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## Out of the Comfort Zone: Institutional Context and the Scope for Legitimate Climate Adaptation Policy

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**ABSTRACT** *Adaptation to climate change is gradually becoming accepted as one of the major challenges in regional and urban planning. However, the scope for options that make our societies less vulnerable to flood risks, disruptive quantities of rainwater in cities, or urban heat stress tends to be narrowed down, often implicitly, by the existing institutional context. Institutions reflect past choices made regarding the legitimate distribution of burdens and benefits between government and society of measures against weather-related calamities. Alternative options, like innovative dyke concepts, green roofs, or urban planning to reduce heat stress, would require political debate on the legitimacy of different arrangements and would take climate adaptation policy out of the technocratic 'comfort zone'. This article offers a framework of analysis for describing the institutionalized distribution of responsibilities for initiation, implementation, costs and liability for climate adaptation measures, and the shift in these that alternative options would entail. Furthermore, it offers four perspectives for assessing the legitimacy of present and alternative distributions. The framework is applied to the Dutch context in three cases concerning flooding, urban water drainage and urban heat stress.*

**KEY WORDS:** Climate adaptation policy, institutional context, legitimacy, national adaptation strategies, governance

### 1. Introduction

Adaptation to the effects of climate change has become a major topic on the spatial planning agenda over the last 10 years. In many countries, adaptation strategies have been developed that address the problem on various spatial scales: the city, the regional, the national, and even the international scale (e.g. Bauer *et al.*,

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2012; European Commission, 2007, 2009; Mees & Driessen, 2011; PBL Netherlands environmental Assessment Agency, 2011; Swart *et al.*, 2009). The line of argument in climate adaptation strategy documents is often the same; the reality of climate change is being established, a scientific-based conjecture about possible effects on a particular area is being made, possible options to counteract or adapt to these effects are being proposed (technical, spatial, behavioural, or organizational), and finally these options are being assessed in terms of (cost-effectiveness).

In this article, we argue that this usual line of argument lacks one important step. It is crucial to address the institutional setting in which effects take place and adaptation options have to be implemented. For, as we will try to show, the present institutional setting is an important factor in setting the scope for adaptation policy. Adaptation options that stay within the established institutional order tend to be assessed as legitimate in that they appear to be the 'natural' response. In contrast, adaptation measures that redistribute costs and benefits, risks and responsibilities to public and private actors, or over different government levels, easily appear less attractive, even though they may be equally or even more effective in terms of their contribution to the goal of making society less vulnerable to the effects of climate change. The scope for climate change adaptation options seems to be path-dependent (e.g. Pierson, 2000) on institutionalized solutions that have been established in the past.

This article focuses on the question of how the existing, institutionalized distribution of responsibilities for solving the weather-related problems which have always existed, now sets the scope for options in the new challenge to adapt to climate change. If climate change adaptation is to be taken seriously as a major, long-term challenge, it is necessary to think beyond the established institutional boundaries and to increase the range of possible successful options. This means that decision-makers must be prepared to engage in a discussion regarding the distribution of burdens and benefits associated with different adaptation measures. New distributions are not necessarily less legitimate, but their legitimacy has to be discussed and settled anew. In short, alternative adaptation measures entail making new societal arrangements and taking actors 'out of their comfort zones', which is something that most of us do only reluctantly.

There has been a focus in the academic literature on institutions of climate adaptation in the sense of the (re)design of organizations—governmental or otherwise—for effective adaptation policy (e.g. Anguelovski & Carmin, 2011; Gupta *et al.*, 2010; Mees & Driessen, 2011). Institutions are conceptualized as organizational capacity or policy instruments that are deployed as a *means* to decrease society's vulnerability to climate change.

There has been less attention paid to institutions as the *context* in which possible adaptation options are being developed. This article focuses on one aspect of this institutional context, that is, the distribution of responsibilities amongst societal actors and the way in which this context influences the assessment of adaptation options as legitimate or illegitimate. It does so by presenting a framework for analysis and assessment, and by providing illustrations from adaptation practice in the Dutch context.

The paper demonstrates that there is room for new choices in institutional arrangements; new choices which, although out of the comfort zone, can be argued to be just as legitimate as existing ones. In general, legitimacy relates to substantive and procedural fairness and to the extent to which decisions are acceptable to stakeholders and participants in policy processes (van Buuren

*et al.*, 2013). It is not our ambition to provide decisive arguments in favour of a particular adaptation measure, either in terms of its effectiveness or its legitimacy. What we do want to show is that there is a greater range of potentially legitimate options for potentially effective climate adaptation measures if the present institutionalized distributions of costs, benefits, risks, and responsibilities are not taken as given.

We will present our argument in three steps. First, a framework is outlined in Section 2 for: (a) the analysis of processes in which climate change adaptation measures in the domain of planning raise institutional issues concerning the distribution of burdens and benefits, and (b) the analysis of the legitimacy of a different distribution. Section 3 presents three cases from the Dutch context based on the results of a multidisciplinary research project of the Netherlands Environmental Assessment Agency (PBL, 2011): safety against flooding, urban water drainage, and protection from urban heat stress. Adaptation plans from a 'default' institutional perspective are compared with alternatives that demand new institutionalization. Section 4 concludes with some reflections on the possibilities to stimulate the debate on alternative adaptation measures, which would bring politicians and stakeholders out of their comfort zone for more effective climate adaptation policies.

## 2. Framework of Analysis

Although discussions in science and practice mostly centre on the effectiveness and cost-effectiveness of particular adaptation measures, presuppositions about the distribution of adaptation burdens or benefits over government and society are often left implicit. Making them explicit, as a first step of analysis, is therefore necessary. We aim to do this with the help of four fundamental questions regarding the burdens and benefits that are distributed among societal actors. After that, we introduce four different perspectives on the legitimacy of these distributions, which are of particular relevance to climate adaptation policy.

### 2.1 Four Questions About Distributions of Burdens and Benefits

The first question one may ask to make the institutional context of adaptation options more explicit is: who is primarily responsible for taking the initiative to adapt to climate change? Who has to see that it is carried out to a certain level? This need not necessarily be the government. Different national systems have institutionalized this responsibility quite differently. For example, flood protection in the Netherlands is an exclusive government task, while in the USA private persons in flood prone areas are deemed much more responsible for their own protection. Another way of formulating this question is to ask: who in society is the *problem-owner* of the need to adapt to climate change (Runhaar *et al.*, 2012)?

The second question is: who is responsible for designing and *carrying out* adaptation measures? Even if the government takes the first responsibility, this does not mean that it has to carry out the adaptation measures itself. The government can oblige other actors through norms, targets or obligatory procedures, leaving the design and implementation to private persons or the private sector. For instance, if the government wants to increase the water retention capacity in cities, a subsidy can be helpful in stimulating house owners to construct green roofs.

This brings us to the third question: who should *pay* for adaptation measures? This question is clearly distinct from the previous questions. Central government may implement far-reaching safety measures, but it can choose either to recoup the related costs from those who benefit from them, or to finance them from general taxes. In the case that it leaves the implementation to private actors, the costs would normally accrue to them, but government can choose to subsidize adaptation measures.

Fourthly, who will bear the risks of damages that, with or without adaptation measures, will always exist? As opposed to the first question, which designates the political responsibility for taking the initiative, this question addresses *liability*. Does the government have the task of compensating for damages that occur? The distinction between tortious liability and no-fault liability is of importance here. No-fault liability means that damages that occur as a result of legitimate and legally correct (public) action may be compensated. An example is the changing or strengthening of dykes which will have an impact on private property. Tortious liability will occur in cases where the government acts unlawfully. This may be the case when necessary measures have not been taken, in cases where measures taken are disproportionate or in cases where the wrong measures have been taken. It is clear that there is a strong relationship between liability and the scope of the public responsibilities in the sense of question 1, and that this question will be answered differently by different political ideologies (Keessen *et al.*, 2013). Whereas in certain societies it will be accepted that the government leaves it to private parties to take responsibility for the risk, in others the government will take responsibility for certain damages, even if there has been no formal duty to take action or no error has been made.

With the answers to these questions, we are able to describe the distribution of tasks and burdens that appear to be the 'self-evident' starting point for adaptation policy. In the past, and in every society, choices about the distribution of these tasks or burdens have been institutionalized in formal rules as well as in informal practices, routines and discourses (Hajer, 1995; Scott, 2001). Although 'climate change' has only recently come to the political agenda, protection against different weather-related risks in general has historically come to be accepted either as government responsibility or that of individuals or civil society. Adaptation options that take the existing distribution of responsibilities as a point of departure have this advantage over alternative options, in that their legitimacy is relatively seldom called into question. Default (comfort zone) adaptation options leave existing institutions in place, while implementing alternative (out of the comfort zone) solutions means transforming the institutional distribution of the above-mentioned responsibilities.

## 2.2 Perspectives on Legitimacy

Discussing alternative adaptation options inevitably leads to questions what the foundations are for the legitimacy of distributions of responsibilities (Driessen & Van Rijswick, 2011; Mees *et al.*, 2013). Bekkers and Edwards (2007) hold that the legitimacy of political decisions can be based on their *lawfulness* and on the factual *recognition* of the decision as a 'good' decision (p. 37). In the first case, the question is whether a particular distribution of adaptation tasks and

burdens can be derived from legal premises such as constitutions, laws, and treaties. In the second case, legitimacy has to be seen as an act of members of a political system who recognize a particular distribution as legitimate. The motivation they have for recognizing it as legitimate could be that it results in a satisfying policy output (Scharpf, 1999) in terms of an effective reduction of vulnerability to climate change.

We present four perspectives, or lines of argument, that are particularly relevant to the discussion on the legitimacy of different adaptation policy options. The first perspective is based on lawfulness. The other three perspectives are based on economic theory, public administration theories and theories about the adaptive capacity of society, and are each in their own way related to output legitimacy.

*2.2.1 Legitimacy Through Lawfulness.* The first strand of arguments considers the *legal* aspects of adaptation responsibilities. In most European countries, there are some basic rights relating to the protection of citizens from negative effects of climate change that form a ‘firm’ boundary in the choices to be made. These rights are based on the European Convention on Human Rights, the European Charter of Human Rights, the EU Treaty, national constitutions, or ordinary legislation (Larmuseau, 2008; Shelton, 2002; Smets, 2012; Verschuuren, 1995). These established fundamental rights—mostly following from classical fundamental rights and including environmental and health protection, as well as adequately dealing with flooding—compel a government to ensure a country’s habitability and to protect and improve the living environment. Rather than speaking of ‘rights’, it is better to speak of a *duty of care* of the government for the protection of certain interests, given that these rights cannot always be directly enforced by a court of law. Both European law and national legislation indicate (not always directly) the fields in which the government has a duty of care for adaptation to climate change, such as care for human habitation, health, economic development, protection of biodiversity, the environment and protection against flooding, a certain amount of fresh water, the protection of the countryside, and the protection of the quality of the living environment (which includes, for example, measures against excessively high heat loads in urban areas due to their effects on human health).

These duties of care, laid down in treaties, charters, constitutions, directives and national legislation, and further developed in jurisprudence, relate in the first place to the responsibility for the first task mentioned above. Namely, the responsibility to take the initiative to adapt to climate change and to see that it is carried out to a certain level. They also have a bearing on the fourth question: when damage occurs, even though government has taken adaptation measures, the question of what defines the duty of care is crucial for judicial decisions about government compensation or liability. Acknowledging the governmental obligation to care, however, leaves a lot of room with regard to the level of protection that must guide government actions, and what can be considered private or personal responsibilities. It also leaves unanswered the other questions of distribution mentioned above. Does this governmental obligation imply protection by regulation of private actors only, or should government take and finance any measures itself? Will those measures be at the expense of the state budget fed by general taxes, or regional budgets, or should the cost be redeemed from those who benefit from them?

**2.2.2 Output Legitimacy: Classical Economic Arguments.** Arguments for legitimacy that are derived from the problem-solving capacity of a particular distribution of responsibilities can be found in three different strands of thinking. One takes recourse to classical economic theory about the role of the state (Bovens *et al.*, 2007) and tries to answer the question of the distribution of initiative, implementation, and costs over societal actors, by defining in which cases government can legitimately intervene in society and the market (in this case to protect its citizens from the negative effects of climate change). The provision of *collective goods* is one of the most important reasons for government to take the lead in climate adaptation. By definition, other societal actors, such as private companies, are unlikely to deliver these goods, as it is beyond their primary role of making profit and because they are unable to prevent people who do not pay for them benefiting from them. Many adaptation measures have these characteristics. Water safety against flooding through dykes and infrastructural facilities, for example, are collective goods *par excellence* (Section 3.1). *External effects* are another reason for governmental intervention. These are the effects of our economic and social activities that are not discounted in the price of goods and services. The draining of rainwater into public places by individuals is one such example (Section 3.2).

**2.2.3 Output Legitimacy: Effective Governance.** Government action for adaptation may be legitimate on the basis of the above-mentioned legal or economic grounds. This does not mean, however, that a top-down approach, where the government regulates, sets targets, implements, and/or enforces the measures, is necessarily the most successful. The governance approach in public administration and policy sciences (Kooiman, 2003; Rhodes, 1996) adds an additional and complementary strand to perspectives on output legitimacy, as it focuses on shaping government–society interactions to increase government effectiveness in the face of the uncertain, controversial, and complex problem of climate adaptation (Van Buuren *et al.*, 2013; Van Rijswick & Salet, 2012). In terms of the four questions, it takes for granted that the government takes the initiative for adaptation (question 1), but limits itself to creating conditions for other actors to become active. It focuses on questions 2 and 3, describing alternatives to top-down governmental management such as the self-regulation of societal groups, the creation of market mechanisms, and knowledge provision as a catalyst for new interaction patterns (Driessen & Glasbergen, 2002; Van Buuren & Eshuis, 2010).

**2.2.4 Output Legitimacy: Adaptive Capacity of Society.** The last strand of arguments for the output legitimacy of the distribution of responsibilities is particular to the policy field of adaptation. It stresses the need to maintain the adaptive capacity of society and its institutions (Green *et al.*, 2013; Gupta *et al.*, 2010; Keessen & Van Rijswick, 2012; Van Rijswick & Salet, 2012). In the face of the uncertainty of knowledge about future climate and societal change, the adaptive capacity of society is crucial as a counterbalance to state reasoning, which can be one-sided in its inherent inclination to structure the problem from a technocratic point of view (Hoppe, 2002). According to van Rijswick and Salet (2012), it is necessary to take the self-regulating capacity of society as the cornerstone

of any institutional arrangement that is designed to reduce vulnerability to climate change.

This strand focuses on the first, second and fourth question (Who takes initiative? Who implements? Who is liable?). Government initiatives and solutions to climate change problems should not stifle citizens' awareness of the problem. People must remain aware of their own contribution to the problem as well as their own abilities to solve it. It is therefore legitimate that government leaves the initiative, design, and implementation to other actors in society. This also increases the learning capacity of society, which in turn is crucial to its adaptive capacity (Gupta *et al.*, 2010; Huntjes, 2010). In the face of uncertainty, it is better to have experience with a variety of ways of dealing with problems (Wildavsky, 1988). Variety in the first place relates to content—that is, different technical or organisational measures. But it is also possible to secure variety by involving different kinds of actors in the policy process. Putting adaptation in the hands of one specialized organization has many advantages, but there is always the danger that such an organisation becomes impermeable to criticism from outside and to possible alternatives.

The theoretical framework presented in this section with the help of four questions enables us to analyse the institutional context of planning for adaptation in terms of the distribution of responsibilities in society. Making this context explicit and offering perspectives to assess the legitimacy of the answers to these questions can help to open up the discussion on the legitimacy of these responsibilities, so that taken-for-granted distributions do not narrow down the scope for adaptation options.

A particular legitimacy perspective may be of more relevance for some questions than for others. The first question, of responsibility for taking the initiative to ensure that sufficient adaptation takes place, should be discussed from the perspective of legal arguments (duty of care and other legal principles), economic arguments for government intervention and the adaptive capacity of society. The second and third questions, that is, who should design, implement, carry out, and pay for these measures, are dealt with by economic arguments, arguments of governance as opposed to top-down government and the argument that citizens' participation in adaptation efforts raises the adaptive capacity of society. The last question, about a legitimate way of sharing responsibility for damage that may occur in spite of adaptation measures, should be discussed in the light of the perspectives of legal (social) rights to protection and of the adaptive capacity of society.

These different perspectives may not come to the same conclusions about the legitimacy of a particular distribution of responsibilities. It is perfectly possible to plead for government intervention on the grounds of legal and economic theory and conversely for a smaller role for government in the interest of the adaptive capacity of society. Moreover, different ideological perspectives would favour particular outcomes: a neo-liberal approach would strive for less government intervention than a welfare state approach.

The contribution of the framework presented here is not that it offers a kind of procedure for arriving at the 'best' institutions. Rather, its theoretical contribution is that it takes one step back, assessing the institutional setting not primarily in terms of its instrumental effectiveness for adaptation to climate change, but in terms of its capacity to set the scope for alternatives considered. This will, of course, not decide the (ideological) discussion, but only, and hopefully, stimulate it.

### 3. Cases

Three cases from the Dutch context illustrate the ways in which adaptation policy causes a rethinking of existing institutional arrangements and their legitimacy. A recent multidisciplinary research project coordinated by the Netherlands Environmental Assessment Agency considered ‘standard’ solutions and alternatives (PBL, 2011). Climate effects were identified and traditional and alternative adaptation options were systematically compared for several policy fields, including water safety (Klijn *et al.*, 2012a; Klijn *et al.*, 2012b), urban storm water drainage, and heat stress (Van de Ven *et al.*, 2011). The study found that alternative options could be strategically more interesting in terms of effectiveness, efficiency, or flexibility. The examples used in this article are drawn from some of the alternatives developed in these studies. Although these cases are by definition country-specific, the mechanisms they reveal may be valid beyond the Dutch setting.

For each case, we first give a brief summary of the expected negative effects of climate change in the Netherlands. We then outline options that counter the exposure to these effects. The first of these options is the default option, which continues with the way in which weather-related problems have been dealt with in the past, while the second is one of the possible alternative options considered in the PBL study (PBL, 2011). An analysis is made of the distributions of responsibilities for initiation, implementation, costs, and liability, as presupposed in the different options. The last part of each section explores questions of legitimacy for both default and alternative options.

#### 3.1 *Water Safety and Innovative Dykes*

Many European countries already frequently face the burden of flood risk (European Environmental Agency, EEA, 2012, pp. 35–52). Between 2000 and 2005, Europe suffered more than 100 floods, including nine major flood disasters. These major flood events caused 155 casualties and economic losses of more than €35 billion. The material damage of floods in 2002 is estimated to be higher than in any previous single year (Barredo, 2007). The risk projections for river floods and coastal floods show that a warmer climate will increase the likelihood and intensity of flooding in many parts of Europe (EEA, 2012).

The Netherlands is a delta, in which four European river basins meet and flow into the North Sea. Flood risk management has therefore been an important part of urban and spatial development throughout the nation’s history. Low-lying areas have been made habitable using constructions such as dykes, locks, and pumps, as well as through major alterations to the natural morphology and hydrodynamics of water courses. Benefiting in many ways from its location in the delta, the Netherlands has the highest densities of population, urban structures, industry, livestock, and transport in Europe, but 26% of the area of the Netherlands lies below sea level (up to 7 m), and about 60% of the country is susceptible to flooding either from the sea or the rivers. Projections suggest that climate change will increase the need to take additional measures in order to keep risk and vulnerability low.

**3.1.1 *Default Adaptation Option: Strengthen Existing Dykes.*** In the present institutional structure, the default adaptation option in the light of climate change is to strengthen existing dykes. This is what a special national commission

for climate change adaptation advised the Dutch government (Deltacommissie, 2008). In the Netherlands, water safety against flooding has always been one of the prime tasks for government. ‘The state, that is the dykes’ is a famous saying in the water safety sector. Rijkswaterstaat, a specialized service of the Dutch Ministry of Infrastructure and Environment, together with the regional water boards, is responsible for policy for dykes, dams, and dunes. Policy regarding some important defences is in the hands of Rijkswaterstaat, while other defence works are designed, constructed, regulated, monitored, maintained, and paid for by the water boards.

In the existing institutional design, these government bodies can do their work without too much interference. They can implement their policy not only independently from partisan interests in society, but also independently from other government interests. The water boards are decentralized governmental bodies with one specific task—water management at the sub-river basin level—and have their own powers regarding regulation, taxation, management, and enforcement. Almost all costs for flood protection are borne by those who live within the territory of a water board (van Rijswick & Havekes, 2012). Rijkswaterstaat falls under the responsibility of the Minister of Infrastructure and the Environment. Although its budget is dependent on priorities set at the national political level (Nehmelman *et al.*, 2011), its enormous prestige in defending the Dutch against flooding (van den Brink, 2009) means that its budget is relatively uncontroversial. In the light of climate change, recent policy reforms even aim to immunize its budget against the whims of subsequent national political coalitions.

This institutional design means also that constructing and maintaining water defences is more or less separate from the spatial planning system. In the Dutch spatial planning system, decision-making regarding the planning process is mainly concentrated at the municipal level. However, the water defence works and a zone around them must be kept free from urban development, so that they may be inspected, maintained, and strengthened when necessary. With the aid of ‘project plans’, the water boards and Rijkswaterstaat are authorized to incorporate the construction of their water defence systems into local spatial plans. Although they cooperate with municipalities and conform to the standards of provincial authorities, ‘planning the dykes’ and ‘planning urban development’ each tend to have their own dynamic. The water authorities take the initiative for dyke construction or reinforcement according to their specific agenda, which arises from their duty of care to guarantee the legally set level for protection against flooding, financing it from their own, earmarked funds. Part of this institutional arrangement is a very strict liability regime: the competent water authority is fully liable for damages that occur, independent of the liability that is at stake: tortious or no-fault liability.

**3.1.2 Alternative Adaptation Options: Build Burst-Proof Dykes.** The alternative option is to build ‘burst-proof’ dykes at strategic points, especially in areas with the highest population densities, economic activities, and related fixed assets. Burst-proof dykes can be overtopped by high water levels, but would not break, greatly reducing the volume of water that enters the hinterland. In this way, they not only reduce the chance, but also the impact of flooding. These new types of dykes exist in a mono-functional and a multifunctional variant. In the first variant, a normal dyke is ‘upgraded’, for example, by positioning a

solid wall inside it. In the second ('Delta dyke') variant, the dyke is made burst-proof by its very broad proportions, with this also making it possible to add other uses to it than water defence alone (Hartog *et al.*, 2009). This is a great advantage in many places, where high flood risks in terms of the number of people affected (Pieterse *et al.*, 2012) are combined with high densities and scarce space. Multifunctional dykes make more efficient use of available spatial capacity. By combining the safety function with economic, housing, and recreational activities, they may increase liveability by creating an attractive and water-rich, but also water-safe, area. This multifunctional land use also makes it possible to recoup some of the huge investment costs. An example is the *Roofpark Rotterdam* (Figure 1).

The multifunctional dyke, however, is institutionally problematic. Burst-proof dykes imply a break in two ways with the existing practice in which Rijkswaterstaat and the water boards could work without much interference. First, during the construction phase, the project would become subject to local dynamics on the real estate market and depend on local planning and decision-making processes. Private parties, such as project developers and municipalities, would have influence over the design and financing. Rijkswaterstaat and the water boards would cease to be able to decide—solely on the basis of their assessment of optimal security—when and how these dykes would be built. Design and realisation would be a shared responsibility. They would, far more than is the case today, have to take local developments into account and reconcile these with their responsibility and liability for flood defence works. In addition, it



**Figure 1.** Impression of the burst-proof, multifunctional Delta dyke 'Roofpark' in Rotterdam.  
 Source: Buro Sant en Co Landscape Architecture ([www.santenco.nl](http://www.santenco.nl)).

would also no longer be suitable for local residents to pay for the building and maintenance of flood defence works through the existing water tax system because individual property owners are the ones who profit from the investment. Secondly, the inspection of these dykes during the maintenance phase could become more difficult as the dykes would be covered by buildings and pavements owned by parties other than the water authorities. Furthermore, the companies that would invest in real estate on the dyke would need some assurance, for a reasonably long period of time, that their property would not be torn down for new construction work on the dyke. This would conflict with Rijkswaterstaat's five-year cycle for reassessing the strength of its dykes. The interference of other parties, both in the phase of construction and maintenance, conflicts with the present liability of the water authorities.

*3.1.3 Considerations of Legitimacy of Adaptation Options.* In the present situation, specialized government agencies carry all the responsibilities. They take the initiative for adaptation, they design new dykes, and tender their construction (questions 1 and 2). Costs are collectivized—partly through special taxes, partly through general taxation—and a strict liability regime holds government responsible (tortious and no-fault liability) (questions 3 and 4).

This strong role for specialized agencies is legitimized from the *legal* and *economic* perspective. Ensuring safety against life-threatening floods from both the sea and the rivers belongs definitively to the government's duty of care under Dutch law, as large parts of the country would not be habitable without the complex water safety systems now in place. Providing dykes to protect citizens is a case *par excellence* of a collective good.

Delta dykes would mean a shift in responsibilities, as the specialized agencies would be more dependent on new actors such as real estate developers and local spatial planning actors (municipalities) for initiation, realization and financing. The legitimization of this alternative is to be found in the third perspective of our framework, that of *governance*. What is the most effective way of ensuring a safe delta? Are specialized government bodies with high autonomy the best guarantee, or does the integration between safety policy and spatial planning provide the greatest chance of innovative, robust and cost-effective design? The traditional separation of the policy fields of flood defence and spatial planning has led to a situation in which planners have not always chosen the best locations for housing and other real estate investments from the perspective of safety, increasing the necessity for better protection through dykes and dams. A 'risk approach', in which decisions on safety improvement and housing are informed by one another, has a better chance in terms of cost-effectiveness (PBL, 2011).

Moreover, in terms of *adaptive capacity*, the fourth perspective, the innovative delta dyke increases the repertoire of options and involves more actors in the process, which from this viewpoint is an advantage. Here, the advantages of specialized government agencies, with clear responsibilities regarding their tasks and liabilities, that can act quickly and without interference on the basis of proven expertise and sufficient financial means have to be weighed against the advantages of a slower, more complicated, but in the end possibly more effective and cost-effective process.

In short, legitimizing multifunctional dykes asks for a shift from arguments that conceptualize a dyke purely as a public good from the legal and classical

economic perspective, to arguments of governance and the adaptive capacity of society.

### 3.2 *Urban Drainage Floods and the Boundary Between Public and Private Space*

Peak precipitation events with long and intense rainfall cause urban flooding at various places across the Netherlands, several times a year. In fact, urban flooding occurs in many urban areas in northern and western Europe, such as Copenhagen in 2011 and in Dresden in 2003 (EEA, 2012, pp. 43–44). Projections show a substantial increase in the annual mean number of days with extreme precipitation (EEA, 2012, p. 41). The effects of climate change and, thus, the nature and extent of the adaptation measures required to ensure a flood-proof urban environment, vary considerably, depending on the form and layout of each city and the district or neighbourhood characteristics. The potential damage or nuisance depends on the type, density, and quality of the buildings, the water permeation quality of open soil and public green spaces (parks, gardens, and trees), the presence of water bodies (ponds and canals) and the capacity and state of repair of the sewerage system. Flood-proofing is hardest to achieve in highly urbanized and compact areas.

**3.2.1 *Default Adaptation Option: Increase Drainage Capacity.*** In the Netherlands, the default option to counter the increased risk of storm water floods is to take measures in the public domain that increase drainage capacity by enlarging the sewerage system, but also by increasing surface water capacity such as canals and ponds. More innovative concepts like water squares (Boer, 2010) store excess rainfall temporarily in the public space.

Under present legislation (the Environmental Management Act and the Water Act), the rights and responsibilities of citizens are reasonably clear; in principle, property owners are obliged to dispose of rainwater on their own land, draining it onto the public domain only when it is not reasonably possible to do otherwise. The latter clause applies, for example, to individual apartment owners who are compelled to dispose of rainwater onto the public domain, as they have no land at their disposal. In cases of exceptionally heavy rainfall, municipalities are obliged to deal with water from private terrain by ensuring adequate capacity within the sewerage system or a separate rainwater collection system. Even so, this capacity is not unlimited. For the sake of efficiency, municipalities are not required to design a system that could handle the heaviest possible rainfall. Urban drainage floods may therefore still occur.

Since climate change is likely to entail more heavy rainfall, situations that are exceptional now will become more common in the future. Following the formal responsibilities of private owners as laid down in Dutch legislation, this means that both private owners and municipalities will have to dispose of more water on their own land than before (Van Rijswick & Havekes, 2012). In practice, however, in cases of urban drainage floods, municipalities step in to improve sewerage and drainage systems, giving the residents the impression that it is the municipality's responsibility and that they are covering up for past lapses (Bergsma et al., 2009), especially as payments in taxes are made to the municipality for water management in urban areas. In short, in spite of recent emphasis by the Dutch government on individual co-responsibilities, causes and solutions of the problem are projected into the public arena, where government takes the initiative

and the costs are paid for collectively, whilst personal responsibility for drainage on private land is not addressed.

*3.2.2 Alternative Adaptation Option: More Responsibility for Citizens.* The default option of improving sewerage systems ignores the potential for reducing the amount of water that is drained to public space. For example, green roofs can slow down drainage to the street (Mees *et al.*, 2013; Oberndorfer *et al.*, 2007), whilst simple solutions such as water butts and a more permeable surface in gardens can diminish the problem, reducing the need for investment in the public domain. Some municipalities have policies of this sort. For example, the municipality of Rotterdam has taken the initiative of promoting the installation of green roofs through a promotion campaign and a subsidy that covers almost half the installation costs. However, unlike the approach of municipalities in other countries, this municipality did not choose to make green roofs obligatory in new or renovated buildings (Mees *et al.*, 2013). As green roofs are not mandatory, installations very much depend on property owners' willingness to take responsibility for adaptation. Relatively low installation rates show that this responsibility is not yet widely felt. Politically therefore, it remains easier to take measures that exclusively affect the public domain, such as to enlarge sewerage capacity or adapt the level of road surfaces, than to oblige citizens, who do not consider solving the problem their responsibility, to act.

*3.2.3 Considerations of Legitimacy of Adaptation Options.* In the present situation, municipal governments feel responsible for taking the initiative to adapt to future higher precipitation levels, for designing and realizing this and for taxing all inhabitants through special sewerage taxes. Legitimization for this responsibility can be found in *economic* arguments; the drainage of exceptional rainfall is not possible for private persons or companies on their own and can be seen as a public good. Moreover, urban drainage is clearly a case where government intervention can be justified on the basis of the negative externalities of private action. Landowners who drain their excess water onto public land may inflict damage on other, more low-lying, properties.

From a *legal* perspective, the duty of care of government is formally laid down. However, the law already includes the limits of its responsibilities: only insofar as there has been 'exceptional rainfall' and only insofar as municipal investments to cope with the rainfall are 'efficient'. From the legal perspective, a greater initiative and investments in drainage solutions on behalf of private persons is legitimate. As climate change will increase the volumes of what can be considered 'normal' rainfall, from a legal perspective landowners will have to invest more in drainage, just as the municipality will have to for exceptional rainfall. It can be concluded that the legal system runs ahead of the policy discourse. Responsibilities and damage risks are quite clearly regulated.

From the perspective of *adaptive capacity*, a more active role for private property owners in the disposal of excessive rainwater is also preferable to the present situation. As long as municipalities do not explain that water on the street and in cellars is not a sign of municipal incompetence, citizens, and companies (e.g. glass house agriculture, cf. Gillissen *et al.*, 2010) will not realize that these situations are partly a consequence of their own decisions on the spatial organization of their land.

### 3.3 Higher Urban Heat Loads and the Split Incentive

Among the natural disasters that have occurred in recent decades in Europe, heat waves have had the largest impact on human health (EEA, 2010, pp. 41–46; EEA; 2012, pp. 18–34). The severe heat wave in central and western Europe, during the summer of 2003 was estimated to have caused up to 70,000 excess deaths in vulnerable groups such as the old and chronically ill (EEA, 2012, pp. 18–19). It is very likely that the frequency, duration, and intensity of heat waves will increase as a result of climate change (EEA, 2012, pp.24–25). The design of many densely built and compact cities with few green urban areas, but many artificial surfaces, aggravates the impact of heat waves within cities, in particular by increasing night-time temperatures. The urban heat island effects may vary considerably in nature and scale, from city to city and from neighbourhood to neighbourhood; adaptation (technical or spatial) therefore requires tailor-made measures.

**3.3.1 Default Adaptation Option: Increase the Capacity of Health Care.** In contrast to the climate change effects described in Sections 3.1 and 3.2, prior to climate change becoming a topic in public discourse heat waves had never been an established policy problem in the Netherlands (Runhaar et al., 2012). As heat waves seldom occurred, they were not as important a parameter in urban design, as is the case in the more southern European regions. Heat waves are treated as a personal health problem covered by a public-private health security system. The default adaptation option would be to start campaigns to inform the public about the dangers of heat waves and to increase the capacity of (emergency) health care when people suffer health problems as a consequence of heat waves. The initiation, implementation, and costs of preventive adaptive measures therefore rest with the individual, or for example, with care home management; the remaining risk (that is, should people still suffer from health problems) is borne by government and people's insurances, which—in the Dutch regulated health sector—have to plan capacity (government) and bear the costs (insurance), respectively.

This way of adaptation obviously has its limitations. Making heat adaptation an individual responsibility carries the risk of increasing the private acquisition of air conditioning, which would only contribute to the urban heat load (in addition to an increase in energy use and greenhouse gas emissions).

**3.3.2 Alternative Adaptation Option: Solutions Within Urban Planning.** Alternative options treat heat stress as part of urban planning, aiming to alter the city's heat characteristics gradually, at the pace of urban (re)development (PBL, 2011). Measures to reduce heat loads in urban areas can be implemented on various scales. On the scale of individual buildings, developers could focus on the installation of insulation and green roofs, or on the orientation of buildings. Structural spatial adaptations at the neighbourhood or city level, such as the construction of cooling and shading parks, ponds, greening street structures, or thermal energy storage systems, are more profound interventions in the urban fabric that involve longer lead times. In the Netherlands, however, they could be applied in new residential areas or in the numerous post-war neighbourhoods that require renovation in the coming decades (PBL, 2011).

Expanding the problem onto a larger scale—that of the neighbourhood or even the city—the responsibility for the initiative would fall to the municipal

planning authorities. Getting the theme of adaptation onto the municipality's agenda is problematic in itself, as the long-term character of climate change may result in a lack of political attention (Biesbroek *et al.*, 2011). Also even when adaptation is on the policy agenda, the additional cost of adaptation measures is likely to be an important obstacle. Who bears the costs of investment in preventive measures? Considering the high land prices in the Netherlands, the cost of reserving more land for open green spaces would be considerable. How could these extra investments be paid for? In the Dutch structure of housing provision (Ball, 2003), municipalities cooperate and negotiate with large investors, such as project developers, institutional investors, and large housing corporations, to recover costs. Under the Dutch spatial planning act of 2008, participating investors, both private companies and participating municipalities, may enter into a contract under private law regarding cost settlement. When agreement under private law cannot be reached, the municipality may establish a cost settlement plan under public law. Municipalities could therefore impose a mandatory inclusion of adaptation measures in the public development plan. However, in the current condition of economic crisis, it is less likely that municipalities will exercise this legal option in practice. Even if municipalities are determined to integrate adaptation measures into their new city expansion or restructuring plans, they still have to deal with project developers who do not necessarily share their objectives. In the Dutch structure of housing provision with a large role for project developers, there is the problem of the 'split incentive': investing parties are not those who benefit from investments. When project developers bear the costs of adaptation measures, there is no guarantee that their investments will be reflected in a higher market price, as even proven money-savers like heat insulation fail to be installed in the Netherlands (Hoppe & Faber, 2011). In the Dutch housing market, rather than prices being determined by consumer preferences about the physical characteristics of the house and its surroundings, they are determined by location and buyers' credit possibilities (Besseling *et al.*, 2008), or (in the regulated rental sector) by the administrative reality of official 'quality indicators'. In their bargaining with the municipality, project developers may claim that extra costs would be a prohibitive barrier to the entire development project, especially in the present post-crisis context. The project developers have a good bargaining position on this point, as municipalities themselves are involved as investors in development projects (Buitelaar, 2010). Neither can these extra costs be borne collectively, as Dutch municipalities have few possibilities for municipal taxation at their disposal (Hoorens, 2008).

*3.3.3 Considerations of Legitimacy of Adaptation Options.* In contrast to the other, water-related themes, heat stress does not have a firm basis in Dutch jurisprudence regarding the duty of care of government towards society. High urban heat loads are not accepted as an issue of government intervention by the general public, simply because the problem has not yet been urgent enough. Public discourse leaves most of the responsibilities and initiative to the private citizen. It is for him or her to prevent or counteract negative effects of heat waves in their own house, inclusive of implementation and costs. In this case, liability—the cost of health damage that occurs in spite of possible measures the private person may have taken—lies with the insurance, which has a collective component. In the alternative adaptation option of measures in the urban fabric, the initiative for adaptation action would lie with the municipal government, while

implementation and costs would be borne by real estate developers and ultimately by private persons who buy or rent the house.

As far as *economic* arguments are concerned, adaptation measures like parks and other green spaces, ponds and canals, can be considered collective goods (at least with regard to their heat-reducing properties). Just acknowledging the need for taking a municipal initiative is, however, not enough. As long as adaptation measures enter the negotiation process between government and project developers in a phase where plans have already been made and land has already been acquired, they are bound to disappear from the programme. There may be some economic leverage for creating parks and artificial water bodies, as housing prices in their vicinity may rise, but as long as these price increases are not enough to pay for these structures—or as long as there are no tax mechanisms in the Netherlands to collect such value increases (De Groot *et al.*, 2010)—economic reasons alone will not suffice to undertake such investments.

In this case, legitimacy could be argued from a *legal* perspective. Heat-related criteria could easily become legally integrated within the existing general judicial norm of ‘good spatial planning’. Better regulation through a set of nationally or municipally fixed standards could take adaptation out of *ad hoc* negotiations between a municipality and project developers. It should be stable enough to influence the calculations of project developers on their business case before they step in. Following Munoz Gielen’s (2010) suggestion, certainty about future costs would lead to—according to Ricardian land value theory—lower prices on the land market. In this way, costs for adaptation would be borne by the land sellers.

#### 4. Conclusion

Adaptation to climate change is gradually becoming accepted as one of the major challenges in regional and urban planning. The range and scope for adaptation options to make our societies less vulnerable to adverse effects of climate change, however, tend to be narrowed down, often implicitly, by the existing institutional context. In academic and policy publications, more attention has been paid to institutions as *instruments* for adaptation planning (e.g. Gupta *et al.*, 2010), than to institutions as the *context* in which adaptation options have to be discussed. This article has analysed the existing institutional context as a reflection of past choices, for a legitimate distribution between government and society of tasks and burdens regarding weather-related problems, and between different government levels and sectors. Within this context, path dependency raises the costs of considering alternative climate adaptation options, which could be equally or more efficient in the long run. It limits the scope for the answer to the questions: who takes the initiative to adapt, who implements, who pays and who bears the remaining risk? As we have illustrated, using the cases from the Dutch context, considering other options often entails a redistribution of tasks and burdens that has to be justified by new arguments concerning its legitimacy, founded on lawfulness or effectiveness. We saw that in cases where there was historically a strong government responsibility, alternative options would entail a governance mode with more private responsibilities. By contrast, the issue of urban heat stress (which historically has not been a problem in Dutch cities) was left to private responsibilities. In this case, alternative options seek a balance with more public involvement.

Of course, answering the four questions is a matter of ideology: broadening the scope of discussion is no substitute for answering fundamental questions on the role and responsibility of public and private actors in transforming society. Supporters of a neo-liberal approach will put more emphasis on private initiatives than supporters of a welfare state approach. To many decision-makers, it is a rather discouraging prospect that a particular decision on climate adaptation measures would mean an ideological discussion on the redistribution of burdens and benefits. In many instances, it may seem more prudent and comfortable to keep the adaptation dossier as technocratic as possible, taking as few political actors as possible out of their comfort zone. However, as this article has tried to show, potentially interesting alternatives would then stay out of sight.

What mechanisms could break this situation to the benefit of adaptation policy? Part of the answer to this question is to bring adaptation to the political process, by showing that it is *already* a political issue. Uncovering the mechanisms through which seemingly technical solutions are in fact institutionalized distributions of burdens and benefits, is of interest to actors in society who do not profit from this distribution. These include, for instance, municipalities that have little say over dyke areas within their urban territory, inhabitants of low-lying parts of the city who suffer from the excess of rainwater that has to be drained because of high soil sealing in the rest of the city, and health insurance and other companies that would bear the costs of an increase in the number of heat waves. These actors could all benefit from more reflexivity in the political process, regarding the way in which the burdens of climate change and the benefits of climate adaptation are currently distributed. Only when it is clear that the present situation is also a distribution mechanism for burdens and benefits could alternatives be better discussed based on their advantages in terms of cost and effectiveness, as well as in terms of their legitimacy. In this way, moving out of the comfort zone increases the possibility that adaptation policy will result in more effective and efficient reduction of climate vulnerability. This alternative view on climate adaptation policy will challenge researchers and decision-makers to provide evidence-based mechanisms and best practices for new institutional architectures.

## References

- Anguelovski, I. & Carmin, J. (2011) Something borrowed, everything new: Innovation and institutionalization in urban climate governance, *Current Opinion in Environmental Sustainability*, 3(3), pp. 169–175.
- Ball, M. (2003) Markets and the structure of the housebuilding industry, an international perspective, *Urban Studies*, 40(5–6), pp. 897–916.
- Barredo, J. I. (2007) Major flood disasters in Europe: 1950–2005, *Natural Hazards*, 42(1), pp. 125–148.
- Bauer, A., Feichtinger, J. & Steurer, R. (2012) The governance of climate change adaptation in 10 OECD countries: Challenges and approaches, *Journal of Environmental Policy & Planning*, 14(3), pp. 279–304.
- Bekkers, V. & Edwards, A. (2007) Legitimacy and democracy: A conceptual framework for assessing governance practices, in: V. Bekkers, G. Dijkstra, A. Edwards & M. Fenger (Eds) *Governance and the Democratic Deficit*, pp. 35–60 (Aldershot: Ashgate).
- Bergsma, E., Gupta, J. & De Jong, P. (2009) *Institutions for Climate Change, Working Document 7, Case Study on Individual Responsibility in Adaptive Capacity* (Amsterdam: Institute for Environmental Studies at the Free University).
- Besseling, P., Bovenberg, L., Romijn, G. & Vermeulen, W. (2008) De Nederlandse woningmarkt en overheidsbeleid [Dutch housing market and government policy], in: F. Don (Ed.) *Agenda voor de woningmarkt* (Amsterdam: Koninklijke Vereniging voor de Staatshuishoudkunde).
- Biesbroek, R., Klostermann, J., Termeer, C. & Kabat, P. (2011) Barriers to climate adaptation in the Netherlands, *Climate Law*, 2, pp. 181–199. doi:10.3233/CL-2011-033

- Boer, F. (2010) Watersquares, the elegant way of buffering rainwater in cities, *Topos*, 70(1), pp. 42–47.
- Bovens, M. A. P., 't Hart, P. & Van Twist, M. J. W. (2007) *Openbaar bestuur; beleid, organisatie en politiek* [Public administration; policy, organisation and politics] (Deventer: Kluwer).
- Buitelaar, E. (2010) Cracks in the myth: Challenges to land policy in the Netherlands, *Tijdschrift voor economische en sociale geografie*, 101(3), pp. 349–357.
- De Groot, H., Marlet, G., Teulings, C. & Vermeulen, W. (2010) *Stad en land* [City and countryside] (Den Haag: Centraal Planbureau).
- Deltacommissie (2008) *Samen werken met water* [Working together with the water] (The Hague: Ministry of Infrastructure and Environment).
- Driessen, P. P. J. & Glasbergen, P. (2002) *Greening Society; The Paradigm Shift in Dutch Environmental Politics* (Deventer: Kluwer Academic Publishers).
- Driessen, P. P. J. & Van Rijswijk, H. F. M. W. (2011) Normative aspects of climate adaptation policies, *Climate Law*, 2, pp. 559–581. doi:10.3233/CL-2011-051
- EEA (2010) *Mapping the Impacts of Natural Hazards and Technological Accidents in Europe. An Overview of the Last Decade*. EEA Technical Report No 13/2010, Copenhagen: European Environmental Agency.
- EEA (2012) *Urban Adaptation to Climate Change in Europe. Challenges and Opportunities for Cities Together with Supportive National and European Policies* (Copenhagen: European Environmental Agency).
- European Commission (2007) *Directive 2007/60/EC on the Assessment and Management of Flood Risks* (Brussels: European Commission).
- European Commission (2009) *Adapting to Climate Change: Towards a European Framework for Action*, COM(2009) 147 Final. White Paper (Brussels: European Commission).
- Gillissen, H. K., Van Rijswijk, H. F. M. W., & De Gier, A. A. J. (2010) *De kwantitatieve wateropgave in sterk verharde gebieden* [Quantitative water challenges in paved areas] (Utrecht: Centrum voor Omgevingsrecht en Beleid, Utrecht University).
- Green, O. O., Garmestani, A. S., Van Rijswijk, H. F. M. W. & Keesen, A. M. (2013) EU water governance: Striking the right balance between regulatory flexibility and enforcement, *Ecology and Society*, 18(20), p. 10. doi:10.5751/ES-05357-180210
- Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., Van den Brink, M., De Jong, P., Nooteboom, S. & Bergsma, E. (2010) The adaptive capacity wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society, *Environmental Science and Policy*, 13(6), pp. 459–471.
- Hajer, M. A. (1995) *The Politics of Environmental Discourse: Ecological Modernization and the Policy Process* (Alderley: Clarendon Press).
- Hartog, M., Van Loon-Steensma, J. M., Schelfhout, H., Slim, P. A., & Zantinge, A. (2009) *Klimaatdijk een verkenning*. Knowledge for Climate Report 011/09, Wageningen: Knowledge for Climate.
- Hoorens, D. (Ed.) (2008) *Sub-National Governments in the European Union, Organization, Responsibilities and Finance* (Paris: Dexia Editions).
- Hoppe, R. (2002) Cultures of public policy problems, *Journal of Comparative Policy Analysis*, 4(3), pp. 305–326.
- Hoppe, T. & Faber, A. (2011) Waarom de transitie van de woningsector naar een duurzame energiehuishouding niet opschiet [Why transition to sustainable energy does not get off the ground in the housing sector], *Milieu Dossier*, 17(4), pp. 21–25.
- Huntjes, P. (2010) *Water Management and Water Governance in a Changing Climate, Experiences and Insights on Climate Change Adaptation in Europe, Africa, Asia and Australia* (Delft: Eburon).
- Keessen, A., Hamer, J., Van Rijswijk, H. F. M. W. & Wiering, M. (2013) The concept of resilience from a normative perspective: Examples from Dutch adaptation strategies, *Ecology and Society*, 18(2), p. 45.
- Keessen, A. M. & Van Rijswijk, H. F. M. W. (2012) Adaptation to climate change in European water law and policy, *Utrecht Law Review*, 8(3), pp. 38–50.
- Klijn, F., Knoop, J. M., Ligtoet, M. & Mens, M. (2012a) In search of robust flood risk management alternatives for the Netherlands, *Natural Hazards and Earth System Science*, 12(5), pp. 1469–1479.
- Klijn, F., Knoop, J. M. & Ligtoet, W. (2012b) On the potential contribution of spatial planning in combination with unbreachable embankments in the design of a robust flood risk system, exemplified for the Netherlands, in: *Klijn & Schweckendiek (Eds) Comprehensive Flood Risk Management* (London: Taylor & Francis Group).
- Kooiman, J. (2003) *Governing as Governance* (London: Sage Publications).
- Larmuseau, I. (ed.) (2008) *Constitutional Rights to an Ecologically Balanced Environment*. V.V.O.R.-Report 2007/2 (Gent: Vlaamse Vereniging voor Omgevingsrecht).
- Mees, H-L. P. & Driessen, P. P. J. (2011) Adaptation to climate change in urban areas: Climate-greening London, Rotterdam and Toronto, *Climate Law*, 2, pp. 251–280.

- Mees, H. L. P., Driessen, P. P. J., Runhaar, H. A. C. & Stamatelos, J. (2013) Who governs climate adaptation; getting green roofs for storm-water retention off the ground, *Journal of Environmental Planning & Management*, 56(6), pp. 802–825.
- Munoz Gielen, D. (2010) *Capturing Value Increase in Urban Development, a Study of How the Economic Value Increase in Economic Redevelopment Can Be Used to Finance the Necessary Public Infrastructure and Other Facilities* (Leiden: Sidestone Press).
- Nehmelman, R., Tappeiner, I. U., Van Rijswijk, H. F. M. W., Kummeling, H. R. B. M. & Steenman, S. (2011) *De constitutionele inbedding van het waterschap* (Nijmegen: Wolf Legal Publishers).
- Oberndorfer, E., Lundholm, J., Bass, B., Coffman, R., Doshi, H., Dunnet, N., Gaffin, S., Köhler, M., Liu, K. & Rowe, B. (2007) Green roofs as urban ecosystems: Ecological structures, functions and services, *Bio Sciences*, 57(10), pp. 823–833.
- PBL Netherlands Environmental Assessment Agency (2011) *Een delta in beweging, bouwstenen voor een klimaatbestendige ontwikkeling van Nederland* [Climate adaptation in the Dutch delta—strategic options for a climate-proof development of the Netherlands] (The Hague: PBL).
- Pierson, P. (2000) Increasing returns, path dependence, and the study of politics, *American Political Science Review*, 94(2), pp. 251–267.
- Pieterse, N., Klijn, F., Van de Pas, B., Slager, K. & Tennekes, J. (2012) Flood hazard mapping for spatial planning: Conceptual and methodological considerations. Paper presented at Flood Risk Congress, Rotterdam.
- Rhodes, R. A. W. (1996) The new governance: Governing without government, *Political Studies*, 44(4), pp. 652–667.
- Runhaar, H., Mees, H., Wardekker, A., Van der Sluijs, J. & Driessen, P. P. J. (2012) Adaptation to climate change-related risks in Dutch urban areas: Stimuli and barriers, *Regional Environmental Change*, 12(4), pp. 777–790.
- Scharpf, F. (1999) *Governing in Europe: Effective and Democratic?* (Oxford: Oxford University Press).
- Scott, R. W. (2001) *Institutions and Organizations* (London: Sage).
- Shelton, D. (2002) *Human Rights, Health & Environmental Protection: Linkages in Law & Practice*. Health and Human Rights Working Paper Series No 1 (London: London Notre Dame Law Center).
- Smets, H. (ed.) (2012) *Le droit à l'eau potable et à assainissement, sa mise en oeuvre en Europe* [The right to safe drinking water and sanitation in Europe] (Nanterre: Editions Johanet).
- Swart, R., Biesbroek, R., Binnerup, S., Carter, T. R., Cowan, C., Henrichs, T., Loquen, S., Mela, H., Morecroft, M., Reese, M. & Rey, D. (2009) *Europe Adapts to Climate Change, Comparing National Adaptation Strategies* (Helsinki: PEER).
- Van Buuren, A., Driessen, P. P. J., Teisman, G. & Van Rijswijk, H. F. M. W. (2013) Towards legitimate strategies for climate adaptation in the Netherlands; combining insights from a legal, planning, and network perspectives, *Regional Environmental Change*. doi:10.1007/s10113-013-0448-0
- Van Buuren, A. & Eshuis, J. (2010) Knowledge governance: Complementing hierarchies, networks and markets? in: R. 't Veld (Ed.) *Knowledge Democracy: Consequences for Science, Politics and Media*, pp. 283–298 (Heidelberg: Springer Verlag).
- Van de Ven, F., Veerbeek, W., Rijke, J., Van Herk, S. & Zevenbergen, C. (2011) *Building the Netherlands Climate Proof. Urban areas* (Delft: UNESCO IHE/Deltares).
- Van den Brink, M. (2009) *Rijkswaterstaat on the Horns of a Dilemma* (Delft: Eburon).
- Van Rijswijk, H. F. M. W. & Salet, W. (2012) Enabling the contextualization of legal rules in responsive strategies to climate change, *Ecology and Society*, 17, art.18. doi:10.5751/ES-04895-170218
- Van Rijswijk, H. F. M. W. & Havekes, H. J. M. (2012) *European and Dutch Water Law* (Groningen: Europa Law Publishing).
- Verschuuren, J. M. (1995) The constitutional right to environmental protection, *Current Legal Theory*, 6(2), pp. 23–36.
- Wildavsky, A. (1988) *Searching for Safety* (New Brunswick, NJ: Transaction Press).