, lack of knowledge, uncertainty, and complexity seem to be important barriers and challenges. The problem is reflected both in the arguments of the state for excluding climate change from the plans and in the municipalities' perception of it as the main challenge of integrating climate change in action plans. These results support one of the important theoretical challenges of dealing with climate change in the risk society. For the state, the challenge leads to inaction in the form of excluding climate change. Adger et al. (2009) discuss the validity of lack of knowledge as an argument for inaction. They argue that "we should not consider uncertainties associated with foresight of future climate change a limit to adaptation" (Adger et al. 2009, p. 342). Among other things, they emphasise the fact that climate predictions are inherently uncertain and should not be the central tool for adaptation and that instead an approach of robust decision-making should be used (Adger et al. 2009). Ulrich Beck in his theory of risk society also suggests other ways of dealing with the lack of knowledge, increased complexity, differing perceptions and so on. Beck emphasises the need for open criticism of science, knowledge, progress and experts, from science itself and from society at large. Going into detail about these suggestions is outside the scope of this article, but they serve the purpose of indicating that inaction is not the only possible response to problems of the risk society.

In conclusion, the process in Denmark reflects parts of the theory of risk society, for example debate about risk and subpolitics as well as uncertainty, complexity, and lack of knowledge. However, it is also clear that when it comes to acting, such as in the case of the state RBMPs, it is still the mindset of the modern society that prevails, with a dominant perceived need to base decisions on exact scientific knowledge. If this cannot be achieved, inaction has been the preferred solution.

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# Integrated approach to climate change: Is SEA responding to the challenge?

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## Abstract

Previous research has suggested that there are three overall ways of integrating climate change in strategic environmental assessment (SEA): Mitigation, adaptation and baseline adaptation, and that all three are needed as part of an integrated policy response. In this article it is reviewed to what degree climate change and specifically these three issues are dealt with in SEA practice, and what the motivation and challenges are for such a practice. For this purpose Danish SEA reports are analysed through document analysis and interviews. The analysis shows that most SEAs deal with mitigation of climate change, while fewer deal with adaptation and even fewer with baseline adaptation. The consequences of separation are both risk of trade offs and missed opportunities for synergies between mitigation and adaptation. The interviews show that the integration of climate change is not based on a systematic consideration and that one of the issues of relevance is the lack of overall guidance. The evidence gathered and presented in the article reveals that there is a need to develop the SEA process and methodology in Denmark to include climate change in the assessments in a more systematic and integrated manner.

**Key words:** Strategic environmental assessment, climate change, integrated assessment, trade off, synergies

## 1 Introduction

Climate change is viewed as one of the major environmental challenges for society in general and for Denmark specifically. On the global level, IPCC in their 4th assessment stress that *"warming of the climate system is unequivocal"* and that it is very likely that the warming is caused by anthropogenic green house gas emissions (Bernstein et al. 2007, 1, 5). The warming is predicted to have various impacts, e.g. on water availability, ecosystems and flooding (IPCC 2007).

Predictions of future climate change in Denmark in 2100 compared to 1990 are a rise in average yearly temperature of 0.7-4.6 °C. The rise in temperature is followed by an increase in precipitation in winter and a decrease in precipitation in summer, as well as more extreme events in the shape of extreme precipitation or drought. With increased temperature follows increased evaporation, increased

water temperature, and a small increase in storms. On the basis of predictions of global sea level rise and the change in wind patterns, a sea level rise of 0.6-0.9 meters is predicted for the west coast of Denmark. (DMI n.d.; Bates et al. 2008)

SEA in the European context is governed by the EU Directive *"on the assessment of the effects of certain plans and programmes on the environment"* from 2001. The directive points out *"climatic factors"* as one of the factors for which likely significant impacts need to be assessed (European Parliament and Council of the European Union 2001, Annex 1). This has been transferred directly into the Danish legislation (LBK nr 1398 2007). There is no specific guidance on the integration of climate change in SEA in Denmark. However, in the strategy for climate change adaptation published by the Danish Government, impact assessment is also mentioned, since it asks for

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“an assessment of whether the existing arrangements for impact assessment, for instance SEA (Strategic Environmental Assessment) and EIA (Environmental Impact Assessment) are sufficient from a climate change adaptation point of view or if changes are required” (Danish Government 2008, 30). Thus impact assessment has been pointed out as a relevant area of focus for dealing with climate change. On this background, it is relevant to investigate the current state of integrating climate change in SEA in Denmark, since knowledge of current practice must serve as the foundation for any possible further developments.

Internationally different authors have worked with methods for integrating climate change in impact assessment of projects (see for example Byer and Yeomans 2007; Duinker and Greig 2007; The Federal-Provincial-Territorial Committee on Climate Change and Environmental Assessment 2003). Also authors have dealt with the issues of integrating climate change in SEA. Notably Levett-Therivel Sustainability Consultants (2007) have published UK guidance on integrating climate change in SEA while in Larsen and Kørnøv (2009) a conceptu-

al approach to integrating climate change in SEA is suggested. Also the OECD has published guidance specifically on integrating climate change adaptation in SEA (Risse and Brooks 2008). However, this literature on integrating climate change in SEA appears to be based on a conceptual approach of how it should be done rather than empirical studies of what the current practice is. This is where this article seeks to contribute. The purpose of the article is to analyse the current integration of climate change in SEA practise in Denmark. The primary focus in this analysis is on the actual scope in SEA and thereby how practice responds to the challenge of an integrated approach to assessment with both climate change mitigation and adaptation. For this purpose an analytical framework based on Larsen and Kørnøv (2009) is used.

**1.1 Analytical framework: Scope of integration**

In Larsen and Kørnøv (2009) it is suggested that there are three overall approaches to integrating climate change in SEA: Mitigation, adaptation, and baseline adaptation, as illustrated in figure 1.

Mitigation is a known concept related to

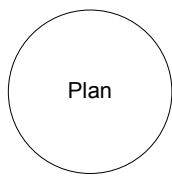

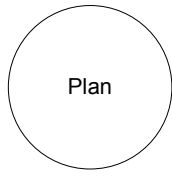

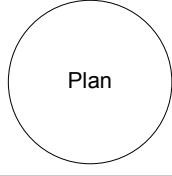
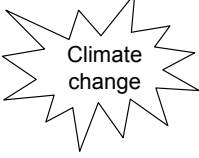
	SEA →		<i>How can GHG emissions from activities of the plan be reduced?</i>	<b>Mitigation</b>
	← SEA		<i>How can activities of the plan be adapted to climate change?</i>	<b>Adaptation</b>
	← SEA ← Baseline		<i>How is climate change changing the environmental baseline and what influence will it have on targets in the plan?</i>	<b>Baseline adaptation</b>

Figure 1 Approaches to integrating climate change in SEA (Based on Larsen and Kørnøv 2009)

climate change defined as “*an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases*” (McCarthy et al. 2001, 982). In SEA mitigation refers to assessing the effects of the plan on the environment in terms of potential emissions of greenhouse gasses (GHG) resulting from the plan, and the abatement of this in the form of minimising GHG emissions (Larsen and Kørnøv 2009). For example, an SEA of a development plan for a new urban area can include assessments of GHG emissions from generated traffic.

Adaptation is also a well-known concept, which is defined as “*adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*” (McCarthy et al. 2001, 990). In relation to SEA, adaptation deals with climate change as an environmental problem of relevance for the plan and if and how it is expedient to adapt the plan to future climate change (Larsen and Kørnøv 2009). For example SEA of an overall spatial plan can include assessments regarding at which elevation it is expedient to build in the light of future sea level rise.

Baseline adaptation on the other hand, is a new concept. It refers to assessing the potential of climate change to change the baseline for the assessment, and thus whether the plan and the targets of the plan should be adapted and at what level (Larsen and Kørnøv 2009). For example climate change might worsen problems with oxygen depletion in a water body covered by a river basin management plan. This affects the baseline as a frame of reference of the SEA and the baseline should be adapted accordingly. Baseline adaptation is closely connected to adaptation, because the adaptation of the baseline is a prerequisite for adapting the plan. In the previous example, the adaptation of the baseline can lead to the

assessment that either the efforts or the targets of the plan should be adapted in accordance with the new baseline.

### 1.2 Research questions

When climate change was first put on the agenda, focus in both science and politics was primarily on mitigation (Briesbroek, Swart and van der Knaap 2009). This discourse, with an emphasis on climate change mitigation, has continued to be the dominating one scientifically and for policy making (Füssel 2007; Kates 2005, p. 5; Michaelowa 2001; Wilbanks and Sathave 2007; Wilbanks et al. 2003; Swart et al. 2007). This highlights that linking mitigation and adaptation represents a particular challenge for practice. In recent years the importance of adaptation has gained focus, and in the 4th assessment by the IPCC it is stated that “*There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts. Adaptation is necessary both in the short term and longer term to address impacts resulting from the warming that would occur even for the lowest stabilisation scenarios assessed. There are barriers, limits and costs that are not fully understood. Adaptation and mitigation can complement each other and together can significantly reduce the risks of climate change*” (Bernstein et al. 2007, 65). Within planning Briesbroek, Swart and van der Knaap (2009) have detected a tendency to what they term the ‘mitigation-adaptation dichotomy’, where climate change mitigation and adaptation is seen as separate approaches and not viewed holistically. The expediency of the holistic approach is emphasised by the work of Hamin and Gurran (2009), who point out that mitigation and adaptation may have different and conflicting goals and solutions in spatial planning. These issues will be elaborated on in section 3.1.

Thus it seems that there are reasons to suspect that there might be different em-

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Type of plan	Municipal spatial plan	Local spatial plan	Sector plan			
	79 (all)	50	24 (all)			

Region	Capital Area	Zealand	South Denmark	Central Denmark	North Denmark
	38	30	25	35	25

Year of publication	2004	2005	2006	2007	2008	2009
	3	15	14	13	20	88

Figure 2 Characteristics of the environmental reports included in the document study

phasis on the three approaches to integrating climate change in SEA. However, part of the purpose of SEA is to provide an integrated assessment of potential consequences of policies, plans and programmes, which calls for a consideration of all three approaches in SEA. On the basis of this, the following questions are put forward:

- **Are the three approaches to climate change integrated in SEA practice?**
- **What are the motivation and challenges for such integration?**

The methodology applied to investigate these issues is presented in the following section.

## 2 Methodology

In order to answer the questions stated above, two investigations have been undertaken: A document study to determine how broad the scope in integrating climate change is in Danish SEAs and interviews to discuss what the motivation and challenges are for integrating climate change in SEA.

### 2.1 Document study

153 Danish SEA reports were gathered and analysed in terms of how climate change had been integrated. The reports were chosen on the basis of the following parameters:

- Type of plan: covering both sectoral, local and comprehensive plans
- Region of origin: covering all the regions in Denmark
- Year of publication: covering the time from the implementation of SEA in Denmark to the end of 2009

This has led to identifying 153 environmental reports with the characteristics shown in figure 2.

The reports have been chosen with an aim to get a spread on the different characteristics. However, for both the comprehensive spatial plans and the sector plans all published environmental reports are included in the study for the sake of completeness. Regarding the time of publication figure 2 shows a majority of reports from recent years. This is because very few reports were published in the first years after SEA became mandatory in Denmark in 2004. The choice to include all municipal spatial plans and sector plans also affects this, because the majority of these were published in 2009.

The reports were analysed in terms of how climate has been integrated. For this article it is of interest that any occurrence of mitigation, adaptation or baseline adaptation was registered. The data was analysed using the software SPSS. The results are presented in section 3.

**2.2 Interviews**

On the basis of the document analysis three cases were chosen for further investigation. These were the only ones where climate change was integrated in a broad scope, thus including both mitigation, adaptation and baseline adaptation. The chosen cases are all SEAs of municipal spatial plans from:

- Municipality of Aalborg (North Denmark) 2009
- Municipality of Egedal (Zealand) 2009
- Municipality of Favrskov (Central Denmark) 2009

The cases were investigated through interviews with key staff in the municipalities who had been leading in preparing the environmental reports. Because the subject area is one without previous evidence base, the interviews were conducted in an open and explorative way, in order to uncover the experiences with climate change in SEA. The interviews were guided by the following overall themes:

- Motivation for integration of climate change in SEA
- Challenges related to integration of climate change in SEA

The results of the interviews are discussed in Section 4.

**3 The scope of integration of climate change in SEA**

Figure 3 shows the results of the document study of SEA reports regarding whether climate change is integrated. The analysis shows that climate change is integrated in 58% of the SEA reports, corresponding to 89 of the 153 reports. From figure 3 it can also be seen that climate change is integrated in an increasing percentage of the reports published each year. This increasing focus on climate change in SEA corresponds well to the increasing focus on climate change in society in general. The large increase in SEAs including climate change in 2009 is especially due to the SEAs of the new municipal plans that were prepared this year. Almost 60% of these include climate change. This could be due to the fact that climate change had particular focus in Denmark in 2009 because of the COP15 in Copenhagen. Also the municipal plans are comprehensive and holistic plans, thus including more issues of relevance in relation to climate change.

Figure 4 shows results of the analysis regarding whether the three approaches to integrating climate change are included. Figure 4 shows that mitigation is the approach mainly integrated in the SEA reports while adaptation and especially

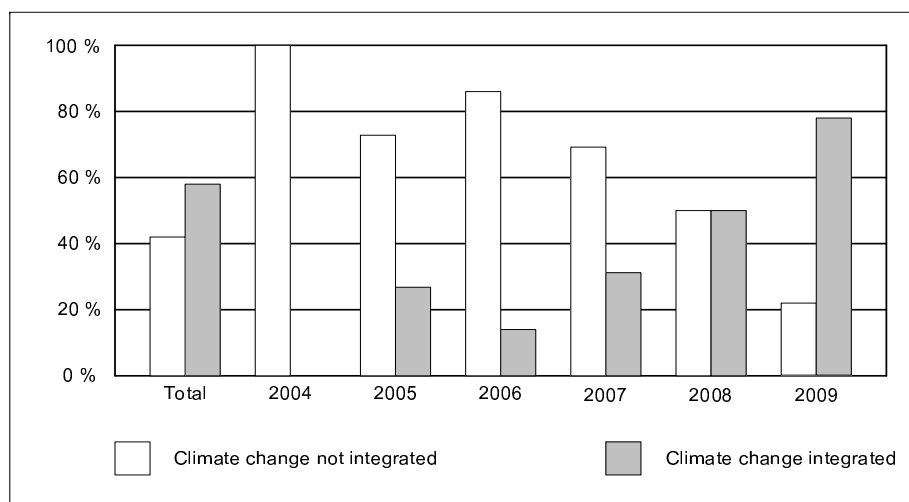


Figure 3 Percentage of the reports published each year which have integrated climate change (based on document study)

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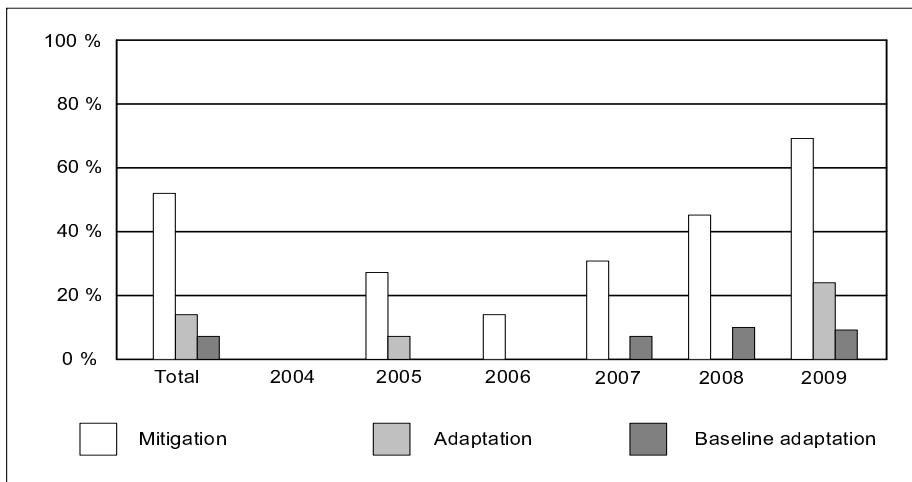


Figure 4 Percentage of reports published in total and each year that include the three approaches (based on document study)

baseline adaptation is much less common. Figure 4 also shows the development in inclusion of the approaches over time. It can be seen that mitigation is more and more often included in reports, peaking in 2009 where it was integrated in 69% of the analysed SEA reports. The results show that in 65% of the SEA reports where climate change is integrated, only mitigation is included; this is especially the case for local plans where all the reports that integrate climate change are limited to mitigation. For sector plans 78% of the SEA reports that integrate climate change only include mitigation, while for municipal plans it is 57%. The focus on baseline adaptation also appears to have increased during the time period, and adaptation has really surfaced as an issue in 2009. Only four SEA reports out of the 153 included in the analysis integrate both mitigation, adaptation and baseline adaptation and these reports are the only ones to integrate both adaptation and baseline adaptation. The integration of both mitigation and adaptation is most common in SEA of municipal plans, since all the reports that integrate these two approaches are assessments of municipal plans. Consequently all the reports that include mitigation, adaptation and baseline adaptation are assessments of municipal plans. There are no regional differences in whether or not the

different approaches to climate change are included.

### 3.1 Discussion of consequences

The document analysis shows that only 12% of the 153 cases include both mitigation and adaptation. Further analysis of the reports shows that none are linking mitigation and adaptation directly by looking into the overlaps. In addition, only 5 cases, or approximately 3% of the cases, include both adaptation and baseline adaptation, which is remarkable in the light of the close connection between the two approaches pointed out in section 1.1. This indicates that the plans are adapted without a systematic consideration of what they should be adapted to. What are the consequences of the separation between mitigation and adaptation in SEA practice? The consequences are a risk of tradeoffs and missed opportunities for exploring and promoting synergies while addressing climate change. Figure 5 shows some categories, definitions and examples of tradeoffs and synergies.

A greater integration of all three aspects of climate change in SEA will enhance the understanding of synergies, conflicts and trade offs as exemplified above. This will help provide a more integrated assessment and climate proofing planning and decision-making. However, it ap-

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Categories	Definitions	Examples
<b>Climate trade offs</b>	<i>Loosing mitigation benefits in return for gaining adaptation and visa versa</i>	<p><b>Mitigation - mitigation</b> Densification in urban areas to reduce car dependency to increase bicycling, walking and public transport can create an increase in city temperature and thereby increase heat island effect. The consequence can be increased use of electricity for ventilation – but also increased car transport out of the city in the summer.</p> <p><b>Mitigation - adaptation</b> Densification can happen at the expense of rainwater drainage, and thereby increase the flooding risk.</p> <p><b>Adaptation – baseline adaptation</b> Climate change is influencing the temperature in water systems, and thereby changing the premises for assessing and deciding upon adaptation means that can secure a specific water quality.</p>
<b>Climate synergies</b>	<i>Adaptation and/or mitigation measures interact in a way enhancing effects on climate change goals</i>	Trees and other vegetation in urban areas create a carbon sink, and due to shading and increased precipitation, reduce the temperature, whereby the necessity for ventilation is reduced.

Figure 5 Categories, definitions and examples of tradeoffs and synergies.

pears that at this point in time, the scope of integrating climate change in SEA in Denmark is not as broad as the scope of possible approaches. Also there is a clear focus on mitigation but an increasing interest in all three approaches – indicating a growing awareness that mitigation, adaptation and baseline adaptation are needed. The next section provides insight into the experiences of some of those that do integrate the three approaches – though without explicitly addressing climate tradeoffs and synergies.

#### **4 The experiences of dealing with climate change**

To seek a better understanding of the integration of climate change and the issues found in the statistical analysis, interviews were conducted.

One of the main conclusions from the interviews with the three municipalities is that even though they all included mitigation, adaptation and baseline adaptation,

none of them did so, on the background of conscious, systematic contemplation. As stated by the respondent from Favrskov municipality: *“We have not necessarily been very conscious of climate change as a theme in the SEA, rather it has come naturally”*.

The motivating factors for integrating climate change differ between the municipalities. The respondent from Aalborg mentions the demand in legislation to include climate change as the basic motivation and in Egedal municipality part of the motivation is, as the respondent puts it, that *“you should attempt to make something which is future-proofed”*. Concrete issues of climate change also play a role. Both the respondents from Aalborg and Favrskov municipalities mention existing problems with e.g. drainage and flooding as motivating factors. Aalborg and Egedal municipalities both point to the influence of previous strategies, plans and projects in motivating



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integration of climate change. For Aalborg this is mostly related to the direction the municipality set out in its overall strategy for the development in the municipality: *"It is part of the strategy for sustainability which has a focus on water drainage, CO<sub>2</sub>, low energy buildings, etc."*. For Egedal, on the other hand, it is mainly related to a tradition which started with a new urban development project where the new development had a specific focus on sustainability, e.g. climate change. Also the political interest plays a part in the integration of climate change. For Egedal Municipality, this again relates to the tradition from their previous project, which the politicians have taken to heart. As the respondent from Egedal states: *"Now the politicians are in. Now it is sometimes the public servants who tell the politicians to relax!"* The respondent from Favrskov also mentions an increasing media interest in climate change as a motivating factor.

Public interest has not been a motivating factor in Aalborg and Egedal. Both municipalities stress the lack of interest from the public in climate change in the SEA. According to the respondent from Aalborg municipality *"there has not been much focus on it in general or in relation to the municipal plan. It 'drowns' in all the other issues in the municipal plan"*. Further the respondent states that this lack of debate is the same internally in the municipality. In Favrskov Municipality the experience is different, since they had much external debate about climate change: *"There has been an interest from citizens through objections in relation to the process, for example pushing for the municipality to become a front-runner regarding climate change mitigation"*. Internally Egedal Municipality have experienced debate among professionals regarding which climate change scenarios to base the plan and SEA on, e.g. in terms of what to expect of sea-level rise. In spite of this, Egedal municipality

also stresses good cooperation between different disciplines such as planners and hydrologists during the process of preparing the SEA.

The challenges for integrating climate change in the SEA of municipal plans differ significantly between the municipalities. The respondent from Aalborg municipality mentions uncertainty and the fact that the issues of climate change in a municipal plan are not very concrete: *"It is not as concrete as dealing with a specific nature area. How much is the sea level going to rise? There are more scenarios"*. In line with this, both the respondent from Aalborg and Egedal mention the challenge of choosing a scenario to base assessments on, and the respondent from Egedal calls for a national guideline. The respondent from Egedal municipality also points to limitations of the Danish planning legislation in providing a legal basis for implementing initiatives in relation to climate change. Finally the respondent from Favrskov sees the most important challenge in being holistic: *"You never know if you are encompassing everything, there is usually something you have not foreseen, but which is important for the totality and thus whether or not your initiative works as intended"*. This is to be understood as the challenge of having an overview and not missing any issues that could jeopardise the entirety of the plan and fulfillment of the goals set out.

## 5 Conclusion

Response to climate change is not just a challenge across the different policy sectors but also a challenge for SEA practice, which is legally required to assess 'climatic factors'. The evidence gathered from the SEA reports and from interview sources leaves little doubt that SEA practice has a role to play in relation to climate change and that integration can have positive consequences. However, the extent to which SEA practice responds to the need for an integrated assessment is ques-

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tioned. While there is a growing body of literature on both climate change mitigation and adaptation, and on the necessity to keep a complementary scope while assessing the climate challenge, SEA practice tends to focus only on one domain, and the research shows that practice is not incorporating a broad scope. The focus is mostly on mitigation, while less is placed on adaptation and baseline adaptation. The lack of systematic and integrated assessment of climate change indicates that:

- The potential to explore and promote synergies while addressing climate change in SEA is high and
- The risk of trade offs and losing climate change benefits are high

The scope is getting broader though, and is seen as a growing recognition of the need to explore important overlaps between climate change mitigation and adaptation.

Looking into the motivation for the few observed integrated assessment, reveals that the local authorities are not motivated by overall legislation or guidance, but by local issues such as political or public support and concrete problems. This means that the integration of the different approaches to climate change is not systematic but rather has a random aspect. The interviews with practitioners show that there are a range of different challenges also relating to maintaining the holistic view which is stressed as important. All of this points to a need for development, research and guidance promoting an integrated approach to climate change in Danish SEA practice.

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# The non-handling of climate change uncertainties in strategic environmental assessment

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## Abstract

This paper is concerned with two questions: how is climate change uncertainty handled in strategic environmental assessment (SEA) practice? and what are the mechanisms behind coping with uncertainty in decision-making? To answer the first question 153 Danish environmental reports are analysed, with a focus on the mandatory explicit consideration of uncertainties encountered in the assessment. The results show that uncertainties to a great extent are not handled explicitly in Danish SEA. For the discussion on mechanisms behind non-handling of climate change uncertainties, coping mechanisms are derived from literature on decision-making. The decision-makers' coping with uncertainties is described by the following strategies for non-handling: denying uncertainty, ignoring uncertainty and, finally, postponing consideration of uncertainty. A further five possible reasons for avoiding uncertainty are proposed: uncertainty itself, cognitive limitations, conflict avoidance, instilling trust and reliance on quantification.

**Keywords:** Climate change, strategic environmental assessment, uncertainty, decision-making

## 1 Introduction

Since SEA is concerned with the future, dealing with uncertainty is an unavoidable part of assessment processes (Thissen and Agusdinata 2008; Wilson 2010; Tennøy, Kværner and Gjerstad 2006), though the degree and source may differ from case to case. Since uncertainty is involved in prediction, we rarely or never succeed in compiling all the information required, and thus reach decision-making under certainty. Like the consideration of certainty in impact predictions, handling uncertainties also involves presentation and communication, "especially in documents that most often reach decision-makers, the public and other actors" (Tennøy, Kværner and Gjerstad 2006, p. 55), which in this case is the environmental report required by the EU Directive on SEA (European Parliament and Council of the European Union 2001). Handling uncertainty requires us to attempt to express uncertainties in a way "...which both matches scientific practice and can be understood by lay people" (Petersen 2002, p. 87).

The uncertainty embedded in SEA is highly relevant and critical in relation to climate change and the complex natural and social processes involved. In the European context integration of climate change in SEA is also legally required. Further, it is demanded that any uncertainty, not just in relation to climate change but for the SEA per se, is accounted for in the environmental report. In the five-year monitoring review of the SEA Directive, however, it is revealed that member states in general lack integration of climate change and that "... much progress is still to be made to address biodiversity and climate change in SEAs" (COWI 2009, p. 42).

Handling climate change uncertainties in SEA is the focus of this paper and we first analyse the presentation and communication of uncertainty in Danish environmental reports and secondly suggest and discuss theoretical explanation models for 'uncertainty avoidance'. Before presenting the legal requirements and available guidance, we look at the conceptualisation of uncertainty and its sources.

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### Sources of uncertainty

There are many potential sources of uncertainty, and different ways of categorising these. In this paper we use the specification by Walker et al. (2003), who point to two overall sources of uncertainty:

- Epistemic uncertainty
- Variability uncertainty.

The same distinction is presented by van Asselt, who distinguishes between “*variability*” versus “*lack of knowledge*” (van Asselt 2000, p. 85). Epistemic uncertainty is rooted in imperfect knowledge and incomplete information (Walker et al., 2003). Forms of epistemic uncertainty are, for example, data uncertainty, stemming from the limitations as to what data we can collect and have available, and model uncertainty, stemming from not having enough knowledge to produce a satisfactory model (Willows and Connell 2003, pp. 50-2).

Variability uncertainty is related to inherent variability in systems. Walker et al. (2003) specify that this relates to inherent randomness of nature, such as unforeseen volcanic eruptions or variability in weather. Variability can also relate, however, to unpredictable and non-rational issues such as human behaviour, economic and cultural processes and technological development (Walker et al. 2003). The influence of these issues is uncertain as they are based on mechanisms such as perceptions, understandings, power, values and preferences, which are changeable and probably not transparent. This leads to another aspect of uncertainty, namely conflicting meanings. Lipshitz and Strauss (1997, p. 151) state that “*decision makers are sometimes unable to act not because they lack information but because they are overwhelmed by the abundance of conflicting meanings that it conveys*”.

Another issue of interest is whether more information acquired through the SEA will automatically lead to decreased uncertainty. Petersen (2002) and Walker et al. (2003) agree that, although there is no clear cut distinction, there is a tendency for variability uncertainty to be irreducible whereas epistemic uncertainty is more often reducible through further research. Thus it is not always possible to reduce uncertainties. Also, as pointed out by van Asselt et al. (2001, p. 15): “*Uncertainty can still prevail in situations where a lot of information is available. Besides, new information can either decrease or increase uncertainty. New knowledge on complex processes may reveal the presence of uncertainties that were previously unknown or were understated. In this way, more knowledge illuminates that our understanding is more limited or that processes are more complex than thought before*”. Lower epistemic uncertainty, through more knowledge obtained, therefore does not necessarily solve the challenge of uncertainty.

There are several forms of uncertainty. In the following section, the perspectives on uncertainty put forward in legislation and guidance on SEA are briefly reviewed.

### 2 Uncertainty in legislation and guidance on SEA

In the European Union Directive on SEA, the provisions for the content of environmental reports state that they should include “*an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information*” (European Parliament and Council of the European Union 2001, Annex 1 (j)). One of the difficulties encountered in an assessment may be uncertainty in different forms, including the uncertainty of the consequences of climate change in relation to the plan

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or programme. Consideration of climate change issues should not only cover the impacts of the plan or programme on climate change, e.g. calculations of greenhouse gas emissions, but also the climate change induced impacts on the plan and programme themselves, e.g. increased flooding events (Larsen and Kørnøv 2010). SEA is particularly well suited for taking into account climate change objectives as it allows a broader strategic scope and also better consideration of cumulative effects associated with plans and programmes in a given sector or region.

The provisions of the directive have been translated directly into the Danish legislation on SEA (LBK nr 1398 2007, Annex 1 (h)). In the Danish guidance they are supplemented with statements to the effect that the potential impacts of a plan may be uncertain, e.g. because of the geographical extent of plans and the range of activities they may encompass. Also, it is stated that any assumptions made in the assessment should be made clear. (VEJ nr 9664 2006, pp. 45-6) From this it is clear that the emphasis in the Danish guidance is on uncertainty of the impacts resulting from the plan rather than uncertainty of impacts on the plan, such as those of climate change. Also there is in both the EU and Danish documents a focus on epistemic uncertainty.

### 3 Methodology for investigating practice

153 Danish environmental reports were gathered and analysed in terms of how

climate change had been integrated. The reports were chosen on the basis of the following parameters:

- Type of plan: covering sectoral, local and comprehensive plans
- Region of origin: covering all the regions in Denmark
- Year of publication: covering the time from the implementation of SEA in Denmark to the end of 2009.

This allowed the identification of the characteristics shown in figure 1.

The reports were chosen to obtain a spread of the different characteristics. With regard to both the comprehensive spatial plans and the sector plans, however, all published environmental reports are included in the study for the sake of completeness. Regarding the time of publication figure 1 shows a majority of reports from recent years. This is because very few reports were published in the first years after SEA became mandatory in Denmark in 2004. The decision to include all municipal spatial plans and sector plans is also relevant in this context, because the majority of these were published in 2009.

The reports were analysed in terms of how climate has been integrated. The analysis of climate change uncertainty in SEA reports is based upon Funtowicz and Ravetz (1990), who distinguish between three ways of presenting uncertainty: presentation of a range of results, characterisation of the methodological

Type of plan	Municipal spatial plan		Local spatial plan		Sector plan	
	79 (all)		50		24 (all)	
Region	Capital Area	Zealand	South Denmark	Central Denmark	North Denmark	
	38	30	25	35	25	
Year of publication	2004	2005	2006	2007	2008	2009
	3	15	14	13	20	88

Figure 1 Characteristics of the environmental reports included in the document study

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acceptability of results, and acknowledgement of ignorance about the system studied. In the case of communicating uncertainty in SEA, we therefore looked for expressions of uncertainty through:

1. Presentation of a range, quantitative or qualitative, of expected CO<sub>2</sub> emissions or climate change impacts, such as rise in sea level, rise in ground water level, etc.
2. Presentation of acceptability of methodology used in the SEA. For instance the reliability of modelling sea level rise in an area.
3. Acknowledgement of ignorance. It can e.g. be explicitly acknowledged that the assessment is made without integration of uncertainty but that the latter may be relevant in the future.

The results of the analysis are presented in section 4.

### 4 Results

Very few environmental reports mention uncertainty. Only five of the 153 analysed reports have an explicit consideration of climate change uncertainty. These are presented below:

#### Aalborg Municipality: Waste handling plan 2007

In the environmental report, the difference in CO<sub>2</sub> emissions between two alternatives for collecting waste is calculated. The calculations are based on explicit assumptions about transport need for the alternatives and it is stated that "*if this assumption proves correct, an implementation of the collection method as described, will induce an environmental benefit in the form of energy consumption and emission of CO<sub>2</sub> and particles*" (Aalborg Municipality 2007, p. 65).

#### Aalborg Municipality: Water supply plan 2009

In the environmental report uncertainty and lack of knowledge are addressed ex-

plicitly. Several issues are mentioned, one of them being climate change. It is stated that "*the actual climate changes and the consequences of these for Aalborg Municipality are difficult to predict. The environmental baseline for climate change is thus subject to uncertainty and only indicates impacts*" (Aalborg Municipality 2009, Appendix 11 p. 23). Uncertainty and reservations connected to climate models are mentioned.

#### Hjørring Municipality: Municipal spatial plan 2009

In this environmental report climate change is also mentioned in relation to the environmental baseline with roughly the same wording: "*since the actual climate changes and the consequences of these for Hjørring Municipality are difficult to predict, among these the level of sea rise, the environmental baseline for climate change is thus subject to uncertainty and only indicates impacts*" (Hjørring Municipality 2009, p. 42).

#### Struer Municipality: Municipal spatial plan 2009

Like the two previous reports this environmental report addresses uncertainty of climate change consequences. It is stated that "*the actual climate changes and the consequences of these for Hjørring Municipality are difficult to predict*" and that the quantitative uncertainty means that the environmental baseline is uncertain (Struer Municipality 2009, pp. 29-30).

#### Vesthimmerland Municipality: Municipal spatial plan 2009

In this environmental report, the same wording as in the report from Hjørring Municipality is used: "*since the actual climate changes and the consequences of these for Vesthimmerland Municipality are difficult to predict, among these the level of sea rise, the environmental baseline for climate change is thus subject to uncertainty and only indicates impacts*"

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(Vesthimmerland Municipality 2009, p. 30). Also, impacts on climate change in the form of CO<sub>2</sub> emissions are mentioned, since it is added that since these are dependent on the specific implementation, they are difficult to determine at an overall level of planning.

Interestingly, the last four reports are prepared by or with assistance from the COWI consultancy. This may account for the similar wording. The reports contain comments on uncertainty connected to both the predictions of future climate change and to the assessment of impacts on climate change. Compared with the different ways of presenting uncertainty shown in section 3, the representations of uncertainty found in the environmental reports are assessed as being mainly acknowledgements of ignorance. The exception is that Aalborg Municipality in their water supply plan mention climate change models and thus touch upon the acceptability of methodologies.

Not many of the Danish environmental reports address climate change uncertainty: in the following sections, strategies and reasons for this are reviewed.

### **5 Strategies involved in uncertainty avoidance in decision-making**

The question of how people respond to uncertainty has for decades had a focus within literature on decision-making, and these theoretical insights can play an important role in our understanding of how actors cope with climate change uncertainty in SEA.

Climate change uncertainty can be tackled explicitly (e.g. documented in the environmental report) or implicitly (e.g. discussed by the person or group making the impact assessment but not communicated beyond the group). This relates to transparency in decision-making. In the investigation performed, we only studied

the written documents and are therefore not able to discuss any implicit handling of uncertainty that might have taken place during the assessment process.

Our focus is on explanatory models for why people avoid uncertainty. Based upon Hofstede (1980), uncertainty avoidance is here understood as the extent to which people feel threatened by uncertainty and take actions to avoid such situations. Another term, used to describe deliberate ignoring of uncertainty, is 'ambiguity aversion'. According to Krähmer and Stone ambiguity aversion refers to: "...an agent's distaste for making choices under conditions of uncertainty in which some relevant probabilities are unknown *ex ante* as opposed to conditions of risk in which all relevant probabilities are known *in advance*" (Krähmer and Stone 2006, p. 2). That organisations try to avoid uncertainty rather than confront it is discussed in the organisation literature (see e.g. Cyert and March 1963), which describes both psychological and social processes of decision-making. In the following we will focus upon strategies involved in avoidance, and thereafter in paragraph six explore the possible reasons.

Coping with uncertainty in decision-making can happen according to different strategies. A basic premise for understanding how decision-makers cope with uncertainty is to ascertain if he/she is aware of the uncertainty in question and whether he/she accepts its presence. If uncertainty is not accepted as real and relevant, explicit or implicit denial is a likely strategy. Denial can e.g. be in relation to "*the existence of climate change and human contribution to climate change, and could include more specific denial of the role that one's behavior or one's group's behaviors has in harming others*" (Swin et al. 2009, p. 126).

If the decision-maker on the other hand accepts uncertainty, there are two prin-



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cial paths to follow: handling or non-handling.

Ignoring is a non-handling strategy for coping with uncertainty: "*We often dread uncertainty. A common way of dealing with uncertainty in life is to ignore it completely, or to invent some 'higher rationale' to explain it, often a rationale that makes it more apparent than real*" (Dawes 1988, p. 256). As a strategy, ignoring uncertainty is historically the one applied most often within policy analysis (Morgan and Henrion 1990).

The last strategy discussed here is postponement. Postponing assessment and decision-making on climate change uncertainties is a way to handle uncertainties until more and better information is available. This strategy also implies postponing short-term investments in both mitigation and adaptation measures. Postponement is in line with coping strategies such as 'wait-and see' or 'business-as-usual'. Postponing uncertainty as well as the other strategies can be either explicit or implicit.

In summary, we have discussed non-handling of uncertainty, based upon the following strategies: denying the relevance of uncertainty, ignoring uncertainty, and postponing consideration of uncertainty until more information is available. These strategies combined with the choice of being explicit or implicit gives rise to an avoidance hypothesis for coping with climate change uncertainties in SEA practice, which is summarised in figure 2.

Figure 2 adds a preliminary hypothesis about handling uncertainty based on the work of Dessai and Sluijs (2007), where it is proposed that when handling uncertainty decision-makers can take a reduction or a resilience approach. Dessai and Sluijs (2007, p. 24) define a reduction approach as one that "*argues that if there is uncertainty about climate change*

*then uncertainty needs to be characterised, reduced, managed and communicated*". This approach might give cause for action in the form of, for example, modelling and data collection. The proponents for the resilience approach on the other hand argue for a need to "*accept that some uncertainties associated with climate change are irreducible, therefore they emphasise learning from past events*" (Dessai and Sluijs 2007, p. 24). With this approach it could be relevant to consider strategies of seeking robust solutions or using adaptive management (Dessai and Sluijs 2007).

The emphasis on the non-handling part of figure 2, it illustrates that non-handling is in focus in this article. In the following section, possible backgrounds for such avoidance of uncertainty are explored.

### 6 Why avoidance?

What then is the theoretical reasoning behind the use of these non-handling strategies? In the following we present different explanatory models for why uncertainties are not handled explicitly in decision-making and thus in SEA. The models are not exhaustive, but represent a palette of possible underlying reasons.

*Uncertainty itself.* Uncertainty, owing to disagreement in scientific communities about certainty and requisite actions, can explain avoidance behaviour: "*Uncertainty about climate change probably functions as a justification for inaction or postponed action related to climate change*" (Swin et al. 2009, p. 125). Uncertainty becomes an acceptable argument because "*if not even the experts can provide clear answers how can we assess the potential impacts and know what to do?*" (Swin et al. 2009, p. 125). In line with this argument, Budescu Broomell and Por (2009) investigate the presentations made by IPCC, and find that people's understanding of IPCC's communication of uncertainty leads to different interpreta-

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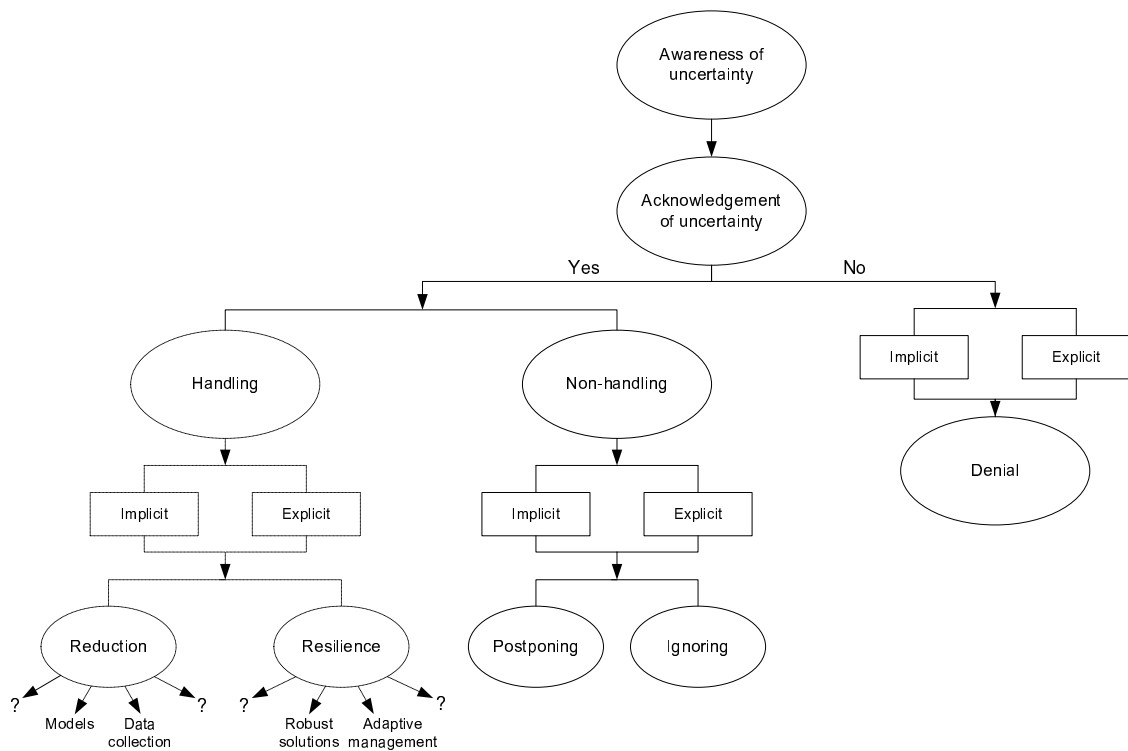


Figure 2 Coping with climate change uncertainty in SEA: The avoidance hypothesis

tions with resulting confusion and lower risk estimation, and subsequently non-handling of uncertainty.

*Cognitive limitations.* One important explanation is the heuristic involved in coping with uncertainty that was introduced and discussed by Simon (1957) in his work on 'limited rationality'. In line with Simon's argument for cognitive limitations, Kahneman and Tversky also underline that humans need to construct simplifications in order to make decisions: "In making predictions and judgments under uncertainty, people do not appear to follow the calculus of chance or the statistical theory of prediction. Instead, they rely on a limited number of heuristics which sometimes yield reasonable judgments and sometimes lead to severe and systematic errors" (Kahneman and Tversky 1973, p. 237). An illustration of this is the satisficing strategy that Simon (1957) identified in which human cognitive resources limit the search for information so that the focus shifts from maximisation to achieving the acceptable.

Besides cognitive restraint, simplification can also be imposed by limited time. Ultimately, satisficing can lead to a decision to fully ignore complexity and uncertainty. Satisficing behaviour is closely linked to the context in which decision-making takes place. Satisficing behaviour can be framed by both formal and informal expectations for coping with uncertainty. One example is a situation in which neither politicians nor the public expect and call for handling climate change uncertainties in SEA.

*Conflict avoidance.* Avoiding uncertainty can also be owed to conflict situations. Decision-makers need to attain accountability and support for their decisions. Seen in this light uncertainty is threatening to decision-makers, and makes them vulnerable to criticism and attack (Jaeger et al. 2001, p. 214). Thus decision-makers could ignore uncertainty to avoid opening the door to conflicts and opposition to their decisions. Dessai and Sluijs (2007, p. 11) point out the inexpediency of this argument for avoiding uncertain-

## THE NON-HANDLING OF CLIMATE CHANGE UNCERTAINTIES

ty when they state that not addressing uncertainties leaves "...policies highly vulnerable to deconstruction in societal discourses and controversies on these policies". Further, they stress that such vulnerability can be used in conflicts by those opposed to a decision (Dessai and Sluijs 2007).

*Instilling trust.* People and thus decision-makers sometimes choose to ignore uncertainty in order to create more or less deliberately a (false) sense of security or trust (Lipshitz and Strauss, 1997). Fun-towicz and Ravetz (2005, p. 368) add that "*much of the success of traditional science lay in its powers to abstract from uncertainty in knowledge and values; this is shown in the dominant teaching tradition in science, which created a universe of unquestionable facts, presented dogmatically for assimilation by uncritical students*". Thus science is a basic example of not acknowledging uncertainty in order to instil trust that things are under control.

*Reliance on quantification.* A perceived need for quantification of uncertainty can be part of the choice of not addressing uncertainty when quantification is not possible. Our propensity to quantify everything is described by Ben-Haim (2006, p. 9) and nicely captured in the statement that "*We are an age of number-givers, and the first advice to a novice in the modern world would be: if it stands still, measure it; if it moves, clock its speed*". Dessai and Sluijs (2007, p. 11) suggest that "*The focus on statistical and quantitative methods of uncertainty assessment leads to a tendency to ignore policy relevant uncertainty information about the deeper dimensions of uncertainty that in principle cannot be quantified*". That being so, people can refrain from dealing with uncertainty because it does not always meet the demand for quantification.

It is clear that this is not an exhaustive list of reasons for avoiding uncertainty but a range of possible ones. Some of the reasons listed above are closely related; for example, the need for security and the reliance on quantification, which can be seen as helping to give an impression of security.

### **7 Discussion and conclusion**

Among the concerns dealt with in SEA, the potential impacts of, and on, climate change are relatively new and receiving increasing attention. The European Commission's evaluation of 2009 shows that in SEA "*specific attention to climate change issues appears still to be limited in many Member States*" but that there seems to be increasing attention paid to the issue (COWI 2009, p. 116). Wilson (2010) has examined UK sustainability appraisals and found that they do address climate change, but that development of the approach is still needed. Weiland (2010) states in relation to the German experience that questions of climate change in SEA are not often raised. This points to climate change in SEA as an emerging issue for research and practice.

#### **SEA reports tend to misrepresent certainty**

The primary finding in this paper is that Danish SEA practice does not seem to recognise, take into account and communicate problems arising from climate change uncertainty. The analysis reveals that only five of 153 environmental reports explicitly communicate climate change uncertainty. In this study it has not been possible to determine whether uncertainty is handled implicitly within the SEA process and not communicated in writing. If this is the case, and the handling of uncertainty is more extensive in practice, it is still problematic to have an SEA practice with inexplicit handling and no transparency regarding uncertainty.

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Environmental reports which fail to report uncertainties tend to misrepresent certainty, with a risk of both politicians and the public interpreting the impact assessments as more certain than they actually are. This is in accordance with other studies within the field. Tennøy et al. (2006), for example, found in a study of 22 Norwegian cases of EIA that uncertainty was not mentioned in 43% of the documents, in 23 % uncertainty was suggested but not explained as uncertainty, 13 % indicated uncertainty without any further discussion and only in 21 % was uncertainty explained or discussed at various levels. Similar findings are documented by e.g. Geneletti et al. (2003), Andrews (1988) and Dipper et al. (1998). Giving an impression of certainty is at the same time one of several possible reasons behind avoiding uncertainty in decision-making and SEA; others are uncertainty itself, cognitive limitations, conflict avoidance and reliance on quantification.

### Testing of avoidance hypothesis

The paper has discussed different explanatory models for what lies behind denying, ignoring and/or postponing uncertainty. The models have not been tested empirically yet, and thus remain hypothetical. An issue for further empirical research is to explore the uncertainty avoidance hypothesis. The model and discussions provide an insight into the complexity of and reasons for dealing with uncertainty in integrating climate change in SEA.

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# Results

## Experiences with climate change in SEA and RBMPs

# 7

*In this chapter conclusions are drawn on the first part of the thesis. This encompasses answering the research questions posed in the introductory part of the thesis. This chapter forms the background for discussing paths for further development in the following part of the thesis.*

The first research question is dealt with in section 7.1 in the conclusions drawn regarding the level of focus on climate change in relation to RBMPs and SEA in Denmark. The second research question is dealt with in section 7.2, namely the concept and practice of integrating climate change in SEA in Denmark. The third research question about the theoretical challenges and focus points of integrating climate change in SEA and the reflection of these in practice is answered in section 7.3.

### 7.1 Level of focus on climate change

This section deals with the research question:

- What is the level of focus on climate change in SEA and RBMPs in Den-

mark?

The level of focus on climate change in RBMPs is investigated through a document analysis of submissions for the initial hearing, supplemented with a survey. The level of focus on climate change in SEA is investigated through a document analysis of environmental reports.

#### 7.1.1 RBMPs

The submissions for the initial hearing come from a range of different actors with an interest in the RBMPs, namely state institutions, regions, municipalities, NGOs, citizens and businesses. Figure 7.1 shows the level of focus on climate change among these actors in terms of how many of them encourage integration of climate change as a factor in the RBMPs.

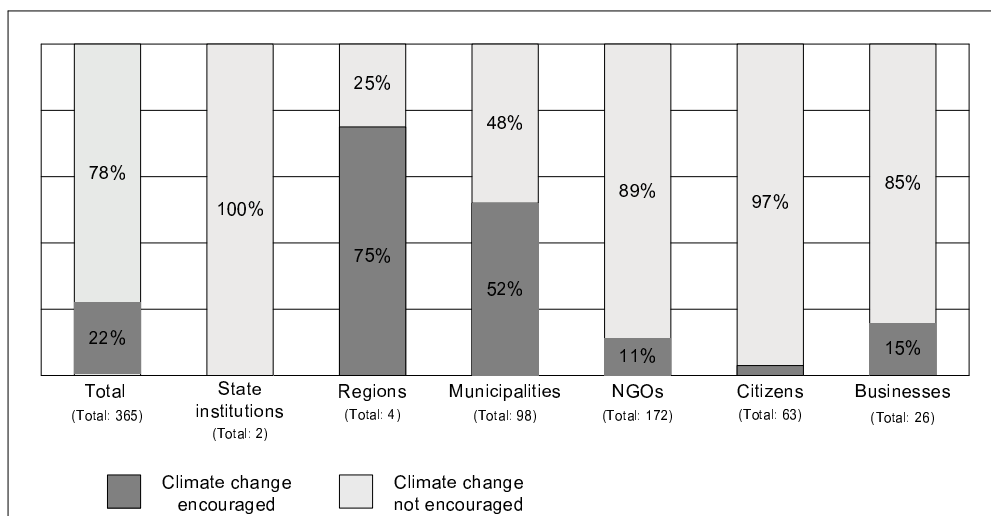


Figure 7.1 Percentage of the actors and actor groups that encourage integration of climate change as a factor in the RBMPs (Larsen 2010)



## RESULTS

Of the total number of different actors 22% encourage integration of climate change in the RBMPs, and thus these go against the decision by the state to exclude climate change. This means that the majority - 78% - do not encourage integration of climate change in the RBMPs, and thus there is a discrepancy among the actors on this issue. (Larsen 2010) Analysis of the hearing further shows that a significant number (82%) of those actors that encourage integration of climate change have specific suggestions (presented in appendix A). It is perhaps surprising that the NGOs are not more active in encouraging climate change in RBMPs; they are often viewed as conducting critical review of actions by authorities. The NGOs as well as the citizens and businesses appear to place more emphasis on more specific and local interests, however (Larsen 2010).

The Danish municipalities and regions are the actors most actively encouraging integration of climate change in RBMPs. This is interesting because the municipalities are to continue the planning processes and thus have the opportunity to include climate change in these.

(Larsen 2010) When asked in the survey whether or not they intend to include climate change in their action plans 65% of the responding municipalities stated that they will include climate change. It remains to be seen whether or not the municipalities will follow through on their intention when they prepare their plans.

### 7.1.2 SEA

It can be seen from figure 7.2 that climate change is integrated in 58% of the environmental reports examined (Larsen and Kørnøv 2010). The analysis also shows that climate change is mainly integrated in SEA of municipal spatial plans and sector plans (respectively 79% and 75% of the environmental reports where climate change is integrated) and to a lesser extent in SEAs of local spatial plans (16% of the environmental reports where climate change is integrated).

Figure 7.2 also shows that climate change has become more frequently integrated over the years with no SEA reports integrating climate change in 2004 and 78% integrating climate change in 2009. This is perceived to be in line with the development of a focus on climate change in

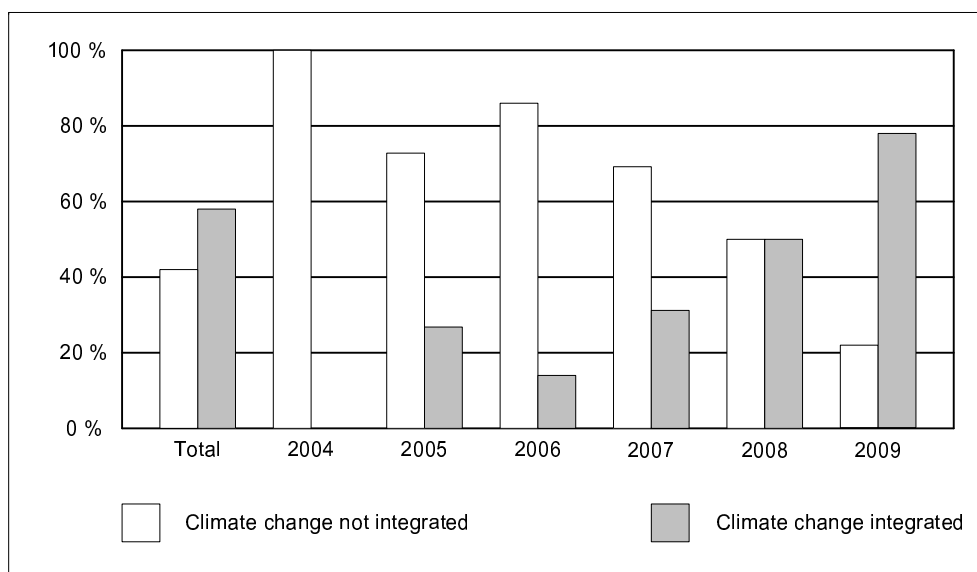


Figure 7.2 The percentage of environmental reports in which climate change is integrated or not integrated in total and per year of publication (Larsen and Kørnøv 2010)

general. The reason for the high percentage of integration of climate change in 2009 is also that the Danish municipalities prepared new municipal spatial plans, and climate change is integrated in 85% of these. (Larsen and Kørnøv 2010)

### 7.2 Integrating climate change: concept and practice

This section deals with the research question:

- How can climate change conceptually be integrated in SEA, and how is this concept reflected in practice in relation to SEA and RBMPs?

A conceptual approach to integrating climate change in SEA is developed from literature studies. The reflection of the concept in practice in relation to RBMPs is investigated through a document analysis of submissions for the initial hearing supplemented with a survey. The reflection of the concept in practice in SEA is investigated through a document analysis of 153 environmental reports supplemented with interviews.

#### 7.2.1 Concept

It is suggested that there are three ap-

proaches to integrating climate change in SEA; mitigation, adaptation and baseline adaptation (Larsen and Kørnøv 2009). The three approaches are visualised in figure 7.3

Mitigation deals with the impacts of a plan on the environment in the form of climate change. This entails assessing emissions of GHGs caused by the plan and how they can be reduced. An example could be assessing how a planned urban development will impact on traffic volumes and subsequent emissions, and whether this can be mitigated through improving public transport. Another example is assessing the positive effect of planned urban vegetation working as a CO<sub>2</sub> sink and whether this effect could be enhanced.

Adaptation deals with the impacts of the environment on the plan. This builds on the demand of legislation that environmental problems relevant to the plan or programme are taken into consideration. Here it is assessed which activities in the plan are exposed to climate change and how they can be adapted to this; for example, whether a planned urban development in a valley will be exposed to flooding and whether defences can be

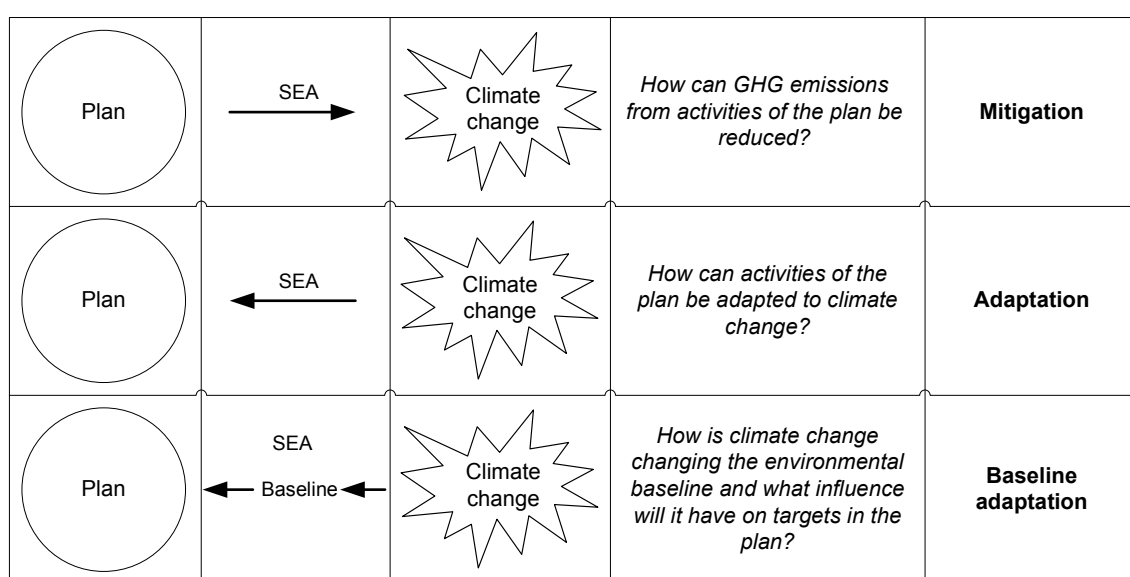


Figure 7.3 Three approaches for integration of climate change in SEA (Larsen and Kørnøv 2009)

## RESULTS

built or the development relocated.

Baseline adaptation deals with the impacts of climate change on the baseline of the SEA and how one can adapt the baseline and the targets of the plan to this. Baseline adaptation is a precondition for adaptation, because it constitutes the information about what to adapt to; for example, increased frequency of drought and how this affects targets of decreased use of water in planned urban development.

The following sections assess experiences with these approaches in practice.

### 7.2.2 Suggestions for climate change in RBMPs

In relation to the RBMPs, the document analysis of the initial hearing reveals how the three approaches to climate change are reflected in the suggestions of the actors. The results are shown in figure 7.4.

Figure 7.4 shows that 14% of the actors suggest that mitigation should be integrated whereas 5% contribute concrete suggestions for mitigation measures. The suggestions from the actors about mitigation are of two kinds:

- Planting more trees as part of nature restoration projects, which will also

function as CO2 sinks

- Decreasing amount of nutrients in the water environment, meaning less production of the GHG N2O

As shown in figure 7.4, 75% of the actors have suggested adaptation. Also, 59% of the actors have concrete suggestions for adaptation, for example that low-lying areas should be converted to wetlands which would provide water storage as well as environmental and recreational benefits. Another example is the exemption of areas near streams for use in agriculture or for buildings, which has environmental benefits and decreases the risk of flooding important assets. All the specific suggestions for adaptation measures made by participants in the hearing are summarised in appendix A.

Finally, figure 7.4 shows that 71% of the actors encourage baseline adaptation, and 51% have concrete suggestions. The concrete suggestions include, for example, adjusting the plan to the increased leaching of nutrients and pesticides as a consequence of increased precipitation or the increased risk of algae blooms and oxygen depletion owing to increased water temperatures. All the specific suggestions for baseline adaptation made by participants in the hearing are summarised in appendix A.

Approaches	Support	Concrete ideas
<b>Mitigation:</b> Reducing GHG-emissions from water management activities in the RBMPs or implementing measures to enhance the sinks	14% of the actors encouraging climate change in the RBMPs encourage mitigation	5% of the actors encouraging climate change in the RBMPs have concrete ideas for mitigation
<b>Adaptation:</b> Adapting the planned water management activities in the RBMPs to future climate change	75% of the actors encouraging climate change in the RBMPs encourage adaptation	59% of the actors encouraging climate change in the RBMPs have concrete ideas for adaptation
<b>Baseline adaptation:</b> Adjusting the environmental baseline and goals of the plans to reflect the consequences of future climate change	71% of the actors encouraging climate change in the RBMPs encourage baseline adaptation	51% of the actors encouraging climate change in the RBMPs have concrete ideas for baseline adaptation

Figure 7.4 Reflection of the three approaches to climate change in the suggestions from actors in relation to the RBMPs

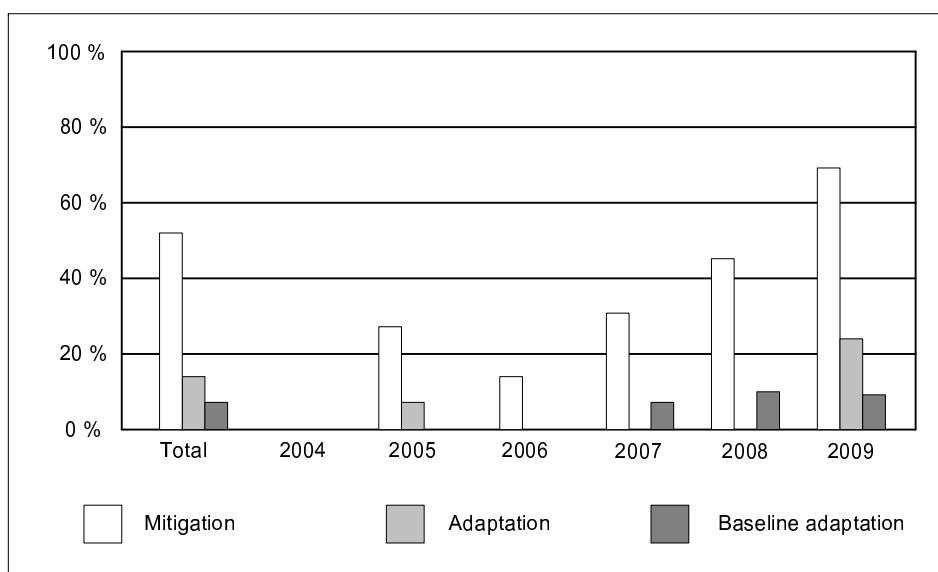


Figure 7.5 Percentage of the analysed reports that integrate the three approaches in total and per year of publication (Larsen and Kørnøv 2010)

### 7.2.3 Climate change in SEA practice

In SEA the focus on the approaches is different from that in the RBMPs. Figure 7.5 shows that mitigation is the most common of the approaches in Danish SEA practice, since it is integrated in more than 50% of the analysed environmental reports. There is comparably less experience with adaptation and baseline adaptation, which are integrated in respectively 14% and 7% of the reports. (Larsen and Kørnøv 2010) The document analysis of environmental reports also shows that mitigation is most often dealt with in relation to transport and energy consumption in buildings. An overview of the mitigation issues dealt with in the environmental reports is provided in appendix B.

Figure 7.5 shows that there has been an increase in integration of climate change, and especially that the integration of adaptation and baseline adaptation has increased in recent years. The document analysis of environmental reports shows that the issues mostly dealt with in relation to adaptation and baseline adaptation are rises in sea level, surface water and extreme precipitation events. An overview of the adaptation and baseline

adaptation issues dealt with in the environmental reports is provided in appendix B.

The analysis also shows that only 12% of the analysed SEA reports integrate both mitigation and adaptation. The lack of integration means that neither synergies nor trade-offs between mitigation and adaptation are dealt with. (Larsen and Kørnøv 2010) These measures could, however, include:

- Synergy: establishment of wetlands as an adaptation measure for reducing risk of flooding; also function as CO<sub>2</sub> sinks.
- Trade-off: pumps meant as an adaptation measure for pumping away water from low-lying areas reducing the risk of flooding. This also means increased energy consumption and thus increased CO<sub>2</sub> emission.

Similar results are found by Wilson (2010), who finds the consideration of interactions between mitigation and adaptation lacking in sustainability appraisals in the UK. Also, only 3% of the reports include both adaptation and baseline adaptation. This is remarkable since base-

## RESULTS

line adaptation can be viewed as closely linked to adaptation – in order to adapt you need to know what you are adapting to. This points to a lack of systematic consideration of the approaches and an unrealised potential for addressing synergies and trade-offs in SEA. This is confirmed by interviews where respondents express limited conscious and systematic considerations of climate change. (Larsen and Kørnøv 2010)

Of course, the relevance of the three approaches can vary between different plans and SEAs. For example, mitigation received less emphasis among the actors in the RBMPs than adaptation and baseline adaptation. This could be a sign that mitigation is less relevant in relation to the RBMPs, or at least this could be the perception of the actors. It is also interesting that the focus on adaptation and especially baseline adaptation is high in relation to RBMPs but low in relation to SEA practice. This can be interpreted as a gap between issues that are important in relation to SEA of the RBMPs, namely adaptation and baseline adaptation, and what there is experience of in SEA practice, namely mitigation.

The question which arises after having looked at how the approaches are dealt with in SEA is why the trends we see are present, and particularly what causes the lack of integration of climate change. This is dealt with in the following sections in the analysis of possible challenges based on theory.

### **7.3 Challenges and focus points for integration of climate change**

This section deals with the research question:

- What are the theoretical challenges and focus points which are relevant when integrating climate change in SEA, and how are these reflected in

practice?

The background to why climate change is integrated or not integrated is analysed by utilising the theoretical framework developed in chapters 4 and 5. The reflection of the challenges in practice is investigated through a document analysis of submissions for an initial hearing supplemented with a survey, as well as a document analysis of SEA reports supplemented with interviews.

#### **7.3.1 Theoretical challenges and focus points**

In the light of the theory of risk society presented in chapters 4 and 5, two main challenges of integrating climate change in SEA are proposed as well as four focus points. These are based on the characteristics of climate change according to the theory, and the consequences these have in terms of science, social definition processes and sub-politics. This is illustrated in figure 7.6.

As can be seen in figure 7.6 it is suggested that one of the challenges of integrating climate change in SEA is delivering assessments and predictions under conditions of complexity and uncertainty which characterise risk. The other challenge is handling increased differences of opinion and debate in the assessment process. The focus points for development which are based on the theory can also be seen from figure 7.6: inclusion of local knowledge and values, addressing uncertainty and dialogue. In the following sections the reflection of these issues in practice is discussed.

#### **7.3.2 The challenge of delivering assessments and predictions**

The challenge of delivering assessments and predictions under conditions of complexity and uncertainty is reflected in the actual situation where the Danish state has excluded climate change as a factor in the RBMPs. This decision is made

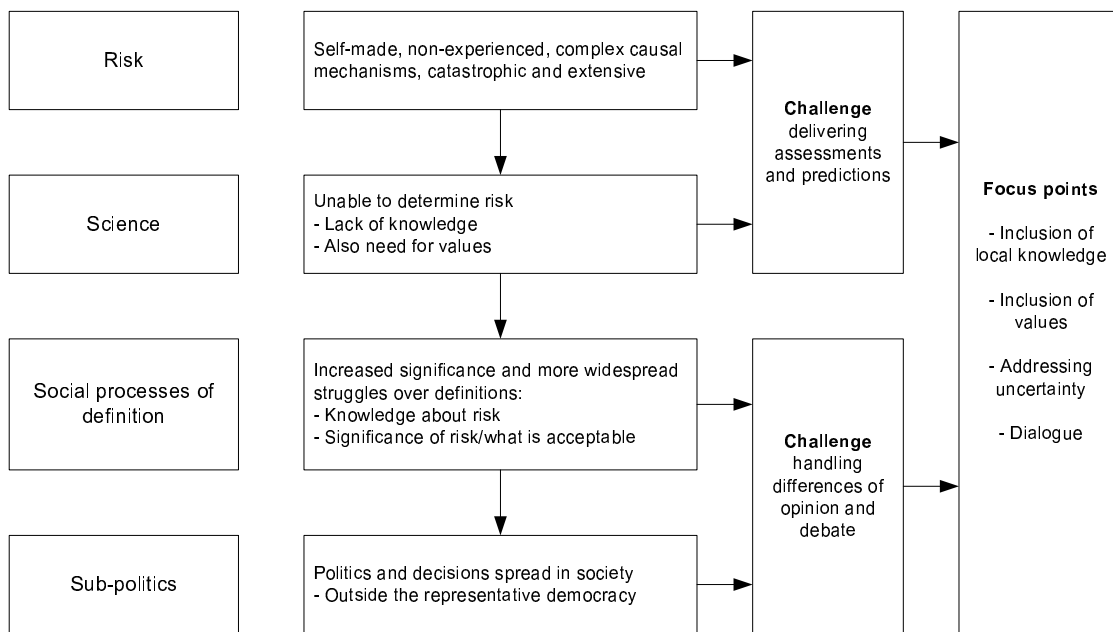


Figure 7.6 The challenges and focus points proposed on the basis of the theory of risk society (see also chapter 5)

on the basis of not having an adequate knowledge base and thus reflects that this is viewed as a challenge by the state – a challenge it does not believe it can overcome at this stage.

Also in relation to the RBMPs, the survey among the Danish municipalities shows that the complexity and non-transparency of climate changes are viewed as the most important challenge to integrating climate change (45% of the respondents), along with the long time horizons (33% of the respondents), lack of unequivocal answers (35% of the respondents) and scientific knowledge (29% of the respondents). All of this relates to and supports the assumption that uncertainty and lack of knowledge constitute an important challenge. (Larsen 2010)

In relation to SEA, the respondents in the interviews also point to uncertainty as a challenge. This is especially in relation to climate change adaptation, because there is uncertainty about the basis, about what the consequences of climate change will be, and thus uncertainty about how to adapt. The respond-

ents also point to the challenge of handling multiple scenarios or choosing one. (Larsen and Kørnøv 2010) It is interesting that the respondents mostly mention uncertainty in relation to adaptation and baseline adaptation compared with mitigation. Given that mitigation is the approach most often addressed, this could reflect that mitigation is more approachable. On the other hand, mitigation is the approach where most experience is gathered, which could account for its being perceived as less uncertain.

### 7.3.3 The challenge of handling differences of opinion and debate

The issue of differences of opinion and debate is reflected in relation to the RBMPs because of the fact that a considerable number of the actors disagree with the state decision to exclude climate change as a factor in the RBMPs (cf. section 7.1.1). The decision of the state is however also accepted by many actors, and for 26% of the respondents in the survey among the municipalities the decision has been the reason for not suggesting an integration of climate change (Larsen 2010).

## RESULTS

According to the survey conducted, debate and differences in opinion are not identified as significant challenges in relation to integrating climate change in the RBMPs (3% of the respondents). Rather, lack of focus on climate change seems to be a relevant factor and a possible challenge, since, according to the survey, a lack of focus can act as a barrier to integration of climate change (54% of the respondents not encouraging climate change inclusion). At the same time the survey shows that only a few respondents consider the public an important driver for the specific choice of encouraging climate change in RBMPs (2% of the respondents encouraging climate change inclusion). Also, a considerable number of the respondents point to focus both in general (31% of the respondents encouraging climate change inclusion) and in the form of previous work in the organisation with climate change strategies (25% of the respondents encouraging climate change inclusion) as a driver for suggesting an integration of climate change. (Larsen 2010) This is interesting in relation to the theory of risk society because it implies that risks are dependent on our focus on and awareness of them. Therefore, the fact that lack of focus is a barrier to integration reflects the theory. This could reflect that the submission for the initial hearing was an administrative exercise rather than an inclusive one. To sum up, this points to focus on climate change as a driver for encouraging inclusion of climate change, and at the same time to possible lack of focus on climate change. Also, nothing seems to point to either focus on or disagreements about climate change as a challenge.

In relation to SEA it appears from interviews that public debate and differences of opinion are not an important factors. The respondents are divided on the question of the involvement of the public in climate change in SEA. Two of them have experienced a lack of inter-

est from the public in climate change in the SEA and one of them that the public have pushed for climate change to be integrated in SEA. (Larsen and Kørnøv 2010) The suggested lack of public interest in some municipalities in relation to both SEA and RBMPs is interesting in view of Beck's theory about sub-politics, which seems not to be entirely applicable in this case. Whether this is caused by a lack of interest in the plans, in SEA or in climate change is not clear. None of the respondents in the interviews mention experience of disagreements among the public, and only one of the respondents mentions disagreements internally in the municipality (Larsen and Kørnøv 2010).

The importance of actual experiences of negative consequences of climate change, emphasised in relation to RBMPs, is also emphasised in relation to SEA, since two of the respondents mention this as a factor motivating their work with climate change. The respondents point to focus on climate change as an important factor since work with climate change in other plans and projects motivates them to work with climate change in SEA. (Larsen and Kørnøv 2010) This emphasises the importance of a general focus on climate change, which corresponds with results in relation to the RBMPs.

### **7.4 Discussion of focus points**

The focus point about addressing uncertainty has been investigated separately as part of the document analysis of environmental reports. As stated earlier, this focus point is emphasised in practice and is the only one it has been possible to investigate within the timeframe of this research project. The study shows that only 3% of the 153 SEA reports mention uncertainty in relation to climate change (Kørnøv and Larsen 2010). This failure to address uncertainty is striking considering the legal demand to include any difficulties in gathering the required information for the environmental report. As

mentioned in chapter 3 and in Kørnøv and Larsen (2010) different reasons for not addressing uncertainty are suggested:

- Cognitive limitations: that humans have a need for simplification
- Conflict avoidance: the need for accountability and consensus
- Instilling trust: the need for confidence and reliance
- Reliance on quantification: the need for quantitative knowledge and methods

Whether these points are indeed reasons for not handling uncertainty in SEA is an issue for further empirical investigation.

It appears that differences of opinion and debate are not so far reflected as an important challenge in practice. Rather, the issue of delivering assessments and predictions under conditions of uncertainty and lack of knowledge is emphasised. This means that the focus point about mediation appears less applicable in relation to the case. It is interesting that some of the respondents in the interviews have experienced lack of interest by the public in climate change in relation to SEA. If this is a broader trend, it is in contradiction with the idea of including actors in terms of local knowledge and values.

The analysis of experiences emphasises another point, which is the apparent lack of a systematic approach to climate change and the different approaches, as stated in section 7.2.3. The investigations carried out during this research project reveal a lack not only of knowledge but of a general overview of the basic issues of climate change. This is important in relation to the discussion on further development and is thus taken forward as an empirically-based focus point. Thus, the reviewed list of focus points is:

- Systematic approach to climate

change

- Inclusion of local knowledge
- Inclusion of values
- Addressing uncertainty

The understanding of current experiences with climate change in SEA and RBMPs as well as the discussion of focus points in this chapter are taken into consideration in the discussion of further development in the following part of the thesis.

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# Part 3

Discussion and conclusion



# Development

## Where can we go from here?

# 8

*In this chapter the issue of further development of integration of climate change in SEA is discussed. The discussion takes its point of departure from the focus points and results of the analysis, and attempts to provide an overview of possible paths for development.*

The main contribution of this research project to further development is the focus points derived. These are issues that could be the focus when integrating climate change in SEA:

- Systematic approach to climate change
- Inclusion of local knowledge
- Inclusion of values
- Addressing uncertainty

However, there may be far from these focus points to operational actions or tools for practice. The question remains how we move forward from this point and is the theme for discussion in this chapter. In section 8.1, operationalisation of the focus points is discussed, and in section 8.2 more fundamental questions about the scope of SEA are touched upon.

The term “we” used in the heading of this chapter refers to the fact that the questions raised here could be relevant for several actors in relation to SEA. They could be issues for further research, and thus for researchers in the field of SEA. They could be for SEA practitioners to consider if they wish to work with integration of climate change in SEA, or they could be questions for decision-makers to consider when they integrate an SEA in their decision-making. They could also be questions for the public to include as part of their engagement.

### **8.1 Operationalisation: unanswered questions**

If the focus points are to be operationalised, there are a multitude of questions to reflect on. This is illustrated in figure 8.1 where questions for reflection and operationalisation are suggested.

The questions in figure 8.1 are examples of issues that can further develop the focus points. In the following sections the overall themes of the questions are discussed.

#### **8.1.1 Definition**

As figure 8.1 suggests, before any of the focus points can be acted on, a process of definition is warranted. This needs, for example, to define what uncertainty is. It can be seen from the deliberations in section 3.2 that uncertainty can be many things and have various sources, so before we address it, it is important to be aware of what is meant. One definition is that in Danish legislation and guidance which focuses on epistemic uncertainty (Kørnøv and Larsen 2010). Uncertainty, however, can also encompass variability; for example, changing preferences. With regard to the focus point of having a systematic approach, the question is also about defining how broad a scope the approach should have: choosing and defining aspects to treat systematically. An example of this is the model developed in this research project (cf. section 7.2.1) encompassing mitigation, adaptation and baseline adaptation. This model could be the point of departure for an approach where systematic consideration of the three aspects and the interactions

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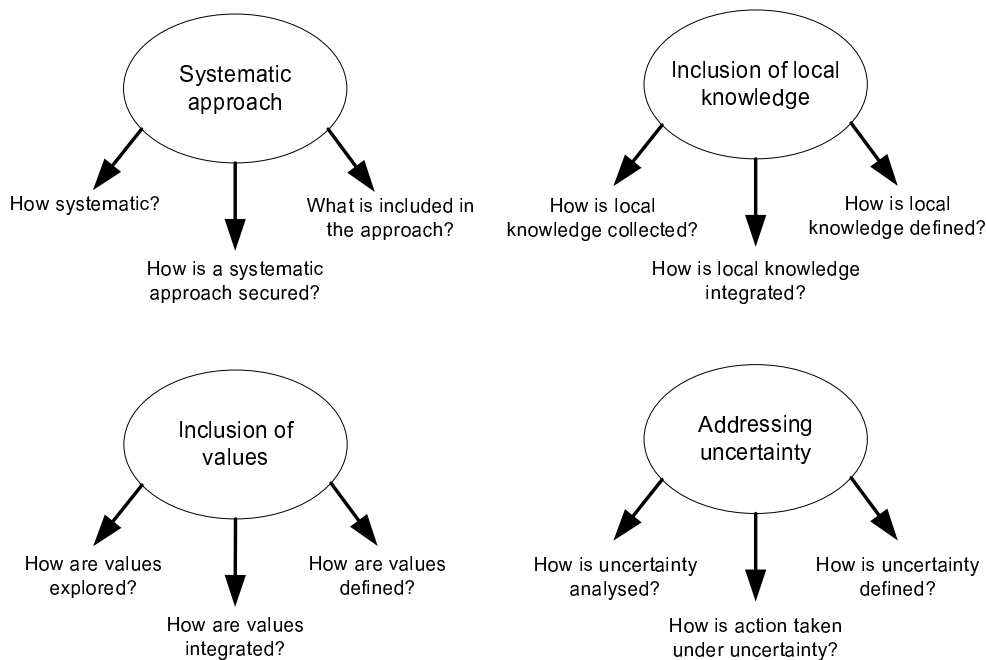


Figure 8.1 Suggested questions for further reflection and operationalisation of the focus points

between them is secured.

### 8.1.2 Collection and exploration

Figure 8.1 also shows questions about how to collect or explore, for example, values or local knowledge. These questions call for consideration of specific methodology such as different forms of participation or methods for analysing uncertainty, whereas other questions call for more procedural or conceptual reflection.

It is clear that the questions posed in figure 8.1 are very different in terms of how instrumental an approach is called for. This is illustrated in figure 8.2.

As illustrated in figure 8.2, regarding inclusion of values, for example, there are

questions ranging from which participation or dialogue tools could be used to explore values to the more ethical aspects of how we should act on this knowledge. In relation to issues of participation and dialogue it is worth noting the discussion in chapter 7 about a possible lack of engagement on the part of the public. If this is a general tendency, it may cause problems in relation to e.g. local knowledge and values. A lack of engagement and participation can be discussed in the light of research on perception of risks such as climate change and the implications of this for action. For example, investigations by Olofsson and Öhman (2007) show that people are prone to being more concerned about near risks of everyday life such as fires and accidents than more distant global risks such as

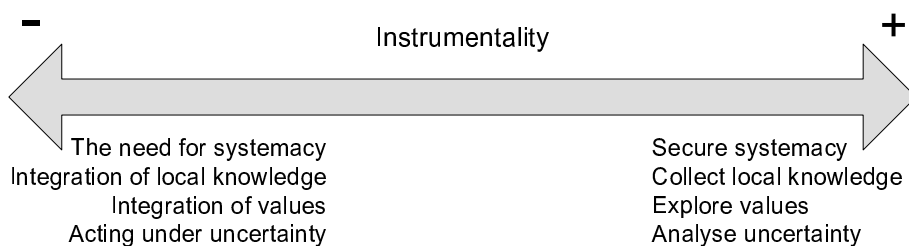


Figure 8.2 Spectrum of instrumentality

climate change. Their investigations lead them to question people's will to engage in issues relating to risks such as climate and thus question Beck's thesis about the emergence of sub-politics (Olofsson and Öhman 2007). These issues could be part of the reason why a lack of engagement has been registered in relation to climate change in SEA.

It should be noted that figure 8.2 is a simplification in that the levels of instrumentality could have been further detailed and dissociated: for example, questions of the need for systemacy might be considered more instrumental than questions about how to integrate values. During interviews with municipalities (cf. section 6.4) questions on the need for instruments or tools were raised in relation to integrating climate change in SEA and planning, and it appears that for some of the municipalities specific tools are not necessarily what is needed. The respondents from Ringsted Municipality state that they have not used specific tools to integrate climate change in their municipal spatial plan and SEA, and that they rather need knowledge about strategies and process (Ringsted Municipality 2010). The respondents from Roskilde Municipality contributed with the reflection that the use of specific tools is dependent on the level of planning. Tools are not necessarily expedient in relation to the municipal spatial plan where they are dealing with very broad issues compared with more local plans, and they might have a greater need for process tools than more "engineering-like" tools. (Roskilde Municipality 2010) These statements add to the perspective that there is a need for development in both an instrumental and a procedural sense.

### 8.1.3 Integration and action

Another issue suggested in figure 8.1 is that of actual integration and action. In relation to values, for example, once there is knowledge of these, how and to

what extent are they then integrated in the assessment? How uncritical should we be of local knowledge? If there are significant local values attached to something do we then protect it by all means? What about the considerations of greater good for society? This is discussed by Therivel (2004, pp. 154-5), who points to the dangers of relying solely on the viewpoints of local actors, since this could mean that "*local interests could outweigh national ones, and cute, furry but common animals (like bunnies) could be given more priority than less lovely but more endangered species (like liverworts)*".

In relation to addressing uncertainty, one course of action discussed at the outset of this research project was that of avoidance in the form of either postponing or ignoring uncertainty (cf. chapter 3). According to the discussions in chapter 3, however, there are also different options for action if addressing uncertainty. Strategies of reduction or resilience can be chosen, that is either to attempt to reduce uncertainty or to accept and deal with it. As stated in section 3.2, uncertainty is not always reducible, and thus consideration of the second approach is warranted. In pursuit of a reduction strategy, there are different methodologies which can be applied; for example, forms of data collection and modelling. Regarding the resilience approach (and partly the reduction approach) a stand has to be taken on how to make decisions under uncertainty; for example, looking for robust solutions (cf. section 3.2) or applying precautionary principles or adaptive management.

Many issues have been discussed in this chapter so far, leading now to the fundamental issue of how wide the scope of SEA should be.

## 8.2 Scope of SEA

The discussions in this chapter so far also

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raise the fundamental question of the scope of SEA: what should be included in SEA? This question arises mainly in relation to issues of values, uncertainty and local knowledge. If these should have a role in SEA, what should the role be? Should they be part of the decision-making or planning process independently of SEA, or perhaps not have a role at all?

Regarding values there are different stands on the issue of the scope of SEA and the interface of decision-making, two of which I will present here. Elling (2008) argues that the values and lifeworlds of citizens should play a role in impact assessment in the form of a dialogue aimed at consensus on the acceptability of environmental problems. Elling (2008, p. 252) emphasises that weighing, balancing or judging interests and values should not take place in the impact assessment process. That being so, the process *"is not aimed at producing a solution to environmental problems associated with the implementation of a specific project, or for instance a planning activity. It is meant to shed light on the likely environmental advantages and disadvantages to the best of abilities through the participants' dialogue about this"*. Rather, balancing different aspects and building a solution should take place in the decision-making process, which should be separate from the impact assessment process (Elling 2008). Richardson (2005) on the other hand argues that it is impossible to separate value judgements from the practice of impact assessment, since they are filled with micro-judgements and *"the inescapable presence of values in the activity of scoping, filtering, and assessing impacts of development"* (Richardson 2005, p. 351). Further, he argues that impact assessment is seen by stakeholders as a possibility to *"persuade, to mediate, and to contest"* and thus forms an arena for value discussions and judgements (Richardson 2005, p. 359).

Thus there are different opinions about whether the role of impact assessment and SEA is objectively providing information or whether it should also mediate and weigh impacts against each other. Such discussions also relate to the questions raised in section 2.2 about rational decision-making processes and SEA. I agree that judgements are and should be made in SEA. The basic term *"significant impacts"*, which are what SEA deals with, in itself suggests a judgement, and if actors are not involved in this, judgements will be largely based on the viewpoints of public servants. My own stand on the basis of this research project must be that fundamentally uncertain issues such as climate change (further) impede the ability to carry out SEA on a scientific and objective basis, which in turn impedes our ability to take improved action. On this basis, I argue that for dealing with issues such as climate change a broad scope of SEA is warranted both in terms of including issues such as values and local knowledge and in terms of not limiting SEA and its judgements to the scientific and objective.

The discussions in this chapter raise many questions, many more than can be answered within the frame of this research project. A first step towards operationalising the focus points, however, could be to relate them to SEA and specifically the SEA process. This is discussed in chapter 9.

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# Discussion

## Climate change in the SEA process

# 9

*In this chapter a first step towards operationalising the focus points is discussed. Based on the previous parts of this thesis, the chapter contains discussions of the relevance of the focus points for different stages of the SEA process and draws up a specification of the focus points.*

This research project so far has provided an understanding of some of the challenges and focus points that an integration of climate change in SEA could entail. In this chapter the relevance of these focus points to the stages of the SEA process is discussed. The stages of SEA dealt with in this chapter are derived from figure 2.2. Screening and scoping are dealt with as one stage and the two hearings are dealt with as one stage, because the issues of relevance for these are the same. The focus points are those described in section 7.7. Thus the stages and focus points discussed here are as follows.

Stages:

- Screening and scoping
- Assessment
- Hearing
- Decision
- Monitoring

Focus points:

- Systematic approach to climate change
- Inclusion of local knowledge
- Inclusion of values
- Addressing uncertainty

It should be noted that the discussion in this chapter is not meant to be an exhaustive or detailed study, nor is it based on extensive literature reviews. Rather it is a discussion on the basis of the understanding gained so far, supplemented with examples and literature, and the result is case-dependent suggestions. The

examples from RBMPs are all derived from the document analysis of submissions for the initial hearing regarding the RBMPs (cf. appendix A). The discussions touch on some of the questions raised in chapter 8. There may be many ways of responding to them, and the discussion in this chapter offers just one suggestion. With regard to the scale of instrumentality in figure 8.2, this chapter is more instrumental than previous chapters since it takes the focus points one step further; it has, however, a procedural focus rather than a focus on specific tools.

### 9.1 Screening and scoping

At both the screening and the scoping stages the focus is on identifying and exploring possible significant impacts of the plan under consideration, in order to determine whether assessment is needed and what the more specific focus of the assessment should be (cf. section 1.2). This research project so far has shown that in Danish SEA there is a lack of systematic consideration of climate change and the different approaches to it, and particularly that adaptation and baseline adaptation are not widely recognised (cf. section 7.2.3). This issue is relevant for the screening and scoping stages, which, for example, can consider whether there are significant impacts in the form of mitigation, adaptation and baseline environment. Thus it is relevant at the scoping stage to consider questions such as:

- Is the plan likely to result in any GHG emissions?

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- Are climate changes likely to affect the plan and goals?
- Are climate changes likely to affect the baseline environment?

In relation to a RBMP, for example, a systematic approach to climate change in scoping might show that relevant issues for assessment are the impacts of planned use of water pumps and the impacts of future extreme rain on sewage leaks in the water environment.

As described, the initial explorations of the possible impacts of, and on, a plan take place in the screening and scoping stages. When we are dealing with risks such as climate change, insight into the values and preferences of actors gains in importance. Insight into values can be used when assessing whether impacts are significant enough to warrant SEA and which impacts are significant enough to be assessed further.

### 9.2 Assessment

The systematic approach to climate change applied in screening and scoping should be carried out in the assessment itself, integrating any climate change issues identified. This means posing the same questions as in the previous section and establishing more precisely how the impacts identified are likely to unfold, e.g.:

- Which GHG emissions is the plan to result in?
- How are climate changes likely to affect the baseline environment?
- How are climate changes likely to affect the plan and goals?

As a result of this exercise, mitigation measures in the form of reducing GHG emissions and adapting goals and activities in the plan are identified where relevant. This could mean, for example:

- Assessing how much CO<sub>2</sub> will be emit-

ted from the planned use of pumps and suggesting more energy-efficient pumps as a mitigation measure

- Assessing how many extreme precipitation events and ensuing sewage leaks are likely to happen in the future and what impacts this will have on water environment and goals; suggesting separate sewage systems as an adaptation measure.

A further initiative to secure a systematic integration of climate change at the assessment stage is assessment of any interaction between the different approaches to climate change (cf. section 7.2.3). In accordance with the Danish legislation on SEA, different kinds of impacts and interactions between impacts, such as cumulative and synergistic impacts, should be included in the assessment (cf. section 2.2). In the case of RBMPs, this could mean considering the energy use of pumps to prevent floods and their ensuing impact on GHG emissions and thus mitigation efforts.

Another issue pointed out earlier in this thesis is the fact that uncertainty connected to climate change constitutes a challenge for SEA and it is suggested that uncertainty should be addressed as a focus point (cf. section 7.3). At the same time uncertainty is rarely addressed explicitly in Danish environmental reports (cf. section 7.4). Uncertainty can be addressed at the assessment stage where it may be encountered in the knowledge base of assessments. Different methods can be used for addressing uncertainty, as suggested by Therivel (2004, p. 147). One of the instances where uncertainty is a relevant issue is in the establishment of the baseline. As stated in section 2.3, uncertainties are attached to the predictions of the consequences of climate change and how they will affect the different elements of the baseline environment and in turn affect the plan and assessment. In this context baseline adaptation and the

uncertainties related to this are relevant. In SEA of RBMPs, for example, this could mean addressing uncertainty in predicting sea level rise and assessing the impacts of this on intrusion of salt water into ground water.

Including local knowledge has been identified as a focus point given uncertainty in the form of a lack of knowledge. The problems caused by lack of knowledge can be seen both in the argument for not integrating climate change in RBMPs and as a challenge in integrating climate change in RBMPs, as pointed out by municipalities (cf. section 7.3). At the assessment stage much knowledge is gathered and it is important to be aware of the possibilities of using local knowledge about the consequences of climate change. For example, for SEA of a RBMP, knowledge could be needed about which areas are likely to flood in the future. Here the experience of farmers regarding which parts of their land have been prone to flooding in the past could be of relevance as a supplement to scientifically-based knowledge. An example of local knowledge in relation to climate change is provided in box 3.

The assessment stage also includes as-

essment of significance of impacts. Similarly to the screening and scoping stages, insight into values can be used in the assessment of significance. This is supported by Therivel (2004, p. 154), who states that as part of an evaluation of significance "*the public or stakeholder can be asked what environmental/sustainability aspects they consider to be the most important*". For example, an activity suggested as part of a RBMP might be to stop cutting weeds in a stream, and a possible, but uncertain, impact of this is that the extreme rain events predicted as a consequence of climate change might cause flooding of a surrounding area. This might not be assessed as a significant impact or risk. If, however, the area is part of local myth, say, and highly valued by locals who view the risk to the area as unacceptable, this can affect the assessment of significance. It should be noted that taking this aspect into consideration adds to the variability uncertainty of assessment, because values and preferences are dynamic and may change over time.

### 9.3 Hearing

The focus point about local knowledge is also relevant for the hearing stages, both the hearing during the scoping and the

#### **Box 3: Example of local knowledge**

In 2004, the English village of Boscastle in Cornwall experienced severe flooding from the River Valency caused by extreme precipitation. In this case, two possible issues of local knowledge were identified by Jennings (2008). First, the most severe flooding occurred at the bottom of the river valley, where originally no houses were built because of historical knowledge and experience of previous floodings. The houses in the high risk area at the bottom of the river valley were primarily built by non-local developers. Second, the closed manor of Boscastle used to maintain waterways and their surroundings; for example, by maintaining slate storm drains and banks directing run-off, and clearing brush from the river banks and valley bottom. This maintenance increased the ability of the river and surroundings to handle the stream flows by decreasing blockages. When Boscastle Manor was closed down, this maintenance ceased for various reasons. This shows the importance of local knowledge of adaptation measures which could help prevent flooding.

(Jennings 2008)

## DISCUSSION

main public hearing. These stages can be seen as a chance to gain insight into local knowledge about climate change issues. For example in relation to RBMPs it might be of relevance to work with local NGOs, since the document study of the initial hearing in relation to the RBMPs shows that NGOs have definite ideas (cf. appendix A). The hearing stages also present opportunities to interact with actors about their values and preferences in order to include them in the assessment.

### 9.4 Decision

Addressing uncertainties, inclusion of local knowledge and inclusion of values also have implications for the decision-making process with which SEA is connected. Addressing uncertainties has to be an acceptable strategy to decision-makers and planners. As stated in section 3.2, there are different reasons for not choosing to address uncertainty; for example, avoiding conflicts. Also, it is important that decision-makers and planners view local knowledge and values as legitimate and valid input to the decision-making process. The investigation in this research project has pointed to some issues related to decision-makers. Two of the important challenges of integrating climate change in RBMPs, as viewed by the actors, are *“providing politicians with unequivocal answers regarding climate change”* and *“long time horizons make it difficult to prioritise climate change politically”* (cf. chapter 7). This indicates difficulties with climate change uncertainties in relation to decision-makers and a

perceived need to provide certainty. The need to accept uncertainty is called for in relation to climate change in other settings: Howard (2009, p. 30) urges planners to *“resist the siren call of sophisticated, detailed, scientific analysis”* when the view of these studies as a prerequisite stands in the way of a decision on how to proceed.

### 9.5 Monitoring

The monitoring stage is important in relation to knowledge about climate change, since one of the benefits of monitoring is to gain more knowledge about actual developments and consequences (Therivel 2004, pp. 179-80; VEJ nr 9664 2006, p. 25). Therefore, as climate changes and their consequences unfold, monitoring can help to build up knowledge about these. The monitoring stage is also important in terms of addressing uncertainty. As ongoing monitoring of impacts increases the knowledge base about actual developments in climate change, this can also be used flexibly for adapting plans and measures as uncertainty is reduced.

A focus on local knowledge is also relevant, since it could be used as a means of monitoring, as in the example in box 4.

### 9.6 Summary

The above discussion is summarised in the following figure 9.1.

Figure 9.1 shows the different stages of SEA, and for each stage the focus points that could be relevant to the integration

#### **Box 4: “Eye on Earth”**

The European Environment Agency has launched an initiative called “Eye on Earth”, also known as a citizen observatory. GIS-based software makes it possible to view scientific observation data as well as citizens’ observations of air and bathing water quality of locations in Europe. Citizens can provide their own observations directly in the online system, which is effectively a two-way communication system.

(European Environment Agency n.d.)

of climate change. It can be noted that many of the issues addressed in this discussion are not new; for example, monitoring has always been important in terms of gathering new knowledge. Integration of climate change in SEA, however, em-

phasises the importance of these issues. That being so, the results presented in figure 9.1 can be seen as ideas for implementing the focus points.

Stages in the SEA process	Relevant focus points	Specification
<i>Screening &amp; scoping</i>	Systematic approach to climate change Inclusion of values	Take different approaches to climate change into consideration Use values to assess significance
<i>Assessment</i>	Systematic approach to climate change  Addressing uncertainty  Inclusion of local knowledge Inclusion of values	Take different approaches to climate change into consideration  Consider interactions Address uncertainty in prediction of baseline and impacts Use local knowledge in assessment of impacts Use values to assess significance
<i>Hearing</i>	Inclusion of local knowledge Inclusion of values	Gain insight into the local knowledge of actors Gain insight into the values of actors
<i>Decision</i>	Addressing uncertainty Inclusion of local knowledge Inclusion of values	Accept uncertainty Accept local knowledge as input to the decision Accept values as input to the decision
<i>Monitoring</i>	Addressing uncertainty Addressing uncertainty Inclusion of local knowledge	Gain more knowledge for future assessments Flexible adaptation Collect local knowledge as part of monitoring

Figure 9.1 Summary of relevant focus points and specifications at the different stages of SEA in the integration of climate change

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This research project takes its point of departure from three central issues: RBMPs, climate change, and SEA. In Denmark it has been decided by the Ministry of the Environment that climate change will not be integrated as a factor when the RBMPs are prepared. This decision was formally taken by the Ministry of the Environment based on an explicit argument of uncertainty in the form of lack of knowledge of the effects of climate change on the water environment. Uncertainty is palpably a barrier to integrating climate change in the RBMPs, as illustrated in figure 10.1.

The decision to exclude climate change from RBMPs is arguably questionable and inexpedient. SEA's overall purpose is to integrate environmental considerations into decision-making and planning processes. Thus SEA could potentially be a tool for integrating climate change in the process of preparing RBMPs is a reason for studying the integration of climate change in SEA. Following this, the research goal is:

*To develop an understanding of the current experiences with integrating climate change in SEA, with the Danish RBMPs as a case and focus on uncertainty, and to discuss paths for further development based on this understanding.*

This goal is pursued through investigating SEA and RBMPs in terms of how much focus there is on climate change. A conceptual model is developed which suggests three approaches to integrating climate change in SEA, and the focus on the different approaches in SEA and RBMPs is investigated. Insight is sought into why climate change is in focus or why it is not in focus. For this purpose a theoretical framework based on Ulrich Beck's theory of risk society is utilised to point at theoretical challenges for integrating climate change that might help explain the current status, as well as potential focus points for further development. The framework is based on the understanding that climate change fits the definition of the risks which characterise risk society.

It is not the purpose of this chapter to recount specific results in detail, as these are reported in chapter 7, but rather to comment on the extended understanding reached through the investigations and view this in relation to the empirical and theoretical points of departure and further development. The chapter first reviews the integration of climate change in RBMP and in SEA, issues which are addressed in sections 10.1 and 10.2. In section 10.3 issues related to uncertainty are reviewed, and reflections on the the-

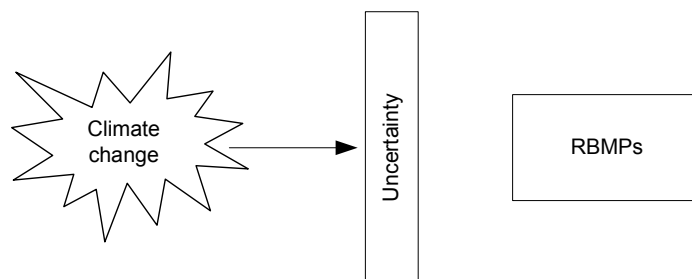


Figure 10.1 Uncertainty acting as a barrier to integration of climate change in RBMPs at state level



## CONCLUSION

oretical framework are presented in section 10.4.

### 10.1 Integrating climate change in the Danish RBMPs

Through investigation of the attitudes of the broader range of actors, a wider understanding of the issue of integrating climate change in RBMPs is gained. First of all, not all actors agree with the decision of the state to exclude climate change from the RBMPs, and in the initial hearing in relation to the plan the regions and municipalities pushed strongly for climate change to be integrated. These and other actors pushing for climate change recognition offer concrete suggestions for improvement of the RBMPs, mainly regarding adaptation and adaptation of the environmental baseline.

In spite of this, the state has not integrated climate change in the drafts for the Danish RBMPs. Figure 10.2 illustrates other ways in which climate change could play a role in the process of preparing RBMPs.

In spring 2010, draft RBMPs were published but not accompanied by the obligatory SEA. Thus at the time of writing, the SEA of the Danish RBMPs has not yet been published, and no statements have been made concerning whether or

not climate change will be integrated. The possibility still remains that climate change could be integrated in the planning process through the SEA. Following the publication of the RBMPs, however, the Danish municipalities will prepare action plans to implement them. According to the survey conducted, the majority of municipalities intend to include climate change in their action plans, and so, as illustrated in figure 10.2, integration of climate change could take place in the action plans and the SEAs of these. The survey among municipalities was conducted in the spring of 2009, before the municipalities had seen the draft RBMPs and had a clear understanding of the task. Further, the task for the municipalities might be more difficult without support from the state and a framework of climate change considerations from the national RBMPs. The decision by the Ministry of the Environment to exclude climate change may motivate the municipalities to do the same, as well as informally legitimise this choice.

These issues can also be viewed as a question of power. The Ministry of the Environment has used their power directly, to exclude climate change from the RBMPs, in spite of the apparently less powerful actors who encourage an integration of climate change. It remains

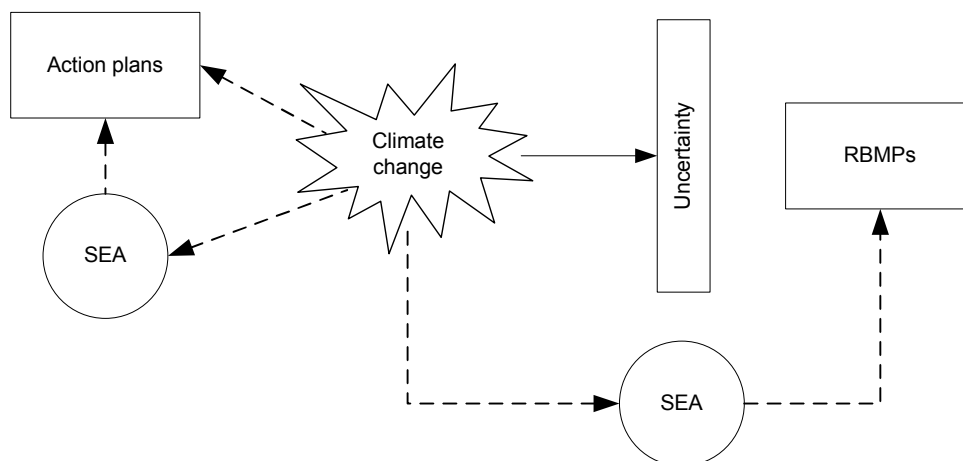


Figure 10.2 Possible ways for climate change to be included in RBMPs and action plans in the further planning process

to be seen whether the Ministry will use this power to also exclude climate change from the subsequent action plans. It should also be noted that the exercise of power from the Ministry of the Environment takes place in interplay with other parts of the state. However, these processes are not transparent and have not been uncovered in this research project. Further the exercise of power, where climate change has been excluded from the political agenda can have more indirect effects in the forms mentioned: a lacking framework and motivation for the municipalities to integrate climate change in their action plans. Based on this, caution might be warranted in terms of the enthusiasm of municipalities for integrating climate change; whether or not this task is actually taken on by the municipalities still remains to be seen.

## 10.2 Integrating climate change in SEA

As a basis for discussing the integration of climate change in SEA a model of approaches is developed. This encompasses the following:

- Mitigation: assessment of GHG emissions resulting from a plan, and how these may be reduced
- Adaptation: the impacts of climate change on the plan and how the plan may be adapted to these
- Baseline adaptation: the impacts of climate change on the environmental baseline for the SEA, and how these might influence targets and assessments.

The model of approaches is perceived to provide an overview of basic ways of integrating climate change in SEA.

Through analysis of Danish environmental reports an understanding of the status of and experience with climate change in SEA in Denmark is gained. Essentially, there is considerable experience of in-

tegrating climate change in SEA in Denmark, but this is largely mitigation rather than adaptation and baseline adaptation. It appears that climate change and especially the three approaches are not considered very systematically – respondents in interviews seemed unaware that they were dealing with distinctly different approaches to climate change. The integration of climate change in SEA is increasing with time, driven by issues such as the wish to future-proof plans, public and political interest, concrete threats, and experience of climate change in other areas.

It is interesting that there is not much experience of handling adaptation and baseline adaptation in SEA, while these issues are most often pointed out as relevant for RBMPs. Thus there seems to be a discrepancy between what experience is needed and what has been built up. This can be viewed as problematic in terms of SEA having the potential to contribute to the integration of climate change in relation to the RBMPs. A comment can be made in this regard. The investigations in this study have not encompassed the quality of the assessments of climate change, and thus the level of experience registered does not necessarily testify to the quality. There are also possibilities for developing the integration of climate change in SEA. In this research project four focus points are identified as possible directions for further development:

- Systematic approach to climate change
- Inclusion of local knowledge
- Inclusion of values
- Addressing uncertainty.

It is important to recognise that climate change is only one of many potentially important environmental factors that could be integrated in SEA. This also emphasises the scoping phase, where it is assessed whether climate change is one

## CONCLUSION

of the core issues to be examined. The issue of which of the three approaches are relevant is dealt with here as well, since they might not always be of equal importance. This could, for example, be the case with the RBMPs, where actors emphasise adaptation and baseline adaptation.

### 10.3 Uncertainty

Uncertainty is a focus of this research project, and it is a challenge in dealing with climate change. In relation to RBMPs, uncertainty is also a barrier given the decision of the state to exclude climate change from the planning process, as illustrated in figure 10.1. Likewise, uncertainty is emphasised by municipalities as one of the main challenges they face in integrating climate change in their action plans. The challenges of dealing with long time horizons of climate change and providing unequivocal answers for decision-makers are viewed as significant in relation to integrating climate change in RBMPs and are indicative of problems facing planners and decision-makers in terms of being explicit about uncertainty. Also, it may be a perceived dependence on scientific rationality and certainty, which has caused the state to exclude climate change from the RBMPs.

Uncertainty is an issue which should be addressed in SEA. In Danish environmental reports, however, uncertainty concerning climate change is very rarely mentioned. The possibility that SEA is not well equipped to handle uncertainty related to climate change can be viewed as problematic in terms of its potential to handle climate change. As discussed in section 3.2 there are several possibilities in relation to dealing with uncertainty. First there is the basic choice of whether or not to acknowledge and address uncertainty; this research project has focused on the instances where uncertainty is not addressed. When uncertainty is not addressed possible strate-

gies are to deny, ignore or postpone dealing with it, and some of the issues underlying this choice could be cognitive limitations, conflict avoidance, need to instil trust and reliance on quantification. If, on the other hand, a decision is taken to address uncertainty, there is a multitude of choices, first whether to reduce uncertainty or deal with it, and beyond this a range of possible methodologies and approaches. It should also be noted that climate change is not necessarily the only uncertain issue in SEA, even if it is an especially prominent characteristic of climate change; other issues might also be uncertain.

### 10.4 Reflections on the theory of risk society

The theory of risk society has overall proven to be a useful framework for discussing climate change in RBMPs and SEA. This is especially true of its focus on and description of uncertainty and risk, which match the challenge which is found to be dominant in the case. Thus, issues such as complexity and lack of knowledge appear to be characteristics of climate change.

Another challenge pointed out in theory is increased debate and differences of opinion. This challenge is found to be less applicable in the case of climate change in RBMPs and SEA, where the municipalities do not seem to consider it problematic. This is illustrated in figure 10.3.

Of course, as stated previously, the municipalities have not yet begun their action plans, and thus their predictions of what will be the most significant challenges could be proven wrong. As indicated in figure 10.3, assessing that the challenge of handling differences of opinion and debate is less applicable in this specific case calls into question the focus point of dialogue, as well as the applicability of sub-politics and struggles over risk definitions in this case.

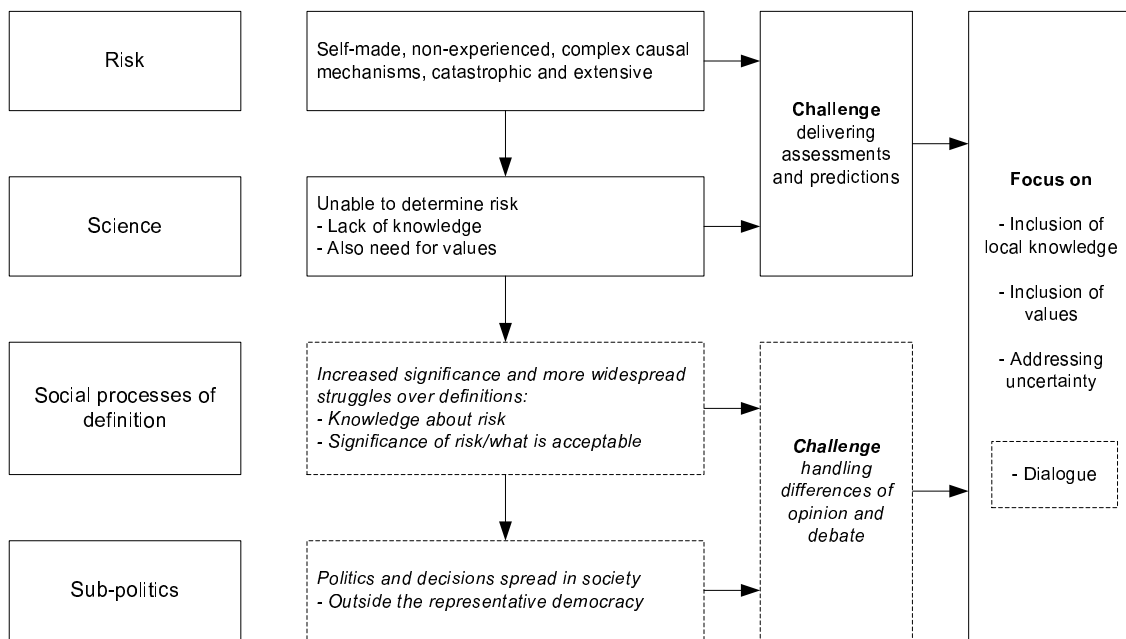


Figure 10.3 Illustration of the less applicable parts of the theoretical framework

In relation to the process of preparing RBMPs, actors, through the initial hearing, have attempted to gain influence over risk definitions and define climate change as an important factor. This can be seen as a struggle over definitions and an example of sub-politics, even if it is unsuccessful. However, the municipalities do not believe that similar issues will challenge their action plans. In relation to SEA, struggles over definitions and sub-politics could be made irrelevant because of a lack of general interest and participation, which was the case in some of the municipalities where interviews were conducted. This all calls into question the applicability of that part of the theoretical framework concerning struggles over risk definitions and sub-politics in the specific case of climate change in SEA of RBMPs and action plans.

The case of climate change in RBMPs is interesting theoretically, because in many ways it reflects the mindset of modern society: for example, the fact that technical arguments and tangible experiences with climate change are important drivers of actors pushing for an integration of climate change in RBMPs. Theoretically, in risk society arguments

about different values and perceptions play a part alongside arguments drawn from technical science. The exclusion of climate change from the RBMPs is an example of a clash between reliance on exact scientific knowledge characteristic of the modern society, and challenges in terms of uncertainty and disagreement characteristic of risk society. This echoes Beck, in that we do not live exclusively in either modern or risk society (cf. section 4.1.2). In this case, the solution to the problem of not being able to base our action on certain scientific knowledge is inaction in the form of excluding climate change from the process. Therefore, in this case, when it comes to action, it is still the mindset of the modern society that prevails. This suggests we should broaden our horizons and scope in order to tackle the challenges of a renewed modernity.



# Appendix



# Appendix

## Climate change in RBMPs

# A

*This appendix summarises suggestions related to climate change from the initial hearing for RBMPs. This encompasses issues of mitigation, adaptation and baseline adaptation, which are suggested for consideration in RBMPs.*

This appendix is based on the document analysis of written submissions for the initial hearing regarding the RBMPs, as described in section 6.4. If more actors have suggested the same or a very similar issue these are summarised. It is not indicated how many actors have suggested each issue.

The actors' suggestions for mitigation measures relevant for the RBMPs are:

- Planting more trees as part of nature restoration projects, which will also function as CO2 sinks.
- Decreasing the amount of nutrients in the environment, meaning less pro-

Sectors	Adaptation measures
Coastal development	Use low-lying areas for recreational purposes rather than construction Put streams in pipes at outflow to the sea (due to sanding up)
Building and construction	Adapt sewer systems: Larger dimensions, separate rainwater and sewage, percolation, re-use of rainwater Construct reservoirs
Agriculture and forestry	Designate agricultural land for flooding areas or wetlands Stop drainage and intensive agriculture in river valleys Establish more non-cultivated rims along streams
Fishery	Establish new areas for spawning to make fish stocks more robust
Nature and nature protection	Secure a dynamic nature and its ability to react to changes Create more interconnected nature to make it more robust Establish new areas for spawning to make fish stocks more robust Secure more pasture or reaping to prevent plants from running wild Adjust nature management Omit maintenance of streams (delay increased run-off) Increase maintenance of streams (improve flow of increased run-off)
Spatial planning	Exempt areas near streams from construction Establish flooding areas or wetlands Establish more permanent vegetation to improve management of extreme precipitation

Figure A.1 Adaptation



## APPENDIX A

duction of the GHG N2O.

The actors' suggestions for adaptation measures are summarised in the following figure A.1. The suggestions are categorised using the categories of adaptation used by the Danish government in

their climate change adaptation strategy from 2008.

The actors' suggestions for which climate changes and consequences, that are relevant for the baseline of the RBMPs are summarised in the following figure A.2.

Basic climate changes	Changes in water	Consequences
Increased temperature	Higher levels of ground water	Changes in ability of streams to handle water flow
Increased precipitation - Increased precipitation in winter - Decreased precipitation in summer	Increase in surface water in winter	Increased leaching of nutrients
Increased extreme precipitation events	Decrease in surface water in summer	Changes in ground water resources
Increased evaporation	Sea level rise	Increased competition for drinking water
		Increased irrigation
		Increased drought
		Increased sanding up
		Increased salt water intrusion
		Increased flooding
		Increased erosion
		Increased oxygen depletion
		Increased alga blooms
		Prolonged growth season with increasing manuring
		Changes in biological conditions
		Decreased dissolution of oxygen in water

Figure A.2 Baseline adaptation

# Appendix

## Climate change in environmental reports

# B

*This appendix summarises the main climate change issues dealt with in Danish environmental reports. This includes mitigation, adaptation and baseline adaptation.*

The appendix is based on the document analysis of 153 Danish environmental reports, as described in section 6.4. The following figures show for mitigation, adaptation and baseline adaptation how many positive, neutral and negative

assessments were made in the environmental reports. Further the figures show the dominance of different impacts; based on how many times the different categories were part of an assessment in the reports.

<b>Mitigation</b>	Positive	Neutral	Negative			
	89	12	70			
	Transport	Buildings	Agriculture	Nature/Forestry	Other	
	72	42	4	13	44	

Figure B.1 Mitigation in environmental reports

<b>Adaptation</b>	Positive	Neutral	Negative				
	12	1	11				
	Sea level	Temperature	Extreme events	Surface water	Ground water	Precipitation	Other
	9	1	10	10	2	4	1

Figure B.2 Adaptation in environmental reports

<b>Baseline adaptation</b>	Positive	Neutral	Negative				
	6	8	50				
	Sea level	Temperature	Extreme events	Surface water	Ground water	Precipitation	Other
	8	5	6	4	2	8	8

Figure B.3 Baseline adaptation in environmental reports



# Appendix

Article from DanskVAND



*In this appendix the article "The role of climate changes in water planning: From initial hearing to municipal action plans" published in DanskVAND in October 2009 is reproduced along with an English summary. DanskVAND is a magazine for members of the Danish Water and Wastewater Association.*

## **Summary**

Climate change is gaining importance on the agenda at the same time as the Danish water sector is implementing the WFD. However, it has been decided by the Danish Ministry of the Environment that climate change will not play a role in the state RBMPs. In spite of this, 22% of the actors participating in an initial hearing have encouraged an integration of climate change in the RBMPs. Especially the regions and municipalities are positive. The actors also contribute with specific suggestions for relevant climate change issues, mostly in the categories of adaptation and baseline adaptation. Here, the majority of contributions come from municipalities and NGOs. The main motivating factors for the municipalities to encourage integration of climate change are that they find it a necessary factor for producing RBMPs, or that they have experienced climate related incidents. Conversely the municipalities see uncertainty and lack of knowledge as well as long time horizons of climate change as significant challenges of integrating it in their action plans. A way for the municipalities to meet the challenges of integrating climate change in their action plans is to collect and share knowledge through cooperations and hearings, for example entering into dialogue with other municipalities, NGOs, consultants or research institutions. Another possibility is being open to and working with different scenarios for the consequences of climate change. Using these and other suggestions, lack of knowledge and uncertainty do not need to be barriers to proper action in the water sector. (The article is reproduced on the following pages)



Sanne Vammen Larsen, civilingeniør, Ph.D.-studerende,  
Rambøll/Aalborg Universitet

Klimaændringer lader indtil videre ikke til at få en stor rolle i den igangværende proces med at udarbejde statslige vandplaner. Omvendt er klimaændringer blevet bragt på bane af aktører i løbet af idéfasen, så måske der er en større rolle til klimaændringer i den fremtidige proces. I artiklen undersøges hvad aktørernes holdninger og ideer i relation til klima er, hvorefter der zoomes ind på kommunernes motivation og udfordringer i forbindelse med inddragelse af klimaændringer i handleplanerne.

## Klimaændringers rolle i vandplanlægningen: Fra idéfase til kommunale handleplaner

Der er i de senere år kommet øget fokus på de mulige negative effekter af klimaændringer, og forskellige organisationer og myndigheder har sat problemet på dagsordenen. Sammenhængen mellem klima og vand er således velkendt. Især har mange af de konsekvenser af klimaændringer som er påpeget i den danske kontekst, sammenhæng med vand. Nogle af de effekter der forventes, er ændringer i nedbørmængder og nedbørmønstre, ændringer i grundvandsstanden, ændringer i afstrømning og stigende havoverflade (Sonnenborg et al., 2006).

Den danske vandsektor står netop nu over for udfordringen med at implementere EU's vandrammedirektiv via de statslige vandplaner og kommunale handleplaner. Staten har indtil videre haft en afvisende holdning over for at inddrage klimaændringer som en væsentlig faktor i vandplanerne. Dette begrundes med manglende fagligt grundlag (Miljøministeriet 2007). På trods heraf har visse aktører fra

vandsektoren, heriblandt DANVA, i vandplanprocessens idéfase påpeget det hensigtsmæssige i at tage klimaændringer i betragtning i de kommende vand- og handleplaner. Dette rejser spørgsmålet om, hvor stor interessen for at inddrage klimaændringer i vandplanlægningen er blandt aktørerne. Hvor mange opfordrer til, at klimaændringer tages i betragtning, og hvilke begrundelser ligger bag opfordringerne?

### Idéfasen: Aktørernes holdninger og ideer

Gennem en dokumentanalyse af aktørernes indlæg til idéfasen opnås et overblik over aktørernes holdninger til klimaændringer i vandplanlægningen (se boks om metode til dokumentanalyse). Figur 1 viser, hvor mange og hvilke kategorier af aktører der i idéfasen har opfordret til, at klimaændringer inddrages i vandplanerne.

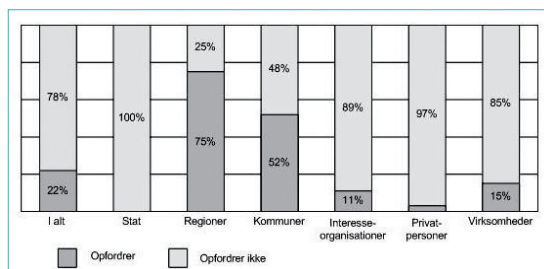
Det ses af figur 1, at 22 % af det totale antal aktører har opfordret til, at klimaændringer indarbejdes i vandplanerne. Det fremgår også, at myndighederne i form af regioner og kommuner er de aktører, der er mest positive over for at inddrage klima i vandplanerne. At kommunerne er så positivt indstillede er særligt interessant, fordi de skal udarbejde handleplaner og derfor har mulighed for at arbejde med klimaændringer i den konkrete implementering af planlægningen.

Ses der på de enkelte indlæg, indeholder mange af dem, udover en holdningstilkendegivelse, konkrete ideer til klimarelaterede emner der er relevante for vandplanlægningen. I figur 2 ses en opsummering af disse ideer.

#### Metode for dokumentanalyse af indlæg til idéfasen

Alle tilgængelige indlæg fra idéfasen vedrørende vandplanerne er indsamlet fra hjemmesiden [www.vandognatur.dk](http://www.vandognatur.dk). I alt 670 indlæg fra 365 aktører er gennemgået, og omtale af klima og klimaændringer er registreret og analyseret. Aktørerne er fordelt på to statslige institutioner, fire regioner, 98 kommuner, 172 interesseorganisationer (inklusive lokale afdelinger), 63 privatpersoner og 26 virksomheder.

## FRA IDÉFASE TIL KOMMUNALE HANDLEPLANER



Figur 1. Procentdel af aktørerne i alt og fordelt på kategorier, som opfordrer til inddragelse af klimaændringer i vandplanlægningen.

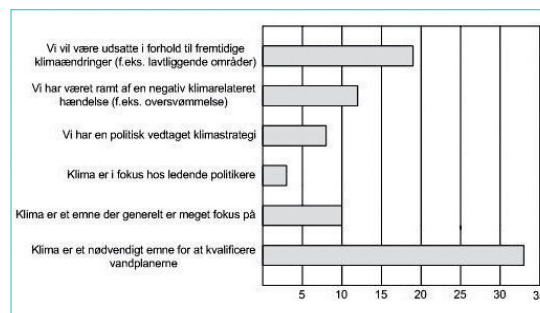
Kategorier	Konkrete idéer
<b>Forebyggelse:</b> Minskelse eller forebyggelse af CO <sub>2</sub> -udledning	Naturgenopretning/skovrejsning: Fastholdelse af næringsstoffer, genopbygning af kulstoflagre gennem optagelse af CO <sub>2</sub> .
<b>Tilpasning:</b> Tilpasning for at undgå eller mindske negative effekter af fremtidige klimaændringer.	Håndtering af øgede vandmængder: Oprettelse af vandopsamlingsbassiner, flere dyrkningsfrie bræmmer, oprettelse af vådområder/oversvømmelsesarealer, tilpasse vandløbsvedligeholdelse, stop for intensivt landbrug i ådale, afgræsning eller høstet i ådale, ændret brug af lavtliggende/vandløbsnære arealer. Tilpasning af kloaksystemer: separatkloakering, nedsvimning og genbrug af regnvand, større dimensioner. Planlægning: Dynamiske mål og planer. Naturpleje: Op- og nedprioritering af naturpleje, skabe grønne sammenhænge for at gøre naturen robust, sikre naturens dynamik og evne til at reagere på forandringer.
<b>Tilpasning af baseline:</b> Fremtidige klimaændringer og konsekvenser heraf som baseline og mål bør tilpasses til.	Øget temperatur: Mindsket opløsning af alt i vandet, ændrede biologiske forhold (f.eks. artsudbredelse), større algeopblomstring, længere vækstsæson i landbruget med øget gødsning, ændret fordampning, ændret vanding i landbruget. Nedbør: Øget nedbør, flere ekstremhændelser. Sligende grundvand. Øget risiko for saltvandspåvirkning. Sligende havoverflade. Højere vandstand i overfladevand. Udtørring af vandløb om sommeren. Øget afstrømning: Udvasning af næringsstoffer, vandføringsevne, erosion/materialevandring. Oversvømmelser: Bebyggelse, natur og landbrug.

Figur 2. Oversigt over konkrete idéer fra aktørerne fordelt på kategorier. Kategorierne er bygget på (Larsen og Kornøv).

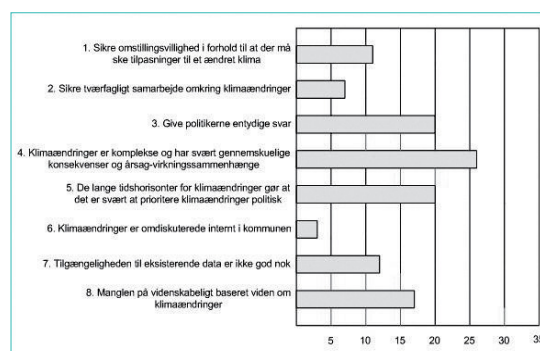
De konkrete idéer er opdelt i tre kategorier: Forebyggelse, tilpasning og tilpasning af baseline, som er forklaret i figur 2. Der er 12 aktører der nævner forebyggelse i deres indlæg, og det ses af figur 2, at det er her, der er færrest konkrete idéer. Således opfatter aktørerne tilsyneladende forebyggelse som det mindst presserende emne i forbindelse med vandplanerne. Derimod nævnes tilpasning af 66 aktører og tilpasning til baseline af 61 aktører, og de opfattes altså som mere væsentlige emner. Dette antydes også i figur 2 af de mange konkrete idéer til, hvilke effekter af klimaændringer der er relevante at tage hensyn til i vandplanlægningen, og

#### Metode for spørgeskemaundersøgelse blandt kommunerne

Undersøgelsen baserer sig på 4 indledende interviews afholdt i efteråret 2008 med kommunale afdelingsledere og områdechefer med ansvar for vandplanlægningen. Interviewene er herefter benyttet som inspiration til at opstille et spørgeskema, som er udsendt i foråret 2009 til ansatte i forvaltningen i de danske kommuner inden for vand, miljø og planlægning. Der er indhentet 58 besvarelser fra 50 kommuner.



Figur 3. Antal respondenter som tilslutter sig forskellige faktorer som motivation for opfordringen til at inddrage klimaændringer i vandplanerne.



Figur 4. Antal respondenter som tilslutter sig forskellige mulige udfordringer ved at arbejde med klimaændringer i handleplanerne.

hvordan planerne kan bruges til tilpasning til effekterne. Ca. 60 % af de konkrete idéer præsenteret i figur 2 kommer fra kommunerne og ca. 30 % fra interesseorganisationerne, således at disse tilsammen står for 90 % af idéerne.

#### Kommunernes motivation og udfordring

Kommunerne adskiller sig altså fra de øvrige aktører ved at udtrykke den mest positive holdning over for klimaændringer i vandplanlægningen, have de fleste konkrete idéer samt ved at have stor indflydelse, idet de skal implementere vandplanerne gennem deres handleplaner.

Motivation i kommunerne til at opfordre til inddragelse af klimaændringer i vandplanlægningen er undersøgt gennem interviews og en spørgeskemaundersøgelse, og resultaterne ses i figur 3 (se boks om metode for spørgeskemaundersøgelse).

Respondenterne er langt overvejende motiveret af en opfattelse af, at vandplanerne vil blive mere kvalificerede, hvis klimaændringer tages i betragtning. Herudover er negative klimarelaterede hændelser enten i fortiden eller i fremtiden en væsentlig motiverende faktor. Der er altså en tendens til,

at helt konkrete faktorer har virket motiverende. Denne tendens skal dog ses i sammenhæng med, at de adspurgte er fagpersoner i forvaltningen, og at der måske havde været større fokus på de mere politiske faktorer, hvis det samme spørgsmål var stillet til kommunalpolitikere.

I forbindelse med spørgeskemaundersøgelsen er det også klarlagt, at 38 af de 58 respondenter planlægger at arbejde med klimaændringer i handleplanerne. En sådan inddragelse af klimaændringer kan naturligvis give anledning til nye udfordringer. Staten har allerede peget på en udfordring i form af manglende fagligt grundlag eller viden. *Figur 4* giver et overblik over, hvordan respondenterne i kommunerne opfatter forskellige mulige udfordringer ved at arbejde med klimaændringer i handleplanerne.

Det ses af *figur 4*, at respondenterne primært tilslutter sig udfordringerne med numrene 3, 4 og 8. Disse udfordringer har alle sammenhæng til manglende viden og usikkerhed, som kan være problematisk både i relation til at sikre faglighed og til at samarbejde med politikere. Herudover tilslutter respondenterne sig udfordring nr. 5, de lange tidshorisonter for konsekvenserne af klimaændringer som et problem i relation til politikere. Mens motivationen hos respondenterne for at opfordre til at arbejde med klimaændringer i vandplanerne primært var faglig, er udfordringerne ved at inddrage klimaændringer altså både knyttet til det faglige og det politiske.

#### Perspektiver for klimaændringer i handleplanerne

Der er i idéfasen udtrykt mange forskellige holdninger til klimaændringer i vandplanlægningen. Især kommunerne er positive over for at inddrage klimaændringer som en faktor i planlægningen, ud fra en opfattelse af at det vil kvalificere planerne. Kommunernes holdninger er specielt interessante på grund af deres kommende opgave med at udarbejde handleplaner, hvilket giver dem mulighed for selv at indtænke klimaændringer i vandplanlægningen. Mange af kommunerne giver udtryk for, at de vil arbejde med klimaændringer i deres handleplaner, hvilket står i modsætning til statens beslutning om ikke at medtage klimaændringer som et specifikt tema i vandplanerne.

Idéfasen er dog ikke begrænset til udmeldinger om holdning til klimaændringer. Der er også fremkommet konkrete idéer til emner der kan medtages i planlægningen. Samtidig tilkendegiver kommunerne dog, at manglende viden og usikkerhed er væsentlige udfordringer i forbindelse med deres arbejde med klimaændringer, og spørgsmålet er så, hvordan kommunerne kan tackle disse udfordringer?

En måde at tackle det på kan måske være at indhente og dele viden via samarbejder og høringer, som en del af kommunerne allerede har gjort i forbindelse med idéfasen. Det kunne f.eks. være samarbejder med andre kommuner, interesseorganisationer, konsulenter, eller forskningsinstitutioner. Interesseorganisationerne har i undersøgelsen vist sig at have mange konkrete idéer på klimaområdet, så der kan være god grund til at indgå samarbejder med disse. En anden del af løsningen kan måske være at arbejde med fleksibel planlægning og fleksible målsætninger, som nogle af kommunerne har foreslået i idéfasen. Dette kan eventuelt kobles med at arbejde med forskellige scenarier for udviklingen. Ved at skabe åbenhed og mulighed for at rette planer og målsætninger til, efterhånden som ny viden bliver tilgængelig, behøver manglen på viden ikke at være en barriere for handling på vand- og klimaområdet. ■

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#### Baggrund for artiklen

Artiklen er blevet til i forbindelse med et Ph.D.-projekt omkring klimaændringer i strategisk miljøvurdering af vand- og handleplaner. Ph.D.-projektet udføres i samarbejde mellem Rambøll og Aalborg Universitet.