Kennis voor Klimaat

The governance of adaptation to climate change

A collaborative action research programme to develop and test legitimate, effective and resilient governance arrangements for climate adaptation

Midterm review

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A collaborative action research programme to develop and test legitimate, effective and resilient governance arrangements for climate adaptation

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Introduction

Adapting to possible impacts of climate change presents a demanding challenge to the existing governance structures and arrangements. It raises normative questions (e.g. who should be responsible?) and may require innovative experiments, leadership approaches and process designs. Furthermore, governments may need to reconsider the economic instruments and governance structures that allocate risks and responsibilities between public and private partners. To complicate matters even further, climate change is surrounded by uncertainties, contested knowledge and differences in stakeholders' perspectives. Hence, the specific complexities of adaptation governance call for new advanced governance knowledge. In that sense, the governance of climate adaptation also poses a new scientific challenge.

The Knowledge for Climate, Governance of Adaptation programme aims to integrate existing knowledge from the fields of public administration, economics, political science, spatial planning, law, environmental studies and psychology. Through close cooperation with hotspots, this programme will add new empirical evidence to test innovative theoretical propositions about the governance of climate adaptation. How this is done in the past two years, and what our plans are for the coming two years, is described in this report.

Reading guide

The report starts with an introduction to the general vision of the programme. It does so by explaining the need for new governance arrangements when dealing with adaptation to climate change (section 1.1). In section 1.2 the overall theories that form the foundation under the work of this theme. The research questions are formulated in the last section (1.3).
The organisation of the programme's consortium is detailed in chapter 2, by giving an overview of the different work packages and organisation structure.
Collaboration between scientists and policy makers is an important part of our approach. Chapter 3 describes how this collaboration with hotspots, Delta Programme and other policy projects is executed. It starts with a description of the main proposed method for the science policy collaboration; collaborative action research. Section 3.2 explains how collaborative research is reconciled in existing policy and research institutions. High ambitions were set beforehand, which unfortunately had to be adjusted (section 3.3).
Chapter 4 describes the cooperation with our international partners from the UK, Sweden and Germany. This collaboration makes a comparative analysis possible of the climate adaptation policies of the four countries, which is described in section 4.2.
Chapter 5 highlights the scientific results of the four work packages that study the four research questions; organizing connectivity (section 5.1), (re)allocating responsibilities and risk (5.2), normative principles (5.3) and dealing with controversies (5.4). Each of these sections will provide you with the main scientific insights and results, the main contributions to scientific, policy and societal debates, and the knowledge gaps and key questions for the remaining two years.
The report finishes with the overall, preliminary, conclusions of the project and an outlook of our plans for the rest of the project (chapter 6).

1. Vision on the theme and key research questions

> *"Scholars are slowly shifting from positing simple systems to using more complex frameworks, theories, and models to understand the diversity of puzzles and problems facing humans interacting in contemporary societies" … "When the world we are trying to explain and improve, however, is not well described by a simple model, we must continue to improve our frameworks and theories so as to be able to understand complexity and not simply reject it".* (Elinor Ostrom, Nobel prize winning lecture 2009).

1.1. Adaptation as matter of governance

Adaptation to climate change is a relatively new topic on policy agendas throughout the world. Reinforced by the IPCC's Fourth Assessment Report (IPCC, 2007), there is increasing recognition of the need for society to adapt to the (projected) impacts of climate change. Societies are facing three key challenges: 1) developing and implementing infrastructural adjustments, such as enhancing dykes or creating water storage capacity; 2) enhancing broader processes of societal change, such as agricultural transitions or new spatial planning concepts; 3) increasing the adaptive capacity of society to deal with unexpected and unpredictable future changes climate change and vulnerabilities.

Because of the high stakes and many uncertainties surrounding climate change, climate adaptation has been called a "*wicked problem par excellence*" (Davoudi, et al., 2009; Jordan, et al., 2010). Wicked problems are highly complex problems in which all aspects are interlinked. This has consequences for the governance questions that emerge in connection with climate change. Dealing with adaptation successfully does not only depend on the ability to develop advanced adaptation strategies, based on the latest scientific insights with respect to climate change, but also on the ability to adjust adaptation to the demands of the complex institutional context in which these strategies have to be developed, implemented and evaluated. Governance of adaption will face all the usual difficulties, barriers, and opportunities of tackling wicked problems, such as changing political and societal agendas, power-play, conflicting interests, the need for lengthy negotiations, resistance from key groups, and windows of opportunity. On top of that, adaptation to climate change poses some specific, particularly demanding, governance challenges and dilemmas, like the context of institutional fragmentation as climate change involves almost all policy domains and governance levels; the lack of an institutionalised policy domain; the persistent uncertainties about the nature and scale of risks and proposed solutions; and the inevitable controversies as urgencies vary and stakes are high (Termeer, et al., 2011; Termeer, et al., 2012).
Therefore, climate change is not only a technical issue but above all a demanding matter of governance stretching from the global to the local scale (Adger, et al., 2003). The mission of this programme is to contribute to scientific progress, to societal debates, and to the reflective practice of professionals (involved in the Dutch Hotspot areas and the Delta programme) by studying the governance of climate adaptation.

1.2. Underlying theories: Complex frameworks to understand complex institutions

Up to now, most climate adaptation literature is dominated by natural sciences. Within this body of literature the attention for governance questions is increasing (Nieuwaal, et al, 2009). Given the wicked, complex nature of climate change and its governance issues, there are no easy fixes and several dilemma's come to the fore. Different theoretical viewpoints can be taken; this section will describe which theoretical views we take in our research.

Most of the scholar work on governance of climate adaptation departs from a monocentric perspective (Ostrom, 1972), also referred to as the government perspective (Rhodes, 1997), hierarchical governance (Hill and Lynn, 2004), or command and control systems of governance (Kooiman, 1993). Following this perspective, the state is the centre of political power and authority, policy processes are orderly phased, and the technical rationality dominates. The state will, on the basis of scientific research and considering the interests at stake, choose the best technical climate adaption strategy. Afterwards this will be implemented and evaluated. Generally, the monocentric approach is evaluated as not appropriate for coping with wicked problems (Duit and Galaz, 2008; Koppenjan and Klijn, 2004). This approach may serve its purpose for tame problems, but does not result in lasting solutions for wicked problems.

The alternative perspective, also referred to as the polycentric (Ostrom, 1972) or the governance perspective (Rhodes, 1997; Pierre, 2000; Kooiman, 2003), departs from complex systems including many centres of power tied together through dynamic interdependencies, apparently chaotic policy processes and a variety of competing rationalities. Following this perspective, successfully adapting to climate change depends upon the involvement of many public, private and societal actors with their own ambitions, interests, beliefs, knowledge and resources; upon being sensitive for policy dynamics and windows of opportunity; and upon fitting climate change into the formal and informal rules of existing institutions. This governance approach is much more promising for dealing with wicked problems (Duit and Galaz, 2008; Koppenjan and Klijn, 2004) and therefore forms our perspective.

However, when discussing this perspective with policy makers and other scientist three dilemmas come to the fore:
A first dilemma arises when the involvement of an array of stakeholders and networks is perceived as giving rise to opposition or delay. In response, more centralised and top-down forms of governance may appear attractive, as — from this perspective — fragmented governance structures will not be able to provide the capacity required to tackle such an important issue as climate change. However, in our view this multi-actor, multi-sector, multi-level and multi-rationality governance world forms the inescapable context for climate adaptation, because the ramifications of climate adaptation stretch across the traditional jurisdiction scales (of state, province, municipality), the routines of organizations, the boundaries between the public and private sector, and the relation between authorities and civil society. Furthermore, fragmented networks can provide the governance capacity to enable climate adaptation, as they are inherently characterised by redundancy and thus tend to be more resilient.

Table 1: Overview of dilemma's between monocentric and polycentric governance views.

Monocentric government view	**Polycentric governance view**
– Climate change is too important for experimenting with new governance forms	– Multi-actor/sector/rationality is inescapable context
– Fragmented structures and involvement of networks lead to delay	– Fragmented networks can provide adaptive capacity
– Governance knowledge used in implementation phase	– Governance knowledge integral part of whole process
– Assessment of strategies on technical arguments only	– Strategies should be legitimate, effective and resilient

A second dilemma concerns the timing of involving governance knowledge. Departing from a monocentric perspective, governance knowledge is preferably used in the implementation phase, thus after the best adaptation strategy has been chosen. At that moment governance researchers are expected to provide tools to increase the effectiveness of implementation. However, when good outcomes need to be achieved in a complex institutional context, the way strategies are being developed is very important. Separating the development of an adaptation strategy from the governance processes is not very fruitful. Advanced governance arrangements are regarded as ways to enrich policy proposals, to increase the chance on realisation, to mobilize necessary resources and to decrease the perceived gap between government, business and society. In our view, governance arrangements need to become an integral part of the adaptation strategy.

A third dilemma involves the assessment of climate adaptation strategies. The arguments outlined above have significant consequences for evaluating adaptation strategies. Assessments based on technical arguments only (does it work with respect to climate adaptation?) do not suffice. In our view, good governance of adaptation should be: (a) legitimate, i.e. ensuring transparency, accountability, fairness and equity; (b) effective, i.e. address the adaptation task decisively and efficiently through the right mix of norms, instruments, strategies and processes, and; (c) resilient, i.e. both enabling autonomous adaptation and building long term adaptive capacity.

1.3. Aims and research questions

Given the relatively recent recognition of the need for adaptation, the still emerging and contested policy frameworks, the dominant position of natural sciences, the incline towards simplified monocentric government concepts, and the above mentioned dilemmas, it is no surprise that our understanding of the governance of adaptation is still relatively limited and evolving. The twofold aim of the governance of

adaptation programme is (1) to develop in-depth knowledge of the governance of adaptation in the context of complex institutions, and; (2) to use these insights to develop and test governance arrangements that will contribute to adaptation to climate change.

It will do so by addressing the following key questions:

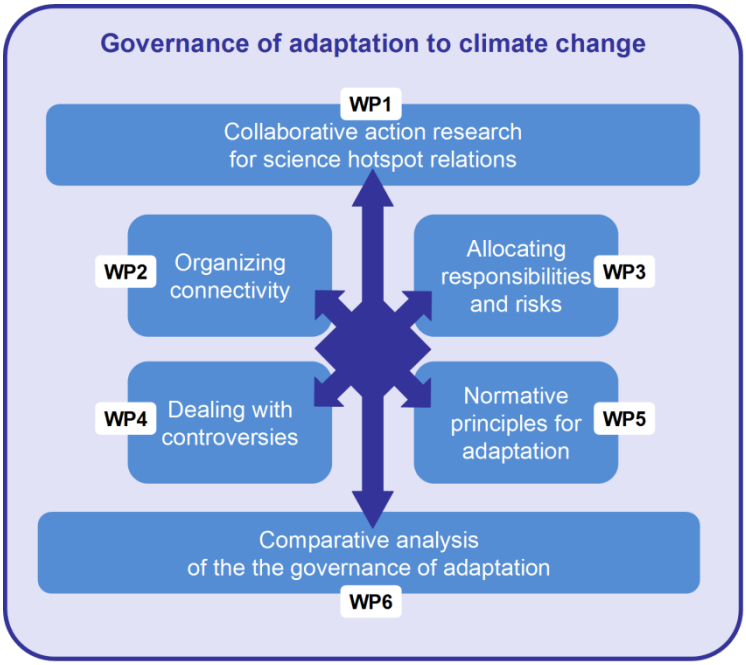
1. Why and to what extent do governance arrangements, such as innovative experiments, leadership approaches and process designs, enhance connectivity within fragmented governance systems, and how can these insights be translated into design principles for organizing climate adaptation arrangements with a high connectivity?
2. Which economic instruments and governance structures to allocate risks and responsibilities between the public and the private are promising, and how can they be implemented in the Dutch situation?
3. What are the consequences of uncertainties, stakeholders' perceptions and contested knowledge, and which methods help to cope with them in decision-making processes?
4. How can the principles of legitimacy, effectiveness and resilience be elaborated and what are the implications for the governance of adaptation?

When comparing these aims and questions with those of our full proposal, the focus on analysing and developing in-depth knowledge has become more important at the expense of designing and testing arrangements. We aimed for a very strong action research component, with strong collaboration with stakeholders, but for several reasons this proofed difficult to arrange at this moment in time(see section 3.1). Therefore we concluded that a focus on testing concepts and insight in hotspots and with hotspot actors is premature in many cases.

2. Approach and organisation

The governance of adaptation programme consists of six work packages (WPs, see figure 1). We set up two methodological WPs. WP1 deals with the development of a collaborative action research programme that facilitates and directs the interactions between hotspots and research projects (see chapter 3). WP6 deals with international comparative research and exchange of learning experiences across regional and national boundaries (see chapter 4). Four key WPs address the four research questions. Each consists of two to four projects (see appendix A). Each project conducts research in at least three different geographical areas, preferably including one international case study. WP2 studies research question number one, via four strategies that may be utilized to organize "connectivity for adaptation": experiments, multifunctional land use, leadership and multilevel governance. WP3 studies the allocation of responsibilities and risk (research question 2) with the use of a conceptual framework consisting of six criteria, grounded in three different disciplines,: public administration, law and economics. WP4 works on the third research question by studying what the consequences are of uncertainties, stakeholders' perceptions and contested knowledge, and which methods help to cope with them in decision-making processes. WP5 studies normative principles for adaptation (research question 4), using a normative framework based on three principles: resilience, effectiveness and legitimacy. As this normative framework has implications for the other work packages as well, it has been developed in collaboration with WP4 and especially WP3. The main scientific insights and results of the four key work packages is presented in chapter 5.

Figure 1: overview of work packages



An enthusiastic interdisciplinary team of researchers from 8 universities collaborates to realise the ambitions of the governance of adaptation programme. The research team consists of 7 professors, 7 senior researchers, 2 post docs and 8 PhDs, representing the disciplines of public administration, economics, political sciences, spatial planning, law, environmental studies and psychology.

To guarantee quality, coherence, added value of the programme and a good administrative and organisational coordination the following management structure has been set up. The consortium leader takes the overall lead of the programme and is the first contact for Knowledge for Climate. She is being assisted by a project manager and a post doc. The project manager facilitates the administrative and organisational matters of the programme, such as organizing meetings and workshops, finances, and communication. In the first year of the programme, the post doc spent most of his time in developing relations with the hotspots and setting up action research projects with PhDs. A new post doc started in August 2012 and will focus on developing synthesis reports and articles.

A Daily Management team, consisting of senior researchers of each institute, meets every 3 months to discuss the progress of the PhD projects, solve practical problems, coordinate activities and prepare for collective events and publications. The main task of the group of professors involved is to increase the societal and scientific value of the programme. They meet twice a year.

The Knowledge for Climate organisation has set up a stakeholder steering committee, chaired by Prof. Dr. R. in 't Veld. This committee meets twice a year to discuss progress, to guarantee quality and to further improve dissemination. Due to job rotations and busy schedules, the attendance during these meetings was rather low. Currently, we are looking for ways to improve the added value of the steering committee for both researchers and stakeholders.

The international committee consists of the three international partners. Their task is to reflect on the international scientific quality and to bring in comparative cases. Members of this committee mostly have e-mail and telephone contact with the leading researchers.

The whole team of researchers meets twice a year, once on the yearly consortium day and once as part of an international workshop. In addition, the PhDs have organised a reading club in which they discuss new and classic journal articles.
We started the programme with both a national and an international kick-off meeting. Besides getting to know each other we elaborated on our theoretical framework. This resulted in a joint publication in the journal of Climate Law (Termeer, et al., 2011) as part of a special issues, edited by the consortium.
In the first year six position papers have been written by the work packages, to provide guiding principles for the other work packages and projects. These papers have been discussed during our second consortium day.

Several of the projects are conducted in the hotspots. In these cases, a project team is set up with key stakeholders and researchers. Besides in the hotspots, several projects are conducted in the Delta programme. Although there have been contacts and discussions with other Knowledge for Climate themes, actual cooperation in projects have been limited.

3. Science-policy collaboration

3.1. Collaborative action research

At the start of the programme we set very high ambitions regarding science policy collaboration. Through an innovative collaborative action research programme we aimed to take guidance from the hotspots as the primary source of questions, dilemmas and empirical data regarding the governance of adaptation. We wanted to collaborate with them in testing insights and concepts and evaluating their usefulness. Scientific quality should be achieved by placing this co-production of knowledge in a well-founded and innovative theoretical framework, and through the involvement of the international consortium partners.

Collaborative action research theories provide the methodological basis for the desired science-policy arrangement (Huntjens, et al. (2011) gives an overview of collaborative action research theories and methods). Collaborative action research is an umbrella term for methodologies that aim at intensive interactions between scientists and practitioners, in our case mainly policy makers. The core philosophy is that the involvement of practitioners enhances the development of actionable knowledge, while scientific researchers provide the scientific underpinning of actionable knowledge and guard the development of scientifically sound theoretical knowledge. Close interaction between researchers and practitioners improves not only the utilization of scientific knowledge, but also its quality in terms of its sensitivity to contextual factors, the incorporation of local knowledge and its relevance. By engaging in complex governance systems, researchers are better able to understand their dynamics. Ideally, collaborative research starts from a joint assessment among 'researchers' and 'researched' of how the central problems should be defined.

3.2. Reconciling collaborative research in existing policy and research institutions

During all phases of the programme (pre-proposal, full proposal, projects) stakeholders were the primary source of questions. Hotspots were invited to give their views from the start, to jointly develop the action research strategy with researchers and to participate in the interpretation of the results. This also included planning and implementing actions (in this case for regional climate adaptation) and documenting how these actions proceed and what they result in, in order to take new and better-informed actions.

When the full proposal was being worked out, seven (out of eight, see Appendix B) hotspots decided governance knowledge to be important for their regional adaptation policies and consequently promised to search for financing and projects. In this phase we identified their practical governance questions and translated them into the research questions of the full proposal. Consequently, the questions from the hotspots, including their local/regional orientations, have highly influenced the full proposal. The first steps were taken to define the projects in each hotspot and to search for co-financing together with hotspot partners.

However, despite the advanced programme design, the involvement of stakeholders in all phases, the initial participants' enthusiasm and the time consuming efforts of both researchers and stakeholders, the collaborative action research programme progresses with difficulties. In one hotspot only (Open waters and peat areas) we managed to define real action research projects, to organize local commitment and to get started. In three hotspots (Rotterdam, Dry rural areas, South West Delta) projects have been set up, but with less intensive relations between researchers and hotspot stakeholders. In other hotpots (Major Rivers, the Hague region, Wadden Sea) no projects have been started yet and negotiations are still on-going. Fortunately we managed to organize some collaborative research projects with parts of the Delta Programme, like Lake IJssel, Major Rivers and South West Delta.

3.3. Adjustment of ambitions

Because further delay of PhD-research was not desirable any longer, we decided to adjust our action research ambitions and to 1) start with action research projects in the hotspot with enough commitment; 2) start with regular research projects (no action research) relevant for hotspots and research questions; 3) search for action research projects with enthusiastic people involved, but outside the hotspots and without co-financing.

Although only few action research projects were set up, the involvement of stakeholders in the first phases of the programme did have important influences on the research questions. The questions from

stakeholders resulted in a stronger focus on the first adaptation challenge: developing and implementing infrastructural adjustments. The challenges of broader processes of societal change and of increasing the adaptive capacity of society got less attention. Furthermore, stakeholder input resulted in a focus on the regional scale, as it was hard to gain support for case studies that crossed the borders of hotspots. Organizing support for transboundary climate adaptation was even worse.

3.4. Main Insights

Given our high ambitions to develop innovative collaborative arrangements, we have tried to understand why the collaborative part of our programme progressed with difficulties. We revealed the following insights regarding science-policy collaboration:

Firstly, it proved to be hard to reconcile innovative knowledge partnerships into existing institutions in the field of climate adaptation. Many of the assumptions underlying the collaborative arrangement (e.g. mutual commitment, room for change, open deliberation) conflict with the routines and beliefs of both the policy institutions, characterised by a logic of decision-making, and the research institutions, characterised by a logic of knowledge-production.
Secondly, when we started the programme the issue of climate change was high on the agenda of ministries, local governments and society. However, due to several developments (financial crisis; budget cuts; merging of ministries; a new coalition government that frames climate change as a left wing playing tool; a lack of recent climate related crisis) climate change disappeared from the agenda and even has become a contested issue.
Thirdly, the Knowledge for Climate programme required local governments to co-finance the action research projects that focused on their research questions. Although the involved civil servants co-produced research questions it proved to be very hard for them to organize political commitment for additional resources for climate research in general and governance research in particular. It resulted in a time consuming and less inspiring process between researchers and hotpots.
Fourthly, the co-production of governance research questions was hampered by different interpretations of the governance challenges at stake. Whilst stakeholders inclined to formulate instrumental questions, researchers emphasized the wickedness of the problem and the complexity of the institutional context. The fact that that most hotpots were represented by a climate knowledge actor, often with a background in natural sciences, instead of people actively involved in policy process further complicated the process of co-production.

These insights were presented at the Amsterdam climate adaptation governance conference of March 2012 and will be submitted to a journal. Many scholars like Pielke, Pahl-Wostl and Hoppe support collaborative arrangements between science and policy as a way to address the specific challenges of adaptation to climate change (e.g. Driessen et al, 2010). The paper assumes that tensions will occur between the assumptions underlying the new collaborative arrangements and the rules and routines of the involved organisations and their institutional environment. Revealing institutional mismatches is one thing, overcoming them another. Therefore the paper also analyses as to what extent and under which conditions it is possible to reconcile innovative knowledge partnerships into existing institutions in the field of climate adaptation.

4. International collaboration

4.1. Activities

The discussions, challenges and choices on governance of adaptation that the Netherlands is facing are not unique to our country. This project seeks to facilitate lesson drawing and exchange with other European countries that are also struggling with these issues. The following international partners are therefore involved in this consortium:

(1) The Tyndall Centre for Climate Research, specifically the University of East Anglia (UK).
Key people: Dr. Tim Rayner, Prof. Neil Adger and Prof. Mike Hulme.

(2) The Stockholm Resilience Centre (Sweden). Key people: Dr. Per Olsson and Dr. Victor Galaz.

(3) Carl von Ossietzky Universität Oldenburg, specifically the Oldenburg Centre for Sustainability Economics and Management (CENTOS)(Germany). Key people: Prof. Dr. Bernd Siebenhüner.

In the first year we organised visits to all three partners. The aim was to further facilitate scientific exchange between the Dutch researchers from our consortium and the international partners. In October 2011 we organised an international writing workshop. We invited our international partners to join us in writing a comparative paper on adaptation policies in the Netherlands, UK, Sweden and Germany. It resulted in a paper (Huitema, et al., 2012).

In March 2012, the international symposium "The Governance of Adaptation" took place in Amsterdam. 205 colleagues responded to a Call for Papers, of which 60 were selected for presentation after a rigid double blind peer review process. The symposium marked one of the first opportunities for the growing group of scholars who address governance issues in the field of climate change to focus purely on their topic. Despite the fact that governance issues are a key component of the problematic climate change adaptation, not much networking, synthesis and exchange has taken place yet, certainly not internationally. This is partly caused by the fact that climate change adaptation is perceived as a local issue, limiting the potential for the advancement of (universal) scientific knowledge. Together with the key note speakers we are developing a proposal for a special feature for Ecology and Society that will include the best papers of the conference.
We will have a 'climate change governance' session as part of the Academic Programme for the ECPR's 7th General Conference (ECPR: European Consortium for Political Research, 5-7.9.2013, Bordeaux). We also aim to be present and visible at the Hamburg Climate Adaptation Conference in 2013 (ECCA, European Climate Change Adaptation Conference, 18-20.3.2013, Hamburg).

4.2. Comparative analysis

For a comparative analysis, the climate adaptation policies in four countries _ Sweden, Germany, UK and the Netherlands — are presented and compared (Huitema, et al., 2012). The most salient findings from this comparison are as follows.

When it comes to problem framing, all four countries have tended to treat adaptation as a developing country issue for much of the 1990s. Extreme weather events seem to have been instrumental in driving home the message that climate adaptation is also necessary in developed countries. Of the four countries analysed, progress towards an independent policy sector seems to be most advanced in the UK, for instance because it has the Climate Change Act of 2008.

Mainstreaming is a popular approach in the other countries. In terms of levels and scales; all countries see adaptation largely as a local or regional issue, but the division of responsibilities still differs somewhat. When it comes to timing and sequencing, all countries show a mixed bag of authorities that pro-actively have started developing climate policies, and authorities that take a wait-and-see approach.

As for modes of governance, it is important to state that in several countries there is some level of trepidation accepting an active role for the state (government) in providing for climate adaptation. Given the emphasis on the "own initiative" in Germany and Sweden, it should not come as a surprise that there is much emphasis on communication and awareness raising through risk mapping and early warning systems.

When it comes to the costs and benefits associated with climate change, these are considered to be clouded in uncertainty in all four countries, but increasingly calculations are being made.
Finally, in terms of implementation and enforcement, it has been noted that Germany and the UK have the clearest time frames.

5. Scientific results

In this chapter we present the scientific results of the four key work packages, their contributions to scientific, policy and societal debates, and the knowledge gaps and key questions for the next two years.

5.1. Organizing connectivity

5.1.1. Research questions

The most important axiom in work package 2 is that climate adaptation takes place in a context in which many interdependent actors are involved with their own ambitions and preferences, responsibilities, problem perceptions and resources. Many of these actors are not dedicated to climate adaptation strategies and will not support the implementation of these strategies. Yet, implementation largely depends on their cooperation, therefore an adaptation strategy will have to take the internal logic of its surrounding context into consideration, or it is bound to fail. We assume that the opportunities for an effective implementation of climate change adaptation strategies will grow considerably when adaptation strategies are connected and synchronized with the implementation of other ambitions. This work package aims to contribute to successful adaptation strategies by exploring possibilities and strategies for 'organizing connectivity'. Connectivity may be defined as the existence of meaningful relationships between actors, policy sectors and policy levels. The central question of this work package is: How to realize connectivity within a highly fragmented governance system?

5.1.2. Main scientific insights and results

Based upon the scientific state of affairs and the questions of the hotspots, we have selected four sets of strategies which may be utilized to organize "connectivity for adaptation": experiments, multifunctional land use, leadership and multilevel governance.

Experimentation

Climate adaptation strategies do not only need to adapt to climate changes that really will take place, they must also be able to adapt to the social context in which these changes take place. Moreover, the developments of the climate system itself are uncertain, as are the reactions of society on them. Climate adaptation strategies therefore must be able to adapt to a context that is often only partly known and understood at the beginning. In order to gain effectiveness it is crucial to apply experimental approaches, to find out what will work and what not, and to reflect on ways of organizing experiments that maximize the opportunities for learning (Huitema, et al., 2010; Haug, et al., 2011).

Experimentation is becoming popular as a way of learning about the impacts of our policy choices. A "policy experiment" is defined as follows: it attempts to test or develop an innovation in a field setting; the institutional context is changed in order to provide a "protected space"; it requires the involvement of participants; it is connected to government policy; and it has intentions to upscale or at least influence the policy domain. Scientific advice on how to design policy experiments for facilitating learning will be of benefit to practitioners, because — although experimentation is increasingly being used in other policy fields — in climate change governance relatively few are conducted. An assessment of policy experiments showed that they do not maximise the learning potential and do not have a strong impact (e.g. be "up-scaled"). Policy makers are aware of this and desire knowledge about the dynamics of experiments. Professionals in hotspots are conducting experiments and want to engage in this project.

This project examines the relationship between experimental design and learning and how it can improve the governance of climate adaptation. It is an attempt to close a significant knowledge gap. Although it is assumed that conducting an experimental approach in adaptation strategies will generate mutual learning, there is still little evidence that this relation does exist (see Huitema, et al., 2009). Quantitative research and analysis of 50 Dutch policy experiments will provide statistical knowledge about the relationship between experimental design and learning. Qualitative research explores this relationship in depth; i.e. in an international comparison of the design of policy experiments. Is there a strong relationship between design and learning and can policy experiments lead to robust policy making processes?

The conceptual framework is largely completed (McFadgen, 2012; but also see Huitema and Munaretto, 2012) and the fieldwork has begun. The conceptual framework discerns two dimensions for learning. The

wider dimension is within the policy domain, where the evidence of an experiment aims to influence the policy decision making process. In this dimension, *policy learning* is conceptualised as the new information and ideas that stem from the evidence produced by the experiment (see Busenberg, 2001). The other dimension where learning can develop is within the experiment itself. In this dimension, *mutual learning* is a normative outcome of the policy experiment because it may connect people and ideas, allow room to reflect on goals and values, and lead to increased trust and cooperation. Learning that occurs between the participants is defined as a change in knowledge, norms, and trust in an individual, conceptualized as "cognitive", "normative", and "relational" learning, respectively. It is hypothesised that a policy experiment produces learning effects that are dependent on the specific design features of the experiment.
Four ideal type policy experiments are conceptualised in order to better compare these design features: the scientific, the participatory, the innovative, and the boundary type. Each ideal type has specific design features and for the purposes of this project design features are conceptualised as rule configurations, based on the Institutional Analysis and Development framework by Elinor Ostrom (2006). This allows for analysis at both the operational and collective-choice levels (e.g. who participates, what they can and cannot do, with what information). Rules can also have a more constitutional character and affect the experiment within its institutional context (for instance, its jurisdictional and geographical boundaries). Analysing policy experiments in this way allows the isolation of particular design features that link the institutional structure to both the learning by participants and learning in the wider policy environment.

Multifunctionality

In densely populated countries like the Netherlands climate adaptation poses challenges for land use and spatial planning. There are strong drivers to look for climate adaptation measures which facilitate multifunctional land-use (Wiggering, et al., 2003), e.g. multifunctional dykes and multifunctional urban water squares. Measures aiming to integrate land use functions explicitly bring together different ambitions and governance systems that have evolved from functional differentiation, each acting upon their own — and possibly contradicting — logics (Van Ark, 2006). The question then is how actors coming from these different governance systems can come to alignment and coherent action. To answer this we focus on how boundaries manifest themselves, when actors from multiple governance systems combine interests and ambitions in multifunctional land use projects (cf. Abbott, 1995). Boundaries are seen as enacted separations between ideas and actions of actors, rising e.g. between organisations acting upon different logics, between actors inside and outside a project group, or between actors with different backgrounds within a project group.

The first case (Dakpark, Rotterdam) analyses a project aiming to integrate a commercial building, a large city park on the roof, an existing flood defence structure and energy infrastructure (see Box1). It reveals various types of boundary behaviour, both on interfaces between different functions as well as over time. An intensive collaboration is established between the actors related to the building and the park, while actors related to the dyke and energy infrastructure are far less involved and fewer possibilities for combinations are sought, following a different interaction pattern. Rather than boundaries being negative and connections solutions to create win-win situations, both seem to have positive and negative effects on certain aspects of the process. The preliminary results indicate that the ways in which boundaries are constructed and reconstructed by the involved actors are crucial explanatory variables for achieving a higher degree of multi-functionality. We aim to understand how boundaries are enacted and where joint-ness or disconnection (1) take place and (2) have effects on the process in climate robust multifunctional land use projects. This will help us to analyse the creation of connections and the overcoming of boundaries between governance systems as solution to combine interests. We will increase our understanding of boundary behaviour in climate robust multifunctional land use projects by two more cases. Additionally, in future research it will be very interesting to research what shapes boundary behaviour of actors.

Box 1: Example of case study in WP2; project 2.2 Realizing climate robust multifunctional land use through system synchronization

As part of project 2.2, Saskia van Broekhoven studied casus Roofpark (*Dakpark*) Rotterdam. She intensively followed the project via interviews, attending project meetings and analysing documents. The Roofpark Rotterdam is situated at the site of an disused train yard, within a highly urbanised area in between the Rotterdam fruit harbour and a disadvantaged neighbourhood. The neighbouring area (Bospolder/Tussendijken) was pauperising, with a lot of drugs and prostitution problems and unoccupied buildings. Inhabitants also complained that there were not enough green areas and started a lobby for more green spaces. The municipality felt the need to do something about the impoverishment.

At the end of the '90s the train yard becomes obsolete, leaving a large area unoccupied. This leads to a discussion on the future destination of this area under pressure of impoverishment. Local residents saw a good opportunity to finally create a neighbourhood park. The municipality and Port Authority saw a good opportunity for economic development in the area, which might have positive effects also on the neighbourhood. In the project Roofpark Rotterdam, the municipality takes up the idea to combine these multiple land use claims by building a rooftop park on a business development, seeing as a good option to finance the park with economic development and a subsidy while illustrating the city's innovative image.

In the project area several existing land use functions are already present, and need to be taken into account in future plans. These include a primary sea defence levee and large underground city heating and electricity infrastructure running adjacent to the levee. Over time, more and more actors became involved, such as Dura Vermeer (construction company), the local water board (Hoogheemraadschap van Delftland) and Eneco (energy company). After a decision making and implementation process of 15 years, the developed combination of functions is currently being constructed. It continues to face challenges in the interaction between different actors involved.

An important question in this research project is how actors interact and come to cooperate together to develop multi-functional land uses. In first instance the Roofpark project was framed as a green project, later it was framed as a climate adaptation project involving a broad climate levee. Yet, the integration between actors related to the business development and the rooftop park seems more successful than the integration with the adjacent levee and infrastructure. The research project continues to answer questions like: why do actors sometimes cooperate better, where do boundaries manifest themselves and what is the influence of boundaries on the process?

Multilevel governance

Climate adaption is a multilevel challenge: local actions have to develop into a joint regional action scheme and regional actions have to culminate into a joint national action scheme and the other way around. None of the levels is in charge and able to define the agenda. In complex multi-level governance processes, the actors involved have their own self-organizing capabilities and are able to act without central command and control. Because of that, the existing ideas of organizing top-down or bottom-up processes have their limits for realizing joint action. A notion which fits to this self-organizing character of governance systems is '*synchronization'*. Synchronization with regard to multi-level governance is about the meaningful and converging evolvement of (more or less) autonomous governance levels (Jaworski, 1996; Teisman & Edelenbos, 2011).

Climate change affects long term water policies and it challenges daily management practices, both taking place in a highly uncertain context. To ensure flood safety and fresh water supply for the long term the Dutch government has started the Delta programme. Governments, NGO's, interest groups and businesses are invited to formulate and implement strategies that are able to cope with the need for adaptation in urban and rural areas. Organizations involved act at different levels and in different domains. This leads to an important question: how to realize multi-level governance processes in which the activities of the different actors strengthen each other and emerge into joint action to realize climate adaptation?

In the Delta programme, we analysed the synchronization between governance levels. From these analyses it becomes clear that synchronization is possible when people within governance levels know about the developments of the other levels, give meaning to these developments and base their actions

on it. Sometimes this synchronization arises directly from the interactions between actors. However, also 'acts' like organizational structures, procedures, rules, and arrangements could result in synchronization.

Leadership

Learning, boundaries and synchronicity urge for a specific leadership style that takes the complexity of the implementation context fully into account. This style is called complexity leadership. The characteristics of this concept are elaborated and translated towards the challenge of climate adaptation. Literature addressing the role of leadership in the context of adaptation to climate change tends to identify leadership as only one of the factors needed for successful adaptation, and fails to address the concept of leadership in a theoretically informed and systematic way. In the first phase of the project we tried to fill this apparent gap by exploring the relevance of modern leadership concepts for climate change adaptation. Inspired by Complexity Leadership Theory (Uhl-Bien, et al., 2007), Meijerink and Stiller (2012) developed a framework for analysing leadership in practices of climate adaptation. The framework distinguishes between five leadership functions within governance networks: the political-administrative, adaptive, enabling, dissemination and connective functions. Leaders may contribute to either one or more of these functions.

Scholten, et al. (2012) used this framework to analyse the role of leadership in two bottom-up induced adaptation practices in the domain of flood risk management: the Manhood Peninsula Partnership in the UK and the Waal Weelde initiative in the Netherlands. The main findings are that non-positional leaders (two active citizens in the Manhood Peninsula Partnership and a university professor and a business entrepreneur in the Waal Weelde initiative) have played a crucial enabling role by convening parties and linking the adaptation agenda to other agendas, such as regional economic development, tourism and nature development. In other words, they did so by deliberately allowing for the inclusion of other perspectives in adaptation practices. Whereas some positional leaders (e.g. governments) played a disabling role, others played an enabling role by making available necessary resources and attracting support from regional councils and Ministries for the newly evolving planning practices. In the Dutch case particularly, the ambitious national Room for the River policy objectives created adaptive tension and enhanced the development of innovative practices, such as setting back the primary embankment. Van Lamoen, et al. (2012) have started a third case study of a bottom-up induced adaptation practice to further test and refine the leadership framework; the Delta plan for the dry rural areas. The planned inclusion of at least one other case study from another country will enable us to learn more about the cultural dimension of leadership in governance networks.

5.1.3. Contributions

To scientific debates

The primary contribution to the international debate on climate change is the insight that climate adaptation strategies are bound to fail when they do not connect to, and fit in with, other domains of public and private actions in which they will have to be implemented.

A new type of implementation and leadership is needed. Complexity leadership theories will support climate experts to develop implementation schemes that will be effective. Important concepts that will enrich the scientific thinking about implementation in general and implementation of climate adaptation strategies in particular, are experimental implementation, boundary construction and reconstruction, and synchronicity. The researchers involved in the four projects already presented their findings to various scientific audiences.

To policy and societal debates

There is a strong tendency in every domain to prioritize its own ambitions and to overestimate its own ability to reach these ambitions by making plans, laws and policies. This is also the case with climate adaptation. Climate experts tend to see climate adaptation as the most important policy aim. This may be the case for climate experts, but is by far not the case for policy and management experts in neighbouring domains like water, urban and regional planning, agriculture and economic development.

By analysing the interdependency between policy domains, levels of governmental action and the public and private domain we are able to prevent practitioners in hotspots from developing adaptation

strategies that overestimate (1) the importance of climate adaptation and (2) the ability to be effective when only focussing on climate change aspects.

Several senior staff members in this work package have a role as evaluator and adviser in the field of water management and climate adaptation. The leaders of the work package have been invited by the Delta programme and its regional programmes to evaluate the existing action programmes and to give advice. Several advices to improve the connections between climate and water on the one side and economic and spatial domains have been accepted and implemented.

5.1.4. Knowledge gaps and key questions for the next two years

The biggest knowledge gap exists in the understanding of the complex social system in which the implementation of adaptation strategies has to take place. A lot of knowledge on the physical aspects of climate system has been developed, but our understanding of the interconnected social systems is still lacking to a considerable degree. With concepts as experimental implementation, boundary (re)judgement and synchronicity we assume to be able to contribute to implementation schemes that can adjust to new insights in climate change as well as to changing demands in other domains. Such dynamic implementation schemes could improve governance capacity considerably.

The primary ambition is to support governments and NGO's in increasing their understanding of (1) the complex social and governance systems they act in, (2) the demands these systems put on the climate adaptation strategies and (3) the implementation of these strategies. Based on this first exploration, some further research steps could be identified. Firstly, it is important to increase our knowledge of the effect of synchronization in fragmented governance systems. Secondly, the way different kinds of actions and interactions lead to synchronization must be studied further. This is especially of importance to come to more practical recommendations. For the various researchers the key challenge has to do with translating their theoretical and empirical findings into usable prescriptions, applied and refined in action-oriented research projects.

5.2. (Re)Allocating responsibilities and risks

5.2.1. Research questions

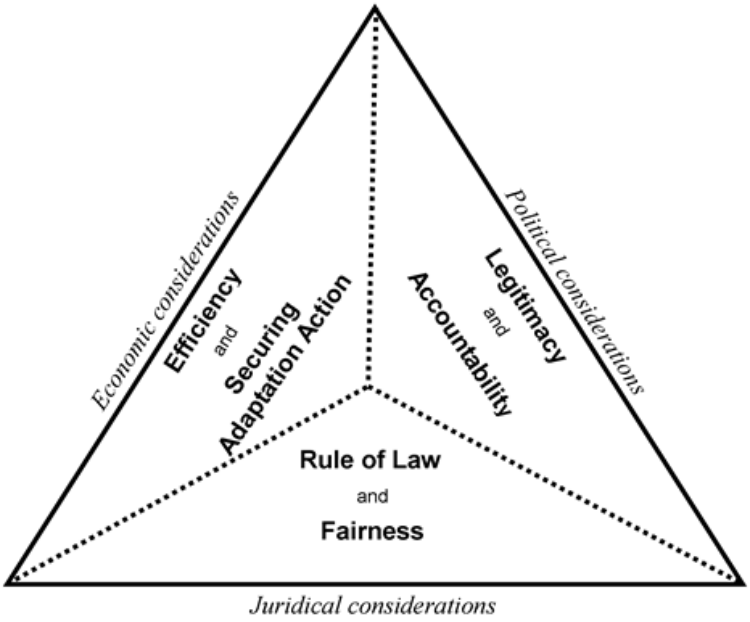
While natural science research plays an important role in informing us what kind of climate adaptation measures need to be implemented, it cannot answer who has to plan, realize and pay for them, what kind of policy instruments need to be used and what kind of governance arrangements are effective, legitimate and fair. Since the late 1990s, adaptation planning is emerging as a new area of public policy across various geo-political scales (Biesbroek, et al., 2010; Preston et al., 2011). In practice, adaptation planning often appears to be government-led (Johnson and Priest, 2008; Mees and Driessen, 2011; Storbjörk, 2010; Wilson and Termeer, 2011), although the involvement of public and private actors in adaptation is widely endorsed by scientists and policy makers (e.g. Agrawala and Fankhauser, 2008; EC 2009; Füssel, 2007). To date, however, the demarcations of responsibilities between public and private parties remain vague (Preston, et al., 2011), and the lack of clear demarcations has been identified as an important barrier to the governance of adaptation (Biesbroek, et al., 2010; Carter, 2011; Dovers and Hezri, 2010; Fünfgeld, 2010; Storbjörk, 2010). If an explicit allocation of responsibilities facilitates the governance of adaptation, the question arises as to what kind of sharing of responsibilities is feasible and desirable among public and/or private actors for adaptation to climate induced risks. By answering these questions this work package aims to contribute to the literature on governance arrangements targeted at stimulating adaptation to climate change.

5.2.2. Main scientific insights and results

Framework

Arrangements of climate adaptation policies can be evaluated on a variety of criteria from three different disciplines: public administration, law and economics. A conceptual framework has been developed that facilitates the comparisons of various arrangements by social scientists and policy makers alike, and allows scientists to identify the demarcation lines for the responsibilities of the various parties (Mees, et al.,2012b). A key element of this conceptual framework is summarized graphically in Figure 2.

Figure 2: Approach for considerations underlying the public-private divide, inspired by Nelissen, 2002.



The framework consists of six criteria — legitimacy, accountability, effectiveness (or securing climate adaptation action), efficiency, fairness and rule of law — that are used as assessment criteria. The framework enables a retrospective analysis of existing governance arrangements, as well as a forward-looking analysis for the design of alternative governance arrangements, in which case well-informed choices can be made based on the deliberate and conscious application of considerations (see Mees, et al., 2012a for more details). In particular, the framework allows the exploration and assessment of promising policy instrument mixes. Applying the framework leads to insights on (1) the performance of individual policy instruments on all criteria, and (2) the performance of certain combinations of policy instruments, whereby a negative score of one policy instrument can be offset by a positive score of another policy instrument.

To showcase the usefulness of the framework we applied it to two specific cases, green roofs and natural climate buffers, as input for our collaboration with hotpots (see table 2 for an example). One main insight is that the performance of especially the economic and policy science criteria depends on whether the adaptation action just requires a one-time investment without much maintenance in later years, or periodic actions that need to be undertaken by the various actors.

Table 2: Example of the framework applied to natural climate buffers.

	criteria					
	Legal perspective		**Economic perspective**		**Political perspective**	
	Legal certainty	**Fairness**	**Efficiency**	**Effectiveness**	**Legitimacy**	**Accountability**
Legal instruments						
Technical requirements (Zoning and relocation)	1	2	9	1	7	1
Contractual agreements/covenants	5	5	7	2	2	1
Economic instruments						
Subsidies	6	5	6	3	3	3
Smart subsidies / auctions	6	5	5	4	4	3
Communication instruments						
Public Information Campaigns	7	6	4	8	5	6
Corporate Social Responsibility	8	7	1	9	1	7

Another insight is that while the scores of the various policy instruments on the two criteria from the legal perspective are quite consistent, this does not hold for the economic and political criteria. Efficiency and legitimacy tend to be positively correlated and so are effectiveness and accountability – but there is a negative correlation between effectiveness and legitimacy on the one hand, and efficiency and accountability on the other. This is important information for policy makers and scientists alike if they wish to produce policy mixes that score well on all criteria.

Public private arrangements

The conceptual framework will be applied for the analysis of governance arrangements in three specific adaptation themes: (1) urban water retention, (2) urban flood risk management and (3) rural fresh water supply. The types of insights such a retrospective analysis generates, concern: (1) patterns of responsibility divisions among public, private and public-private actor constellations throughout the policy process, as well as the steering strategies and policy instruments employed to support particular divisions of responsibilities; (2) patterns in the dominant considerations, demonstrating that deciding on responsibility divisions inherently is a selective process; (3) the inevitable trade-offs between considerations, and; (4) performance of the studied governance arrangements based on one of its dominant considerations.

The first theme, urban water retention, has been empirically studied in 2011 through a comparative case study research of green roofs as a 'no-regrets' storm-water retention measure in five Western democratic cities; Basel, Chicago, London, Rotterdam and Stuttgart (Mees, et al., 2012c). This study reveals that all cities show a co-existence of hierarchical and market arrangements with differences along the stages of the policy process. Interactive arrangements hardly exist. In Basel and Stuttgart hierarchical arrangements dominate throughout the process, while in Chicago, London and Rotterdam market arrangements dominate in the later stages of the policy process. Key criteria for public responsibilities are securing adaptation action and rule of law. The key criterion for private responsibility is efficiency. The most dominant hierarchical arrangements show a significantly higher performance in securing adaptation action in terms of square meters of green roofs installed. The division of responsibilities inherently is a selective process, in the sense that not all considerations are taken into account (equally). Public responsibility is salient for getting green roofs off the ground.

Cost effective arrangements

The economic considerations are covered by Richter and Van Soest (2012), who try to identify which policy instruments are likely to be most effective. Top-down interventions may be counterproductive if it results in crowding out of the intrinsic motivation of actors to voluntarily provide public goods (such as adaptation services). Also, top-down adaptation planning can be very expensive for governments if actors differ in the costs they need to charge when providing services. Standard economic theory predicts that such programmes will provide fewer services than desired and at costs higher than strictly necessary. Arguedas and van Soest (2012) challenge this view, and show that subsidy schemes can be designed that allow governments to achieve their objectives at minimum cost after all. Van Soest and Dijk (2011) build on this to showcase the applicability of the framework for nature conservation in the Netherlands. They also discuss the pros and cons of using procurement auctions as a device to stimulate the private provision of public goods. Dijk et al. (2011) study auctions in more detail, trying to develop an auction design that is able to overcome the key issue in many procurement auctions – the fact that sub-optimally few bidders effectively participate. This research examines if bidding behaviour in repeated procurement auctions can be explained by, among others, a diminishing endowment effect and an increase in strategic behaviour over time. Prospect theory tells us that the loss aversion associated with an endowment leads to asymmetries in valuation and exchange behaviour. Experience with market mechanisms reduces the endowment effect (List, 2003), while the likelihood of strategic behaviour increases with repetition. We hypothesize that by studying the dynamics of these two countervailing effects we can determine an optimal number of rounds (i.e. at least cost for the auctioneer) in repeated procurement auctions.

5.2.3. Contributions

To scientific debates

To date, the work package has produced eleven articles, which have been published — or are in the processes of being published — in international scientific journals. In addition, a number presentations have been given to scientific audiences in conferences, among others at the Governance of Adaptation Symposium, 23.3.2012, Amsterdam, the 24th Aesop Conference, 8.7.2010, Helsinki and at the research seminar of the Exeter Business School, 8.10.2010, Exeter.

One of the key insights obtained thus far in the work package is that instruments that score well in terms of efficiency, tend to also perform well on legitimacy — cost-effective instruments tend to be legitimate too. Here, the preferred instruments are voluntary measures (Corporate Social Responsibility), but also insurance policies. Similarly, the criteria effectiveness and accountability also tend to be positively correlated across instruments – with those scoring well on the one criterion also scoring well on the other. Based on these criteria, the preferred instruments to be used are technical requirements and covenants. Unfortunately, CSR and insurance policies score relatively poorly on effectiveness and accountability, while covenants and especially technical requirements do not perform well in terms of efficiency and legitimacy. Our research thus suggest that either a combination of policies may be the best way forward (for example, covenants accompanied by technical requirements), or that instruments need to be used that score reasonably well on all criteria, like subsidies. The members of WP3 are currently presenting these outcomes to various audiences to test the validity of our conclusions.

To policy and societal debates

The green roof studies resulted in various publications in trade journals. The results were discussed in an interactive workshop with key public and private stakeholders of the city of Rotterdam, March 19 2012. We hope we will be able to employ the design-oriented approach of our conceptual framework for at least one of the hotspots. The framework can thus help to take conscious note of all considerations and their trade-offs, in order to come to well-informed choices for divisions of responsibilities.

Every two months we attend a meeting of the 'Water retention at the source' project in which the status of the pilots is reviewed (see also Box 2). We are designing an experiment that will determine the expected costs of water retention by private parties, and help us answer the question whether this is more efficient than the realisation of public water retention areas in Noord-Brabant. We expect that approximately 60 ZLTO (farmers organization) members will participate. We hope that the result of this experiment can help shape an efficient procurement policy when the 'Water retention at the source' project moves from pilots to policy implementation.

Box 2: Example of case study in WP3; project 3.2 implementing climate adaptation policies: Public policies and private initiatives and benefits

As part of project 3.2 Justin Dijk is involved in the 'Water retention at the source'-case ('*Water vasthouden aan de bron'*). Together with stakeholders, a hypothetical auction experiment for so-called 'blue' services has been developed. In the auction, farmers are asked to state their desired payment for having their land contracted for temporary storage of peak rainfall as to prevent undesirable flooding downstream.
The intention is that farmers will participate in a multi-day internet auction. An internet auction is more accessible for farmers (no travel time, more freedom on when to give input). In the auction, farmers are asked how much compensation they desire for providing a specific blue service. The auctions are designed in close collaboration with the core group of the 'water retention at the source' project. Attention will be given to the duration and characteristics of the blue service (based on the wishes of the water board and the possibilities in the study area), agglomeration bonuses (usefulness of measures can depend on the services offered and bidding behavior of others), possible auction variations (uniform or discriminatory) and the time and risk preferences of individual farmers. This case has no benchmark (e.g. bilateral negotiation vs. auction) to compare the efficiency of the action with, but it can test if costs of the desired blue services will fit the proposed budget, if a discriminatory auction is more efficient than a uniform one, if bids are correlated to risk preferences and other characteristics (total land size, age, etc.) and whether the total costs of purchased blue services are lower than the estimated benefits (e.g. reduced risk of flooding downstream).

5.2.4. Knowledge gaps and key questions for the next two years

International comparative case study research for the two other themes (urban flood risk management and rural fresh water supply) is planned for 2012 and 2013 respectively. These studies will help us to answer key questions like: To what extent do the policy practices for the other two adaptation themes deviate from the key finding from the first empirical research, which indicates towards a necessity for public responsibility? What overall conclusions can be drawn for governance arrangements for climate adaptation, and the roles of governments, businesses and civil society?

We hope we will be able to successfully organize the online auction experiment to study the following key questions: Under what circumstances can the private provision of adaptation services be induced at least societal costs? And, related, given that actors are heterogeneous in their abilities to provide services and their preferences, can these heterogeneities be exploited to improve the efficiency and effectiveness of government intervention?

5.3. Dealing with controversies

5.3.1. Research questions

Work package 4 focuses on how is being dealt with controversies that are part of the discussion on climate change and adaptation. Decision-making in relation to climate change is knowledge-intensive (Termeer, et al., 2011); without systematic observations and advanced mathematical models, even awareness of climate change would be very limited. At the same time, important uncertainties about the nature and scale of risks and the effectiveness of solutions persist. In addition, climate change is also a high-stake issue, affecting a range of sectors and policy domains. Taking climate change seriously requires drastically reconsidering current practices in domains like energy, transport, agriculture, housing etc. Depending on the severity and timing of climate impacts, more or less drastic adjustments will be needed in domains like water management, spatial planning, agriculture, tourism, nature etc. The variety of interests and ideas that are connected to climate change is considerable (Hulme, 2009), causing controversies to arise. In spite of the inherent uncertainties, ambiguities, controversies and conflicts of interest, decisions about adaptation strategies are being taken — or need to be prepared — now.

In this work package, we attempt to gain insight in how these uncertainties and controversies might be handled at the boundaries between science, policy and society in producing climate adaptation policy. We develop a conceptual framework informed by the concepts of co-production (Jasanoff, 2004), powering and puzzling (Heclo, 1974) and interactive framing (Dewulf, et al., 2009). It enables to shed light on the practices of meaning making and relational positioning, which occur when actors coming from different groups interact. As such, it enhances our understanding of the dynamics in the science-policy-society triangle.

5.3.2. Main scientific insights and results

Intertwinement in the science-policy-society triangle

To gain insight in the science-policy-society triangle for climate adaptation governance at work package level, a common pilot case was studied from different angles. The Second Delta Committee, a high-level political advisory committee charged with advising the government on water and climate policy in 2008, has played an important role in the governance of climate adaptation in the Netherlands (Verduijn et al., 2012; Vink et al., forthcoming; Boezeman et al., forthcoming).

Even though no crisis actually occurred, the Second Delta Committee managed to create awareness and set the agenda for climate adaptation policy and the issue of safety in Dutch water management. To a large extent, the public and politics accepted its framing of problems, causes, moral judgments and suggested remedies. The most important framing strategies identified were adherence to the climate adaptation narrative, using the story of our delta identity, creating a sense of urgency and collectiveness, and creating a crisis narrative (Verduijn, et al., 2012).

This successful agenda setting can also be understood by analysing the Second Delta Committee as a boundary organization. The internal processes were shaped by the deliberate composition and organisation of the committee. They were important for the production of useful knowledge and

management of multiple boundaries. The internal processes were paralleled by external processes of continued interaction with a network of political, departmental, scientific and public actors. While the internal processes mainly enabled the production of a high quality advice, the external processes quested for its acceptation and legitimacy (Boezeman, et al., forthcoming). Additionally, when comparing the public announcement of the Second Delta Committee's conclusions with two other announcements of flood safety policies, we find that (1) the framing of the policy proposals differs in the way they depict the importance of climate change, the relevant time frame, and the appropriate governance mode; (2) that the knowledge referred to differs as well; and (3) that the frames about these proposals position themselves against the background of previous proposals through rhetorical connections and disconnections. Significantly, in the framing of the governance structure that was set up to implement the Delta Committee's recommendations (the Delta Programme), flood safety policy is largely disconnected from climate change issue and refers to less extreme impact scenarios. However, the wider time frame set by the Delta Committee's climate change framing is maintained in the Delta Programme's framing, providing political room for delay and linkages with other 'future' issues such as the economy and a prosperous society (Vink, et al., forthcoming). This reflects a changing societal and political context where climate change plummeted on the societal and political agenda after the controversy about "climate gate" and errors in the IPCC reports, and a change towards a right-wing government that focuses on the current economic crisis and ignores climate change issues.

Taken together these results underline the intertwinement of science, policy and society in climate adaptation governance: if societal outreach turns out to be critical for a boundary organization at the science-policy interface; if the publicly framed advice of the committee towards society at large strongly relies on particular knowledge claims; and if controversy at the newly emerging science-society nexus has implications for climate adaptation policy, then considering all sides of the science-policy-society triangle becomes crucial.

Interplay between new governance arrangements and existing institutions

From the evidence we gathered so far, it is clear that climate change (adaptation) indeed affects pre-existing science-policy arrangements or gives rise to the emergence of new ones. Analytically, one can distinguish substantive changes from organizational ones. Substantive changes deal with the kind of (scientific) information to be taken into account, including its (inter-) disciplinary width. Organizational changes deal with the processing of this information, from its very production to its insertion into models, tools, and practices.

The range of case studies we have undertaken so far has amended our initial understanding of the downscaling of climate knowledge from the global level to regional/local projects. Rather than understanding these downscaling processes as linear, we now have a better view on the impact of pre-existing science-policy arrangements. Different policy domains and sectors (e.g. water, housing, urban planning) have distinguished 'modes' of organizing their science-policy interfaces. This clearly affects the way specific climate change knowledge is translated, operationalized and made relevant in those various policy sectors.

An on-going study of the Delta Programme Lake IJssel also identifies challenges in the interplay between this new governance arrangement and existing institutions. The Delta Programme is set up as some kind of by-pass apart from, but strongly dependent on, the usual policy making circuits. Its special position creates opportunities for shaping the new policy domain of climate adaptation governance in relation to a range of current policies and institutions. However, this also creates tensions. The Delta Programme Lake IJssel aims at co-producing viable policy scenarios with regional and local actors, but is perceived by some of those actors as applying a technocratic and bureaucratic logic which emphasis a depoliticized national interest. Accordingly, actors tend to downplay the importance of this new governance arrangement and revert to the usual policy making circuits where they know how to lobby, which enables them to better articulate their regional and local interests.

5.3.3. Contributions

To scientific debates

Developing an analytical perspective on the interplay between meaning and power when actors engage with each other in conflictive and collaborative ways at the boundaries between science, policy and society might sound like an overly ambitious endeavour. However, we believe that our explorations of the science-policy-society triangle provide interesting starting points.

A basic notion to start with is that there are no neutral ideas or neutral knowledge (hence the relevance of the concept of knowledge frames) and there are no neutral policies (hence the relevance of the concept of interests). One way to conceive of the relation between knowledge frames and interests is as a reciprocal, but nondeterministic, relationship: "*frames and interests are logically independent concepts (…) interests are shaped by frames, and frames may be used to promote interests*" (Schön and Rein, 1994, p. 29). On the one hand, issues can be strategically framed to promote certain interests. On the other hand, frames used by actors guide and constrain what they define as being in their interest and where these interests conflict with the interests of others. The concept of interactive framing tries to capture this notion at the level of day-to-day interactions. Throughout the web of interactions at different places and at different times, people continuously negotiate the meaning of issues they face and simultaneously negotiate their mutual relations and positions.

We try to understand the structural aspect of the interplay between meaning and power by identifying two levels of influence. The first level is the level of engaging in the debate, in which arguments and reputations can be lost or won, in which frames guide interests and interests guide frames. The second level focuses on what the debate is about and who is involved, in other words what the playing field looks like. It asks the question who has been involved in setting the terms of the debate and selecting the players. No matter how many actors and issues are included in a debate, there are always many others excluded. Although particular actors or institutions can have an important role in setting the terms of the debate and selecting the players, more structural forms of power become visible here. Institutionalized criteria for who is to participate in the debate, for instance, can monopolize the selection of players. Engrained routines for determining the agenda for the debate can set the terms of the debate. Conversely, actors that do not have the minimally required resources to engage in a debate — or things that are so unconceivable at a particular place or historical juncture that there are no words for it in the available discourses — are very unlikely to even appear on the playing field, let alone being taken seriously.

To understand interactions at various interfaces in the science-policy-society triangle in this light, we rely on the concept of variety. Each interface (e.g. an on-going debate) can be seen to connect various elements, but involves only a particular slice of the total variety that exists. A particular subset of the variety of interests and ideas is tied together in an interface that allows more or less coordinated action, such as determining the expected sea level rise to be referred to in policies, or defining compensation measures for a particular policy. In our view, the capacity to engage in a joint decision process is what ties an interface together, not a set of shared ideas or shared interests. Allowing for this variety of meanings, goals and values is what makes coordination across boundaries possible. At the same time, there are other interests and ideas which are not part of this process. This simultaneous inclusion and exclusion of interests and ideas at a particular interface can be understood by considering both the debate that is contained within the interface, as well as the actions and structures that select the players and set the terms of the debate.

Finally, an established playing field is not to be taken for granted. Interests and ideas outside the decision process may manifest themselves and may be able to contest what's going on, claiming that particular knowledge frames are neglected, that the decision process is biased towards certain interest, or that access needs to be provided for themselves or for others. In this way, the playing field itself may turn into the topic of the debate, adding a layer of contestation to a particular interface in the science-policy-society triangle. In other words, there is always the possibility that "*diversity keeps reappearing and reasserting itself, even in the most entrenched institutions of modernity, such as expert bureaucracies*" (Jasanoff, 2004).

To policy and societal debates

The researchers are doing collaborative action research in the project 'Droge Voeten 2050' ('Dry Feet 2050', 2010 – 2013), a joint effort of three provinces and water boards in the Groningen/Drenthe region. The project assesses climate change impacts on the regional water system, designs policy options and initiates a participation trajectory (see Box 3). The impact of our knowledge is clear from choices made in the development of the project and with references to documents written by the researchers in different project outlines of 'Droge Voeten 2050'.

In addition, one of the researchers is involved in the evaluation of the Dutch Delta Programme Lake IJssel which focusses on climate proofing freshwater supply and flood safety in the Netherlands. The cooperation consists of the researcher's participation in the general governance meetings, with 20-150 stakeholders depending on the character of the meetings. The researcher also has an active role in the organization of reflective and meetings with specific civil servants — by giving presentations on governance theory and research results — has discussions with civil servants and reflective interviews with key decision makers in the governance process. This resulted in a thorough analysis of the difficulties the Delta Programme's governance process is facing in terms of efficiency and legitimacy and yielded concrete policy advises for overcoming the challenges the programme is facing. Due to the trust and legitimacy created by this form of coproduction with stakeholders, civil servants and decision makers the researchers' advises where taken up in the mutual discussions and were largely adopted by the Delta Programme team.

Box 3: Example of case study in WP4: project Droge Voeten 2050

The researchers of projects 4.1 (Making sense of climate impacts. Understanding and dealing with the variety of climate change frames in governance processes) and 4.2 (Science-policy arrangements at regional scale: how to warrant scientific requests and social robustness?) are both involved in an adaptation project in the Northern part of the Netherlands called 'Droge Voeten 2050' (Dry Feet 2050). This project involves the provinces of Groningen, Drenthe and Friesland and the water boards Noorderzijlvest, Hunze & Aa's and Wetterskip Fryslân. The central objective of Droge Voeten 2050 is to assess the impact of climate change, soil subsidence due to natural gas drilling and on-going spatial-economic developments on the regional water system, and to propose policies to adequately deal with these developments to meet safety norms in 2025 and 2050.
This research project is a prime example of a collaborative action research project. The researchers provide state of the art insights from governance and participatory theory to the project group, and develop new knowledge in collaborative workshop sessions. For instance, a series of workshops were organised in which project members, based on their local knowledge of the social constellation in the region, designed a strategy to involve stakeholders in developing shared knowledge and common project ownership with the region. For the researchers this project allows for first hand observations on how climate knowledge is tailored in the region in order to meet local policy needs, and how frames and pre-existing institutional arrangements influence this process. The researchers use a range of methods, most notably focus groups, observations of project group meetings and stakeholder events, and a series of in-depth interviews.

As climate change is an 'epistemologically distant' issue, one of the roles we have is to try to bridge that epistemological gap by clear illustrations of actual and possible impacts of climate change on everyday life. While 'water' is the natural, yet predominant bridge for raising concern and identification with climate change impacts in the Netherlands, other examples might help making the claim as well. Based upon a desk research carried out for the Bordeaux region, we documented the actual impact of climate change on viticulture and wine production, and provided some 'large audience' lectures and publications on the issue (see Leroy, 2011 and 2012).

5.3.4. Knowledge gaps and key questions for the next 2 years

So far our research has mainly focused on providing in depth knowledge of single case studies. Other research focuses on aspects of the science-policy interface. For the Netherlands, research on the interaction between climate science, policy and society in adaptation focuses on learning processes (Hegger, Lamers, Van Zeijl-Rozema and Dieperink, 2012), impact of research programmes (Merkx, Roks and Wardenaar, 2012), single (water) cases (Edelenbos, Van Buuren and van Schie, 2011; Wesselink, De

Vriend, Barneveld, Krol and Bijker, 2009), or policy integration (Van den Berg and Coenen, 2012). Currently, studies presenting an overview of emerging science-policy arrangements for adaptation are lacking. In the coming years we aim to elaborate such a comparative overview and draw lessons from the variety of science-policy interactions in the context of adaptation.

Closely related, we want to investigate under which conditions emerging climate adaptation projects strengthen the institutional capacity to deal with related adaptation questions in the future, and how best practices in adaptation projects can be transferred to other cases.

What are the promising design principles for designing effective, legitimate and resilient governance arrangements, taking into account the interweaving of meaning and power throughout the science-policy-society triangle? When designing an arrangement for interaction between a variety of actors in a governance process, two important design principles would be not to design learning processes without possibilities for negotiation, and not to design negotiation processes without opportunities for learning. How to translate this into governance arrangements that are effective, legitimate and resilient is an important challenge for the next two years.

5.4. Normative principles

5.4.1. Research questions

The research of work package 5 focuses on normative principles of adaptation to climate change. The idea that underlies the research is that adaptation has a normative dimension, which has hardly been discussed in literature and policy. Climate change puts existing normative principles and basic policy viewpoints of what is in the public interest to the test. Key principles or "meta-criteria" for the assessment of governance of adaptation are resilience, legitimacy and effectiveness. The impact of these principles is analysed for the Dutch governance of adaptation to climate change within the main two projects: (1) developing a normative framework to assess and improve the governance of climate adaptation and (2) exploring and connecting adaptation strategies in transboundary areas to specifically analyse principles of transboundary governance of climate adaptation. The research focuses on the question what the ruling principles in practices of co-operation are and to what extent European Directives provide guiding principles, relevant for climate adaptation. It focuses on the way these guiding principles influence the legitimacy, effectiveness and resilience of governance of adaptation.

5.4.2. Main scientific insights and results

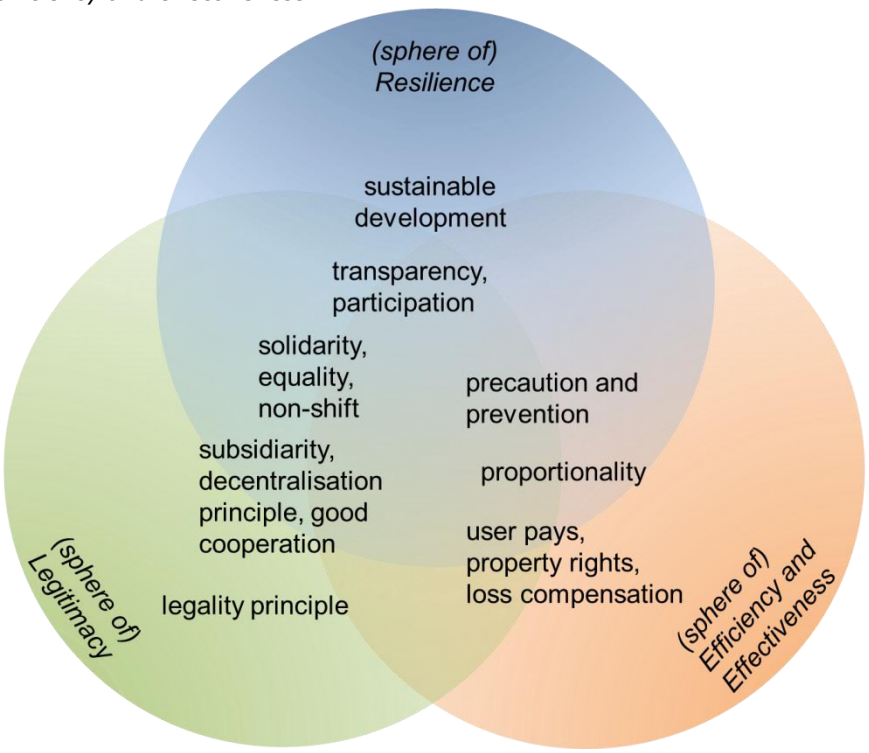
The body of literature on adaptation to climate change does not present uniform definitions of key concepts such as adaptation, vulnerability, resilience and adaptive capacity. The lack of clarity may be due to the relatively recent shift in attention from the bio-physical aspects of climate change to the societal and institutional aspects of adaptation to climate change. Furthermore, we noted that resilience, legitimacy and effectiveness have a different meaning in different disciplines and therefore need to be clarified. Various articles will provide the building blocks to clarify the meanings given to these principles. Some concern the search for a common understanding of what these principles mean (Termeer et al 2011, Van Buuren, Driessen, Van Rijswick, Teisman and Hol, work in progress; Mees et al, work in progress), others what influence the principles exert on the choice of responses and instruments to adapt to climate change (Mees et al, work in progress).We gained the insight that within a social context, these concepts acquire a normative dimension. Adaptation to climate change requires making a choice between combating the impacts of climate change, adjustment or retreat. It also requires deciding upon the share of public or private adaptation (Keessen, et al., forthcoming; Driessen and Van Rijswick, 2011). It can be anticipatory or reactive, planned or autonomous (IPPC TAR, 2001). Moreover, adaptation should be distinguished from maladaptation. Maladaptation is adaptation which directly or indirectly renders more vulnerable to climate change or which increases greenhouse gas emissions (IPPC TAR, 2001). All these different choices are essentially political; they depend on the ideas in society regarding what public tasks are, what is in the public interest and the extent to which governments or people themselves are responsible for taking precautionary measures (Keessen et al, under review).

Normative framework

Driessen and Van Rijswick (2011) paid attention to the importance of the normative aspects of climate adaptation policies. They analysed the principles that follow from the 1992 United Nations Framework Convention on Climate Change (UNFCCC), customary and international water law, EU legislation and case law and normative aspects following from national legal systems, like for example the assurance of the right to water (Van Rijswick 2012; Keessen and Van Rijswick, 2011). While resilience is an emergent principle in the context of adaptation to climate change, it should be complemented as guiding normative principle by the principles of legitimacy and effectiveness (Driessen and Van Rijswick, 2011).

In this work package these three principles are further developed and incorporated into a normative framework. Resilience, legitimacy and effectiveness have a different meaning in different disciplines; which is important to note in the view of the collaboration within this consortium of social scientists from different disciplines, i.e. public administration scholars, lawyers and economists (Van Buuren, Driessen, Van Rijswick, Teisman and Hol, work in progress; Mees, et al. , work in progress). As three meta-criteria acquire a different meaning depending on the legal, economic or public administration context, it is essential to clarify the meanings that can be given to these concepts and what their influence can be on the choice of instruments to adapt to climate change (Mees, et al., work in progress).To operationalize the meta-criteria, work has started to link them to different principles. This is illustrated in figure3.

Figure 3:Overview of the relation between several principles and the spheres of resilience, legitimacy and efficiency and effectiveness.



Resilience

Resilience is the capacity of a system to absorb disturbance and to maintain essentially the same structures and processes (Holling, 1973). Or, stated differently, the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity and feedbacks (Walker, et al., 2002). When a system is forced beyond the boundaries of its regime, the system shifts into a new regime, which is governed by a different set of structures and processes. A regime shift can be dramatic or subtle, and the characteristics of the new regime will depend on the feedback between the attraction that characterizes the new regime and the driving variables in the system (Folke, et al., 2004). Since the human influence on the resilience of ecosystems can hardly be overestimated, the concept of social-ecological resilience has been developed. Both society and nature have to adapt to climate change. Social-ecological resilience is the capacity of linked social and ecological systems to absorb as well as adapt to change (Adger. et al., 2005).

There are various ways to operationalize resilience (E.g. Carpenter et al 2001; Wardekker et al 2010). Van Buuren et al (accepted) evaluated the possibilities to combine flexibility and robustness in the field of spatial planning when adapting to climate change. Ebbeson (2010) identified four process oriented factors which increase social-ecological resilience on the basis of empirical research, which can be applied in the field of law and public administration: (1) flexibility of rules and structures to deal with change; (2) openness and participation in decision-making and administration; (3) effectiveness of multilevel governance, and; (4) adaptability of rules and structures to enable learning.

Keessen and Van Rijswick (under review) have used the typology of Ebbeson (2010) to evaluate the resilience of the European body of water law, as this body of law exerts a strong influence on Dutch adaptation policies, which are mainly about water management. The establishment in the European water Directives of a programmatic, cyclical approach, promotion of openness and public participation, and the focus of the Water Framework Directive on achieving good status — including good ecological status — will increase the social-ecological resilience of the European waters. However, critical remarks can be made, in particular, whether the right balance has been struck between flexibility and enforceability (Green et al, under review). It is yet unknown whether the procedural and flexible approach will bring home results, but the first implementation reports are not promising (Keessen and Van Rijswick, under review).

Legitimacy

The legal meaning of legitimacy has as its starting point in the legality principle. From a legal perspective, legality is an important element of legitimacy of governmental decision-making and implementation. The principle of legality requires an explicit legal basis for the exercise of state power. Yet legitimacy has acquired a broader meaning in the legal literature. It refers to many other principles, as legitimacy is used to evaluate the procedure that is followed to implement government action; a legitimate procedure complies with good governance principles, such as proportionality, openness and ensuring procedural fairness. Finally, it can even incorporate institutional principles such as decentralization (De Gier, et al., under review) and substantive principles, such as equity, fairness (Van Rijswick, 2011), good neighbourliness and solidarity, leading to substantial fairness (Van Buuren, et al., work in progress).

From a political science perspective it is interesting to consider the theory of Rosanvallon (2011), which distinguishes various perceptions of legitimacy. Legitimacy stands for trust in the law, which represents the general interest (impartiality). As time goes by, people feel that the legislator is partial as well and that influence from society (for instance through expert advice bodies) is necessary to correct that partiality, the so-called stage of legitimacy through reflexivity. Currently, we are in the stage in which politics and institutions can only acquire legitimacy through proximity, i.e. by demonstrating that the various individual interests are under consideration.

With regard to the legitimacy of government intervention it is important to understand that it is a political question how large the role of the government in adaptation strategies and their implementation should be. The question whether governance of adaptation is in the public interest depends on political philosophical orientation within societies (Keessen, et al., under review). In the Netherlands, adaptation is largely a government-based water management question. It could be stated that the Netherlands is in transition from a (fully) public approach to a more mixed approach of public and private responsibilities (Keessen, et al., under review). Especially the concept of a multi-layered safety in flood policies hints at such a shift. Traditionally, all political parties in the Netherlands support public water management, but the need to adapt to climate change has brought up more liberal ideas about letting private actors take their responsibility both in the discussion on adaptation strategies and in experiments (Keessen, et al., under review).

Effectiveness

Effectiveness is commonly understood as the achievement of goals. In the case of climate adaptation, this refers to securing adaptation goals. Economists relate effectiveness to efficient goal attainment. Efficiency concerns the optimum allocation of scarce resources, which means in this case supplying an adaptation good at the lowest cost. Mees et al (work in progress) elaborated this in the following table (table 3).

Table 3: Effectiveness and efficiency

Effectiveness	• Chances that the adaptation goal is reached
Efficiency	• The extent to which least cost parties are selected (or select themselves) to perform/supply adaptation service/good • The extent to which public funds are used to stimulate uptake and maintenance of an adaptation good. Also the risk of moral hazard (if it applies). While moral hazard is mostly considered in the ranking for effectiveness, the use of public funds in monitoring can make a difference in efficiency between instruments • The amount of windfall profits that are left with the private parties

Lawyers define effectiveness in two ways. Put simply, a legal rule is effective when it has entered into effect and has become applicable. Yet the legal dimension of effectiveness is broader. Legal effectiveness also requires that the legal framework is adequate to enable the achievement of its aims (Keessen 2008). For this purpose, the legal framework should provide for the necessary conditions for the implementation of the rules, which includes their enforcement, and not provide for obstacles which hinder implementation (Buijze 2009).
In political sciences effectiveness relates to the level to which policies result in the intended goals (Rosenthal et al., 1996) or to faster and better results (Driessen and Van Rijswick, 2011). Governance arrangements are effective "when the chosen mixture of tools and strategies fulfis the wishes of those involved" (Termeer et al, 2011). An important question is if the results are indeed reached because of the policies or other factors (Hoogerwerf and Herwijer, 2003). A policy is effective if it leads to results that are in accordance with the goals. It depends on the perspective of different actors if a policy is perceived as effective.

The evaluation of the WFD for the effectiveness criterion shows a mixed picture. The advantages of the flexibility combined with multilevel governance may at the same time seriously hamper the effectiveness of the WFD(OECD 2011). The flexibility offered by the WFD is justifiable by differences between Member States. It is, however, not only used to legitimate subsidiarity concerns relating to regional, climatological and societal differences and needs, but also promotes less legitimate differences concerning their level of ambition to protect waters, their choices to prioritize and facilitate the water needs of the various users, and in the way they interpret the main concepts and obligations of the WFD. While the procedural approach allows for these differences, they potentially hamper taking adaptation measures in a coordinated fashion throughout the entire river basin (Keessen and Van Rijswick, under review). Differences in ambitions concerning implementation can entrench institutional inertia against taking adaptation measures. Without robust enforcement or incentive to adapt, member states may be unlikely to change course in response to monitoring data (Green, et al,. under review) in many circumstances the application of resilience principles is plagued by a balancing of the need for regulatory flexibility to achieve environmental objectives with enough certainty and enforcement to ensure performance (Benson and Garmestani, 2011). In the case of the Water Framework Directive, it seems that the European Union has failed to strike the right balance by granting too much weight to flexibility, without the necessary counterweight of requiring measures to achieve the good status objectives.

Normative principles in a European and transboundary context

The Netherlands is a delta area and its major rivers (the Meuse, Scheldt, Rhine and Ems) are connecting different European countries. It therefore seems obvious to consider adaptation to climate change in its transboundary and European context. This international dimension becomes even more relevant when we take into account that climate change is expected to not only cause high river discharges, but also low water levels (e.g. in the Rhine-Waal), a higher temperature of the river-water and changes in the ecology of flood plains,. This variety of issues relates to the rich functions of European rivers; supply of freshwater, navigation, cooling for power plants, tourism as well as ecological functions. The governance of these issues is partly already guided by several EU legislative frameworks, especially the Floods Directive, the Water Framework Directive (WFD), and the Birds and Habitat Directives.

Both the Floods Directive and the WFD share a river basin approach, emphasizing system-based, integrated river policies and stimulating a transboundary outlook. In general, EU Directives contain different principles that are potentially relevant for the governance of adaptation, e.g. the principles of

solidarity, proportionality, subsidiarity or non-shift, and the general principle of 'good neighbourliness'. Indirectly, or more implicitly, the concept of river basin management contains principles of integration and system-based governance. To what extent are these principles also influencing, directly or indirectly, national or regional adaptation policies in the Netherlands? There is no straightforward answer to this question. First of all, we should distinguish between national and regional adaptation policies and politics. On the national level there is a strong inclination to frame climate adaptation in terms of (only) water management, while, within this domain, predominantly stressing safety issues. Secondly, the national Delta programme has divided the challenge of climate adaptation in separate hotspots that all focus on specific problems, e.g. drought, floods, fresh water, rural and urban management, etc. Thereby it addresses climate adaptation mostly in a segregated (non–integrated) and sometimes even fragmented way. An example of this is that some hotspot-based Delta-programmes deal with rivers and flood management, while low water levels and related drought problems are part of another programme. This is not very helpful when looking for more integrated, hydro- and ecosystem-based forms of climate change management. Thirdly, we can draw the preliminary conclusion that the international and transboundary outlook of the Delta-programme has so far been very limited, although it was not non-existent.

On the regional level there are interesting plans and programmes that strive for more integrated and encompassing problem solutions while sometimes crossing geographical borders. The province of Gelderland, for example, has frequent contacts with North-Rhine Westphalia by way of the Dutch-German Working Group on High Water (Wiering and Verwijmeren, 2012/forthcoming). One of the most interesting ideas that is circulated by the Province of Gelderland is the concept of a West European Climate Corridor that has the ambition to deal with the full dynamics of European rivers in light of climate change: connecting high discharges of water in winter with low levels in the summer and integrating flood management or shipping with nature conservation and biodiversity in flood plains. But at this stage of national policy formulation, these ideas are mainly brought forward by policy entrepreneurs that have difficulties to get access to climate adaptation politics.

Box 4: project 5.2 Principles and practices of transboundary governance of climate adaptation

Climate change adaptation poses transboundary challenges for water management. Yet, the governance of climate change adaptation has mainly been a domestic responsibility, even though other environmental policies have become increasingly transboundary and transnational (Leroy & Arts, 2006). By requiring Member States to apply a river basin approach to water management, the European Union has been making a push for more transboundary governance on water related issues, which would include climate change adaptation. The development of such transboundary governance may be stimulated or hampered by differences — and possibly similarities — in the involved governance arrangements (how policies are made and institutions function). By studying these differences and similarities we aim to identify which factors influence the development of transboundary governance. What factors stimulate or hamper transboundary governance?

Because the Rhine is the largest river basin in Western Europe and has such a significant economic importance, it is used as a case-study for this research. The research focusses on the Dutch and North Rhine-Westphalia regions of the Rhine river basin. The Policy arrangement approach will be applied as an analytical framework to conduct this comparative analysis. An literature research of policy documents supplemented by interviews with experts from both regions will lead to a comprehensive overview of the governance arrangements and of the initiatives of transboundary governance between those arrangements. This in turn will help us to answer the question which factors stimulate or hamper transboundary governance?

EU law and transboundary co-operation in river basins

The European Commission has encouraged Member States to work and think in terms of river basin management and go beyond national borders in their river policies, thereby gradually redesigning the map of Europe (Liefferink, Wiering and Leroy, 2010). But it did so without making use of strong legal instruments. Although the WFD has river basin management at its heart, it contains hardly any general

formal requirements for transboundary governance of water bodies. Each Member State is only liable for meeting the chemical and ecological objectives of the WFD in its own part of the river basin. They are only obliged to discuss their river basin management plans and programmes of measures in international river basin committee meetings and to attempt to coordinate overarching management plans and programmes of measures. The available instruments to realize this cooperation are traditional international treaties between riparian states, which do not offer a proper legal system to enforce shared responsibilities (Van Rijswick, et al., 2010, Hey and Van Rijswick, 2011). Administrative cooperation between the various authorities and states involved therefore only proceeds on a weak legal or voluntary basis. River basin management presupposes shared responsibility and accountability for achievement of the objectives per river basin instead of per Member State (Keessen, et al., 2008; Hey and Van Rijswick, 2011; Van Kempen, 2012a). Only the Marine Strategy Framework Directive takes this element partly into account as it offers non-compliance by another (Member) State as a justification for non-compliance. Van Kempen (2012b) also concludes that European water law lacks a mechanism for the fair share of risks, costs, measures and benefits between several Member States that share a river basin, although this follows from under international law (Helsinki Treaty; UN Water Courses Convention). When it comes to the legitimacy and resilience of climate adaptation policies this may be the most problematic issue in the future, while it is a major aspect of the normative element in adaptation policies.

5.4.3. Contributions

To scientific debates

To date, the work package has produced fourteen articles, which have been published — or are in the processes of being published — in international scientific journals. In addition, a further six are being worked on at the moment and more are expected to follow. Furthermore, several presentations have been given to scientific audiences in conferences, among others at the Delta's in times of climate change' conference, Rotterdam (2010), the Resilience and Law conference in Stockholm, Sweden (2010) and the IUCN Environmental Law Academy on Water and Sustainability, South Africa (2011).

At the start of this project we found out that each discipline (law, economics and public administration) gives different meanings to the key concepts resilience, effectiveness and adaptation. It takes more time than we initially thought to fully understand these principles and to operationalize criteria to measure how they are dealt with in practice. Various articles are (being) written (Mees et al, work in progress; Green et al, under review; Keessen et al, under review; Termeer et al, 2011) that will provide building blocks for a final paper with a normative framework.

To policy and societal debates

Work package 5.1 is not directly connected to a hotspot. It contributed to many societal debates, such as opportunities for adapting Rotterdam to climate change, new designs for the Dutch coast and new fresh water policies (Delta programme Fresh water) by emphasizing the normative aspects of climate adaptation policies. Work package 5.2 is mostly related to the Deltaprogramme Major Rivers, at the moment specifically focusing on the Lower-Rhine/ Waal river basin. Many people involved in both the Major Rivers -programme as well as the cross border cooperation were interviewed and we are planning a workshop on river basin management at the Radboud University in Nijmegen.

The development of the normative framework is in full swing. The main challenge is to ensure that it will inspire policy makers as much as academics. Perhaps we should try to communicate more to the hotspots how inspiring it is to consider the normative foundation when developing a truly adaptive adaptation to climate change strategy.

We also participate in the Malta Forum on adaptation to climate change. It focuses on – amongst others – the normative aspects of climate adaptation and the societal struggles that may arise between states, sectors and societal groups. The work of the Forum is directed towards fleshing out the necessary integrated approach of climate adaptation policies (infrastructure, energy, water, nature conservation etc.) and the multilevel and multi sector approach in discussions with the adaptation unit of DG CLIMA in order to assist them in developing an EU Adaptation Framework.

5.4.4. Knowledge gaps and key questions for the next two years

So far, the theoretical development of the normative framework has been brought forward by empirical research that has taken place without intensive contact with the hotspots. Yet, to improve our understanding of the normative framework, empirical research is necessary on the use by the hotspots of the normative framework to assess and improve governance of adaptation.
General normative principles relevant for the legitimacy of climate change adaptation must be further elaborated in legal terms. This includes principles such as equity, non-shift, compensation, right to water and right to flood protection. The international law dimension of these principles has been elaborated in the PhD thesis of Teresa Thorp, who has almost finished the first draft of the manuscript.

The differences and similarities of governance of adaptation between member states across borders still have to be investigated, f.i. in the Netherlands and North-Rhine Westphalia and Belgium. The transboundary and European dimension of climate adaptation can be connected to the discussion on the impact of the Floods Directive, which we expect to gain more attention in the coming years. This work package will also elaborate the dependencies and the international dimension of flood risk management regarding the major rivers.

6. Conclusions and outlook

This governance of climate adaptation programme aims to (1) develop in-depth knowledge of the governance of adaptation in the context of complex institutions; and (2) to use these insights to develop and test governance arrangements that will contribute to adaptation to climate change. In this chapter we will present some preliminary conclusions and the plans we have to elaborate them in the next two years.

1. Practices of monocentric and polycentric governance develop simultaneously
Due to the wickedness of the climate adaptation problem, polycentric theories are most promising for understanding and designing governance. However, polycentric governance knowledge comes with ambiguity. In general, many of its underlying assumptions do not fit with on-going interpretations of effective processes, good policies, measurable outcomes and sound scientific underpinning of policies (Keast and Brown, 2006; Vonk, et al., 2007; Termeer, 2009). Researchers, public servants, private actors and societal actors also still operate within the rules and values of the institutions based on monocentric governance, which do not simply fade away (Hajer and Wagenaar, 2003). An important conclusion of our programme is that practices of monocentric and polycentric governance develop simultaneously. It has consequences for designing arrangements also. Where monocentric arrangements may ignore bottom-up approaches, and polycentric arrangements may lack the authority to accelerate adaptation processes, hybrid forms might be promising (Scharpf, 1997). With our programme we aim to make use of these simultaneous practices, to search for ways to reconcile new governance insights into existing institutions and to develop and study such hybrid forms of arrangements.

2. Small incremental steps instead of large structural change
A picture of abrupt change of governance processes is not feasible nor desirable. More in order is a learning process of gradual change with delays, accelerations and small improvements. The first results from the various projects show that climate change adaptation is mainly dealt with by small, incremental steps instead of large ones. Instead of taking a holistic approach, climate change issues are taken apart and are dealt with by the different sectors. Only certain aspects are selected and presented out of their climate change context. This is at least partly caused by the current political climate in the Netherlands that has lost its attention to climate change, which has become a contested issue. Where politicians deny climate change, climate change issues are reframed by civil servants as, for instance, drought problems for agriculture or flood safety problems in general.

3. Focus on developing infrastructural adjustments
We started this report by mentioning the three key adaptation challenges: 1) developing and implementing infrastructural adjustments, 2) enhancing broader processes of societal change 3) increasing the adaptive capacity of society to deal with unexpected and unpredictable future changes, climate change and vulnerabilities. Due to intensive collaboration with stakeholders, the focus so far was on the first challenge. We will maintain the core philosophy of our research approach; developing a powerful combination between practice-driven collaborative action research and theoretically-informed scientific research. Because not all problems and research areas require or allow for a full collaborative action research approach, a pragmatic combination of research and action has been sought for each project. The next two years we will deliberately pay attention to the other challenges — enhancing societal change and increasing the adaptive capacity — as we believe that finally, they too are necessary for climate proofing the Netherlands.

4. Tensions and connections between normative principles
The idea was to develop a normative framework to assess existing forms of governance and to guide the search for new forms of governance. This would require a further elaboration of the principles of legitimacy, effectiveness and resilience. These three normative principles are still key in our programme. However, developing an integrative normative framework beforehand proved to be less fruitful. The different disciplines in our consortium —economics, law, political science, public administration, planning— define the three principles differently, the principles all carry their own dilemmas and traps (e.g. too much resilience leads to paralysis) and the principles are potentially conflicting (e.g. resilience can be perceived as not effective and not legitimate). Therefore we have chosen to develop a series of papers to address the different normative aspects and dilemmas. Finally, we aim to write an overview article in which we will integrate all these insights.

5. Need for stronger focus on uncertainty and long term
Climate change is a long term process that incorporates much uncertainty. This uncertainty and long term perspective poses a specific challenge for the governance of climate change adaptation. In our case studies we also see that this long term perspective and especially the associated uncertainty plays a role, but it does not lead to changes in governance arrangements. So, the context of uncertainty and long term is taken into account, but we do not yet have a clear view on the specific demands this poses for governance and policy arrangements. Many concepts that are traditionally used in the different disciplines in our program are not focussed on uncertainty and long term. In the next two years we will have to find ways to more explicitly deal with this challenge that climate change adaptation is posing us, for instance by developing new concepts and theories on how governance and policy arrangements can better deal with uncertainty and long term, thereby adding to the governance literature.

6. Need for design principles
So far our research has mainly focused on analysing governance processes. In some projects advise was given to improve governance processes and instruments. In the next two years we aim to use the gained insights for developing design principles for governance arrangements. We will therefore systematically compare the analyses of different single case studies. Plans are being made to develop a database of the case studies to ease comparison. We will also use one running case study that will be studied with the methodologies of the different work packages. This will help us to systematically compare the work packages' analyses and their results. How can the different approaches strengthen each other and where do they lead to possible contradicting results? The comparison of case studies and the running case should help us to provide a critical reflection on the current state of the governance of adaptation to climate change in the Netherlands.

7. Insights do not fit dominant international climate governance literature
Mainstream literature about climate adaption governance focusses on emphasizing the big long term challenges of climate change, the many controversies, the need for participative approaches, the advantage of smart science-policy arrangement's and boundary workers, the importance of decision support tools to deal with the many uncertainties involved, the importance of mainstreaming, etc. The first insights from our project, however, show a different picture. Emphasising the enormous challenge of climate change problems can also result in leaning backwards, participation is not always effective, emphasizing controversies can result in deadlocks, science-policy arrangements can also result in less innovative approaches, drawing of clear boundaries between (for example) the public and the private is as important as boundary spanning, in some cases cherry-picking can be more effective than integrating and mainstreaming everything, etc. Of course more elaboration is needed. We aim to write a synthesis paper in a high impact climate change journal in which we more precisely discuss the differences between our insights and those of the mainstream literature.

8. Increasing scientific impact
Scientific impact will be realized through a large amount of publications in relevant journals, the development of a special issue, the organization of panels at international conferences and finally the writing of a book with our international partners. This book, entitled "*Effective, resilient and legitimate governance of adaptation"* may contain the following chapters:

1) Key challenges of the governance of adaptation,
2) Normative principles of effectiveness, resilience and legitimacy,
3) Organizing connectivity across scales, domains and timeframes,
4) New policy instruments,
5) Reallocating public private responsibilities,
6) Experimenting and learning for climate change adaptation,
7) Climate adaption leadership,
8) Science-policy-society arrangements,
9) Framing climate change,
10) Transboundary adaptation policies,
11) Running case study,
12) Infrastructural adjustments, societal transitions and adaptive capacity,
13) Design principles for governance arrangements.

9. Increasing societal impact

Societal and policy impact in the next two years will continue through close involvement with concrete cases and stakeholders in a collaborative action research approach. The challenge is to achieve impact at a broader societal scale and on a broader range of policy makers at different levels. We believe that multiple and innovative forms of communication will be crucial here, as part of a programme-wide strategy. Initial ideas about this include: the use of professional publication channels to reach relevant groups of professionals (e.g. engineers, planners, municipalities, provinces, ...); the increased use of social media to create communities of interest and communicate results (e.g. LinkedIn —the governance of adaptation group currently has over 300 members—, Twitter, ...); and the production of video material that is accessible to a broader public.

References

Abbott, A., 1995. Things of boundaries. *Social Research* 62 (4).

Adger, W., K. Brown, J. Fairbrass, A. Jordan, J. Paavola, Rosendo, S., et al., 2003. Governance for sustainability: towards a thick analysis of environmental decision-making. *Environment and Planning A* 35(6): 1095-1110.

Adger, W.N., T.P. Hughes, C. Folke, S.R. Carpenter and J. Rockstrom, 2005. Social-ecological resilience to coastal disasters. *Science* 309(5737): 1036-1039.

Agrawala, S. and S. Fankhauser (Eds.), 2008. *Economic Aspects of Adaptation to Climate Change: Costs, Benefits, and Policy Instruments*. *Executive summary*, OECD Paris.

Arguedas, C. and D.P. van Soest, 2011. Optimal conservation programs, asymmetric information and the role of fixed costs, *Environmental and Resource Economics* 50: 305–323.

Ark, van R., 2006. Meervoudig ruimtegebruik: dogma of eye-opener? In: *Meervoudig ruimtegebruik, enkelvoudig recht: de spanningsvolle relatie tussen recht en innovatie*, Chapter 2.

Berg, M., van den, and F. Coenen, 2012. Integrating climate change adaptation into Dutch local policies and the role of contextual factors. *Local Environment* 17(4): 441-460.

Biesbroek, G.R., R.J.Swart, T.R. Carter, C. Cowan, T. Henrichs, H. Mela, M.D. Morecroft and D. Rey, 2010. Europe adapts to climate Change: Comparing National Adaptation Strategies. *Global Environmental Change* 20: 440-450.

Buijze, A.W.G.J., 2009. Effectiviteit in het bestuursrecht, *Nederlands Tijdschrift voor Bestuursrecht* 8:228-237.

Buuren, A., van, P.P.J. Driessen, M. van Rijswick, G. Teisman, P. Rietveld, W. Salet and T. Spit, 2012. Towards adaptive spatial planning for climate change; Balancing between robustness and flexibility. *Journal of European Environmental and Planning Law* (accepted).

Buuren, A. van, P.P.J. Driessen, G. Teisman, H. van Rijswick and T. Hol, 2012. Towards legitimate strategies for climate adaptation. Combining insights from legal, planning and governance perspectives, *Regional Environmental Change* (accepted)

Carpenter, S., B. Walker, J.M. Anderies, N. Abel, 2001. From Metaphor to Measurement: Resilience of What to What?, *Ecosystems* 4: 765-781.

Carter, J.G., 2011. Climate change adaptation in European cities. *Current opinion in Environmental Sustainability* 3(3): 193-198.

Dewulf, A., B. Gray, L. Putnam, R. Lewicki, N. Aarts, R. Bouwen, et al., 2009. Disentangling approaches to framing in conflict and negotiation research: A meta-paradigmatic perspective. *Human Relations* 62(2): 155-193.

Dijk, J.J., D.P. van Soest and E. Ansink, 2012. *The Endowment Effect and Strategic Behavior in Repeated Procurement Auctions*, mimeo.

Dovers, S.R. and A.A. Hezri, 2010. Institutions and policy processes: the means to the end of adaptation. *Wiley Interdisciplinary Review: Climate Change* 1: 212-231.

Driessen, Peter P.J., Helena F.M.W. and van Rijswick, 2011. Normative Aspects of Climate Adaptation Policy. *Climate Law* 2(4): 559-581.

Driessen, P.J., P. Leroy, and W. van Vierssen (eds.), 2010, From Climate Change to Social Change, International Books Utrecht

Duit, A. and V. Galaz. 2008. Governance and Complexity; Emerging Issues for Governance Theory. *Governance* 21(3):311-335.

EC, 2009. European Commission White paper COM(2009) 147. *Adapting to climate change: Towards a European framework for action*. Retrieved from: http://www.eurosite.org/en-UK/content/adapting-climate-change-towards-european-framework-action.

Edelenbos, J., A. van Buuren and N. van Schie, 2011. Co-producing knowledge: joint knowledge production between experts, bureaucrats and stakeholders in Dutch water management projects. *Environmental Science & Policy* 14(6): 675-684.

Folke, C., S. Carpenter, B. Walker, M. Scheffer, T. Elmqvist, L. Gunderson and C.S. Holling, 2004. Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology, Evolution, & Systematics* 35: 557-581.

Füssel, H.M., 2007. Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustainability Science* 2: 265-275.

Fünfgeld, H., 2010. Institutional challenges to climate risk management in cities. *Current Opinion in Environmental Sustainability* 2(3): 156-160.

Hajer, M.A. and Wagenaar, H., eds., 2003. *Deliberative Policy Analysis. Understanding Governance in the Network Society*. Cambridge: Cambridge University Press.

Haug, C., D. Huitema and I. Wenzler, 2011. Learning through games? Evaluating the learning effect of a policy exercise on European climate policy. *Technological Forecasting and Social Change*, 78(6): 968-981.

Heclo, H., 1974. *Modern social politics in Britain and Sweden: From relief to income maintenance*. Yale University Press New Haven CT, and London.

Hegger, D., M. Lamers, A. Van Zeijl-Rozema and C. Dieperink, 2012. Conceptualising joint knowledge production in regional climate change adaptation projects: success conditions and levers for action. *Environmental Science & Policy* 18: 52-65

Hill, C. J. and L. E. Lynn, 2004. Is Hierarchical Governance in Decline? Evidence from Empirical Research. *Journal of Public Administration Research and Theory* 15:173-195.

Hoogerwerf and Herwijer, 2003. *Overheidsbeleid, een inleiding in de beleidswetenschap*, Kluwer, Alphen aan de Rijn.

Huitema, D., C. Cornelisse and B. Ottow, 2010. Is the jury still out? Toward greater insight in policy learning in participatory decision processes—the case of Dutch Citizens' juries on water management in the Rhine Basin. *Ecology and Society* 15(1): 52-65.

Hulme, M., 2009. *Why we disagree about climate change: understanding controversy, inaction and opportunity*. Cambridge University Press, Cambridge.

Huntjens, P., C. Termeer, J. Eshuis, M.W. Van Buuren, 2011. *Collaborative action research for the governance of climate adaptation - foundations, conditions and pitfalls* (KvK Theme 7 Deliverable 1A).

Jasanoff, S., 2004. *States of knowledge: the co-production of science and social order*. Routledge, New York.

Jaworski, J., 1996. *Synchronicity: the inner path of leadership*. Berrett-Koehler Publishers, San Francisco.

Johnson, C.L. and S.J. Priest, 2008. Flood Risk Management in England: A Changing Landscape of Risk Responsibility. *Water Resources Development* 24(4): 513-525.

Jordan, A., D Huitema, H. van Asselt, T. Rayner, and F. Berkhout (Eds.), 2010. *Climate change policy in the European Union: confronting the dilemmas of mitigation and adaptation*. Cambridge University Press, Cambridge.

Keast, R. and K. Brown, 2006. Adjusting to New Ways of Working: Experiments with Service Delivery in the Public Sector. *Australian Journal of Public Administration*. 65 (4): 41–53.

Keessen, A.M., 2008, *European Administrative Decisions: How the EU Regulates Products on the Internal Market*, Europa Law Publishing.

Keessen, A.M., J.J.H. Van Kempen, H.F.M.W. Van Rijswick, 2008. Transnational River Basin Management in Europe, *Utrecht Law Review*: 35-56 (www.utrechtlawreview.org);

Keessen, A.M., J.J.H. Van Kempen, H.F.M.W. Van Rijswick, J. Robbe and C.W. Backes, 2010. European river basin districts: are they swimming in the same implementation pool? *Journal of Environmental Law*, 22(2): 197-222

Keessen, A.M and H.F.M.W. van Rijswick, 2011. Legal Protection of the Right to Water in the European Union, In: Sultana, F. and A. Loftus (Eds.), *The Right to Water: Politics, Governance and Social Struggles* Earthscan, London: 123- 138

Kempen, J.J.H., van, 2012a. *Europees waterbeheer: eerlijk zullen we alles delen?* [European water management: a fair share for all?], diss. Universiteit Utrecht, Utrecht

Kempen,J.J.H., van 2012b 'Countering the Obscurity of Obligations in European Environmental Law, Illustrated by an Analysis of Article 4 of the European Water Framework Directive', *Journal of Environmental Law* 3 (accepted).

Kooiman, J., 2003. *Governing as governance*. Sage, London.

Koppenjan, J.F.M. and E.H. Klijn, 2004. *Managing Uncertainties in Networks*. Routledge, London /New York

Lamoen, F. van, S. Meijerink, S. Stiller and C.J.A.M. Termeer, 2012. *Climate adaptation in the dry rural areas in the Netherlands: a complexity leadership perspective*. proceedings MOPAN conference, Wageningen University, 2.7.2012.

Liefferink, D., M. Wiering and P. Leroy, 2010. The Water framework directive: redesigning the map of Europe? In: Tvedt, T., G. Chapman & R. Hagen (Eds.). *Water, Geopolitics and The New World Order*. I.B. Tauris Publishers / Palgrave- Macmillan, Basingstoke, UK.

List, John A., 2003. Does Market Experience Eliminate Market Anomalies? *Quarterly Journal of Economics* 118(1): 41-71.

McFadgen, B., 2012. *What is the value of twisting the lion's tail? Evaluating the use of policy experiments in adaptation governance and how they can facilitate learning.* (KvKTheme7, Deliverable 2.1.2), Amsterdam.

Mees, H.L.P. and P.P.J. Driessen, 2011. Adaptation to climate change in urban areas: Climate-greening London, Rotterdam, and Toronto. *Climate Law* 2(2): 251-280.

Mees, H, J. Dijk, D. van Soest, P.P.J. Driesen, H. van Rijswick and H. Runhaar, 2012a. *Policy instruments for promoting adaptation to climate change; a framework for assessing public, private and interactive instruments*. Paper conform Kvk Deliverable 3.2.1; to be submitted as article.

Mees, H.L.P., P.P.J. Driessen and H.A.C. Runhaar, 2012b. Exploring the Scope of Public and Private Responsibilities for Climate Adaptation. Journal of Environmental Policy and Planning 14 (3): 305-330.

Mees, H.L.P., P.P.J. Driessen and H.A.C. Runhaar, 2012c. Who governs climate adaptation; getting green roofs for storm-water retention off the ground. *Journal of Environmental Planning en Management* (accepted).

Meijerink, S. and S. Stiller, 2012 What kind of leadership do we need for climate adaptation? A framework for analyzing leadership functions and tasks in climate change adaptation? *Environment and Planning C* (accepted).

Merkx, F., D. Roks and T. Wardenaar, 2012. *Impact van Klimaatkennis. Maatschappelijke impactanalyse van Klimaat voor Ruimte en Kennis voor Klimaat*. Rathenau Institute, The Hague.

Munaretto, S. and D. Huitema, Adaptive co-management in the Venice lagoon? An analysis of current water and environmental management practices and prospects for change. *Ecology and Society* 17(2): 19. http://dx.doi.org/10.5751/ES-04772-170219

Nelissen N., 2002. The Administrative Capacity of New Types of Governance. *Public Organization Review: A Global Journal* 2: 5-22.

Nieuwaal, K. van, P. Driessen, T. Spit and C.J.A.M. Termeer, 2009. *A State of the art of governance literature on adaptation to climate change: towards a research agenda*. Knowledge for Climate: KfC 003/2009.

Ostrom, Elinor., 1972. Metropolitan Reform: Propositions Derived from Two Traditions. *Social Science Quarterly* 53: 474–493.

Pierre, J. (Ed). (2000). *Debating Governance*. Oxford University Press, Oxford.

Preston, B.L., R.M. Westaway and E.J. Yuen, 2011. Climate adaptation planning in practice: an evaluation of adaptation plans from three developed nations. *Mitigation & Adaptation Strategies for Global Change* 16: 407-438.

Richter, A. and D.P. van Soest, 2012. Global environmental problems, voluntary action and government intervention, In E. Brousseau (ed.), *Governance of Global Commons*, Oxford University Press, Oxford, forthcoming.

Rijswick, H. van, 2012. Searching for the right to water in the legislation and case law of the European Union. In: H. Smets (Ed.). *The right to safe drinking water and sanitation in Europe/ Le droit à l' eau potable et à assainissement, sa mise en oeuvre en Europe*, Académie de l` eau, Editions Johanet, Paris: 87-113.

Rijswick, H.F.M.W. van, H.K. Gilissen and J.J.H. van Kempen, 2010. The need for international and regional transboundary cooperation in European river basin management as a result of new approaches in EC water law. *ERA Forum*, 11(1): 129-157.

Rijswick, M. van, 2011. Improving the right to water in the Netherlands. In: H. Smets (Ed.). *The right to safe drinking water and sanitation in Europe/ Le droit à l' eau potable et à assainissement, sa mise en oeuvre en Europe*, Academie de l ` eau, Editions Johanet, Paris: 369-391.

Rosanvallon, P., 2011. *Democratic legitimacy. Impartiality, reflexivity, proximity*. Princeton University Press, Princeton & Oxford.

Rosenthal, U., A.B. Ringeling, M.A.P. Bovens, P. 't Hart, M.J.W. van Twist, 1996, *Openbaar bestuur. Beleid, organisatie en politiek,* Drukkerij Wilco

Rhodes, R.A.W., 1997. *Understanding governance: policy networks, governance, reflexivity and accountability*. Milton Keynes: Open University Press.

Schön, D. A. and M. Rein, 1994. *Frame reflection: Toward a resolution of intractable policy controversies.* Basic Books, New York.

Scholten, P., C. Keskitalo, S. Meijerink, 2012. *Bottom-up initiatives towards climate adaptation in cases in the Netherlands and the UK: a complexity leadership perspective*. Paper presented to the 6th ECPR General Conference, 27.8.2011, Reykjavik, and the Knowledge for Climate's Governance of Adaptation Symposium in Amsterdam, 23.3.2012.

Scharpf, F.W., 1997. *Games Real Actors Play. Actor-centred Institutionalism in Policy Research.* Westview Press, Boulder.

Soest, D. van and J. Dijk, 2011. De economische efficiëntie van agrarisch natuurbeheer. *Economische Statistische Berichten* 96 (4612S): 11-15.

Storbjörk, S., 2010. It Takes More to Get a Ship to Change Course: Barriers for Organizational Learning and Local Climate Adaptation in Sweden. *Journal of Environmental Policy & Planning* 12(3): 235-254.

Teisman, G.R. & J. Edelenbos, 2011. Towards a perspective of system synchronization in water governance: a synthesis of empirical lessons and complexity theory. *International Review of Administrative Science* 77: 101-118.

Termeer, C., A. Dewulf, H. van Rijswick, A. van Buuren, D. Huitema, S. Meijerink, et al., 2011. The regional governance of climate adaptation: A framework for developing legitimate, effective, and resilient governance arrangements. *Climate law*, 2(2): 159-179.

Termeer, C.J.A.M., 2009. Barriers to new modes of horizontal governance. *Public Management Review* 11(3): 299-316.

Termeer, C.J.A.M. and M. van den Brink, 2012. Organizational conditions for dealing with the unknown unknowns, illustrated by how a Dutch water management authority is preparing for climate change. *Public Management Review* http://dx.doi.org/10.1080/14719037.2012.664014.

Termeer, C.J.A.M., A. Dewulf and G. Breeman, 2012. Governance of wicked climate adaptation problems. In: J. Knieling and W.L. Filho (Eds). *Climate Change Governance*. Springer, Berlin: 27 – 41.

Uhl-Bien, M, R. Marion and B. McKelvey, 2007. Complexity Leadership Theory; Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly* 18: 298-318.

Vonk, G., S. Geertman and P Schot, 2007. New technologies stuck in old hierarchies. *Public Administration Review* 67(4): 745-755.

Walker, B., S. Carpenter, J, Anderies, et al., 2002. Resilience management in Social-ecological Systems: a working Hypothesis for a participatory approach, *Conservation Ecology* 6(1) - 14.

J.A. Wardekker, A. de Jong, J.M. Knoop and J.P. van der Sluis, 2010. Operationalising a resilience approach to adapting an urban delta to uncertain climate changes, *Technological Forecasting and Social Change*, 77: 987-998.

Wesselink, A., H. de Vriend, H. Barneveld, M. Krol, and W. Bijker, 2009. Hydrology and hydraulics expertise in participatory processes for climate change adaptation in the Dutch Meuse. *Water Science & Technology* 60(3): 583-595.

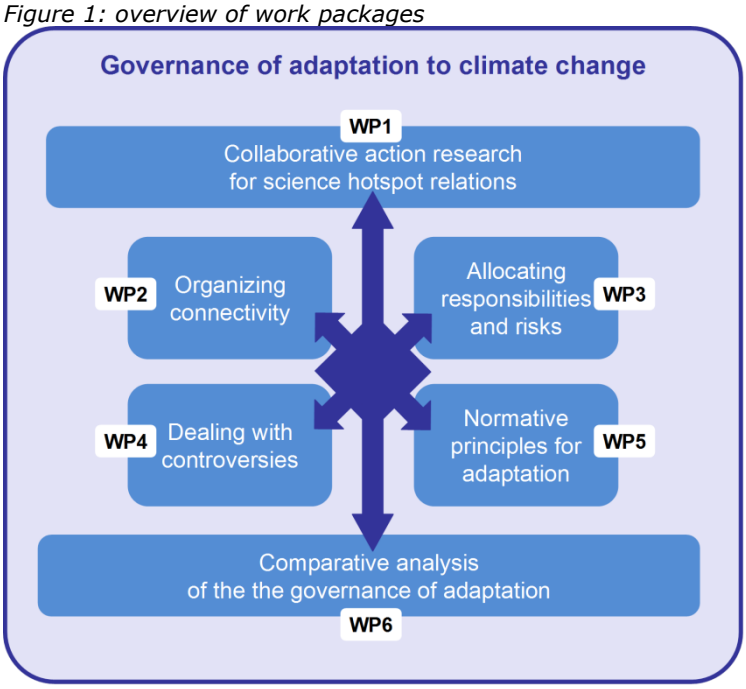
Wiering, M.A. and J. Verwijmeren, 2012. Limits and borders. Stages of transboundary water management, *Journal for Borderlands Studies* (forthcoming).

Wiggering, H., K. Müller, A. Werner and K. Helming, 2003. The concept of multifunctionality in sustainable land development. In: Helming, K. and H. Wiggering (Eds), 2003. Sustainable Development of Multifunctional Landscapes. Springer-Verlag, Berlin Heidel-berg New York.

Appendix A. Brief overview of the programme and the projects

The project consists of six work packages that each consist of two to four projects.

Figure 1: overview of work packages



WP 1. Collaborative action research for science hotspot relations, Termeer, van Buuren, Eshuis

Setting up a collaborative action research and consultancy programme that facilitates and directs the interactions between hotspots and research projects.

1.1 Knowledge brokering between scientists and hotspot partners (Huntjens, Termeer)

Organizing interfaces between hotspots/Delta programmes and researchers

1.2 Enhancing, supporting and reflecting upon collaborative action research approach methodology

Action research workshops with PhDs

WP 2. Organising connectivity (Teisman, Meijerink)

Developing and testing strategies to establish connectivity in order to implement climate adaptation measures within the existing structures.

2.1 Learning from Experiments in Adaptation Governance (McFagden (PhD), Huitema, Berkhout)

Case studies: negotiations on-going with hotspot Haaglanden and Hotspot Dry Rural Areas

2.2 Realizing climate robust multifunctional land use through system synchronization (Broekhoven (PhD), van Buuren, Teisman)

Case studies: a) Dakpark Rotterdam. Multifunctional land use project integrating a commercial building, a large city park on the roof, an existing flood defence structure and energy infrastructure (Hotspot Rotterdam) b) Floating Roses (Hotspot Haaglanden negotiations on-going)

2.3 Entrepreneurial leadership strategies for connecting across boundaries (Lamoen (external PhD) Meijerink, Stiller)

> Case studies: a) Leadership of the province of Noord-Brabant (Hotspot Dry Rural Areas), b) Waalweelde (own case study), c) Delta programme Rivers: leadership workshops (Delta programme, negotiations on-going)

2.4 The multilevel governance of climate adaptation (Verkerk (PhD), van Buuren, Teisman)

> Case studies: a) Programme development South West Delta (Hotspot South West Delta); b) Delta decision Rijn-Maasdelta (Delta programme); c) Delta programme rivers (negotiations on-going)

WP3. (Re)Allocating responsibilities and risks (Van Soest, Driessen)

Developing and testing new instruments and structures to increase adaption to climate change through adjusting the allocation of responsibilities or costs

3.1 Allocating public and/or private responsibilities for climate adaptation (Mees (PhD), Driessen, Runhaar)

> Case studies: a) Green roofs, comparing Rotterdam, Basel, Chicago, London and Stuttgart (Hotspot Rotterdam); b) Adaptive flood risk management in HafenCity Hamburg and Heijplaat (Hotspot Rotterdam); c) Fresh water supply (Hotspot South West Delta, the original case of the Volkerak Zoommeer need to be replaced by another one).

3.2 Implementing climate adaptation policies: Public policies and private initiatives and benefits (Dijk (PhD), van Soest)

> Case studies: a) 'Water vasthouden aan de bron' experiment with costs of water retention in Noord-Brabant (co-organised by Hotspot South West delta, three water boards, farmer's organization ZLTO)

WP 4. Dealing with controversies (Dewulf, Leroy)

Developing and testing methods to deal with climate related uncertainties, stakeholders' perceptions and contested knowledge, especially concerning relevant temporal and spatial scales of climate impacts and adaptation solutions.

4.1 Making sense of climate impacts. Understanding and dealing with the variety of climate change frames in governance processes (Vink (PhD), Dewulf, Termeer)

> Case studies: a) Delta committee (Ministry IenM); b) Project "Dry Feet" Process to prepare for climate change (Water board Noordzijlvest, Hotspot Open waters and peat areas); c) Evaluation of process Delta Programme Lake IJssel (Delta Programme Lake IJssel); d) coastal erosion in Eastern England or Delta Programme in Vietnam.

4.2 Science-policy arrangements at regional scale: how to warrant scientific requests and social robustness? (Boezeman, Leroy)

> Case studies: a) Delta committee (Ministry IenM); b) Project "Dry Feet" Process to prepare for climate change (Water board Noordzijlvest, Hotspot Open waters and peat areas);

WP 5. Normative principles for adaptation (van Rijswick, Wiering)

Elaborating the principles of legitimacy, effectiveness and resilience and analysing their impacts for the

5.1 Transitions of the normative governance framework of climate adaptation (van Rijswick, Keessen)

> Case studies: no specific projects. Advices for Rotterdam and Delta programme fresh water supply.

5.2 Principles and practices of the transboundary governance of climate adaptation Dutch governance of adaptation (Van Os (PhD), Wiering, Leroy)

Case studies: Rijn-Niederrhein?, Border the Netherlands, Germany (on-going negotiations with Hotspot Major Rivers, Delta programme Rivers)

WP 6. Comparative analysis of the governance of adaptation (Huitema, Berkhout, Termeer)

Setting up and conducting an international programme for comparative research and exchange of learning experiences across regional and national boundaries.

6.1 International comparative analysis and exchange (Huitema, Berkhout, Termeer)

Projects: international conference, comparative analysis

6.2 Integration and exchange between work packages (Termeer, van Vliet)

Appendix B. Overview of stakeholders involved

Overview co-financing partners

Hotspot	Task	Realised
HSWZ	€ 112,500	€ 0
HSRR	€ 125.000	€ 60.000
HSDR	€ 50.000	€ 50.000
HSZD	€ 80.000	€ 60.000
HSGR	€ 62.500	€ 0
HSHL	€ 250.000	€ 0
HSOV	€ 25.000	€ 45.000
Min IenM	-	€ 25.000

Appendix C. Communication activities

2010.01	newsletter no. 1
2010.05	PhD Reading Club
2010.06	PhD Reading Club
2010.08	Kick-off meeting Dutch partners
2010.10	Flyer Deltas in Times of Climate change
2010.10	Action Research workshop 1 for PhDs
2010.10	Kick-off meeting international partners
2010.11	Start Steering Committee
2010.12	visit international partner: Carl von Ossietzky Universität Oldenburg
2011.01	visit international partner: University of East Anglia
2011.02	Action Research workshop 2 for PhDs
2011.04	KfC Project Day: presentations, information desk
2011.04	newsletter no. 2
2011.06	visit international partner: Resilience Centre Stockholm
2011.06	Action Research workshop 3 for PhDs
2011.09.09	PhD Reading Club
2011.09.14	Consortium Day 2011
2011.10.14	Action Research workshop 4 for PhDs
2011.11.11	PhD Reading Club
2011.12.09	PhD Reading Club
2012.03.22-23	International Symposium 'The Governance of Adaptation', Amsterdam
2012.03.30	PhD Reading Club
18-4-2012	newsletter no. 3
2012.08.29	Action Research workshop 5 for PhDs
2012.08.31	Consortium Day 2012
2012.10.04	Midterm Review KfC
2013.03.18-20	ECCA Conference Hamburg
2013.09.05-07	ECPR General Conference, Bordeaux, T7 section and panels

Appendix D. Publications

Overview of publication, updated to August 1, 2012

Publication type	Year	Reference
Book (public site)	2012	Termeer, C.J.A.M., Dewulf, A. & Breeman, G. (2012). Governance of wicked climate adaptation problems. In: J. Knieling & W.L. Filho (Eds). Climate Change Governance. Springer, Berlin, pp. 27–41.
Book (public site)	2011	Huntjens, P. (2011). Water Management and Water Governance in a Changing Climate. Experiences and insights on climate change adaptation in Europe, Africa, Asia and Australia. Delft: Eburon, pp. 398, ISBN: 9789059725096.
Book (public site)	2011	Rijswick, H.F.M.W. van (2011). De verdeling van schaarse waterrechten. In: F.J. van Ommeren, W. den Ouden & C.J. Wolswinkel (Eds.). Schaarse publieke rechten, Boom Juridische Uitgevers, Den Haag, p. 133-158.
Book (public site)	2011	Rijswick, H.F.M.W. van & Hey, E. (2011). Transnational watermanagement. In: O. Jansen & B. Schöndorf-Haubold (Eds.). The European Composite Administration, Intersentia, p. 227-249.
Brochure (public site)	2010	Termeer, C.J.A.M. (2010). Governance of Adaptation. Flyer on theme 7, Knowledge of Climate.
Media (public site)	2011	Huntjens, P.M.J.M. (2011). Kosten extreme droogte in Nederland half miljard, 11 mei, www.bnr.nl.
Media (public site)	2011	Huntjens, P.M.J.M. (2011). Uitzending van Uitgesproken VARA 20 mei 2011. Nederland is droog, heel droog.
Media (public site)	2011	Huntjens, P.M.J.M. (2011). Uitzending van EenVandaag op 3 juni 2011: Wat zijn de gevolgen van de droogte in Nederland.
Popular Article about Science (public site)	2012	Bos, A. & Mees, H. (2012). Effectief beleid voor groene daken. Wat kunnen we leren van het buitenland? Dak en Gevelgroen, uitgave 2, juni 2012.
Popular Article about Science (public site)	2012	Bos, A. & Mees, H. (2012). Effectief beleid voor groene daken. Wat kunnen we leren van het buitenland. VHG Magazine, juli 2012.
Popular Article about Science (public site)	2012	Hammer, F., Termeer, K. & Thissen, W. (2012). H2O tijdschrift voor watervoorziening en afvalwaterbehandeling, issue 30.3.2012: 4-7 (Theme 7, deliverable 1.1.4).
Popular Article about Science (public site)	2012	Termeer, C.J.A.M. (2012) Spraakwater. Contra intuïtief innoveren in de waterwereld. Water Governance, 1(2012): 72-73 (Theme 7, deliverable 1.1.3).
Popular Article about Science (public site)	2010	Wiering, M. (2010). Grenzen aan de samenwerking in het Rijnstroomgebied. Geografie, juni 2010: 34-37.
Poster (public site)	2010	Dewulf, A., Vink, M. and Termeer, C.J.A.M. (2010). Climate Gate. Poster for the Deltas Conference, 29 September - 1 October, Rotterdam.
Poster (public site)	2010	Mees, H. & Driessen P. (2010). Climate Greening Rotterdam, London and Toronto. Deltas in Times of Climate Change Conference, 29.9.2010, Rotterdam.
Poster (public site)	2010	Poster Theme 7 (2010). For the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 1, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 2, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 3, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 4, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 5, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.
Poster (public site)	2010	Poster of Theme 7 (2010). Work Package 6, for the stand at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.

Proceedings (intranet)	2011	Mees, H.L.P., Driessen, P.P.J. & Runhaar, H.A.C. (2011). Towards hybridization? A conceptual model to explore the role of public and/or private parties in governance arrangements for climate adaptation. Paper for ECPR Joint Session "The Transformation of Global Climate Governance: Assessing Architecture, Agency and Accountability", University of St Gallen, Switzerland, 12-17 April 2011 (Theme 7, Deliverable 3.1.1.).
Proceedings (intranet)	2011	Termeer, C.J.A.M. & Brink, M. van den (2011). Are Dutch water management authorities able to make sense of the 'unknown unknowns' of climate change? Paper IRSPM Conference, Dublin, 11-13 April 2011.
Proceedings (intranet)	2011	Verkerk, J. & Buuren, A. van (2011). Climate adaptation processes in a multi-level governance setting Principles for effective system synchronization in the Dutch Delta1. IGS-Sence Conference Resilient Societies -Governing Risk and Vulnerability for Water, Energy and Climate Change, 19-21 October 2011, University of Twente, Enschede.
Proceedings (intranet)	2011	Vink, M.J., Boezeman, D., Dewulf, A.R.P.J. & Termeer, C.J.A.M. (2011). Changing climate, changing frames; the role of frame interactions in Dutch water safety policy. Conference paper for the 6th International Conference in Interpretative Policy Analysis (IPA), Cardiff, 23-25 June 2011.
Proceedings (public site)	2010	Mees, H. & Driesen, P. (2010). Climate Greening London, Rotterdam and Toronto. 24th Annual Aesop Conference, 7-10.7.2010, Helsinki, Finland.
Project Factsheet (public site)	2012	Mees, H.L.P. (2012). Allocation of public and-or private responsibilities. Governance arrangements for green roofs. Project Factsheet Work Package 7.3.1.
Project Factsheet (public site)	2011	Mees, H.L.P. (2011). Allocation of public and/or private responsibilities: sturings-arrangementen voor groene daken. Project Factsheet Theme 7, work package 7.3.1.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Scientific aspects of the research proposal.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Summary of the research proposal.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 1 - Collaborative action research for science hotspot relations.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 2 - Organising connectivity.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 3 - (Re)Allocating responsibilities and risks.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 4 - Dealing with controversies.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 5 - Normative principles for adaptation.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Description of Work Package 6 - Comparative analysis of the governance of adaptation.
Project Factsheet (public site)	2010	Governance of Adaptation (2010). Societal aspects of the research proposal.
Project Newsletter (public site)	2012	Thema 7 Newsletter Governance of Climate Adaption (2012). Special issue International Symposium Governance of Adaptation, 22-23.3.2012, Amsterdam. Nummer 3, april 2012 (Thema 7, deliverable 1.1.7).
Project Newsletter (public site)	2011	Thema 7 Newsletter Governance of Climate Adaption (2011). Nummer 2, april 2011 (Thema 7, deliverable 1.1.7.) .
Project Newsletter (public site)	2010	Thema 7 Newsletter Governance of Climate Adaption (2010). Nummer 1, oktober 2010 (Thema 7, deliverable 1.1.7.).
Report (intranet)	2012	Mees, H., Dijk, J., Soest, D. van, Driessen, P., Rijswick, M. van & Runhaar, H. (2012). Policy instruments for promoting adaptation to climate change. A framework for assessing public, private and interactive instruments and mixes (Deliverable 3.2.1).
Report (intranet)	2011	Broekhoven, S. van, Buuren, A. van, Huitema, D., McFadgen, B., Meijerink, S., Teisman, G. & Verkerk, J. (2011). Climate adaptation and the challenge of realizing connectivity within fragmented governance systems. Position paper Work Package 2 (Theme 7, Deliverable 2.A).
Report (intranet)	2011	Dijk, J., Mees, H., Soest, D. van, Driessen, P., Runhaar, H. & Rijswick, M. van (2011). On the implementation of climate adaptation policies. Public responsibilities and private initiatives? (Theme 7, Deliverable 3.A).

Report (intranet)	2011	Huitema, D., Massey, E., Mees, H., Termeer, K., Storbjörk, S., Garrelts, H., Grecksch, K., Winges, M. & Rayner, T. (2011). Handling adaptation governance choices in Sweden, Germany, the UK and the Netherlands (Deliverable 6.A., Theme 7).
Report (intranet)	2011	Keessen, J., Hamer, J., Rijswick, M. van & Wiering, M. (2011). Ways towards resilience. Shifts in defining the public interest with regard to adaptation to climate change. Submitted to Ecology and Society (Theme 7, Deliverable 5.1.1.).
Report (intranet)	2011	Meijerink, S. & Stiller, S.J. (2011). What kind of leadership do we need for climate adaptation? A framework for analyzing leadership functions and tasks in climate change adaptation, pp. 26 (Theme 7, Deliverable 2.3.1.).
Report (public site)	2012	McFadgen, B. (2012). What is the value of 'twisting the lion's Tail?' Evaluating the use of policy experiments in adaptation governance and how they can facilitate learning (Theme 7, Deliverable 2.1.1).
Report (public site)	2011	Dewulf, A., Boezeman, D., Vink, M. & Leroy, P. (2011). The interplay of meaning and power in the science-policy-society triangle: powering, puzzling and co-producing climate change adaptation (Deliverable 4.A, Theme 7).
Report (public site)	2011	Huitema, D., Massey, E., Mees, H., Termeer, K., Storbjörk, S., Garrelts, H., Grecksch, K., Winges, M. & Rayner, T. (2011). Handling adaptation governance choices in Sweden, Germany, the UK and the Netherlands (Theme 7, Deliverable 6.A).
Report (public site)	2011	Rijswick, H.F.M.W. van, Wiering, M.A., Gilissen, H.K., Morales, I., Thorp, T. & Keessen, A. (2011). Normative principles of adaptation. Shifts in defining the public interest and the role of principles with regard to adaptation to climate change. (Theme 7, Deliverable 5.A).
Report (public site)	2011	Schueler, B.J., Rijswick, H.F.M.W. van, Gier, A.A.J. de, Driessen, P.P.J., Meijerink, S.V., Pot, W.D., Reuding, M.A., Tennekes, J. & Termeer, C.J.A.M. (2011). Beleids- en rechtswetenschappelijke aspecten van klimaatadaptatie, Den Haag/Bilthoven: Planbureau voor de leefomgeving, KfC report no. KfC040/2011, ISBN/EAN 978-94-9007-045-8.
Scientific Paper (intranet)	2011	Mees, H-L.P., Driessen, P.P.J., Runhaar, H.A.C. & Stamatelos, J. (2011). Governance arrangements for climate adaptation. The case of green roofs for storm water retention in urban areas. IGS-Sense Conference Resilient Societies, 19-21.10.2011, Enschede (KvK Theme 7, Deliverable 3.1.3).
Scientific Paper (intranet)	2011	Soest, D.P. van & Dijk, J.J. (2011). De economische efficiëntie van agrarisch natuurbeheer. Economische Statistische Berichten, ESB Dossier "De economie van natuur", Vol. 96 (46125): 11-15.
Scientific Paper (public site)	2011	Brink, M. van der, Termeer, C.J.A.M. & Meijerink, S. (2011). Are Dutch water safety institutions prepared for climate change? Journal of Water and Climate Change. 2.4.: 272-287.
Scientific Paper (public site)	2011	Huntjens, P., Termeer, C, Eshuis, J., Van Buuren, M.W. (2011). Collaborative action research for the governance of climate adaptation - foundations, conditions and pitfalls (Theme 7 Deliverable 1A).
Scientific Paper (public site)	2011	Runhaar, H., Mees, H., Sluijs, J. van der, Wardekker, A. & Driessen, P. (2011). Omgaan met hittestress en wateroverlast in de stad. Milieu 2011-2, rubriek milieu dossier, p. 22-25.
Scientific Paper (public site)	2011	Wilson, E. & Termeer, C.J.A.M. (2011). Governance of climate change adaptation: Introduction to the Special Issue. Special Issue Climate Law, vol. 2: 149-157.
Scientific paper peer reviewed (intranet	2012	Scholten, P., Keskitalo, E.C.H. & Meijerink, S. (2012). Bottom-up initiatives towards climate adaptation in cases in the Netherlands and the UK: a complexity leadership perspective (Deliverable 2.3.2).
Scientific paper peer reviewed (intranet	2011	Buuren, A. van, Klijn, E.H. & Edelenbos, J. (2011). Democratic legitimacy of new forms of water management in the Netherlands, International Journal of Water Resources Development, 1-17. DOI:10.1080/07900627.2011.627756 (online first).
Scientific paper peer reviewed (public site)	2012	Mees, H.L.P., Driessen, P.P.J. & Runhaar, H.A.C. (2012). Exploring the Scope of Public and Private Responsibilities for Climate Adaptation. Journal of Environmental Policy & Planning, 14(3): 305-330.
Scientific paper peer reviewed (public site)	2012	Munaretto, S. & Huitema, D. (2012). Adaptive comanagement in the Venice lagoon? An analysis of current water and environmental management practices and prospects for change. Ecology and Society, 17(2): 19.

Scientific paper peer reviewed (public site)	2012	Runhaar, H., Mees, H., Wardekker, A., Sluijs, J. van der, Driessen, P.P.J. (Utrecht University) (2012). Adaptation to climate change-related risks in Dutch urban areas: stimuli and barriers. Regional Environmental Change (online first, 28.2.2012).
Scientific paper peer reviewed (public site)	2012	Termeer, C.J.A.M. & Brink, M. van den (2012). Organizational conditions for dealing with the unknown unknowns, illustrated by how a Dutch water management authority is preparing for climate change. Public Management Review (ONLINE FIRST).
Scientific paper peer reviewed (public site)	2011	Arguedas, C. & Soest, D.P. van (2011). Optimal conservation programmes, asymmetric information and the role of fixed costs. Environmental and Resource Economics, 50: 305–323.
Scientific paper peer reviewed (public site)	2011	Biesbroek, R., Klostermann, J., Termeer, C. & Kabat, P. (2011). Barriers to climate change adaptation in the Netherlands, Climate Law, vol. 2: 181–199.
Scientific paper peer reviewed (public site)	2011	Dewulf, A.R.P.J., Mancero, M., Cárdenas, G. & Sucozhañay, D. (2011). Fragmentation and connection of frames in collaborative water governance. International Review of Administrative Sciences, 77(1): 50-75.
Scientific paper peer reviewed (public site)	2011	Driessen, P.P.J. & H.F.M.W. van Rijswick (2011). Normative aspects of climate adaptation policies. Climate Law, 2(4): 559-581.
Scientific paper peer reviewed (public site)	2011	Huitema, D., Jordan, A., Massey, E., Rayner, T., Asselt, H. van, Haug, C., Hildingsson, R., Monni, S. & Stripple, J. (2011). The evaluation of climate policy: theory and emerging practice in Europe. Policy Sciences, Vol. 44, pp. 179-198.
Scientific paper peer reviewed (public site)	2011	Huntjens, P., Pahl-Wostl, C., Rihoux, B., Schlüter, M., Flachner, Z., Neto, S., Koskova, R., Dickens, C. and Nabide Kiti, I. (2011). Adaptative water management and policy learning in a changing climate: a formal comparative analysis of eight water management regimes in Europe, Africa and Asia. Environmental Policy and Governance, 21(3): 145-163.
Scientific paper peer reviewed (public site)	2011	Mees, H.L.P. & Driessen, P.P.J. (2011). Adaptation to Climate Change in Urban areas: Climate-greening London, Rotterdam, and Toronto, Climate Law, vol. 2: 251-280.
Scientific paper peer reviewed (public site)	2011	Rijswick, H.F.M.W. van (2011). The status of consumers in European water regulation. In: Ch. Verdure (Ed.). Environmental Law and Consumer Protection, European Journal of Consumer Law, vol. 1: 115-148.
Scientific paper peer reviewed (public site)	2011	Termeer, C.J.A.M., Biesbroek, G.R. & Brink, M.A. van den (2011). Institutions for adaptation to climate change: comparing national adaptation strategies in Europe (online first). European Political Science, 1-13.
Scientific paper peer reviewed (public site)	2011	Termeer, C., Dewulf, A., Van Rijswick, H.., Van Buuren, A., Huitema, D., Meijerink, S., Rayner, T. & Wiering, M. (2011). The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements. Climate Law, vol. 2: 159-179, Position Paper (Theme 7, Deliverable 0.A).
Scientific paper peer reviewed (public site)	2010	Wiering, M., Verwijmeren, J., Lulofs, K. & Feld, C. (2010). Experiences in Regional Cross Border Co-operation in River Management. Comparing Three Cases at the Dutch-German Border. Water Resources Management, on line access: DOI: 10.1007/s11269-009-9572-5.

Deliverables

Overview of Deliverables, updated to August 1, 2012

Publication Type	Year	Reference
Scientific paper peer reviewed (public site)	2011	Termeer, C., Dewulf, A., Van Rijswick, H.., Van Buuren, A., Huitema, D., Meijerink, S., Rayner, T. & Wiering, M. (2011). The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements. Climate Law, vol. 2: 159-179, Position Paper (Theme 7, Deliverable 0.A).
Scientific paper peer reviewed (intranet	2012	Scholten, P., Keskitalo, E.C.H. & Meijerink, S. (2012). Bottom-up initiatives towards climate adaptation in cases in the Netherlands and the UK: a complexity leadership perspective (Deliverable 2.3.2).
Scientific Paper (public site)	2011	Huntjens, P., Termeer, C, Eshuis, J., Van Buuren, M.W. (2011). Collaborative action research for the governance of climate adaptation - foundations, conditions and pitfalls (Theme 7 Deliverable 1A).
Scientific Paper (intranet)	2011	Mees, H-L.P., Driessen, P.P.J., Runhaar, H.A.C. & Stamatelos, J. (2011). Governance arrangements for climate adaptation. The case of green roofs for storm water retention in urban areas. IGS-Sense Conference Resilient Societies, 19-21.10.2011, Enschede (KvK Theme 7, Deliverable 3.1.3).
Report (public site)	2012	McFadgen, B. (2012). What is the value of 'twisting the lion's Tail?' Evaluating the use of policy experiments in adaptation governance and how they can facilitate learning (Theme 7, Deliverable 2.1.1).
Report (public site)	2011	Dewulf, A., Boezeman, D., Vink, M. & Leroy, P. (2011). The interplay of meaning and power in the science-policy-society triangle: powering, puzzling and co-producing climate change adaptation (Deliverable 4.A, Theme 7).
Report (public site)	2011	Huitema, D., Massey, E., Mees, H., Termeer, K., Storbjörk, S., Garrelts, H., Grecksch, K., Winges, M. & Rayner, T. (2011). Handling adaptation governance choices in Sweden, Germany, the UK and the Netherlands (Theme 7, Deliverable 6.A).
Report (public site)	2011	Rijswick, H.F.M.W. van, Wiering, M.A., Gilissen, H.K., Morales, I., Thorp, T. & Keessen, A. (2011). Normative principles of adaptation. Shifts in defining the public interest and the role of principles with regard to adaptation to climate change. (Theme 7, Deliverable 5.A).
Report (intranet)	2012	Mees, H., Dijk, J., Soest, D. van, Driessen, P., Rijswick, M. van & Runhaar, H. (2012). Policy instruments for promoting adaptation to climate change. A framework for assessing public, private and interactive instruments and mixes (Deliverable 3.2.1).
Report (intranet)	2011	Broekhoven, S. van, Buuren, A. van, Huitema, D., McFadgen, B., Meijerink, S., Teisman, G. & Verkerk, J. (2011). Climate adaptation and the challenge of realizing connectivity within fragmented governance systems. Position paper Work Package 2 (Theme 7, Deliverable 2.A).
Report (intranet)	2011	Dijk, J., Mees, H., Soest, D. van, Driessen, P., Runhaar, H. & Rijswick, M. van (2011). On the implementation of climate adaptation policies. Public responsibilities and private initiatives? (Theme 7, Deliverable 3.A).
Report (intranet)	2011	Huitema, D., Massey, E., Mees, H., Termeer, K., Storbjörk, S., Garrelts, H., Grecksch, K., Winges, M. & Rayner, T. (2011). Handling adaptation governance choices in Sweden, Germany, the UK and the Netherlands (Deliverable 6.A., Theme 7).
Report (intranet)	2011	Keessen, J., Hamer, J., Rijswick, M. van & Wiering, M. (2011). Ways towards resilience. Shifts in defining the public interest with regard to adaptation to climate change. Submitted to Ecology and Society (Theme 7, Deliverable 5.1.1.).
Report (intranet)	2011	Meijerink, S. & Stiller, S.J. (2011). What kind of leadership do we need for climate adaptation? A framework for analyzing leadership functions and tasks in climate change adaptation, pp. 26 (Theme 7, Deliverable 2.3.1.).

Project Newsletter (public site)	2012	Thema 7 Newsletter Governance of Climate Adaption (2012). Special issue International Symposium Governance of Adaptation, 22-23.3.2012, Amsterdam. Nummer 3, april 2012 (Thema 7, deliverable 1.1.7).
Project Newsletter (public site)	2011	Thema 7 Newsletter Governance of Climate Adaption (2011). Nummer 2, april 2011 (Thema 7, deliverable 1.1.7.) .
Project Newsletter (public site)	2010	Thema 7 Newsletter Governance of Climate Adaption (2010). Nummer 1, oktober 2010 (Thema 7, deliverable 1.1.7.).
Proceedings (intranet)	2011	Mees, H.L.P., Driessen, P.P.J. & Runhaar, H.A.C. (2011). Towards hybridization? A conceptual model to explore the role of public and/or private parties in governance arrangements for climate adaptation. Paper for ECPR Joint Session "The Transformation of Global Climate Governance: Assessing Architecture, Agency and Accountability", University of St Gallen, Switzerland, 12-17 April 2011 (Theme 7, Deliverable 3.1.1.).
Popular Article about Science (public site)	2012	Hammer, F., Termeer, K. & Thissen, W. (2012). H2O tijdschrift voor watervoorziening en afvalwaterbehandeling, issue 30.3.2012: 4-7 (Theme 7, deliverable 1.1.4).
Popular Article about Science (public site)	2012	Termeer, C.J.A.M. (2012) Spraakwater. Contra intuïtief innoveren in de waterwereld. Water Governance, 1(2012): 72-73 (Theme 7, deliverable 1.1.3).

Presentations

Overview of presentations, updated to August 1, 2012

Year	Reference
2012	Boezeman, D. (2012). The Delta Committee as a Boundary Organization. SCAPES Seminar Series, Nijmegen, 27.1.2012.
2012	Keessen, A.M. & Rijswick, H.F.M.W. van (2012). Analysis of the potential of EU water law and policy body to adapt to climate change. Malta Forum for Legal Issues on climate adaptation policies, University of Malta in cooperation with DG CLIMA, Valetta, Malta, 17.2.2012.
2012	Mees, H.L.P. et al. (2012). Who Governs Climate Adaptation? Getting green roofs for storm-water retention off the ground. Governance of Adaptation Symposium, Amsterdam, 23.3.2012
2012	Mees, H.L.P., et al. (2012). Policy Instruments for promoting adaptation to climate change. A framework for assessing public, private and interactive instruments. Governance of Adaptation Symposium, Amsterdam, 23.3.2012.
2011	Boezeman, D. (2011). Regional science-policy arrangements. Knowledge for Climate Project Day, Amersfoort, 7.4.2011.
2011	Gilissen, H.K. (2011). The influence of threatening liability on adaptation to climate change in Dutch water management. Ius Commune Congres, Utrecht University, Utrecht, 24.11.2011.
2011	Huntjens, P. (2011). Governance of climate adaptation in Zuidwestelijke Delta. Knowledge for Climate Project Day, Amersfoort, 7.4.2011.
2011	Keessen, A.M. & Rijswick, H.F.M.W. Van (2011). Resilience-based Thinking in European River Basin Management & the Dutch Institutional Arrangement for Common Pool Resource Management. Resilience conference 'Resilience, Innovation and Sustainability: navigating the complexities of global change'. Tempe, Arizona, 12.3.2011.
2011	Kempen, J. van (2011). Environmental obligations in the Water Framework Directive. Expert meeting University of Gothenburg, Sweden, 14.4.2011.
2011	Leroy, P. (2011). Laat klimaatverandering de bordeauxwijn koud? Lezing ter gelegenheid van de uitreiking van de Prijs Rudi Verheyen, Antwerpen, 30.11.2011.
2011	Mees, H.L.P. (2011). Sense PhD training school on the Human Dimensions of Global Environmental Change, IVM Amsterdam, 28.9.2011.
2011	Mees, H.L.P. (2011). VHG vakgroep Dak- en Gevelgroen, Houten, 12.12.2011.
2011	Meijerink, S. (2011). Governance of Climate Adaptation: Main Rivers. Knowledge for Climate Project Day, Amersfoort, 7.4.2011.
2011	Meijerink, S. & Stiller, S. (2011). What kind of leadership do we need for climate adaptation. Presentation at 6th ECPR General Conference, Reykjavik, Iceland, 27.8.2011.
2011	Munaretto, S. & Huitema, D. (2011). Adaptive co-management in the Venice lagoon? An analysis of current water and environmental management practices and prospects for change. Paper presented to the Earth System Governance Conference, Fort Collins (CO), 17-20.5.2011.
2011	Rijswick, H.F.M.W. van (2011). Waterkeringen, inspecties, innovatie en aansprakelijkheid. Kennisdag Inspectie Waterkeringen. Arnhem, 24.3.2011.
2011	Rijswick H.F.M.W. van (2011). Expertmeeting schaarse waterrechten/ schaarse publieke rechten, VU Amsterdam, 25.3.2011.
2011	Rijswick, H.F.M.W. van (2011). Crisis, what crisis? Leidt de economische crisis tot een watercrisis? De betekenis van Europese verplichtingen voor het Nederlandse waterbeheer. Actualiteitendag, Vereniging voor Milieurecht, 31.3.2011.
2011	Rijswick, H.F.M.W. van (2011). Implementing the Water Framework Directive in the Netherlands. Actual discussions. Comparative conference on the implementation of the WFD. University of Gothenburg, Sweden, 13.4.2011.
2011	Rijswick H.F.M.W. van (2011). Challenges in European water Law. Expert meeting University of Gothenburg, Sweden, 14.4.2011.
2011	Rijswick H.F.M.W. van (2011). Presentation 'The governance of water resources in the Netherlands', for a delegation from India India about decentralized water management in the Netherlands. USI Utrecht, Utrecht University, Utrecht, 20.4.2011.
2011	Rijswick H.F.M.W. van (2011). Expertmeeting schaarse waterrechten/ schaarse publieke rechten, VU Amsterdam, 4.6.2011.
2011	Rijswick, H.F.M.W. van (2011). Resilient and Sustainable Governance of River Basins in Times of Climate Change. Avoiding flooding and water scarcity: the Dutch institutional arrangement for regional water management. IUCN AEL Water Colloquium. Eastern Cape, South Africa, 4.7.2011.
2011	Rijswick H.F.M.W. van (2011). Institutional requirements for water management in times of climate change. IUCN Environmental Law Academy on Water and Sustainability, South Africa, 5.7.2011.

2011	Rijswick H.F.M.W. van (2011). Chair conference Koninklijk Waternetwerk & Instituut voor Bouwrecht over de aansprakelijkheid voor opstallen in het waterbeheer (Wilnis), Utrecht University, 29.9.2011.
2011	Rijswick H.F.M.W. van (2011). Dag van de Duurzaamheid, 'Ruimte creeeren voor innovatie en duurzaamheid: verdeling van watergebruiksrechten en watervervuilingsrechten. USI, Utrecht University, Utrecht, 11.11.2011.
2011	Rijswick H.F.M.W. van & Robbe, J. (2011). Normative Principles and the Public Interest with regard to fresh water supply (Deltaprogramma zoetwatervoorziening). LEF-Centre, Utrecht, 12.11.2011.
2011	Termeer, C.J.A.M. (2011). Presentation at 'The Committee for Climate Change'. London, 24.2.2011.
2011	Termeer C.J.A.M. (2011). Presentation at KfC International Scientific Advisory Committee, Amsterdam, 7.3.2011.
2011	Termeer, C.J.A.M., Huntjens, P.M.J.M., Dewulf, A.R.P.J., Buuren, A. van & Eshuis, J. (2011). Reconciling innovative knowledge partnerships into existing institutions: the case of the Dutch Knowledge for Climate program. IRSPM Conference, Dublin, 11-13.4.2011.
2011	Thorp, T. (2011). Principles in the climate regime as a tool for dealing with complexity and flexibility. Ius Commune congres, Utrecht University, Utrecht, 24.11.2011.
2010	Gilissen, H.K. (2010). The Influence of Liability Law on Adaptation to Climate Change. Conference Law for Social-Ecological Resilience, Stockholm University, 18.11.2010.
2010	Mees, H. (2010). Climate Greening London, Rotterdam and Toronto: the Governance Capacity of Spatial Planning to Adapt Cities to Climate Change through Green Space. 24th Annual Aesop Conference, 8.7.2010, Helsinki, Finland.
2010	Rijswick, H.F.M.W. van (2010). European Water Law in Transition New Fundamentals in Fresh Water Regulation. EU-China Conference on Environmental Law. Ghent University, 20.9.2010.
2010	Rijswick, H.F.M.W. van (2010). Legal analysis of the dune reinforcements along the Dutch coast. Deltas in Times of Climate Change Conference, Rotterdam, 29.9.2010.
2010	Rijswick, H.F.M.W. van (2010). Ruimte creëren voor innovatie en duurzaamheid: verdeling van watergebruiksrechten en watervervuilingsrechten. Dag van Duurzaamheid, 11.11.2010.
2010	Rijswick, H.F.M.W. van (2010).Water als potentiële bron van conflicten: de Europese en nationale dimensie. NW Symposium 2010: Water Conflicten. Open Universiteit, Eindhoven, 13.11.2010.
2010	Rijswick H.F.M.W. van (2010). Shifts in the public interest. Conference Law for Social-Ecological Resilience, Stockholm University, 18.11.2010.
2010	Rijswick, H.F.M.W. van (2010). Towards resilience in water law and water management. The Governance of Adaptation to Climate Change. Conference Law for Social-Ecological Resilience, Stockholm University,17-19.11.2010.
2010	Rijswick, H.F.M.W. van (2010). Implementing water adaptation measures within the current legal framework. IUS Commune Research School conference, Leuven, 26.11.2010.
2010	Soest, D. van (2010). On the role of group size in tournaments: theory and evidence from lab and field experiments", paper presented at the research seminar of the Exeter Business School, 8.10.2010.
2010	Termeer, C.J.A.M. (2010). Deltas in Times of Climate Change Conference, 29.9. - 1.10.2010, Rotterdam.
2010	Termeer, C.J.A.M., Dewulf, A., Buuren, A. van, Huitema, D., Meijerink, S., Jordan, A., Rayner, T., Rijswick, H. van & Wiering, M. (2010). Governance of climate adaptation - a framework for developing legitimate, effective and resilient governance arrangements, Presentation at the Deltas in Times of Climate Change Conference, 29.9.-1.10.2010, Rotterdam.