Civil protection and climate change impacts in the Netherlands: Local risk perceptions and actions

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Abstract

Being a delta, one third of the Dutch territory consists of flood-prone areas. This article discusses how the local civil protection system in the Netherlands responds to increasing climate change-induced flooding risks in terms of risk perception and action. Case studies on three Safety Regions are used to better understand the relation between climate change risk and changes in civil protection systems and practices. Data is presented that suggest that a minimum level of climate change risk awareness is present and that proactive action from the civil protection system is exceptional.

1 Introduction

Although we are unable to mark them as climate change impacts, natural hazards are now increasingly occurring and causing increasing damage (O'Brien, 'Keefe, Rose & Wisner 2006). The Netherlands are particularly vulnerable to sea level rise as 60% of its territory is located below sea level. Statistics Netherlands (CBS) estimates that currently one third of the Dutch economy is at risk from climate change-induced flooding risk as the flood-prone parts of the country accommodate 6 million people and one third of the GNP (CBS 2009). Immediate flooding risk is not at stake, as these flood-prone parts are protected by a sophisticated flooding prevention system that developed over centuries. Yet residual risks remain: In 1953, a combination of severe winds and extremely high tide caused the North Sea Flood by breaching through the flooding defence works in the south-western part of the country resulting in 1,800 fatalities.

After the North Sea Flood, the Dutch government implemented measures to prevent sea flooding 'once and for all'. Based on the population size and economical value of the area, extremely high protection levels were determined for flood-prone regions (up to 1/10,000, meaning that the flood defence works are designed to resist water levels occurring once per 10,000 years). Full trust in the reliability of the flood defence works, however, also laid the foundation for the general feeling of being safe 'behind our dykes'. Flooding risk became a notion connected to the past. Large-scale residential districts and industries were developed in the flood-prone, low-lying areas in the west of the country.

After decades of large investments in sea flooding protection, however, the protection against river flooding was now lagging behind. In addition, new residential areas and hospitals were built on riverbanks, while due to upstream developments (e.g. deforestation) rivers discharge much faster than in the past. The 1990s recorded two events of extreme precipitation hitting the catchment areas of the Meuse and the Rhine Rivers resulting in large-scale flooding in the Netherlands. In 1993, 12,000 people were evacuated from the Meuse valley in the Limburg region, many livestock drowned. Two years later, 25,000 people (and all livestock) were evacuated from parts of the Rivierengebied region that were at direct flooding risk –this is the largest post-war evacuation in the country.

After these river floods, politicians decided that the major rivers IJssel, Rhine and Meuse should be given more 'room' instead of using the riverbanks as urban development areas. The new approach was implemented in the national programme 'Room for the River' that consists of many hydrographical projects on dyke improvement, dyke shifting, lowering of flooding beds and removing obstacles along the rivers. The public was informed on the new vision in the campaign 'The Netherlands live with Water' through activities and media attention.

In the early 2000s, after Katrina had hit New Orleans, another shift in flood risk perception took place as politicians now realised that our society is also vulnerable and that we could also be struck by such a flooding catastrophe (TMO 2009). Two committees were appointed to improve the flooding preparedness of the Netherlands: The Delta Commission and the Flooding Management Task Force (TMO). TMO's assignment was to improve the

organisational dimension in flooding events, resulting in strategies and scenarios for the most vulnerable areas in the country –climate change threats as such, however, did not appear to be of decisive significance in its emerge. The Delta Commission had to advise the national government on how to become 'climate proof' in the century to come. The commission advised to strengthen dykes and embankments tenfold (Delta Commission 2008).

The issue of water is indeed high on the policy agenda, as parallel to the Delta Commission's activities also an update of the Administrative Agreement on Water (NBW-Actueel) was signed by the national, regional and local authorities agreeing that the Dutch water system should jointly be put in order at the lowest possible costs. The update was inspired by the fact that new climate change scenarios were available (VNG 2008). Yet technical solutions to prevent us from future flooding are not so much the problem. Difficulties arise when implementing as the current institutional setting does not allow structural solutions to be implemented; at best they result in incidental solutions (Tol et al 2003).

Moreover, climate change does not only include flooding risk induced by sea level rise and increasing river discharges, but 'poses novel risks often outside the range of experience, such as impacts related to drought [and] heat waves' (Adger et al. 2007, p. 719). Increasing frequency of peak rains, heat waves and storms are foreseen for the Netherlands (KNMI 2006). These events are already causing substantial damage, and many deaths in case of heat waves; the 2006 heat wave caused 1,000 Dutch heat-related deaths pushing the Netherlands to position four of the world rankings of natural disasters fatalities (EMDAT 2007). Derived impacts from primary climate change impacts, such as drought, have also already caused serious troubles. The potential impacts from climate change on countries therefore can be seen as a national security issue (Barnett 2003). The National Safety Strategy indicates heat/drought to be 'probable' and causing 'considerably to severe impact'; sea flooding is considered to be 'very unlikely', but causing 'catastrophic' impacts (our translations; Ministry BZK 2008).

The civil protection system in the Netherlands is now facing a various set of climate change-related impacts. Impacts from climate change as such might not be completely new, still the frequency and size of extreme weather events are expected to change and this is something to anticipate on. The civil protection system can adapt its practices and methods at the operational level and its policy and strategies at the strategic level. So far, some studies are available on the interface of climate change and disaster management (Barnett 2003; O'Brien, O'Keefe, Rose & Wisner 2006; Thomalla, Downing, Spanger-Siegfried, Han & Rockstrom 2006), but little research applies a policy focus by exploring the role of adaptive capacity of civil protection systems.

This paper analyses how the Dutch civil protection system is currently incorporating climate change impacts into their practices and policies. We determine the degree to which the system of civil protection in the Netherlands is currently preparing for climate change by addressing the following research questions: 1) what are the recent institutional changes in the Dutch civil protection system? 2) what are recent changes in civil protection practice and civil protection actor perceptions of climate risks? and 3) to what extend are the recent changes in

the civil protection system caused by the perception of climate changes risk, and what were driving factors for these changes? In the following, first we present the method, concepts and data applied in the study (Section 2). We continue with discussing the background of our study (Section 3) and then the findings and results (Section 4). We close the paper by presenting our conclusions (Section 5).

2 Research methodology and data used

2.1 *Concepts used in the study*

Throughout the study, we focus on the concepts of ***adaptation***, ***adaptive capacity*** and ***risk perception*** when addressing the research questions presented in the previous section. In fact, we investigate to what extend the Dutch civil protection system is adapting to climate change. We employ the concept of ***civil protection*** as to describe the public institutions that are concerned with the safety of the Dutch society –in our study we focus on the local and regional level.

Adaptation in the climate change literature generally refers to a process, action or outcome in a system in order for the system to better cope with, manage or adjust to some changing condition, stress, hazard or opportunity. Based on their timing, adaptations can be anticipatory or reactive, and depending on their degree of spontaneity they can be autonomous or planned (Smit & Wandel 2006). In the Netherlands, traditional adaptation is reactive, as it has involved dyke enforcements in the flooding aftermath. Sub-national adaptation to climate change is a research theme that has been given increasing interest (Adger & Vincent 2005; Adger, Arnell & Tompkins 2005; Naess et al. 2005; Wall & Marzall 2006; Wilson 2006).

Adaptation is intimately associated with the concept of ***adaptive capacity*** which reflects the 'capability of the system to cope, adapt, or recover from the effects of climate change' (Wall & Marzall 2006). The IPCC defines adaptive capacity as the 'the ability of a system to adjust to climate change' (IPCC 2007). Community-based analyses have shown that conditions that shape adaptive capacity and hence create the need and opportunities for adaptation are community specific. Adaptive capacity can be influenced by many non-climatic drivers such as managerial ability, access to financial, technological, and information resources and infrastructure. A system's adaptive capacity is not static, but flexible and responds to changes in economic, social, political and institutional conditions over time (Smit & Wandel 2006).

We apply the concept of ***risk perception*** to understand how actors deal with climate change risks. Having started in the nuclear debate of the 1960s, risk perception research is now commonly applied to explain risk acceptance not only from technical benefits, but also including the subjective dimension (Sjöberg 2000). Risk perception is a very relevant concept for it can contribute to understanding why action is absent or taken to prepare for climate change impacts. A national study showed that Americans perceive climate change as 'a moderate risk that will predominantly impact geographically and temporarily distant people and places' (Leiserowitz 2005, p. 1433). The notion of 'dangerous' climate change, Leiserowitz (2005) continues, is thus not only disputed among scientists and policy makers,

but also among the general public. Climate change is also perceived as a serious problem by Europeans: they consider the changing climate to be the second most serious problem of our time, after the number one problem is poverty, the lack of food and drinking water (EC 2008).

2.2 *Case study selection*

The case study methodology is applied as it enables us to derive new hypotheses and 'examine the operation of causal mechanisms in individual cases in detail' (George & Bennett 2005, p. 21). The hypothesis-generating method for case studies in particular (Levy 2008) is of great relevance as we will examine our cases with the purpose to develop more general theoretical propositions on the role of geography, risk awareness and adaptive capacity when analysing the adoption of the climate change issue in the Dutch civil protection system. In the selection of the cases, geographic location and historical experience with (potential climate-induced) disasters are applied as the two conditions that will influence the degree of adaptability of the regional civil protection systems. Of all climate-induced risks we concentrate on flooding risk caused by sea level rise, increasing river discharges and increasing precipitation quantities as these impacts are most widely known and most covered in current adaptation projects. We therefore consider 'water safety' most likely to be first implemented by the civil protection system too.

The cases we selected are so-called Safety Regions. The Safety Regions constitute today's key civil protection system where all civil protection actors cooperate. The current division of 25 Safety Regions correspond to the similar police force regions and the fire brigade regions (WVR 2009). The three Safety Regions studied are: Rotterdam-Rijnmond (flooding risk from sea level rise, increasing river discharges and heavier precipitation), IJsselland (flooding risk from increasing river discharges and heavier precipitation) and Twente (flooding risk from heavier precipitation). The cases have different geographic locations and differ in historical experiences with extreme weather events. Their locations are indicated in Figure1.

Located on the riverbanks of the Meuse, Rotterdam is in close proximity of the North Sea is and situated in the most densely populated part of the country. Most of its territory is located at low-lying, below sea-level locations and some is also outer-dyke. The Measlantkering Storm Surge Barrier (1997) was constructed to protect the Rotterdam area from storm surge events. The barrier was designed for a sea level rise of 60 cm in 100 years. Vulnerable in the Rotterdam area are not only the flood-prone parts of the area, but also the petrochemical industries and the harbour area. Rotterdam did not recently experience extreme weather events, but the 1953 North Sea Flood caused flooding in the southern parts of Rotterdam and the city hosted about 10,000 refugees (Rotterdam Municipal Archives 2009).

IJsselland, a semi-rural area with pastures along the IJssel and woods in the east, is located in the heart of the country and includes 2 midsized cities. Parts of IJsselland territory are prone to flooding from the IJssel River or the IJsselmeer Lake. The Ramspol Storm Surge Barrier (2002) was constructed to protect the region from flooding from the IJsselmeer Lake. The barrier is designed to resist increasing water levels up to 60 cm, while it is now being

Figure 1 *Safety Regions division with the study regions indicated*
Map adopted from Zorgatlas, www.zorgatlas.nl

discussed that the water levels of the IJsselmeer Lake should be elevated to 1.5 m. All levels of government in the IJsselland region cooperate in realising the 'Bypass of Kampen', which is the constructing of an additional mouth to the River IJssel. This project is communicated to be a climate change adaptation measure, as it relieves bottle necks in the river that will become weaker in the future. IJsselland did not face any severe flooding or extreme weather events recently.

Twente is a semi-rural area with agriculture, woods and some midsized cities bordering to Germany. Located on higher sandy grounds, the region does not face immediate flooding risk from large rivers. Still, some smaller rivers pass the area and as the landscape is not fully flat, local water nuisance regularly occurs. Moreover, Twente particularly faces drought problems in summer time–and the frequency of these problems will only increase. Regarding our study, Twente is interesting as a control case where no concrete severe climate change risks are be expected, but where the level of civil protection action might me influenced by other factors. Recently, the region was struck by extremely heavy rainfall resulting in severe local flooding.

2.2 *Data sources and coverage*

The data collected for this paper covers quantitative and qualitative material on institutional changes in the Dutch civil protection system, changes in its working practice and changes in risk perceptions of Dutch civil protection actors. Originating from two research projects, both were driven by the ambition to understand the driving factors behind system changes in the

Dutch regional civil protection system and connections between these changes and climate change. The projects ran parallel with each other in 2009 and 2010.
The Rotterdam case was studied for an international project that also investigated Malmo and Bergen in order to draw lessons on civil protection adaptation in the three north-west European countries Norway, Sweden and the Netherlands. The data for Rotterdam was collected by conducting semi-structured interviews on the policy and practices regarding natural hazards and the perceptions of climate change risks at the key civil protection institutes. We interviewed civil servants employed with Rotterdam municipality, Rotterdam-Rijnmond Safety Region and Schieland and Krimpenerwaard Water Board. The data from the interviews combined with investigations on local and national policy documents and other grey material resulted in a case study report (Van den Berg & Coenen 2010) and a conference paper (Groven, Van den Berg, Carlsson-Kanyama, Aall & Coenen forthcoming).

The data for IJsselland and Twente was gathered through a quantitative survey that was performed in 2010 among the 25 Overijssel municipalities. With the survey we aimed to determine the state of local climate policy actions and perceptions in the province. A group of 76 local civil servants responsible for policy making in the domains of spatial planning, water management and the environment were identified and invited to complete a questionnaire through the web. In total, 64 respondents (84%) in 24 municipalities completed the questionnaire. The survey was part of a larger in-depth study on the degree of civil preparedness for climate change of the local level in the Dutch region of Overijssel.

3 Analysing the Dutch civil protection system

3.1 *A multilevel system for civil protection*

In contrast to neighbouring Belgium and Germany, or comparable welfare states such as Sweden and Norway, the Netherlands has no separate governmental body responsible for civil protection. One historical exception to this pattern is the Dutch government's post-war initiative to establish the organisation 'Protecting Population' (in Dutch: ***Bescherming Bevolking***, BB) in 1952 based on its counterpart from the UK. This civil defence organisation was coordinated by the Minister of the Interior. Its aim was to protect civilians "From the consequences of war" (our own translation of the title; WBB 1952). At its height in 1956, the organisation consisted of 160,000 voluntary members. From then on, the number of volunteers only decreased resulting in the organisation's discontinuation in 1986 (IBB 1986). Its tasks were handed over to the regional fire brigade and the Dutch Red Cross.

The Dutch Disaster Law (in Dutch: ***Wet op rampen en zware ongevallen***; WRZO 1985) was introduced in 1985 –prior to the formal dissolution of the BB. It provides for a legal framework for civil protection by the local government. According to this law, "A disaster or heavy accident is an event which severely disturbs the public safety and seriously threatens or damages the life and safety of many people" (our translation from Article 1b WRZO 1985). Threat of war as a key focus for civil protection is now replaced by 'any' disturbing and seriously threatening or damaging event. From the perspective of our research

it is interesting to conclude that within the legal framework for disaster management, changing climatic impacts are not considered at all.
Nor are they considered in the current Dutch flooding policy, which traditionally has a very strong emphasis on *prevention*, resulting from 1,000 years of dyke construction. The other Safety Chain links (pro-action, preparation, response and recovery) are lesser developed (Table 1). In such a situation, it is rather difficult to organise preparedness, response and recovery for very unlikely, but extreme-impact flood events (Saeijs, van Alphen, Helsloot & ten Brinke 2008). Climate change, however, urges for a broader approach as its impacts are difficult to anticipate on as we did not experience them before. We should therefore put more emphasise on the other links, particular the pro-action should receive more attention as it entails avoiding a disaster to happen at the first place, for example by preventing the development of flood-prone areas and to realise a closer cooperation between spatial planning and water management.

We now leave the framework and go 'into' the system of civil protection to understand how it works. All levels of government have responsibilities concerning safety and disaster management. Whether or not their efforts are employed depends on the scale of the (potential) crisis or disaster. In general, the local government is responsible for preparations and crisis management pertaining to local events. When incidents exceed municipal borders, the province will become involved. In case of large-scale incidents, the national level is responsible. In line of hierarchy, the Water Boards are situated between the regional and local authorities. These water authorities prevent the Dutch from getting 'wet feet' by managing discharging of precipitation and maintaining water ways and dykes. They also distribute tap water and care for the purification of waste water. The National Water Executive (*Rijkswaterstaat*) is responsible for the maintenance of primary dykes and barriers.

At all levels of government, a centrally appointed administrator is responsible for public order and security. Historically, these officers were appointed by the Queen which is still the case today with respectively the Provincial Governor (Commisaris van de Koningin) and the dijkgraaf (head of the water board; his responsibilities are similar to a mayor's) at regional level and the mayor at local level. At regional level, the Provincial Governor is responsible for public order and safety in his respective province (the Netherlands consists of twelve provinces). He or she also secures good cooperation between all civil protection institutions in the province. The province has its own disaster plan. Also Water Boards have civil protection responsibilities. The *dijkgraaf* is authorised to take all necessary safety decisions (such as physical actions on dyke improvements) as long as they do not conflict with the Dutch Constitution or international agreements. The Water Board is obliged to have a disaster plan including a risk-assessment of all water works in its district. The Water Board must inform all concerned municipal boards on the risks and measures concerned with water safety in its district.

Being the most important link responsible for local public order, the mayor is given powers to maintain safety and security in his municipality as a member of the regional fire brigade board in case of (reasonable fears for) a disaster or heavy accident. Because of this,

Table 1 *Applying the safety chain on Dutch flood risk management*

	Safety Chain Links	Efforts
Risk management	Pro-action	Strong
	Prevention	Very strong
Crisis management	Preparation	Strong
	Response	Strong
	Recovery	Average

Data adopted from Saeijs, van Alphen, Helsloot, & ten Brinke (2008), p. 2, 7.

the Mayor's Network (*Nederlands Genootschap van Burgemeesters*) has a strong focus on *crisis* management (but not on *risk* management, see Table 1). On its website www.burgemeesters.nl, evaluations on recent disasters are available including an interview with the mayor responsible. Portfolios are available on high water and critical infrastructure breakdowns.

A municipality has to deliver a four-year disaster plan containing a risk-assessment of 18 'regular' disasters (*maatrampen*), of which flooding and extreme weather events are the only climatic disasters. Furthermore, the Disaster Law prescribes the local tasks in civil protection. These 30 tasks are divided between the municipality, the police, the fire brigade and the medical rescue services. In this division of tasks, the municipality is responsible for most tasks dealing with civil protection, such as public alerts and communication, shelter provision and casualty registering.

3.2 *Recent institutional changes in the civil protection system*

A number of changes in the institutional framework of civil protection took place in the last decade. Most importantly was the development of a system of so-called 'Safety Regions' inspired by two large-scale, but non-weather-related disasters in 2000. In May, the country was shocked by an explosion of a fireworks warehouse in Enschede resulting in 22 casualties and a whole residential area being destroyed; and on New Year's Eve a café in Volendam burned down killing 14 youngsters. The two events demonstrated a stronger need for closer cooperation between the civil protection institutions at regional level. This will be formalised in Safety Regions that are now being established throughout the country.

The institutional framework for civil protection at the Safety Region consists of national, provincial and municipal actors (Table 2). At the national level, the main actors are the ministries of the Interior and Kingdom Affairs (BZK), Housing, Spatial Planning and the Environment (VROM) and Transport, Public Works and Water Management (V&W).[2] BZK is primarily responsible for public order and safety, whereas VROM is responsible for the prevention of ecological disasters, regarding for example drinking water. V&W is particularly responsible for infrastructure-related safety, including the maintaining of dykes and storm surge barriers. Every Safety Region also has a military advisor. The division of 25 Safety Regions correspond to the similar police force regions and the fire brigade regions (WVR 2009). The Safety Regions constitute today's key civil protection system.

[2] As from October 14, 2010, a new national government was established that uses follow a new division of ministries. In this paper, we reflect on the division that was used during several previous cabinet periods.

Our examination of recent changes in the policy and practices of the civil protection systems in the cases studied confirmed that the national development of the Safety Regions was rather fundamental. Interviewees in Rotterdam call the recent emergence of the safety region system *the* major change within the Rotterdam civil protection system. Since close cooperation already existed between the actors of the Safety Region Rotterdam-Rijnmond, the emergence of the safety region is thus a formal consolidation of existing ties. However, Rotterdam interviewees stressed the fact that the concept of Safety Regions is new and that it will take time and efforts to make things run smoothly. The far-reaching safety region development (given the early stage that it is in now) should be followed-up in light of climate-change preparedness.

4 Preparing for climate change by the civil protection system

4.1 *Climate change and developments in civil protection practices*

Our study of three Safety Regions showed that so far increased flooding risk from climate change does not have changed the civil protection practices. Flooding risk is already part of 'regular' risk and crisis management plans, and the other 'regular' disaster type extreme weather events are assessed as being hard to prepare for. Increasing flooding risks are not yet part of the local disaster plans in our case studies nor are have particular plans developed yet in the Twente or IJsselland region that are inspired by climate change. The 'Twente flood' in August 2010 caused major damage (insurer Interpolis estimated 9 million euro; TC Tubantia 2010) and some local policy attention (for instance, an evacuation planning in the village Losser and a flood protocol in Borne), but no pro-active changes are foreseen yet in this region.

In Rotterdam, by contrast, flooding risk awareness was raised in 2008 when the region was a central case in the Flooding Management Task Force TMO. TMO's assignment to improve the flood preparedness in the Netherlands, however, did not primarily be inspired by climate change threats. Flooding risk in Rotterdam is high on the policy agenda anyhow, as Water Plan 2 aims at a waterproof city by 2030; climate change induced sea-level rise and increasing precipitation quantities play a leading role in this plan. It is interesting that Water Plan 2 combines both the water management task of the Water Boards and the civil protection and spatial development tasks of the municipality.

A higher frequency of heat waves caused by climate change also affects the domain of public health, which is a municipal responsibility. The municipal health care system is organised in the Public Health Services (GGD), and GGD obtains its knowledge from the National Institute for Public Health and the Environment (RIVM), the leading Dutch centre of expertise in the fields of health, nutrition and environmental protection. Although RIVM has published several reports on the health effects of climate change on the Netherlands, we earlier found that limited attention is paid to public health in climate adaptation strategies (Van den Berg, Lafferty & Coenen 2010). A GGD interviewee confirmed that in the Twente region, no municipality requested the regional GGD for additional measures on health risks, which prevents the development of proactive health measurements at the local level.

Table 2 *Actors participating in the Safety Region structure*

National actors	Regional actors	Local actors	Private actors
BZK	Province	Fire Brigade	Drinking water companies
V&W	Water Board	Medical rescue	Transport companies
VROM	Public Prosecutor	Police	Hospital(s)
Defence		Municipalities	Electricity companies

Heat waves are not specifically being considered in the municipality disaster plans and we did not find any specific local or regional heat plans (with the exception of the national Heat Plan that instructs how particular vulnerable groups should deal with heat). Rotterdam has indicated heat and heat-related affects as the second major climate change issues next to increasing flooding risk in its adaptation programme Rotterdam Climate Proof. No concrete measures were taken yet; most of the current activities concern information gathering and pilot projects. Heat and drought are not being considered in municipality disaster plans. In Twente, where drought is a reoccurring problem, the Water Board is now cooperating with regional authorities (municipalities or other civil protection actors are not involved) and agricultural organisations to develop structural solutions to cope with drought. A national project that studies drought impacts informs regional water managers on the current situation regarding river discharges, (water) temperatures and groundwater. However, despite the fact that the National Safety Strategy considers drought/heat as a security issue (Section 1), the civil protection system is not involved in the initiatives mentioned above.

4.2 *Civil protection perceptions of climate change risks*

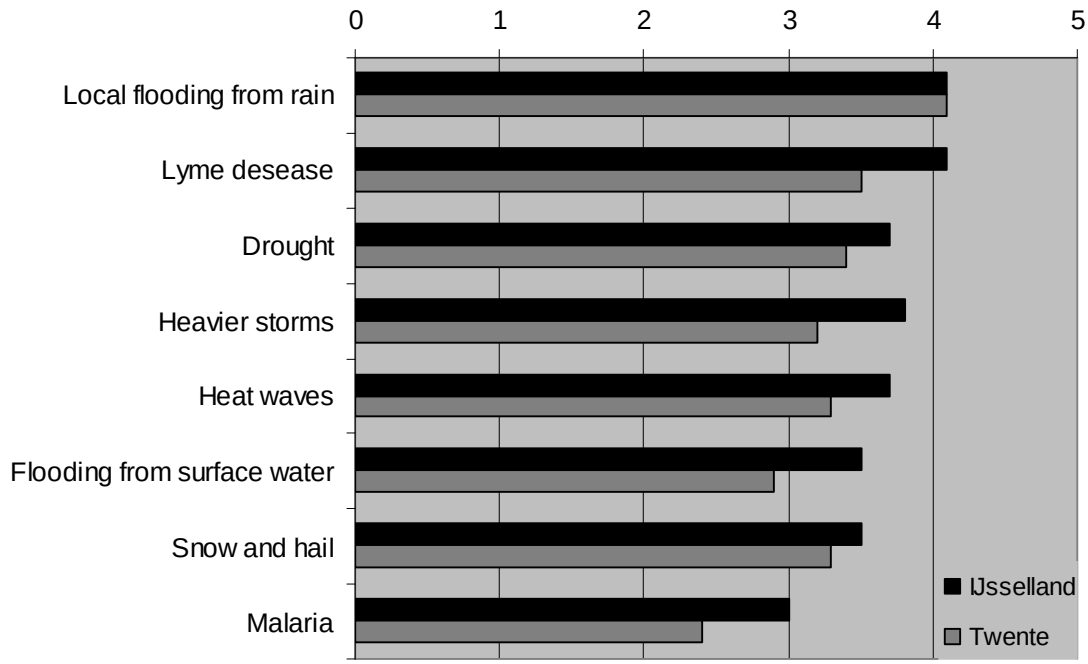
Interviewees in Rotterdam consider climate change impacts not to cause new risks that imply new working methods. Although the operational and strategic units in the Rotterdam civil protection system are now becoming more and more aware of the fact that they need each other's expertise, this rapprochement is only very recent and did not consolidate yet. The two have different perspectives on how to deal with climate change. The *operational* civil protection unit is aware of climate change impacts, but view these impacts either to be 'regular' disasters which are already included in the local disaster plans or as part of a distant future and therefore 'too far and too broad' to include in the current daily practices. Climate change does not fit into their short-term view of disaster plans running for four years. The more ***strategic***-oriented civil protection unit, by contrast, strongly focus on climate change impacts (increasing risk of flooding and heat stress) by preparing for a 'climate proof' Rotterdam by 2025. New spatial planning projects are being designed based on the most recent climate change scenarios.

The strategic-oriented civil protection unit that developed in Rotterdam seems to add the long-term horizon that is required in the civil protection system to prepare for climate change impacts as these are beyond the system's experience. The Twente and IJsselland Safety Regions have not yet developed as well as the Rotterdam Safety Region, which was the front running example for the national development of Safety Regions. It might be a matter of time that also other Safety Regions develop strategic-oriented civil protection units.

Without these units the Twente and IJsselland Safety Regions currently have limited capacity to adapt their systems for climate change impacts.

In Twente and IJsselland, the respondents to our survey perceive climate change as a rather to very important policy issue, but they consider climate change lesser to be an urgent issue. Risks attached to climate change impacts are assessed rather different. The respondents from both regions value flooding, heat waves, Lyme disease and drought as the most likely climate change induced risks (Figure 2). Striking is to note similarities *and* differences between the responses from both regions: although the impacts will be similar in both regions, some risks are clearly being differently perceived. Local flooding induced by heavy rain is expected to be a very likely risk in both regions, whereas flooding from surface water is assessed to be less likely for the Twente region.[3] An increasing occurrence of malaria is judges to be rather unlikely; IJsselland respondents still rate this at 3.0, while Twente respondents rate only 2.4 on a 5-point scale. We could conclude from Figure 2 that Twente respondents rate the 8 climate change risks as less probable than the IJsselland respondents.

Figure 2 *Assessment of climate change risks in IJsselland and Twente*[4]



4.3 *Effects of climate change on civil protection system changes*

To sum up, we conclude this section on the preparations for climate change by the civil protection system by addressing the third and overall research question on how far the recent changes in the civil protection system are caused by the perception of climate changes risk and what the driving factors are behind these changes. Several flooding disaster events influenced the perception of climate-induced risks in the Netherlands. Chronologically, in the

[3] Local flooding induced by heavy rain was rated 4.1 on a 5-point scale in both Twente and IJsselland; flooding from surface water was rated 3.5 in IJsselland and 2.8 in Twente.

[4] Respondents were asked to fill in their opinion on a 5-point scale (1=none, 5=very much) on how realistic an increase of each of the 8 climate change-induced risks would be; N = 60.

second half of the 1990s more attention was given to inland flooding risk caused by extremely high river discharges in 1993 and 1995. No clear changes in the civil protection system were observed, though a serious policy programme was implemented to give the rivers more room to flow. In the first decade of 2000, the flooding disaster caused by hurricane Katrina inspired politicians to improve our level of preparations for worst case flooding. The committees TMO and Delta Commission advised the government on flooding risk and 'climate proofing'. These developments brought climate change -and adapting to it- high on the policy agenda.

The civil protection system in the Netherlands, however, was not directly affected by the developments that followed these events. Flooding is one of the scenarios the local, regional and national authorities prepare for, but the preparations as such have not changed because of the above mentioned events. The major institutional change we reported in our paper was the merge of the Safety Regions concept. This system of regional civil protection bodies was established after two non-climate related disasters struck the country in 2000. Climate change was not at stake in this development. Respondents indicate that climate change impacts should be covered by the 'regular' disaster management planning. The changes we observed were thus clearly event-driven, but the events that laid the basis for the most serious change were not related to climate change.

5 Conclusions

At the outset of our paper we presented three research questions that guided our study: 1) what are the recent institutional changes in the Dutch civil protection system? 2) what are recent changes in civil protection practice and civil protection actor perceptions of climate risks? and 3) to what extend are the recent changes in the civil protection system caused by the perception of climate changes risk, and what were driving factors for these changes? Addressing these questions lead us to concluding our paper by making three propositions.

Firstly, the most important recent change in the Dutch civil protection system was the establishment of a national structure of Safety Regions. This development was inspired by a need for closer cooperation to combat large-scale crises such as the 2000 Fireworks Disaster and the New Year's Eve Fire. This development obviously was not related to any climate change impacts or scenario development. Still, climate change was placed on the policy agenda by the occurrences in New Orleans after hurricane Katrina had broken through the levees. *Secondly*, we could not report any substantial changes in the policy and practices of the civil protection system. This can be explained from the fact that climate change risks and climate change adaptation as such are not being perceived as urgent or important. *Thirdly*, the civil protection system in the Netherlands is not (yet) preparing for climate change risks due to a limited perception of these risks. In Rotterdam, we could discern a clear gap between the strategic and the operational levels dealing with civil protection. Interviewees from both tracks stress the need for more time to 'grow' and to meet each others needs in order to cope with climate-change impacts. For the present, however, we can only conclude that there is a 'missing link' between the existing practices and future aims in the preparedness of the Rotterdam civil protection system.

Our findings underline the low priority politically is being paid to climate change and its related impacts and risks. Of course offer the large set of uncertainties associated with climate change a poor base for politicians that want to now where to make plans on. Still, it is also disturbing to find out that the interviewees expect to have plenty of time to wait and see what will change. They could already incorporate increasing impacts and frequencies in their current plans and not pass it on to next generations. It is crucial that we now start adopting measures to cope with future heat, drought, flood and increased rain that both cover the short and long term perspectives.

Our case studies showed a picture of a 'missing link' within the civil protection system. The Safety Regions might become that arena where the short-term focused, operational part of the civil protection system meets the long-term focused, strategic part. This new structure obviously needs time to grow and should be feed by the proper knowledge and information adapted to regional circumstances of the region that is now present at the different actors participating in the Safety Regions –the new government's plan to reorganise the police regions comes at a bad moment.

Our findings are likely not to be limited to the three cases we studied: municipalities and regions throughout Europe are being affected to a lesser or larger extend by the impacts from climate change and the risks that are caused by these impacts. The Dutch development towards a possible integration of the operational and strategic parts of the civil protection system could demonstrate to be a best practice to cope with future climatic hazards.

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