Flood preparedness in The Netherlands a US perspective

A publication by the Netherlands US Water Crisis Research Network (NUWCReN)

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Preface

This book is the result of a network linking American and Dutch research institutes. De collaboration within NUWCReN started in 2009 to learn from US experience with flood events as Hurricane Katrina in 2005. The Netherlands realised that valuable lessons could be learned from the American experience in handling the aftermath of this great disaster. The Dutch government therefore invested in the "Netherlands U.S. Water Crisis Research Network" (NUWCReN) to promote knowledge sharing. The Netherlands and the U.S. can benefit from each other's insights and experiences.

The establishment of the network can be useful for The Netherlands to further develop the concept of multi-layer safety. This strategy includes prevention as the first layer, sustainable spatial planning as the second layer and disaster and crisis management as the third layer. Flood prevention in The Netherlands is seen as the primary pillar. However, that does not eliminate the need to be well prepared. Flooding can never be ruled out.

I hope that this tangible result of the collaboration can be an inspiration for the Dutch government. The book contains a series of articles in which several aspects of the crisis are addressed. The comparison between the Dutch and American approach is very valuable.

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Flood response an introduction

Dealing with flood risk

A flood can be defined as a (predominantly low frequent) event which is a disturbance of 'normal' life in an existing system and which causes damage and sometimes takes lives. There are circumstances where floods can be beneficial, for example in large agricultural systems where the success of crops is dependent on water and fertile soils. In this booklet, however, we focus on large scale developed areas where people live and work. In these areas a flood is considered to be a crisis, based on the commonly used definition 'a serious threat to the basic structures or the fundamental values and norms of a system, which under time pressure and highly uncertain circumstances necessitates making vital decisions' (Rosenthal et al. 1989).

The Netherlands as a country has largely focused on avoiding such crises through flood prevention measures such as levees, dunes and structures. In the shadows of such engineered structures the country has been able to develop economically and socially. Thanks to flood protection also other, large cities and countries have been able to develop over the last centuries. Nowadays many developed areas are in delta areas throughout the world. The development of these areas has on the one hand led to an increase in the potential consequences of flooding and on the other hand, to a reduced probability of the occurrence of flooding.

The existence of this residual threat is important, particularly because the public expects the government not only to protect the country from flooding, but also to be prepared in case of a threat of flooding. The risk of flooding will remain, even if the probability of an event is further reduced, simply because of the existence of the threat. Therefore all measures have to contribute to an acceptable level of risk.

It is our contention that experiences from the Unites States can be of use to The Netherlands as the country considers its vulnerability and resilience. Experience of the Unites States shows how the public, experts and authorities deal with the concept of risk and safety. While the public does not expect that the risk will be reduced to zero, they do expect that some response will be forthcoming. Despite the fact that time and equipment will be limited, the public and government will be better off when adequate measures are taken to prepare for a potential disaster. Determining exactly how much should be done to prepare for disasters is hard to say particularly when we note that the public, experts and authorities often deal with the concepts of risk and safety differently. Experts often focus on a risk-based approach, while decision makers tend to use a cost benefit analysis. It must be noted that all safety standards are related to an acceptable level of risk. This requires stakeholders to discuss and determine what level of consequences can be accepted and what they need to guard against. Given that all of these measures are based on the same funding (i.e. tax payers' money), attention is required to determine the relationship between the measures taken by the authorities, their functional outcomes, public perception of risk reduction measures, and public desires or expectations for safety. In short, while costs and benefit tools can provide valuable insights in deciding what measures have to be taken, with regard to the acceptable level of risk, without a connection to public debate, they alone are insufficient.

The Netherlands US Water Crisis Research Network (NUWCReN)

A number of lessons learned from the floods after hurricane Katrina as well as other insights from research and practice in the United States were deemed applicable to flood risks in The Netherlands. At the request of the Dutch government, a collaborative network of Dutch and American universities and institutes was formed, the 'Netherlands US Water Crisis Research Network' (NUWCReN). This network was funded by the Dutch government from

2009-2012 in order to develop a sustainable network of US and Dutch partners, that could exchange critical information on water-related crisis situations. The network consists of the following core participants (see Biographie of authors in the back of this booklet):

- George Washington University (GWU), Institute for Crisis, Disaster and Risk Management in collaboration with the Virginia Tech (VT) Centre for Technology, Security and Policy
- University of Delaware, Disaster Research Centre (DRC)
- University of Colorado at Boulder, Natural Hazards Centre (NHC)
- COT Institute for Safety, Security and Crisis Management (COT)
- TNO/The Hague Centre for Strategic Studies (HCSS)
- Wageningen UR (WUR)
- Deltares in collaboration with HKV Lijn in Water (coordination and liaison with the Ministry)

Members of the network have been exchanging ideas for a number of years and have hosted a number of meetings and workshops in The Netherlands and the USA. NUWCReN outcomes are expected to help the Dutch government prepare for, respond to and recover from water-related crisis situations. The network is focused on efforts to reduce damage, casualties and social disruption. In this booklet, the main outcomes of the network are presented.

Emergency management as layer of flood risk

Flood risk management generally consists of a combination of measures, such as prevention with levees, land use planning, building codes, insurance and emergency management. In The Netherlands, a so-called multiple layer safety approach comprising three layers is used:

1. prevention
2. land use planning and
3. emergency management (Ministry of Public Works Transport and Water Management 2008)

In the USA, see for example (Lopez 2006), and Canada, see for example (Fraser Basin Council 2008), similar approaches are used. These are called 'multiple lines of defense'. The concept of multiple layer safety takes the probability of flooding into account as well as the consequences. Therefore the risk is the central element in this approach. Such an approach can be used to evaluate flood risk management (ten Brinke et al. 2008b).

Although investments in each layer can contribute to flood risk reduction, it is not clear what the optimal mix of investments is in an exposed area, from a cost-benefit point of view. The probability of a flood event can be reduced by strengthening levees (in the prevention layer). The consequences can also be influenced positively or negatively by human actions. Movable goods, people and animals can move to places outside the exposed area (Vrijling 2009), if there is a reliable flood warning and enough time is available. Moreover, they can move to relatively safe places inside the exposed area.

Therefore, emergency services are also part of a system where people live and where a certain and hence limited level of protection is provided by flood defenses. These services historically have been developed with a focus on

1953, The Netherlands

The 1953 flood disaster was a low probability, high consequence event for its time. From Saturday 31 January 1953 to Sunday 1 February 1953, a storm tide raged across the European Shelf with a track much closer to The Netherlands than any previous storm track on record. The storm surge peak coincided with spring-tide high water and resulted in multiple levee breaches of the sea defense (mainly levees), followed by breaches in the inner levee system. In response to this event, people fled to their roofs and rescue operations began as quickly as possible. People found themselves in a race against the clock and "increasingly more people succumbed to the cold, or disappeared with their collapsing houses into the deep" (Haan & Haagsma, 1984). The consequences of this event are estimated as follows: 1,836 casualties, 72,000 people evacuated, 47,000 animals and 140,000 poultry perished, over 3,000 houses and farms destroyed and more than 43,000 houses and farms damaged. Levees had around 100 flow gaps, more than 800 km of levees damaged and 200,000 hectares of land were under water (Haan & Haagsma, 1984). The damage totaled approximately 14% of the gross national product and the impact was more pronounced, in view of the ongoing reconstruction in the aftermath of the Second World War (Gerritsen, 2005).

Haan, de H. & Haagsma, I. (1984) De Deltawerken: techniek, politiek, achtergronden. Delft: Waltman, Pg. 10-11.

Gerritsen. 2005. "What happened in 1953? The Big Flood in the Netherlands in retrospect." Philosophical Transactions of The Royal Society 363:1271-1291.

incidents and small disasters such as fires in buildings, car accidents etc. In The Netherlands the capabilities of these services are tuned to an event that occurs roughly once in ten years (AGS 2008). In the case of floods, these services will also be used to mitigate the impact of a flood. The impact can also be reduced by measures taken by the citizens themselves, who will obviously act as well. Due to the low frequency of flooding in The Netherlands, from a cost-benefit perspective it is questionable whether special preparations should be made and whether these preparation will remain effective in the long term.

Using an economic approach, the optimal level of safety (in which the costs of loss of life can be also expressed as economic loss (Bočkarjova et al. 2010), can be defined based on the probability of flooding and the consequences (Kind 2011). Also the risk for loss of life can be taken into account (De Bruijn et al. 2010). The multiple layer safety system should not be interpreted as a serial system: the different layers are not as weak as their weakest link (Jongejan and Vrijling 2006). Research shows that if a multiple layer system is considered as a parallel system of layers (Vrijling 2009); the layer with the lowest marginal costs is implemented and the other(s) is (are) omitted. However, in the Vrijling model, the benefits of emergency management are modelled as a reduction of the probability of flooding. Whereas in fact, it seems more appropriate to view those benefits as a reduction of the consequences of flooding. Emergency management for example, can reduce the consequences by preventing loss of life and possibly even damage. Investments can be made for improvements, to increase the use of existing emergency services and infrastructure (Kolen and Kok 2011), these are generally relatively cheap. A second group of investments are those that increase the number of rescue workers, their equipment and infrastructure. In the Dutch context, with low probability of flooding, relatively small investments in improvement of processes underlying emergency management, will significantly reduce the total costs in a flood risk management strategy. Investments in means, personnel and infrastructure are more costly and therefore in most cases do not reduce the total costs (remaining risk and investments).

Dutch perspective of flood risk management

History on flood risk management

The Netherlands has a long history of flood protection, that began in the middle ages (van de Ven 2004). While the Dutch geography provides fertile soil and easy access to the seas and waterways, it also exposes The Netherlands

to the dangers of river and coastal flooding (Orr and Gandu 2007). Large parts of The Netherlands are vulnerable to flooding (see Figure 1). Levees have been built to reduce the risk, often in response to a flood disaster (van de Ven 2004). The Dutch history of human intervention in the delta, is in fact a history of land reclamation and flood protection. Huge areas of land were reclaimed already in the 17th and the 18th centuries, thanks to technological and economic developments. Land reclamation in the 20th century focused on the Lake IJssel area. Due to the protection provided by levees, dunes and structures, areas in The Netherlands were able to develop economically and socially. The development of these areas has on the one hand led to an increase in the potential consequences of flooding and on the other hand has led to a reduced probability of occurrence of the flood.

1993 and 1995, The Netherlands

In 1993 in total 170 sq km of Dutch territory flooded affecting thousands of homes and businesses and over 8,000 people. The damage amounted to more than 100 million EUR. This was mainly water damage and the Dutch authorities declared a state of emergency.* With the 1993 flooding still in mind, The Netherlands was again confronted with major flooding in 1995. In 1993 the Meuse was the main problem, in 1995 waterlevels in other major Dutch rivers, such as the Rhine and the Waal, also rose to alarming heights (Rosenthal, Bezuyen, Duin, de Vreeze-Verhoef eds, 1997). So not only the province of Limburg was at risk, but also the province of Gelderland. Especially along the Rhine, events escalated as levee instability and possible failure could have caused life threatening situations. Levee failures could have resulted in the inundation of large areas along the river with depths of up to 6 meters within a few hours. Eventually close to 250,000 people (Duin et al, 1995) and 200,000 live stock had to be evacuated within approximately 48 hours, from the low lying areas adjacent to the river. While fortunately the levees did not fail, four people lost their lives due to unfortunate accidents and the total damage amounted to over 400 million EUR, mainly for the evacuation costs.

Rosenthal, U. en M. Bezuyen, Flood Emergency Management in Developed Countries: The experience of 1993, 1995 and 1997 in Europe, in: D.J. Parlur (ed.), Flood, Routledge, London: 2000

M.J. van Duin, M.J. Bezuyen and U. Rosenthal. 1995. "Evacuation in case of extreme water levels, self reliance and care of authorities." Leiden: COT, University of Leiden, Erasmus University Rotterdam.

* http://archive.greenpeace.org/climate/flood_report/4-1.html

Figure 1: Flood prone area of the Netherlands

The 'fight' against water has therefore not just shaped the Dutch landscape, but has also influenced Dutch culture and society as a whole. For example, the Dutch polder-model – a Dutch model of decision-making, characteristic to The Netherlands and distinguished by elements such as consultation, consensus and compromise – is one of the most famous elements of Dutch society that finds its roots in this 'fight' against water. Aside from the polder-model this has become central to the development of water governance in The Netherlands and finds its origins in the water board system. The polder-model can also be found in the crisis management structures in The Netherlands.

1953: Introduction of risk based approach

In 1953, a major storm surge disaster struck the South Western Delta area and took the lives of 1836 people (Gerritsen 2005). The disaster also had considerable economic consequences. The reaction of the people was straight forward: 'This must never happen again'. The governmental response was the establishment of the Delta Committee. The Delta Committee introduced a risk based approach to determine the optimal level of protection based on the

costs and reduction of the risk (Dantzig 1956). In time, the optimal level of protection, in fact a probability of flooding, and frequencies of excessive water levels, along the so-called levee ring areas, were defined. Levee ring areas are "areas protected against floods by a series of water defenses (levees, dunes, hydraulic structures) and high ground" (Jonkman et al. 2008). The protection of a levee ring is determined by law and the norms are determined by the risk of flooding. Flood risk is defined as the product of the probability of flooding and the consequences of flooding. Flood risk can be decreased by a reduction of the probability and/or a reduction of the consequences. Flood risk management is mainly relevant for areas with some kind of man-made value. Consequences are often expressed as economic costs and loss of life. Both indicators are important and must be considered in discussing acceptable (or tolerable) risk.

Figure 2 Current safety standards by dike ring area

Also the economic value for loss of life can be taken into account (Bočkarjova et al. 2010). The consequences of a flood depend on the characteristics of the natural phenomenon, the demographics and economic activity of the exposed area and emergency measures.

Every six years the flood defenses are tested using up to date insights in hydraulic loads and the strength of the flood defenses. These tests are followed by an investment program, if needed, to maintain the required level of protection. A few different levels of safety standards were defined, taking into account the nature of the threat as well as the values to be protected. The safety standards range from 1/250 per year along small catchments along the Meuse and 1/1.250 per year for the river levee rings in the east of the country to 1/10.000 per year for the coastal levee rings of North and South Holland. Figure 2 shows the safety standards for the levee rings of The Netherlands. This resulted in a system with the highest safety standards in the world, based on a risk-based approach that optimizes costs and benefits. A consequence of this successful strategy is the low perception of flood risk by the public and very limited incentive to prepare mitigating measures (Terpstra 2009) and the difficulties to get decision makers involved in preparation for flooding (ten Brinke et al. 2008b). Flooding is no longer a frequently occurring natural event in The Netherlands. Therefore, the general perception is that the risk is effectively mitigated by the government and there is no reason to be preoccupied with the possibility of flooding (COT 2004).

Shift to more attention to the consequences of flooding

In 2004, an evaluation of the water safety policy showed that The Netherlands is not prepared for extreme flooding. Also the loss of life of a group of people (probability for a group of casualties in an event) due to flooding exceeded by far, the group risk as the result of combinations of other risks related to industrial safety. (RIVM 2004; ten Brinke et al. 2008a). Therefore, the need for improved preparation was addressed by the Dutch Government (Ministry of the Interior and Kingdom Relations 2005, 2006). Also, risk analyses for The Netherlands in 2008 (BZK 2008) and 2009 (BZK 2009) showed flooding to be the disaster type with the most extreme, catastrophic consequences, although the probability is "highly unlikely" (Figure 3).

Furthermore, triggered by the flooding of New Orleans in August 2005, caused by Hurricane Katrina, the Dutch Cabinet decided to enhance flood preparedness (Remkes 2006). However, criteria for the level of preparedness in terms of a risk based approach were not defined. In 2008, drafts and first generation plans were tested in a nationwide exercise called "Waterproef" (TMO 2009).

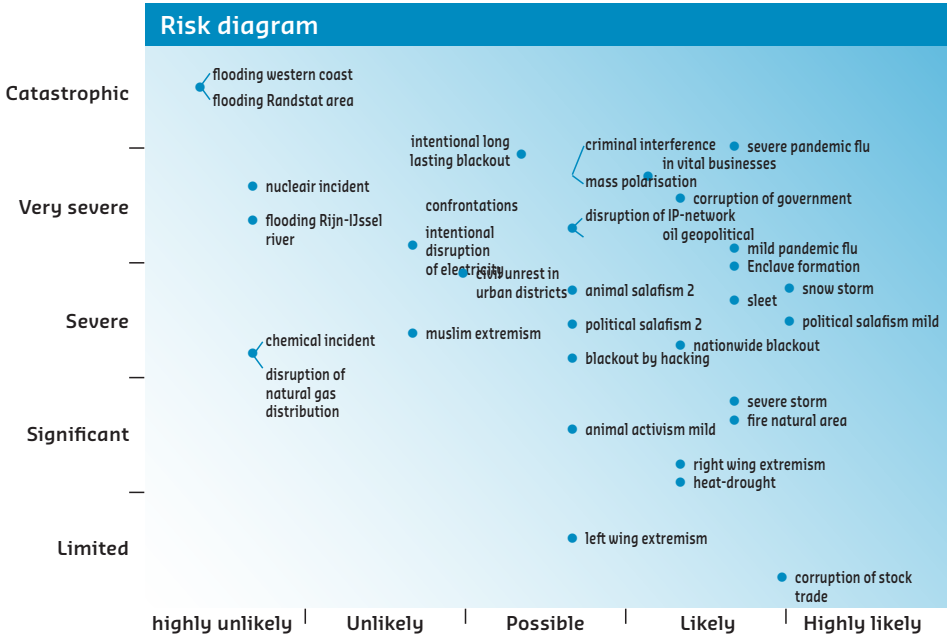


Figure 3 Risk diagram for The Netherlands (in 2009, ((BZK) 2009)) showing the risks of different types of threats.

In 2009 the Dutch Government introduced the previously mentioned Multi Layer Safety approach as flood risk management strategy (Ministry of Public Works Transport and Water Management 2008). This approach contains of three layers:

- Prevention
- Land use planning
- Emergency management

Although the current level of flood protection in The Netherlands is higher than ever before, the second Delta Commission advised a further increase in the safety level for The Netherlands. Their advice was also to take the risk for loss of life into account (Deltacommissie 2008). These subjects are now being investigated as part of the Delta program.

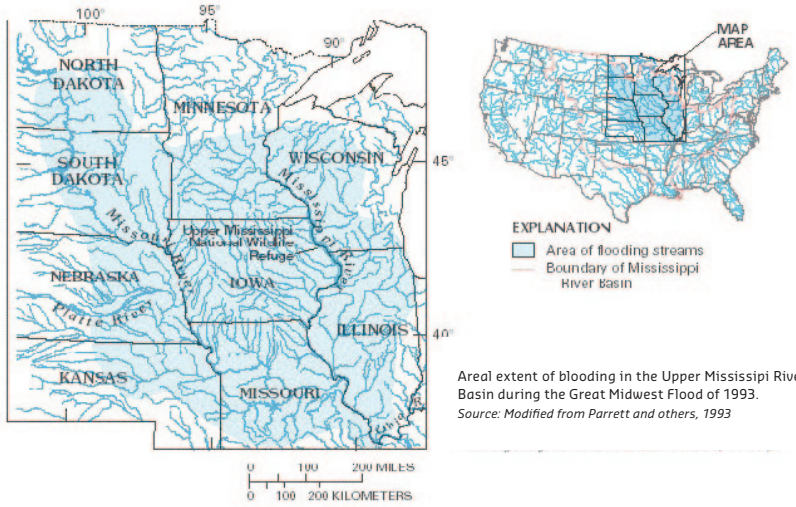
United States perspective of flood risk management

Floods are the most common natural disaster in the United States (US) generating a yearly average of $9 Billion US (adjusted for inflation) in physical damage and 83 deaths over the past 20 years (1991 – 2010) (Administration 2011a). These statistics are inclusive of fresh water flooding and do not include damage and deaths resulting from coastal flooding due to tropical cyclones, the impacts of which would significantly raise the physical and human costs associated with hurricanes such as Katrina and Rita in 2005. When one thinks about flooding in the US, it conjures up images of Hurricane Katrina, with survivors huddled in the New Orleans Superdome or helicopter rescues from the roofs of houses. Beyond such rapid onset and catastrophic flooding events like Katrina, flooding events in the US can occur and remain over protracted periods of time causing significant financial damage and changing the characteristics of the communities they impact. For example, the 1993 Midwest floods were caused by 77 events over several months where rainfall of greater than one inch per event occurred over areas 100 to 200 miles wide and

The 9/11 Terrorist Attacks, United States

The September 11, 2001 hijacking of four airplanes by 19 Al Qaeda terrorists and the resulting attack on the World Trade Center and the Pentagon resulted in the deaths of almost 3,000 people, including 411 fire, police, emergency medical personnel and other first responders. The World Trade Center collapse destroyed the New York City Emergency Operations Center and caused millions to evacuated lower Manhattan. These attacks were a national crisis and were responded to by national resources and leadership. However, the on scene response efforts in New York and in Arlington, VA were capably led by local fire departments, supported by the city/county Emergency Management offices. Both the New York City Fire Department and the Arlington County Virginia fire departments organized their response using the Incident Command System and succeeded in controlling extremely hazardous conditions without incurring additional casualties. The federal government provided critical resources, expertise, and support at both locations. In response to the attacks and to the continuing threat of terrorism, the U.S. created the Department of Homeland Security combining all or part of 22 agencies, including the Federal Emergency Management Agency. As a result of this re-organization, DHS became the lead department for preparedness for and response to all extreme events.

400 to 600 miles long. The cumulative impacts of these rain events resulted in long term flooding of large areas as shown in Figure 4. Similar flooding in the upper and lower Midwest over the past three years due to winter melts and torrential rains has resulted in damage in the Billions of dollars each year with an estimated $5 to 6 Billion (US) during 2011 for the impacted communities, states and the Federal government (Administration 2011b, c).



Areal extent of blooding in the Upper Mississipi River Basin during the Great Midwest Flood of 1993.
Source: Modified from Parrett and others, 1993

Figure 4 The 1983 Great Midwest Floods (http://water.usgs.gov/nwsum/WSP2425/images/fig62.gif)

That being said there is a great deal of regional variation in exposure to flood risks. Some areas experience repeated yearly flooding in drainage basins while others experience few small events but have significant potential for catastrophic floods. Other areas such as New Orleans have a mixture of both types of exposure. Research suggests six elements that capture the major differences between catastrophes and disasters (Quarantelli 2005). In a catastrophe there is:

1. Massive physical impact (in contrast to the localized impact in disasters);
2. Local officials are unable to undertake their usual work roles (in contrast to this happening only at a small scale in the typical disaster);
3. Help will come mostly from more distant areas (in contrast to the massive convergence in disasters from nearby areas);

4. Most everyday community functions are sharply and concurrently interrupted (in contrast to this not usually happening in a typical disaster);
5. Non-local mass media, especially cable TV, socially construct the immediate and ongoing situation (in contrast to the typical disaster where the greatest attention is by the local media and only incidental and brief reporting is done by cable and national media);
6. Very high level officials and governmental agencies from the national level become directly involved (in contrast to disasters where there is often limited and primarily symbolic attention given by other than local persons and agencies -community and state).

The importance of the six dimensions mentioned is that they provide the larger context within which all response activities occurred.

In order to understand how the US approach to flood management compares with that of the Netherlands, one needs to also understand how the context of emergency management in the US varies from that of the Netherlands. While

Hurricane Irene, 2011, United States

Hurricane Irene was a powerful Atlantic hurricane that caused extensive damage throughout the Caribbean and along the United States East Coast. The first major hurricane of the 2011 annual hurricane season, it began to show signs of organizing east of the Lesser Antilles and public advisories were sent out late on August 21st. On August 22nd Hurricane Irene made landfall as a Category 1 hurricane in Puerto Rico, resulting in severe flooding and property damage. As Irene intensified it travelled north of Hispaniola, killing seven people. It transitioned into a Category 3 major hurricane while passing through the Bahamas, resulting in widespread structural damage. Irene's first landfall in the United States occurred on August 27th as a Category 1 hurricane in the outer banks of eastern North Carolina and moved along southeastern Virginia. The second landfall in the United States was on August 28th in the Coney Island area of Brooklyn, New York. This caused extensive damage to eastern upstate New York and Vermont, initiating their worst flooding in centuries. In the U.S., Hurricane Irene generated mandatory evacuation orders for 2.3 million people and t resulted in at least 40 deaths and long-term power outages for approximately 9 million people. Although not yet finalized, combined monetary losses in the Caribbean and in the United States are an estimated 10.1 billion U.S. dollars.

the Netherlands has several hazards most would agree that flooding is by far the greatest threat. The US by contrast has an incredible diversity of hazards each of which is equally threatening in its own way; in fact, the USA may be one of the most hazard prone nations in the world. In a large part due to its size, climatology, and geography the nation faces an incredible number of different threats including floods, tornadoes, earthquakes, hurricanes, and many others. Some of these threats are small in magnitude but have a high probability of repetition others are rare events, but the magnitude and after effects would be catastrophic. This diversity of exposure to risks has led to a similar level of variation in from state to state, region to region, and even from city to city in how such threats are managed. With so many different hazards each competing for national attention it is difficult for one to emerge as "the" central or focal issue of concern. Additionally, it is also important to note that, unlike provinces in the Netherlands, States and in many cases lower levels of government have sovereignty or legal autonomy from higher levels of government. In other

The 2010 BP Deepwater Horizon Oil Disaster, United States

On April 20, 2010 the Deepwater Horizon drilling rig located 50 miles off the Louisiana coast exploded and began to burn in the Northern Gulf of Mexico. The rig, owned by Transocean Ltd. and contracted to British Petroleum (BP) eventually sank leaving a breached wellhead gushing an estimated 55,000 barrels of oil per day. Initial efforts to stop the spill were unsuccessful and the well released an estimated 185 to 205 million gallons of crude oil before it was capped on July 15 and permanently sealed on September 19, 2010. On April 29, US Homeland Security Secretary Janet Napolitano declared the event a "spill of national significance." Oil washed ashore along the Louisiana coast—eventually reaching the coastlines of Mississippi, Alabama, and Florida. Within two weeks after the explosion, the National Oceanic and Atmospheric Administration began restricting fishing in federal waters between Louisiana and Florida, and slowly began opening them after the well was capped and sealed. The spill severely damaged and threatened several 'at-risk' industries along the Northern Gulf, including commercial and recreational fishing, tourism, and other enterprises tied to natural resources. Initial social impacts have been profound and will continue to evolve over time. Issues relating to long-term ecological impacts, seafood safety, water and air quality, dispersant use, beach contamination, tourism, and the claims process have generated contentious debates among scientists, politicians, government officials, and other stakeholders, including area residents.

words there are legal limits on the ability of the federal government to direct lower level entities to take specific course of action within their borders. The intersection of these two facts has led the US to develop an approach to floods and to emergency management generally that is quite different than that of the Netherlands. The US has focused on developing systems that can be applied across the range of threats rather than within a specific type of hazard. Most often national guidance is intended to help local regions and communities adopt approaches to safety based on their vision of the risks, threats, and priorities. In many ways, under this system the federal government has an important, but limited role in determining how lower levels governments will address these threats. Instead local policies and practices often determine the approach any community takes to its hazards. For the most part, the national government exerts influence in these activities through planning guidance, advice, and restrictions or incentives in funding aimed at facilitating the adoption of specific types of programs.

Despite this context, the US does employ a number of specific programs that influence multi-layer flood preparedness. While the choice to adopt these measures rests at the local level, the US government does provide assistance and incentives for communities that address their flood risks. In fact, the National Flood Insurance Program (NFIP) is often cited as one of the most effective emergency management programs in the US system. In many ways the label under specifies the scope of NFIP activities. While insurance is a critical part of the program it also includes a number of other components intended to recognize, motivate, and help fund investments in prevention and preparedness activities. The foundation of the program is official flood risk mapping tied to a mandate that any home with a federally backed mortgage that is also inside a 100 year flood plain purchase insurance through the program. In order to motivate risk reduction and preparations, the program provides financial incentives for communities that take actions. Through the Community Rating System program flood prone areas are able to earn flood insurance premium rate discounts in increments of 5% based on their attention to four categories of activities:

1. Public Information
2. Mapping and Regulations
3. Flood Damage Reduction
4. Flood Preparedness.

Further, these communities can apply for assistance to achieve these goals through the Federal Mitigation programs.

Flood preparedness as an add on to generic emergency planning

To enable an adequate response to a disaster/ crisis situation, The Netherlands utilizes a process-oriented approach to emergency management, which is similar to the all-hazards approach in the USA. The idea is that, regardless of the situation one or various processes need to be activated.

The emergency management processes in The Netherlands are allocated to the municipality, the fire-department, the emergency medical services and the police department. While the responsibility lies at municipal level, the other regional, provincial and national levels are also important partners in the emergency management system (Engel et al. 2010). We describe the role of each of these organizations below. Emergency services in The Netherlands are designed for incidents or disasters that happen approximately once every ten years (AGS 2008). A flood event however occurs far less frequently. On the other hand, the spatial impact of a flood is substantially larger, hence potentially involving more people.

The National Risk analysis shows that a flood in The Netherlands is a low frequency event with a high impact. In The Netherlands, flooding is seen as a national crisis (Helsloot and Scholtens 2007). Earlier research showed, that even in a perfect situation, a completely preventive evacuation is not possible because of limited lead time, the number of people involved and the available infrastructure (Barendregt et al. 2005; Maaskant et al. 2009). In the case of a flood from rivers or sea there will be shortage of rescue workers and time to save all personal property. The question is how to prepare for such events.

Mississippi Flood, 1927, United States

The Mississippi Flood of 1927 was the result of significant precipitation in the drainage basin of the Mississippi River. On and after April 16, major portions of the levee systems collapsed and numerous states were flooded as a result. Hundreds of thousands of buildings were inundated and about 700,000 people were left homeless. Relief activities after the event illustrated tense racial relations. The disaster also indicated the weaknesses of flood control measures, even though levees and dams would become a central feature of U.S. policy over time.

The difficulty in answering this question is directly linked to the particular nature of the risks. Risks are always "something unreal, related to random, chance and possibility, of something that has not yet happened and is difficult to describe in advance." (Bankoff et al. 2004). Dealing with risks is difficult, as they cannot easily be visualized and are not tangible. Communities often prefer to deal with the last disaster, rather than those that are likely to occur in the future, even if the probability is very low, but the potential results are (near) catastrophic (Sutton and Tierney 2006). Other smaller incidents or disasters such as fires in buildings, road accidents, explosion of storage bins, are easier to imagine and happen more frequently. The urgency to prepare for these is clearer. Also, it is easier to fit the available means and capabilities to these events because these can be used in various situations.

Katrina, 2005, United States

Most of the world already knows much about Hurricane Katrina and the problems that resulted. Despite how difficult it is to collect, compare, and interpret disaster statistics, estimates produced by various governmental agencies provide a great deal of insight into the physical, human, and economic impacts of Hurricane Katrina and allow some perspective:

- At least 1500 people lost their lives.
- About 10,745 people were rescued.
- Flooding in some areas that exceeded the 100 year storm estimates by 15 feet.
- 1.3 million people were displaced.
  - Roughly equal to the entire population of the state of Main
- Impact area- Approximately 90,000 square miles
  - About the size of the entire United Kingdom.
- Roughly 300,000 homes destroyed or made uninhabitable
  - 10:1 ratio when compared to homes lost in Hurricane Andrew (1992)
- Total economic impacts believed to be between 125-150 billion dollars.
  - Compared to 48.4 billion (Andrew 1992), 87 billion (9/11) [adjusted to 2005 dollars]
- Gallons of oil spilled in the gulf coast 18.8 million
  - Compared to 10.9 million spilled in the Exxon Valdez Oil Tanker Accident
- Estimated debris created by Hurricane Katrina 118 million cu. yards.
  - 6:1 ratio when comparing tons of debris created by Katrina to the combined debris from the 9/11 attacks and Hurricane Andrew combined.

Even as a simple meteorological event Katrina was massive storm. At second impact, it packed sustained category 3 winds (125 mph) that radiated 120 miles from its core; it spun off at least 11 tornados; and had the third lowest sea level pressure in recorded history. It is important to recognize that with a storm this intense some areas of the gulf coast would have been irreversible changed even if the governmental response had gone exceedingly well. As we all know this was not the case. If the estimates above are wrong by ten or even twenty percent, it is still safe to say Katrina was a catastrophe, a distinction reflecting the view that the two are qualitatively different.

Nowadays the availability of information on a (potential) crisis is no longer limited to the authorities. Information (validated and non-validated, different interpretations and opinions) is spread very quickly using internet and social media. Information is no longer exclusively for the authorities, but is spread across society directly by the authorities and others. This information will influence citizens' responses (Helsloot and Ruitenberg 2004) as well as first responders and decision makers. Measures may be implemented, people will start evacuation, because they will or cannot wait (Helsloot and Scholtens 2007). Literature shows that first responders will primarily act in line with their role during normal life and common disasters. For example firemen will rescue the persons that are close by (Cannon-Bowers 1998; Zsambok and Klein 1997). Also decision makers will act as they are used to acting, despite circumstances being different. Time pressure during decision making is much higher and the consequences of decisions are directly apparent to them in terms of damage and loss of life. This might create a risk of delay in decision making.

The improvements of emergency management in the field of flood risk, result in better overall decisions and possibly better use of knowledge of uncertainties. Decision makers and crisis managers can provide better circumstances for implementing emergency measures and mobilizing citizens' responses, if certain measures are taken on time (Kolen and Helsloot Accepted, scheduled for 2012; Parker et al. 2009). However, choices by decision makers and first responders can also result in worse conditions. Normal procedures such as registration, blockage of roads for rescue workers etc., can limit the possibility for others to evacuate. Also, if all regions evacuate using the same roads, traffic jams can result in a grid lock situation where all transportation stops. When traffic is spread more evenly over the various roads or when some areas evacuate vertically, more people can reach safety in time.

US experience with large scale disasters, shows examples of measures taken during a crisis, being counter productive. For example, it is questionable whether the firemen who went into the World Trade Centre Towers on 9/11 could have saved more lives (including their own) by not entering the buildings. In practice, this situation presents a dilemma for a commander. The primary response for the rescue workers (part of their training), is to enter the building and rescue people. Information on the potential collapse of the building is uncertain and subject to other information (Tong and Canter 1985). Although rescue workers pay attention to their own safety, the information about a possible collapse might not be available for those out in the field, but only for commanders at the central crisis centres. Often it is only available for experts in or outside these centres. Even in hindsight, there are ongoing debates about whether information was available in the case of the Twin Towers and how that information should have impacted decisions (for example, see the weblog 'truth and shadows' (McKee 2011).

This booklet

We claim that, in The Netherlands, emergency management for flooding should be seen as an 'add on' to existing emergency planning. Therefore, some specific preparation is required to minimize loss of life and maximize the use of available information, resources and infrastructure. This booklet discusses this preparation based on the experiences of the NUWCReN network within the context of The Netherlands and other countries with limited budgets for flood preparedness and low risk perception of the public and limited urgency for preparation by decision makers. This booklet discusses them regarding the topics:

Chapter 2	The context of flood risk management and contribution of emergency measures is described. The chapter highlights different sizes of flood scenarios, how to deal with uncertainty in lead time and finally how procedures for emergency management can take uncertainty in probability and consequences into account.
Chapter 3	NUWCReN Theme Self reliance and Community Involvement in Dutch Flood Response
Chapter 4	NUWCReN Theme Managing the response to large scale floods
Chapter 5	NUWCReN Theme Vertical evacuation: rethinking urban, rural and social space
Chapter 6	NUWCReN Theme Public/Private Partnerships for Flood and All Hazard Emergency and Disaster Management
Chapter 7	NUWCReN Theme Mitigating and Managing the Health Impacts For a Catastrophic Coastal Flooding Scenario in The Netherlands
Chapter 8	NUWCReN Theme Evaluation: enriching (flood) emergency preparedness in The Netherlands
Chapter 9	Conclusions and recommendations for Dutch policy makers and practitioners in flood emergency management

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2

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Early warning, forecast, situational assessment and sense making

Introduction

Detection of a possible threat is the boundary condition to initiate the warming and response phase. Criteria and procedures are often related to expected water levels. When the threat does not meet the criteria a warning is not sent out, even when it is clear that the event might be very serious (Boin et al. 2005). Literature (Kroonenberg 2010) shows a case of extreme weather in the Alps, when the use of pre defined criteria resulted in missed calls and false alarms, while better use of the knowledge of the forecaster could have prevented these.

Forecasts (and consequences) are surrounded by uncertainties. In reality the expected value will be surrounded by a bandwidth. The question is, how can we take uncertainties into account in procedures for early warning and for decision makers. For example how do we deal with situations with a low probability that a flood may happen in the next days but with potentially a high level of impact on society, or when the expected forecast does not exceed criteria but some members of the ensemble (of a set of 50 forecasts) exceed them by far?

Lead time & early warning as used nowadays

Lead time

A threat of flooding in The Netherlands is a low frequentcy event (HKV 2010). Emergency planning however, is activated more often for the closure of defense systems or activate precautionary measures and because it is better to be safe than sorry (VenW 2010). Water levels will exceed warning or alarm criteria once in a couple years. Emergency planning for flooding is far more activated when a flood will happen and is sometimes interpreted as false alarm.

The lead time of forecast can range from days to mere hours or minutes before the start of the disaster (such as the onset of a flood). The available time for evacuation or implementation of other measures could be reduced because of extremely stormy weather conditions. Detection and recognition is necessary to start warning and response phases.

Forecasting models and early warnings are used to alert crisis organizations and citizens and to start implementing safety measures. The probability for the time window for preventive evacuation in The Netherlands is defined by experts for different areas (Table 1). This window of time is based on available forecasting models, early warning procedures and the expected willingness to call for evacuation. The table shows the probability for a certain window of available time for evacuation taking into account the available forecasts and the willingness to call for evacuation. For the river areas more time is available for evacuation because better forecasts compared to coastal areas. When the river Rhine and Meuse are compared, a call for evacuation is made later in case of the Meuse because less time is needed for evacuation compared to areas along the river Rhine.

Time	River Rhine	River Meuse	Western Coast
No time	10%	10%	10%
1 day	20%	40%	45%
2 days	50%	50%	30%
3 days	20%	0%	10%
4 days	0%	0%	5%

Table 1 Probability distribution time for emergency management based on forecasts and decision making (Maaskant et al. 2009)

Early warning

Early warning is described as the process of detecting a possible threat using forecasting models and warning crisis managers and decision makers. Before crisis managers act, they must make sense of the possible threat. Sense making is defined as understanding the threat and willingness to think about possible responses (Boin et al. 2005).

Early warning depends on predictions made by forecasting models and experts. These models use the actual circumstances and predictions of the weather. The forecasts result in an expected water level, with a margin of uncertainty (Jonkman 2007; van Noortwijk and Barendregt 2004). When these (forecasted) water levels exceed predefined warning or safety levels, alarms will be triggered and crisis organizations will be put into place. In case of flooding (using early warning), two approaches to initiating these crisis organizations can be distinguished (Kolen 2009; Ministry of Transport Public Works and Water Management 2008a) :

1. Bottom up approach: When water levels are rising, the water boards will be warned by flood forecasting centres for rivers, lakes and the sea. They can then take measures to prevent flooding. Water boards inform Safety Regions in case of a serious risk of flooding, which may lead to measures such as evacuation. If necessary, local and regional organisations inform national organisations.
2. Top down approach, as recently developed by the National Commission of Flooding: in case of extreme water levels that cause a realistic immediate flood risk. After detection of possible extreme water levels, the national crisis organisations and the water boards will be warned of the impending danger. National crisis centres will begin crisis management and coordination between regions.

The bottom up early warning system mainly focuses on the task of the water boards to prevent for flooding, according to operational disaster management plans. Time is sufficient for precautionary measures to be taken by the water board and for levee inspection teams to be formed. For river areas, a few days are available for preparation after the first warning. For coastal areas, only hours to a day may be available (van Noortwijk and Barendregt 2004). The bottom up approach is appropriate for situations with extreme water levels but with small risk for flooding; it might be less effective in cases of possible flooding.

Different flooding scenario's

In The Netherlands there are several scenarios for flooding. These can be divided into two types:

1. most likely scenarios and
2. worst credible floods.

The boundary conditions of the most likely scenarios are equal to the current safety levels of the local flood defence system. The defence system is designed using a probabilistic approach (Duits 2004). The event (combination of several parameters) with the highest probability as regards the safety level, is generally taken as a boundary condition. Most of these scenarios assume a single breach and focus on one levee-ring (area surrounded by one defence system).

Figure 5 Worst credible flood for the western coast (Kolen and Wouters 2007; ten Brinke et al. 2010)

Worst credible floods give an upper limit for flooding scenarios that are still considered realistic or credible by experts and that can be used for emergency planning in addition to the most frequent scenarios. A worst credible flood greatly exceeds the safety level, with a hydraulic load that is 10 higher than the equivalent from the frequency of the safety level; thus, multiple breaches may occur in many different levee-rings (Kolen and Wouters 2007). These worst credible flood scenarios can be seen as worst cases (Clarke 2006; ten Brinke 2009) and reflect the idea of "thinking the unthinkable" (Clarke 2006). Extreme scenarios are used to learn how infrastructure networks (roads, communication) might fail and to think through possible disaster preparations. The projected worst credible flood for the western coast (Figure 5), which

would cause the flooding of approximately 10 percent (about 4,500 km^2) of The Netherlands after more than one week, by far exceeds the 2005 flooding of New Orleans after Hurricane Katrina in terms of the extent of flooding, victims, casualties and damage (about 120 billion euros and >10.000 casualties).

Excercises FloodEx

The need for probabilistic procedures for emergency management

Cost-benefit method

A method based on cost-benefit analysis can be used to judge the applicability of a measure. Cost is all the expected financial effort and/or needed input to initiate and implement the measure. Whereas, benefit is the avoided expected damage due to the measure. When the benefit exceeds the cost then the measure should be applied from a rational economic point of view. When the cost exceeds the benefit, the measure should not be implemented. In reality more parameters influence the decision making process. Insight in the costs and benefits support however can support a decision makers while making complex decisions (Jongejan 2008). In the following figure, a simple model for decision-making, using a cost-benefit approach, is proposed. In the model, the cost and benefit are not necessarily expressed in the same units (e.g., money), because a comparison is made between alternatives.

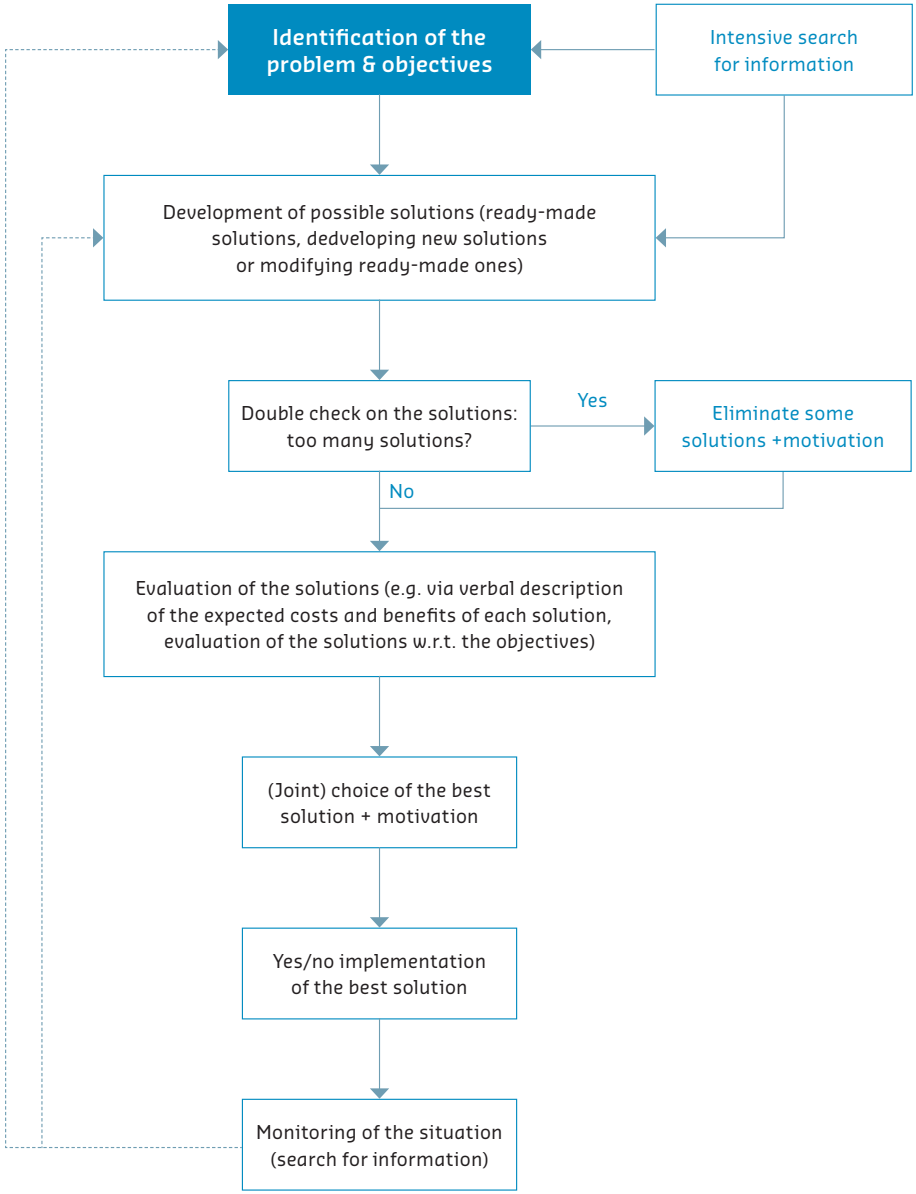

Figure 6 decision-making using a cost-benefit approach

The model can be applied to all decision which have to be made, particularly when cost-benefit is not expressed in amounts of money. We discuss an example some Dutch Waterboards have to deal with during or after large amounts of precipitation. Choices have to be made with regard to the evacuation of a threatened area, which is densely populated and has a high economic value (caused by high water level in the river and long-lasting rainfall). The objective is to minimize the amount of damage and casualties. Using the available information, four initial solutions are considered (Kolen et al. 2010):

Solution 1	Preventive evacuation: movement of people from an exposed area to a safe location outside this area before the disaster.
Solution 2	Vertical evacuation to a shelter: the organisation and the movement to high and strong buildings inside the potentially exposed area before the start of the disaster or moment of exposure.
Solution 3	Vertical evacuation to a safe haven: the organisation and the movement to elevated and dry area inside the potentially exposed area before the start of the disaster or moment of exposure.
Solution 4	Shelter in place: the organisation and the movement to upper levels before the start of the disaster or moment of exposure at the location of the disaster.

A team of experts double-checks the amount of possible solutions and may decide to exclude solutions (1) and (3). In that case, the motivation for the elimination of solutions has to be provided. The experts up weigh the costs and benefits of the remaining two solutions.

The cost of solution (2) amounts to the costs related to the shelter, whereas the benefit is the expected damage reduction (mainly fatalities). The cost of solution (4) is very low: people take their own measures to protect themselves. The benefit is the expected damage reduction (economic damage, fatalities). In this case the experts consider solution (4) to be better than solution (2), i.e., if the comparison of cost and benefit of solution (4) is more favourable than the cost/benefit of solution (2). The experts decide whether the measure should be applied. Regardless of the final decision, monitoring of the situation takes place.

Procedures for early warning: Case study Water boards

In The Netherlands, water boards can have arrangements with the Royal Dutch Meteorological Institute (KNMI). According to this arrangement, the water boards receive early warnings from the KNMI based on rainfall risk profiles that can differ per water board. A rainfall risk profile consists of different rainfall volume events. When one or more of these events are expected to occur then certain warnings are issued. In a warning message, the KNMI indicates the expected rainfall volume (and occasionally also probability forecasts for rainfall volume). More details are however available via the Internet, where observed rainfall, forecasted rainfall and probability forecasts are collected. Depending on the specified profile, the warnings are repeated. The risk profiles are derived using "experience" and "feeling for the behaviour of water".

Within a water board, only a few persons know of the existence and content of the arrangement with the KNMI. In most cases these criteria are based on expert judgment, these criteria are not defined based op optimal values taken costs and benefits into account. Sometimes only one person receives the warning message, interprets it and responds to it according to their own experience and abilities.

The warnings are usually based on deterministic values (i.e., point forecasts), although the water boards and the KNMI are aware of the associated uncertainties. In August 2010, extreme rainfall caused material damage in the regions managed by Regge and Dinkel Water Board and Rhine and IJssel Water Board. Locally, 138 mm/m^2 of rainfall was measured within 24 hours and this was the highest observed rainfall amount since 1998, in the Netherlands. Differences in the rainfall risk profiles, which are motivated by sensitivity of different users areas on weather conditions, led that in August 2010, the Regge and Dinkel Water Board, which has a very complex rainfall risk profile with several windows of time, received dozens of warnings from the KNMI, whereas the Rhine and IJssel Water Board, which has a simpler profile with higher thresholds, did not receive any official warnings. Since the probability forecasts for rainfall volume are available, the question arises as to the inclusion of this information in operational decision-making of the water boards. Examples of such decisions are: taking emergency measures or starting the coordination of a crisis organization. Despite the clear importance, there are no formal procedures that take the uncertainties into account. In the next section, such a procedure is proposed.

Procedure for decision-making using uncertainty information

A procedure for decision-making in a water board, facing an overload danger, is presented in the following figure. The procedure takes into account the probability of an uncertain event (i.e., overload in the managed area), plus the cost and benefit of a considered measure. The proposed procedure contains certain improvements in respect of the currently applied approach.

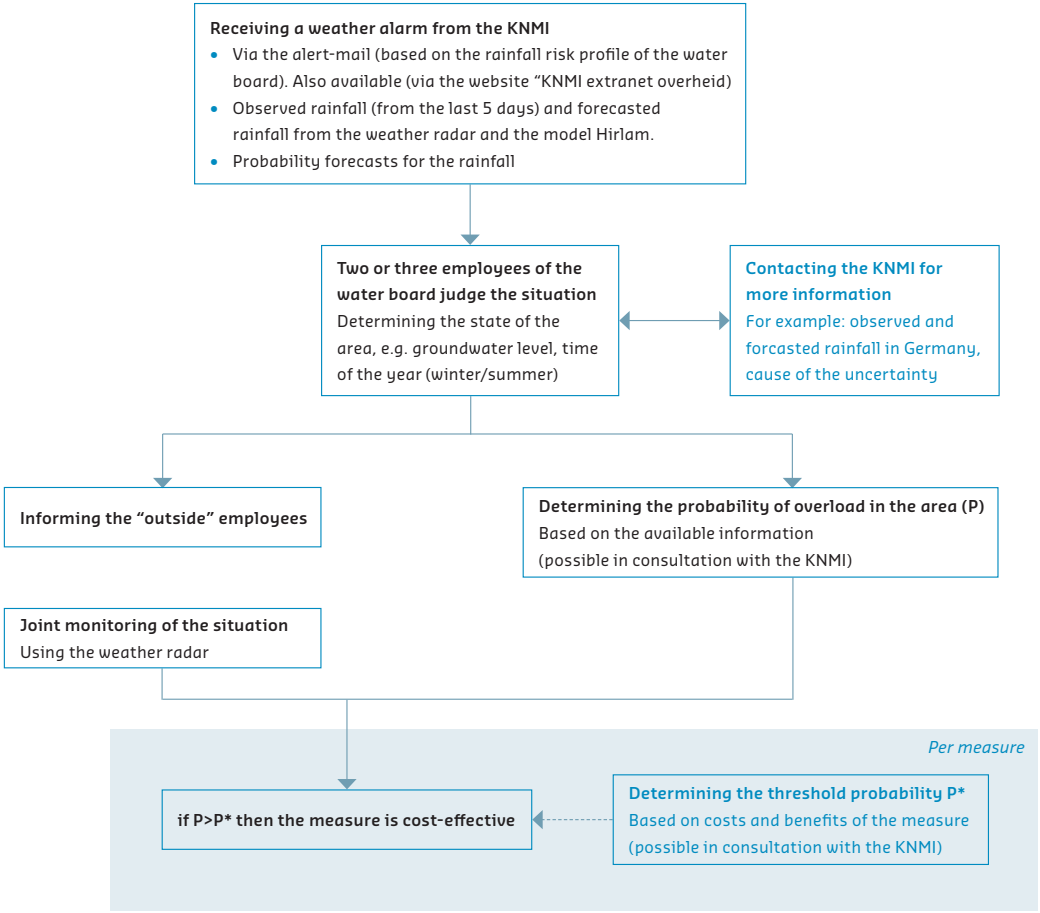

Figure 7 procedure for decision-making in a water board, facing an overload danger

The procedure starts with receipt of a weather alarm from the KNMI via the agreed communication channel (e-mail, internet, sms, etc). The alarm message and the current state of the area (groundwater level, vegetation, time of the day/week/year, etc.) are used by a group of experts to determine the probability of overload in the area (within a certain time period). The probability of overload is then compared with a certain probability threshold that depends on a considered measure. The probability threshold is defined here as the ratio of the cost to the benefit of the measure (both expressed in the same units), also referred to as "the cost-loss ratio". When the probability of overload exceeds the cost-loss ratio then the measure is cost-effective (and should be applied from a rational point of view). Simultaneously, in the procedure, informing of the "outside" employees and joint monitoring of the situation take place. In general, combination of all these factors determines whether the measure should be applied. This procedure could help the water boards to evaluate different solutions (see model) and to substantiate the decision.

Case study Probability of overload

In this paragraph, derivation of the probability of overload in an area is presented as a case study. Here, three rainfall scenarios (which can be produced by the KNMI) are considered. The scenarios are presented in the following table.

Scenario	Rainfall volume within the next 24 hours	Probability of scenario
1	Between 10 and 20 mm	30%
2	Between 20 and 30 mm	40%
3	Between 30 and 40 mm	30%

Table 2 Description of the rainfall scenarios; case study

Assume that the probability of overload in the area is between 0 and 33% when a score for overload in the area is between 0 and 1, between 33% and 66% when the score is between 1 and 2 and between 66% and 100% when the score is between 2 and 3 (see Table 3).

Score for overload in the area	Probability of overload in the area
0-1	0% - 33%
1-2	33% - 66%
2-3	66% - 100%

Table 3 Relations between the score for overload in the area and the probability of overload in the area; case study

The score for overload in the area can be calculated as follows. It is assumed that the state of the area is described by two factors, namely, groundwater level and vegetation. Each of these factors receives score 1, 2 or 3 depending on the actual condition of the factor. Scores 1 and 3 represent the favourable and adverse conditions, respectively. Score 2 indicates a situation in-between. In this case study, the groundwater level is high (this is an adverse condition) corresponding to the highest score (3) and the vegetation is sparse (this is a favourable condition) corresponding to the lowest score 1. Furthermore, the groundwater is judged to be more important that the vegetation. The factors then receive certain weights, here, 0.65 for the groundwater and 0.35 for the vegetation are assumed. The weighted sum of these scores constitutes the total score for the state of the area: 2.3 (0.65*3+0.35*1).

Factor	Score	Weight
Groundwater level	3 (1=low, 2=medium, 3=high)	0.65
Vegetation	1 (1=sparse, 2=medium, 3=concentrated)	0.35
	Total score	2.3

Table 4 Derivation of the total score for the state of the area; case study

This score is consequently combined with the rainfall scenarios yielding conditional scores for overload in the area, which take values 1, 2 or 3. Thus, given scenario 1 and the score 2.3, the conditional score for overload 1 (i.e., experts estimate that the situation is not dangerous). Given scenario 2 and the score 2.3, the conditional score for overload is also 1 (i.e., experts estimate that the situation is not dangerous). Whereas given scenario 3 and the score 2.3, the conditional score for overload is 2 (i.e., experts estimate that the situation may be potentially dangerous). Derivation of the conditional scores is also shown in the following table.

Scenario/state of the area (score)	Between 0 and 1	Between 1 and 2	Between 2 and 3
1 (probability 30%)	1	1	1
2 (probability 40%)	1	1	1
3 (probability 30%)	1	2	2

Table 5 Derivation of the conditional scores for overload in the area; case study

Combining the conditional scores for overload with the probabilities of the rainfall scenarios entails the total score for overload in the area: 1.3 (1*30%+1*30%+2*40%). Hence, the overload probability is between 33% and 66%. Assume conservatively that this probability is equal to 66%.

According to the presented decision criteria, a measure is cost-effective when the probability of overload exceeds the cost-loss ratio of the measure. Since the probability for overload equals 66%, all measures whose cost-loss ratio is lower than this value, are cost-effective.

Concluding remarks

Because of the existing of uncertainties and the high impact of decisions as shown in this chapter for the Netherlands we have defined the following challenges. These challenges apply for the Netherlands as well as other countries as the US if the total costs have to be minimized:

- Definition of the probability of overload needs to be more concrete (e.g., what is exactly being meant by "overload"?, which part of the managed area and what period of time are considered when estimating this probability?). Until now water boards tend to use their intuition and experience for decision making. According to the described procedure, the probability thresholds should be determined based on costs and benefits of a response measure, both expressed in terms of money. The proposed scheme for estimation of the probability of overload can be extended in several ways, e.g., additional factors that influence current state of the area, more variation in the values of the scores (1-5 instead of 1-3), including rainfall in upstream areas.
- Relevant issues for the warning and response phase are lead times, probability in predictions of parameters for threads, time-space oriented accuracy and predefined thresholds related to vulnerability of the area under thread. The trigger levels for activation of predefined and tested measures with the ability to reduce risk are a compromise where the accuracy of the predicted sea level or amount of precipitation, the potential impact are combined with the acceptable risk. The frequency of the scale of the event, the damage and risk on casualties are being used in a cost benefit analysis for optimization of warning and response process.
- Dealing with dilemma's of large uncertainty of in the thread of a large scale disaster and the available lead time to prepared large scale measures (evacuation) have a need for procedures based on cost-benefit analysis. However worst credible floods will never follow the plan and procedures could fail from the beginning. Dealing with these conditions by authorities (managing the response) and citizens (stimulating self reliance and creating resilience) is discussed elsewhere in this booklet.

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Self-Reliance and Community Involvement in Dutch Flood Response

Introduction

This chapter was inspired by the NUWCReN symposium 'Community Vulnerability and Resilience', organised by Disaster Studies, Wageningen University on 23 June 2010 in Wageningen, The Netherlands and prepared by the authors on the basis of available literature and supervised fieldwork carried out by Wageningen University students. The first section of this chapter gives background information on the geographic and policy context of flooding in The Netherlands and the associated shifts in risk paradigms. The second section comprises a description of the organisation of the emergency response in The Netherlands with a special focus on the concept of self-reliance[1] and citizens' involvement. The third section analyses the different aspects of the multi-faceted nexus between government, citizens and flooding. It will first discuss the prevailing perceptions and existing forms of preparedness. Then it will deal with observed cases of citizens' behaviour during disasters and then turn the focus on the relations between the professional agencies and citizens.

1 In Dutch, use is made of the notion of 'zelfredzaamheid' which has no proper equivalent in English. It literally means the 'capability to look after oneself or to save oneself' (self-reliance). In this paper we use the notion of 'self-reliance' though we are aware it does not convey exactly the same meaning as the Dutch concept of 'zelfredzaamheid'. In the second section we present a further conceptual discussion on the notion of 'zelfredzaamheid' and related concepts.

The last section will draw conclusions from the available data and derive policy inferences. It will also indicate what knowledge gaps still prevail and which further research is required to fill those.

The geographic and policy context of flooding in The Netherlands

Citizens and flooding in The Netherlands

While they had lived with floods that claimed thousands of victims throughout the ages, the Dutch considered themselves safe after the construction of the Delta coastal and riverine protection works. However, the 1993 and 1995 high-water events woke The Netherlands up to residual risk. The emergence of extreme climate change-induced coastal and riverine flood scenarios inspired a more salient change from a largely resistance to a risk approach (Brinke et al 2008a) as was already introduced in the 1950s by the first delta commission. The building block for such an approach was the 'dike-ring'.[2] The governmental directive 'Anders omgaan met water' ('Dealing differently with water' (Ministry of Public Works 2000)) urged experts to map residual flood risk for each dike-ring (Veiligheid Nederland in Kaart 2006). Progressive insight also revealed that dikes were never as safe as it was thought. This approach forced Dutch policy-makers to think about acceptable risk levels (Brinke et al 2008b).

A risk approach seeks to reduce the chance on and impact of floods through a 'safety chain' or, at present, a multi-layered approach of prevention, preparedness, response and aftercare. Disaster risk reduction (DRR) instruments include flood-awareness planning, flood zoning, evacuation planning and controlled flooding. A risk approach invites spatial differentiation between stakeholders on the basis of cost-benefit analysis. DRR instruments are still not well ingrained in Dutch flood policy, while risk differentiation is resisted in Dutch society.

2 A dike-ring is 'the area of land that is protected from flooding by a ring of dikes, dunes or structures (of flood defenses) or high grounds. As The Netherlands are constantly at risk from floods, the entire nation has been subdivided into dike-ring areas' (see i.e. Wikipedia, accessed 8 June 2010 and Dutch Water Law)

Involving people in flood policy

While a 'technocratic' DRR policy is perhaps imaginable, the risk approach generally presupposes a different governance model in which not only water managers are responsible for flood management. Horizontally, in addition to the Ministry of Infrastructure and the Environment (that includes Water Management), other ministries would have to get involved and induce behaviours that reduce flood impacts and help in evacuation, including the Ministry of the Interior and Kingdom Relations, the Ministry of Economic Affairs, Agriculture and Innovation and the Provinces. Vertically, lower-level authorities, private and civil-society actors would need to be made flood-aware. DRR in integrated flood management is, according to the Hyogo Framework for Action, also assumed to be community-based and participatory to increase community involvement and resilience.

The flood exercises carried out so far in The Netherlands have had a markedly top-down feel. They only involved formally mandated security actors. In those towns that have citizen participation, like Kampen, it is only on a strictly operational basis according to a pre-set plan that citizens are involved. This general absence of citizen's involvement is perhaps not so strange in the 'repression' link of the security chain in which crisis leaves limited scope for deliberation, but less suitable in earlier and later phases in which participation seems to be of the essence. Pearce (2003) shows for Australia that security professionals see stakeholder participation often as an annoying and complicating distraction. Dutch research (Oberijé & Tonnaer 2008) confirms this finding for The Netherlands. However, the Ministry of the Interior and Kingdom Relations' 'zelfredzaamheid', or 'citizen self-reliance' policy initiated in 2009 appears to have spurred safety regions and local authorities to involve citizens more, though it is too early to say with what effect.

Dutch emergency response and citizens' self-reliance

Emergency response in The Netherlands

Over the past decade Dutch safety agencies have started to integrate their operations better and to increase the speed of decision-making through the creation of so-called safety and security regions ('veiligheidsregio'). Police, fire services, ambulance and public health emergency ('GHOR') services are now organised into 25 such regions, coordinated by the Ministry of Internal Affairs and Kingdom Relations. The water boards are also represented in the safety region's executive boards. Apart from disaster response, the safety

regions are also supposed to take the lead in calamity preparedness. To do so, some of these regions (the South-western province of Zeeland is an example) have started to reach out to social organisations such as churches, as well as the Red Cross.

The magnitude of a disaster determines the administrative level at which it is dealt with. Basically, the organisation of disaster response takes place at one of three levels: the municipality, the safety region (typically the level for dealing with flooding), or the nation as a whole. At each level, responsibility for the coordination of the response activities lies with a small number of individuals, advised by a disaster staff composed of relevant experts. The organisation is top-down and centralised, in order to make sure the response is efficient and sufficient. Organisations involved are the traditional response organisations: police, fire services, emergency public health services, military, and, in case of water-related disaster, water boards, Rijkswaterstaat and the Ministry of Infrastructure and the Environment Response plans at the different levels frequently do not take citizen response into account, and disaster agencies are still wrestling with questions of how to deal with citizens.

The notion of 'zelfredzaamheid'

In June 2009, the Dutch Minister of the Interior and Kingdom Relations, Mrs. Ter Horst informed Parliament about the efforts to increase the 'zelfredzaamheid' of the Dutch people (Ter Horst 2009). With 'zelfredzaamheid', she referred to the capacity of citizens to save themselves and look after themselves (and others) when disaster strikes. In the view of the Dutch government, 'zelfredzaamheid' is a capacity of citizens, as opposed to disaster professionals. It refers to the capacity of citizens to survive on their own and to cope with adverse circumstances; when citizens need help from professionals, it means the limits of their capacity to save themselves have been reached. It is, however, obvious that in most cases citizens' capacities and the efforts of aid organizations will have to be combined.

Although an exact (English) translation of 'zelfredzaamheid' is lacking, literature yields a variety of terms that are connected to it. 'Coping' refers usually to the instantaneous response to a hazard, and may include damaging forms of distress coping undermining long-term prospects for recovery. Other terms used include 'private action' or 'citizen response', but these are not very specific and can refer to a host of activities carried out by private actors. A third notion frequently used is that of 'resilience'. It is this term that Minister Ter Horst employed as the English translation of 'zelfredzaamheid'.

Though zelfredzaamheid' could be seen as a constituent part of, and a first step towards, resilience, the latter term denotes a more systemic, structural and long-term quality present (or to be promoted) at different levels of social organisation. According to Cutter et al, "resilience refers to the ability of human systems to respond and to recover. It includes those inherent conditions that allow the system to absorb impacts and cope with the event, as well as post-event adaptive processes that facilitate the ability of the systems to recognize, change and learn in response to the event" (Cutter et al. 2008). Norris et al define it as follows: Resilience is "a process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance or adversity. .... Community resilience emerges from four primary sets of adaptive capacities – Economic Development, Social Capital, Information and Communication and Community Competence – that together provide a strategy for disaster readiness" (Norris et al. 2008: 127). Among others on the basis of these definitions we argue that 'resilience' should be seen as "The shared capacity (of a group, community or society) to anticipate, resist, absorb, and recover from an adverse or disturbing event or process through adaptive and innovative processes of change, entrepreneurship, learning and increased competence."

Hence, there is a major difference between the fairly individual and instantaneous approach of 'zelfredzaamheid' and the systemic, long-term and collective approach of resilience. The approach of the Dutch government is geared towards the individual (and perhaps household) coping capacity to deal with a disastrous event, while resilience is a longer term adaptive approach based on social learning and change. It definitely includes response and coping, but goes beyond it and is also is more geared to social and systemic aspects of dealing with disaster. Considering all of the above, we feel that the notion of self-reliance comes closest to the Dutch idea of 'zelfredzaamheid', even though it is not a perfect equivalent either. Yet, we opt to use this concept instead of 'resilience', which we deem really quite different from 'zelfredzaamheid'.

Even though the Dutch governmental focus on 'zelfredzaamheid' seems to be geared largely towards the individual, most individuals are part of multiple social networks (Van den Brand 2005: 92). When individuals are socially isolated, they are deemed to be less 'zelfredzaam', and hence form a special concern for the government (Don & de Jong 2008). Thus, the social context implicitly forms part of the individual 'zelfredzaamheid'. This is where the community enters the picture, but unfortunately this is largely ignored in Dutch governmental disaster preparedness policies, while this in effect may

form the missing link between government and citizens: for, as will be shown below, individualized policies to increase 'zelfredzaamheid' to flooding as yet have had little effect.

The nexus between government, citizens and flooding

Citizens and flood risk: perceptions and preparations

When considering the changing approach to risk in The Netherlands, one of the questions coming to mind is how aware citizens are of their 'new' responsibilities and how they perceive the risk of flooding? This section will review a series of Dutch studies that have been undertaken during the last decade to answer these questions (see appendix 1 for an overview of these studies). Though the studies differ with respect to method, scale and place, the combined outcomes do present an overall picture of the attitude of Dutch citizens regarding flood risk and (responsibility for) water safety.

In 2006 The Dutch government launched a major publicity campaign, 'Denk Vooruit' ('Think Ahead') to increase the awareness of Dutch citizens of their co-responsibility for their own safety and provide them with an action perspective, amongst others through the purchase of an emergency supply kit ('noodpakket'). 67 percent of interviewed respondents thought indeed that it was one's own responsibility to prepare for an emergency situation. Also, a majority (56 percent) was positive towards having an emergency supply kit at home (Ter Horst 2009: 4). A year later, 79 percent of the respondents know the government advises them to prepare for an emergency, 81 percent think it is important to know how to prepare, and 6 of every 10 respondents think it is (partly) one's own responsibility to be well-prepared (Ter Horst 2010, appendix 3).

However, when investigating how many people have actually purchased an emergency supply kit, in January 2010 only 0.3 percent of the households had bought an emergency supply kit; the others thought it either too expensive or said they already had the ingredients (NOS.nl 2010).

Terpstra (2008; also discussed in Klopstra & Kok (2009) and Van der Most et al (2010), investigated public perceptions (n=1648) of the risk of flooding in four 'dike-rings' in The Netherlands[3]. Terpstra finds that generally 50-70 percent

3 Noordoostpolder (Dike ring 7), Zuidelijk en Oostelijk Flevoland (Dike ring 8), Alblasserwaard en Vijfheerenlanden (Dike ring 16) and Delfland (Dike ring 14)

of the citizens worry 'a lot less' to 'a little less' about flooding or problems caused by heavy rainfall, compared to other risks. 40 percent indicate that it is 'likely' or 'sure' that they will prepare themselves for flooding. 75 percent of the respondents sees themselves as 'a bit' to 'hardly' responsible, while the government or water managers are seen as 'quite' to 'very' responsible by 73 percent. Thus, Terpstra's findings confirm the image that, when it comes to flooding (and heavy rainfall), citizens do not worry (a low risk perception) and see the government as prime protector.

These findings are confirmed by Baan et al (2008) who find that only a small percentage of the respondents (n=957) worry about flood risk; more than half indicate not or hardly to worry about flooding. The respondents indicate that they do not think it likely that there will be a flood in their region within ten years. Respondents regard the collection of information about the consequences of floods for their surroundings, about evacuation routes and high safe places as the most relevant preparatory actions. However, when asked whether they will take action, a large part of the respondents indicate they will not.

A research on risk perception, conducted by TNS Nipo in the northern province of Groningen yields similar results. People are most aware of 'everyday' risks such as traffic accidents and theft. Only when the researchers made respondents aware of other types of disasters, such as flooding or a power cut, these disasters entered the ranking: 'burglary' now ranked first, 'failure of utilities' came second, and 'flooding' third (2007: 4). However, only one third of the respondents (n=732) mentioned 'flooding' as a risk, while 'burglary' was mentioned by twice as many.

Quantitative research in Zwolle (De Laat 2009) and qualitative research in Dordrecht (Hillebrand 2008) also show a low flood risk-awareness coupled with a low degree of flood preparedness. De Laat (n=107) finds that 'most citizens are not aware of the risks in their environment and have no idea what they can do to reduce these risks', and 'hardly anyone sees themselves as responsible for the safety in their immediate environment' (2009: 32). Hillebrand, in a series of 26 in-depth interviews, finds that inhabitants of Dordrecht expect the municipal government to put sufficient effort into guaranteeing the safety of the city (2008: 4).

Research into citizens' perceptions of risk in the municipality of Oud-Beijerland, prone to flooding from the river Meuse and the North Sea (NEWCOM 2009) and

in several municipalities in the province of Zuid-Limburg at risk from flooding the river Meuse (AcUtHas 2008) shows that citizens look to the government for information on risks and on what to do when a disaster strikes. Again, citizens do not think it likely a disaster will occur and flooding is not seen as an exceptional risk (NEWCOM 2009: 4, 18). In the municipality of Venlo citizens actually believe flood risk has decreased in the last ten years because of improved flood protection works; in Bergen, on the other hand, more than half believe flood risk has stayed the same or has increased, because the municipality has done little to improve flood protection (AcUtHas 2008: 37). This shows the influence of physical flood protection works on the citizens' sense of safety.

Watermonitor, an annual research investigating Dutch citizens' awareness and opinions on water issues, confirms the above trends. A huge 96 percent of the respondents (n=1227) think the (national) government is primarily responsible for water safety in The Netherlands, while only 33 percent think citizens themselves share a large part of this burden. Few respondents (less than 25 percent) indicate that they know how to prepare themselves for flooding (Intomart GfK 2009).

All this evidence strongly indicates that citizens in The Netherlands do not perceive flooding to be a risk requiring much attention; that levels of preparation are correspondingly low and citizens see the government as responsible for water safety. However, there are also several studies that come to different conclusions. For instance, research in 2006 by TNS Nipo investigating flood risk perception in relation to willingness to evacuate, concluded that 'flood risk perception is large in The Netherlands', both in the sense that citizens worry about flooding and how probable citizens believe floods are (TNS Nipo 2006: 3). However, respondents living in areas that had recently been threatened by high water and those that were evacuated in 1995, were a great deal more afraid of flooding than those not living in those areas (2006: 9). But, also in areas not threatened by the 1995 high water levels, respondents mentioned flooding to be the most likely disaster. TMO (2009: 10) mentions research by Van Mierlo et al (2003), who found that more than 75 percent of the inhabitants of the large rivers area (surrounding the Rhine and the Meuse) expected the problems with high water levels to increase in the future, if nothing would be done. Thus, it seems previous experience does make a difference for risk perception. Van Winsum-Westra et al (2010), finds a 10 percent difference between areas with and without recent flooding.

However, even though levels of risk perception may be higher, this does not necessarily affect levels of preparedness. As Reinders (2010) finds in North-East Groningen, citizens may even over-estimate flood risk, but he does not find corresponding higher levels of flood preparedness. Terpstra (2010) and Baan (2008) suggest this may have to do with the relatively low levels of 'dread', which people experience when talking about flooding. Higher levels of anxiety, or fear, might lead people to take flood risk more seriously, and lead to corresponding levels of preparedness. Bočkarjova et al (2009) also find low levels of preparedness, compared to the perceived levels of flood risk, and couple this to the high level of trust in the government (also found by Van den Berg et al (2002)): trust in the government may reduce worry, and lead people to neglect private preparations.

Despite a rise in general disaster awareness and a sense of co-responsibility for their own safety, the various investigations, in different places and by asking different questions, largely come to similar conclusions: Dutch citizens have a low awareness of flood risk and do not perceive flooding as a threat, while few citizens prepare for flooding. The government is seen to carry the prime responsibility for the provision of 'water safety', as Bannink and Ten

Brinke (2004: 192) already concluded. Perhaps one exception has to be made, based on the findings of TNS Nipo (2006) for citizens living in the large rivers area,who recently experienced high water levels. But the general picture is of a relatively unconcerned, uninformed, unprepared Dutch citizen, who does not feel very much responsible for his own safety, when it comes to the risk of flooding.

Citizens and disasters: citizen behaviour

Next to the perceptions and preparations dealt with above, another question related to citizens' involvement in flood management is how citizens actually behave before, during and after disasters.

Ideally, citizens' behaviour before disasters is to make all necessary preparations, ranging from the collection of information to the creation of a 'family emergency plan', as for example advocated by the US Federal Emergency Management Agency (FEMA), or to the installation of flood-proof doors and the rerouting of essential power cables. However, as the previous section showed, few citizens in The Netherlands prepare for a flood disaster.

How then do citizens behave during disasters? In recent years, two Dutch studies of international literature have come to the conclusion that three 'myths' about the behaviour of citizens in disaster situations are exactly that: myths (Ruitenberg & Helsloot 2004; Starmans & Oberijé 2006). These myths are the following: citizens panic when disaster strikes; citizens respond to disaster with apathy and dependency; citizens will start looting when a disaster presents the opportunity. Based on their research, the authors conclude that these myths cannot be confirmed by reality. Instead, citizens behave rationally once the initial fear subsides: they start looking for ways to secure their own safety and that of others, which is a sign of the much sought after 'zelfredzaamheid' or self-reliance. Instead of being helpless victims, citizens 'are the first to start search and rescue activities, victim care and reconstruction'. Looting almost never takes place shortly after disasters (Helsloot & Ruitenberg 2004: 101-103).

In deciding how to act, two different mental systems come into play: the intuitive and the analytical. The first is swift and subconscious, while the second is slower and calls for effort, learning capacity and conscious reasoning. However, the influence of intuition does not mean the decision turns out wrong. In fact, the chosen response is often the right one. As Helsloot and Ruitenberg say, 'citizens react quickly and intuitively in case of a lack

of preparation time and sudden occurrence of the disaster, as with acute disasters such as earthquakes, storms and terrorist attacks. Generally, they respond adequately' (Helsloot & Ruitenberg 2004: 101-102).

Research also shows that after a disaster (during the response and relief phase) there is an 'abundant' willingness of people to assist. This is confirmed by research in the municipality of Oud-Beijerland, The Netherlands where respondents were asked whether they would be willing to assist in case of a disaster. Over two-thirds answered positively (NEWCOM 2009: 12). The widespread involvement of citizens can lead to large numbers of people making their way to the disaster area, such that it has been dubbed an 'informal mass assault' (Helsloot & Ruitenberg 2004: 103). This phenomenon is also called convergence (Starmans & Oberijé 2006: 18). Furthermore, there can be a very large community involvement. Even the most devastating events often leave more non-victims than victims in the area, enabling the community to adjust and take action. Frequently, these non-victims form groups and start helping the victims; this form of spontaneous assistance is also referred to as emergent groups (ibid 2006: 16). This was, for example, observed during the fire in Volendam. Besides these groups, as Dynes (1994) points out in Helsloot and Ruitenberg (2004: 103), local organisations and companies also often get involved and offer many services.

In some countries, such as New Zealand, Canada and the United States, governments have sought to actively equip citizens for when disaster strikes. 'Recovery Managers' in New Zealand are trained for community supervision in the recovery process; 'Home Emergency Response Organization Systems' (HEROS) in Canada make an inventory of useful materials and capacities in the neighbourhood, list vulnerable people that may need help and are responsible for the creation of collective supplies of food, water and medicines; 'Community Emergency Response Teams' (CERTs) in the US are composed of local residents and they receive training in a number of (life-saving) skills (Helsloot & Ruitenberg 2004: 105; Starmans & Oberijé 2006: 45). However, conclusive research on the effectiveness of these initiatives still is lacking.

The above data, refuting the myths about citizen behaviour during disasters, is based largely on evidence found in other (Western) countries. Unfortunately, systematic empirical research in The Netherlands is still lacking, though numerous examples seem to indicate the situation here to be similar. For example, during the flood disaster of 1953 (with a death toll of over 1800), 29 percent of the citizens in the affected area managed to save themselves and

an additional 31 percent were saved by citizens from their own neighbourhood or island (NIFV Nibra 2006: 5). Another example is the fire in a bar in Volendam on New Year's Eve 2000/2001 leaving 14 dead and over 180 casualties. Citizens, family, friends, people from the neighbourhood dominated the relief activities during the first thirty minutes of the disaster, moving wounded to spontaneously created areas in neighbouring bars and helping medical personnel with the treatment. The final report of the commission investigating the fire states that the efforts of non-professionals have been of great importance (Van den Brand 2005: 72).

The evidence collected shows that citizens are not to be neglected in the preparations for a disaster, but also that they are essential in the immediate response and the recovery after the event. Though it proves hard to get citizens to actively prepare for a disaster, numerous examples show that citizens are very willing to come into action when a disaster happens. Helsloot and Ruitenberg put it strongly: 'generally speaking [...] citizen response is what saves the day when disasters strike' (2004: 109). Perhaps this is even more so, when they act in combination with professional disaster agencies.

Professional disaster agencies and citizens

As studies show that citizens' assistance is useful and effective, it would seem logical and desirable for disaster agencies to work together with citizens. However, in general disaster agencies are finding it hard to co-operate with citizens. According to Dynes (1994: 142-144), the reason lies partly with the historical approach to disasters. Disaster management was based on militarily organised civil defence organisations with disaster as their enemy to be dealt with through the military 'C3' doctrine: disasters cause Chaos, to be repressed through Command and Control. In The Netherlands, from the 1950s onwards, citizens were (militarily) organised in the 'Bescherming Bevolking', or 'population protection' forces, with at its height 160,000 (Lepelaar 2008: 13) to 250,000 volunteers (Nationale Collectie Bescherming Bevolking n.d.). This C3 approach to disasters implied or at least strongly suggested that other civic organisations could not be trusted to cope effectively with emergency situations and thus led to mistrust of these organisations ("let the professionals do their job and do not get in the way") (Helsloot & Ruitenberg 2004: 104).

Although the disaster management paradigm has started to shift in the 1980s, Helsloot and Ruitenberg still find remnants of the C3 paradigm in current disaster management structures and practice. Also other studies show that first aid and emergency services generally have many difficulties with individual citizens participating in relief activities. They are reportedly hard to guide and pose a challenge to coordination and communication, so that when there are many, they may form an entirely new problem next to the disaster at hand. Citizens that have already organized themselves as a group (earlier referred to as 'emergent groups'), on the other hand, form a more welcome partner for disaster agencies, since they pose less of a challenge for management and communication (NIFV Nibra 2006: 10).

Helpful citizens arriving in large numbers may also confront relief agencies with very practical issues such as the clogging of transportation routes (Helsloot and Ruitenberg (2004: 106).

Another disadvantage of citizen participation in relief operations is that the helping citizens may get themselves into trouble or worsen the situation due to unprofessional behaviour. Additionally, liability in these cases is often unclear (NIFV Nibra 2006: 11).

There are of course also big advantages to citizen action. The prime advantage is the 'extra hands' which expand capacity, ranging from administering first aid and freeing trapped people from the debris, to sheltering victims, sharing food, or simply holding someone's hand. In the first hour after an acute disaster, termed the 'golden hour' when official disaster agencies are still starting up their response, citizens already helping victims which may prove crucial and life-saving. According to Helsloot and Ruitenberg, evaluations of disasters show this 'time and again' (2004: 106). A second advantage is that citizens frequently know their way around the neighbourhood, better than professional aid workers coming from outside. Citizens may know the whereabouts of vulnerable citizens or the availability of useful materials and implements. Thirdly, being able to help has a positive influence on the (psychological and emotional) recovery process of citizens, victims and professional aid workers. They feel useful or supported which creates courage and hope for the future. Finally, involving citizens in the preparation for disaster makes them aware of risk and offers them a perspective for action in case disaster strikes. Though the dissemination of information through campaigns does not seem to have much effect on the actual preparation of citizens, actually involving citizens in concrete activities might have a more substantial effect (NIFV Nibra 2006: 9-10).

Consequently, the participation of citizens in disaster relief does not only complicate operations, it also offers several advantages. However, the traditional 'military' approach to disasters and the difficulties with incorporating and managing citizen action still influence the attitude of professionals. In January 2002, in about 20 interviews with professional aid workers in the United States, it was found that 'there was a total lack of co-operation and trust from the side of professional aid workers towards such [CERT] teams' (Helsloot and Ruitenberg 2004: 106).

Research conducted in The Netherlands in 2007 seems to show evidence of a gradually more positive attitude of professionals towards the participation of citizens. The Netherlands Institute for Safety NIFV conducted a broad internet survey combined with several in-depth interviews including all regions of The Netherlands and all layers of formal disaster response. The NIFV concluded that 'the large majority of professionals have a positive attitude towards the phenomenon of citizen participation', but that in preparing for disasters, few (12 percent: yes; 25 percent: sometimes) actually take this into account (Oberijé & Tonnaer 2008: 36). In almost half the total number of organisations, citizen participation has never been discussed or the respondent has no knowledge of it (ibid 2008: 20). Lepelaar (2008: 16), looking at disaster management practice as described in the contingency plans of relief organisations, has similar findings: 'apart from a few organisations that might play a role in disaster management, like the Red Cross, nothing is written on the participation of citizens'. In planning, citizens are too often treated as victims instead of as potential aid workers. This was also confirmed by student research in Almere, where a substantial majority of civil society organisations had never been approached by the authorities about their possible role during disaster or with regard to awareness or preparedness of their members.

A reason for a lack of attention for citizen participation found by Lepelaar is the alleged unreliability of these actors: it is hard to predict how much help will be available, making it hard to incorporate this in the plans (2008: 21). Reasons that relief agencies do not take participation of citizens into account range from 'we have not thought of it yet' to 'it is impossible to plan citizen participation'; on the other hand only a few respondents indicate that they would refuse or discourage citizen participation (Oberijé & Tonnaer 2008: 36).

Citizens are also rarely involved in the exercises which are done regularly. Interviews by Lepelaar (2008) with representatives of fire brigades, police and paramedics show that only a few professionals are aware of the value of citizen participation, while the majority prefers to do the job in cooperation with colleagues. The large international exercise FloodEx held in September 2009, simulating an international response to flooding of large parts of The Netherlands with 800 participants from The Netherlands, Great-Britain, Germany, Estonia, and Poland, was done completely without the participation of citizens (Beerens et al. 2010). Similarly, in the large national exercise Waterproef of November 2008, involving a storm surge on the North Sea and dangerously high waters in the rivers, citizens were merely involved in a panel that served as a target for crisis communication (Van Capelleveen & Van der Ven 2009; De Jong & Helsloot 2010).

Recently, however, several exercises have emphasised citizen participation. In May 2008 aid agencies simulated an accident at the Royal Theatre Carré in Amsterdam, with a car driving into several passers-by (resulting in 10 victims). Bystanders were explicitly asked for help by victims or aid workers and started helping voluntarily. In total, 27 citizens participated and the aid agencies were satisfied with the results. A (non-representative) survey (n=131) among the citizens, both those participating and those watching, showed that a majority (60 %) thought the cooperation with professionals went well and that a majority (56 %) was open to participation in these kinds of exercises in the future (Lepelaar 2008).

In 2009/2010 evacuation exercises in the Dutch National Park 'de Veluwe' aimed to answer the question whether the visitors knew what to do when threatened by a wildfire? (Provincie Gelderland 2009). The first time the exercise was done without means of support for citizen participation at an evacuation, the second time these means were made use of, such as indicating evacuation routes, an alarm via text messages, and supplying information about evacuation procedures beforehand (Ter Horst 2010). A large group of volunteers proved enthusiastic to join in the exercises and the second evacuation exercise (with means of citizens' support) proceeded more smoothly then the first (2010, appendix).

During the 'Poldercrash' in 2009 the majority of the passengers was able to evacuate the plane on their own or helped by bystanders and other passengers, before professional services were able to reach the plane (Scholtens & Groenendaal 2011).

A recent study (Groenewegen-ter Morsche & Oberijé 2010) has researched citizens' involvement in ten disasters or major incidents in The Netherlands. The results indicate that citizens have been involved in nearly all response-related tasks, except specialised ones, such as fire-fighting, criminal investigations and burials. It was found that citizens were already present at the disaster location or nearby and could start life-saving and rescuing activities immediately, often before professional aid services had arrived. There were no signs of panic or asocial behaviour among the citizens providing aid. It also transpired that citizens were all prepared to help, whether on their own initiative or when asked to do so. Many of them had relevant (first aid) experience or training. They offered their services as long as needed. The study also documents that the professional aid agencies were glad and satisfied with the civilian support, and considers this to be a trend change as compared to the past when a more negative attitude prevailed among the professional aid workers. The authors formulate a number of recommendations: Allow civilians to help and coordinate civilian aid, if possible; give civilian aid workers recognition and appreciation; involve civilians in evaluation and after-care; stimulate citizens' 'zelfredzaamheid' or self-reliance; include civilian support in education and exercises; and make agreements about safety, accountability and liability (Groenewegen-ter Morsche & Oberijé 2010; 5-8).

Thus, whereas the traditional, 'military' approach to disasters combined with the practical difficulties posed by participating citizens has led many disaster professionals not to welcome citizen participation in relief and recovery activities, the involvement of citizens also offers advantages for relief agencies, which merit a search for ways to improve cooperation. Perhaps, as mentioned by Dynes (1994: 149-155), a new disaster management paradigm, with three new 'C's', is necessary: continuity, coordination and cooperation. One thing is clear: whether disaster agencies like it or not, citizens will get involved. Research in The Netherlands presents incipient evidence of a changing attitude of professionals towards citizens, but the same research also finds that these professionals still frequently do not take citizens into account in their planning and implementation. Also, citizens are rarely involved in disaster exercises. Thus, though professionals' attitudes towards citizen participation might be changing, actual disaster management practice still seems to have a fairly long way to go.

Conclusions, policy inferences and further research

This chapter has provided an overview of available studies on and experiences with Dutch citizens' involvement in disaster response, especially floods. It shows that for a long time, in effect till very recently, disaster management in all its aspects has been characterised by a highly professionalised, largely top-down and technocratic approach based on the assumption that the high safety standards underlying the Dutch infrastructural protection works provided full safety and that this could be fully delivered by the government and its specialised engineering and water management agencies. In this model there was hardly any role (if at all) for local communities and citizens.

This approach has traditionally engendered an attitude among the population in which Dutch citizens place great trust in their government, are not afraid of flooding and, though perhaps aware of some residual risk, remain generally unprepared, counting on the government to help them out when disaster strikes.

In the mean time studies have shown that the levels of safety of dikes and other infrastructural works were in effect not that high as assumed earlier. Yet, old habits die slowly and studies show that citizens, despite several awareness campaigns, still do not take the necessary precautionary measures and are also generally not very worried about a possible flood striking them.

More recently, the government has come close to admitting that it could in fact not guarantee the safety of all its citizens in case of a serious disaster and in 2009 the Ministry of the Interior and Kingdom Relations started propagating the notion of 'zelfredzaamheid' or citizen self-reliance, meaning the capacity of citizens to save themselves and look after themselves (and others) when disaster strikes. This rather drastic change of emphasis needs still to be accepted by involved disaster professionals as well as the citizenry at large. With the notion of 'zelfredzaamheid' the Dutch government seems to allude to a largely individual and instantaneous capacity of the citizen -or at most the household- to cope when disaster strikes. It is therefore quite different from another emerging concept, i.e. resilience, which denotes a more systemic, structural and long-term quality present (or to be promoted) at different levels of social organisation. Hence, there is a major difference between the fairly individual and instantaneous approach of 'zelfredzaamheid' promoted by the Dutch government and the resilience approach which takes a longer-term, adaptive and collective view and is based, among others, on social learning and change.

So far, the governmental campaign to increase 'zelfredzaamheid' has had little effect; that is when we look at targets such as purchasing the emergency kit that the government has been promoting in its televised campaign. Apparently only 0.3 percent of the Dutch population has followed this advice, though the awareness of the (need for an) emergency kit and also a sense of co-responsibility were present among fairly large majorities of the interviewed respondents. Therefore, a salient gap between knowledge and action remained conspicuously present. Nearly all studies conducted in The Netherlands show that citizens are not extremely worried about flood risks and say to rely on government action and information whenever a disaster situation would arise. Though citizens' awareness is definitely growing, it has not (yet) led to perceptible changes in preparedness or attitude. The Dutch continue to have trust in and rely on the government without taking precautionary measures themselves. Here, the subject of water safety may be different from other disasters in view of the predominant reliance by citizens on the state versus private action. While residual risk can never be excluded, it distresses people and tends to makes them close their eyes to it unless given a manageable perspective for action (Harries 2008).

Moving to actual citizen behaviour observed during disasters, a different picture emerges. They do take initiative and save and rescue disaster victims often before professional responders have arrived. Literature (Jonkman, 2007) shows that during flood events about 0.1-1% of the people in an area will lose their life, all others rescue themselves or will be rescued by others. They debunk the myths of panic, apathy and asocial behaviour that are often mentioned with regard to citizens' involvement in disaster. On the contrary, research shows they are acting rationally, effectively and also are very committed. Even if they act intuitively, they tend to act adequately. Citizens are, moreover, involved in virtually all disaster-related tasks except highly specialised ones, as well in all disaster phases, also in the post-disaster rehabilitation or recovery phase. The advantages of citizen involvement clearly outweigh the disadvantages.

Yet, professional disaster agencies find it difficult to get accustomed to the involvement of citizens, as that does not tally with the professionalised, top-down, if not militarised 'C3', approaches that characterised Dutch disaster management for a long time. There is, however, a clear paradigm shift and as of recent a more positive attitude to citizens' involvement is emerging under the professional agencies. The professionals are clearly aware of the advantages of citizens' involvement, especially in terms of expanded capacity and timeliness. There remain a number of issues that require a solution,

including structured collaboration and coordination between professionals and citizens, recognition and after-care of citizen responders, and citizen involvement in training and exercises. Recent 'near'-floods or dike breaches (Province of Groningen 2012) may form a good opportunity to foster new forms of preparation and collaboration, as they make a flood much less hypothetical than thought earlier.

In conclusion we suggest that The Netherlands has to overcome its traditional reliance of professional disaster management by opening the domain for citizens' involvement because of the impossibility of professionals to adequately respond in the case of a serious flood. Also in smaller events citizens' immediate presence and consequent timeliness of response justify their involvement in such events.

A bottleneck so far is the difficulty of the government to reach the public with its messages. This may be caused by the individualised approach the campaigns have taken so far. Social organisations may be the missing link between government and citizens. As promoted in the resilience approach a more long-term, collective, social learning-based and adaptive approach may be more successful in achieving effective citizen-based solutions. About community involvement in disaster management hardly anything is known in The Netherlands. Exploratory studies by the Disaster Studies group of Wageningen University show that there is potential in further studying this subject by looking at community and civil society organisations at the local level. Within the NUWCReN framework a lot can be learned from the US, where community involvement and leadership in disaster management is much more widely accepted and researched. The Natural Hazard Centre in Boulder, Colorado, one of the NUWCReN partners, has for example studied disaster preparedness of community-based organisations in San Francisco (Ritchie et al 2011), while they also have mapped out community capacity through the development of the 'Community Capitals Framework' (Ritchie and Gill 2011a and 2011b). Researchers from the Disaster Research Center, another partner, have participated in ongoing local level research by Wageningen Disaster Studies on community involvement in Limburg, The Netherlands. It is through this type of comparative and collaborative efforts and exchange that insights can be developed, learning achieved and progress made.

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Appendix 1

An overview of studies in The Netherlands that provide information on citizens and flooding

Author	location	n	subject
Van den Berg et al (2002) Alterra	Six coastal communities	60 interviews	How inhabitants of coastal communities experience coastal security
Van Mierlo et al 2003 (2003, in TMO 2009)	the 'large rivers area' around Rhine and Meuse		Baseline measurement communication 'Space for the river' (Ruimte voor de rivier)
TNS Nipo (2006)	Flood-prone areas	n = 1027	Flood risk perception and the relation to willingness to evacuate
Terpstra and Gutteling (2008) (also Terpstra 2010)	Friesland	n = 658	Households' Perceived Responsibilities in Flood Risk Management
TNS Nipo (2007)	Groningen	n =732	Risk perception/awareness
Terpstra (2008)	Noordoostpolder (DR7), Southern en Eastern Flevoland (DR8), Alblasserwaard en Vijfheerenlanden (DR16), Delfland (DR14)	n = 1648	Public perceptions of the risk of flooding
Hillebrand (2008)	Dordrecht	26 interviews	Risk communication and risk perception
AcUtHas (2008)	Noord- en Midden-Limburg	n = 1321	Baseline measurement risk awareness and information needs
Baan et al (2008) 'Waterproef'	Walcheren (DR22), Eiland van Dordrecht (DR29) and Land van Heusden/Maaskant (DR36) and the rest of The Netherlands	n = 957	Report of the data collection on risk perception and risk communication during the large Dutch flood exercise 'Waterproef'
NEWCOM (2009)	Oud-Beijerland	n = 354	'Zelfredzaamheid', or the ability of citizens to save themselves and others, during disasters and heavy accidents; the roles and preparations of citizens
De Laat (2009)	Zwolle	n = 107	Citizen disaster preparedness

Author	location	n	subject
Intomart GfK (2009) Watermonitor	The Netherlands	n = 1227	Dutch citizens' awareness of water issues, opinions on and support for policy and information provision, and involvement with the main themes of the Dutch water policy
Bočkarjova et al (2009)	Land van Heusden / de Maaskant (DR36) south of the river Meuse, 3 islands in Zeeland (DR 28, 29 and 30), a major part of the province Zuid Holland (DR14) on the coast and the Island of Dordrecht (DR22)	n = 1411	Flood risk perception
Terpstra (2010) (see also Terpstra 2008)	Three surveys	3559 (658+1444+ 1457)	Flood preparedness, thoughts, feelings, intentions
Van Winsum-Westra et al (2010) Alterra	Focusgroups in Elst, Westervoort (Gelderland); Bilthoven, Naarden-Bussum (Utrecht), questionnaire in the Nederlands	4 focus groups n = 2121	Level of satisfaction with high water protection measures
Reinders (2010)	De Dollard, noordoost-Groningen: gemeente Delfzijl, Oldambt, Bellingwedde	n = 90	Flood risk perception
Intomart GfK bv (2010) Watermonitor	Youth between 12 and 18	n = 1198	Dutch young citizens' awareness of water issues, opinions on and support for policy and information provision, and involvement with the main themes of the Dutch water policy
Groenewegen-Ter Morsche and Oberijé (2010)	Ten disaster locations	n=79 (professionals) n=73 citizen aid providers	Citizen involvement in ten disaster incidents in The Netherlands, , incl. high water threat


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Authors Kees van Dongen | Joe Trainor | Liesel Ritchie

Managing the response to large scale floods

Introduction

As a strategy to cope with flood risks The Netherlands have mainly focused on flood prevention (Ten Brinke et. al, 2008). Where responding to floods was a natural part of life in The Netherlands before the large land reclamation and flood protection engineering efforts in the past, the frequency of flooding is now limited in The Netherlands. Given our lack of experience with floods we are not experts on managing the response to floods or recovering from them. Managing the response is defined as the reduction of the consequences of a flood by early warning, crisis communication and mobilization of the necessary emergency services and first responders in the disaster area and is based on existing emergency management organizational systems, processes, plans, equipment, training and exercising. We need to remind ourselves, however, that despite the high standards of flood protection in The Netherlands, that protection cannot be perfect and that to reduce the residual risk we need to be prepared to manage the response and to reduce the risk by emergency management. Because of our lack of experience in responding to large-scale floods in The Netherlands, it is important that we learn from lessons identified elsewhere. Lessons about the impacts of floods, how to organize and manage response and recovery, how to deal with scarce resources, how to coordinate, collaborate and communicate between agencies and with the public. In contrast to The Netherlands, the US has had many natural disasters among

which floods. Hurricane Katrina for instance resulted in as many casualties (1836) as when the storm tide hit The Netherlands in 1953.

An important question is what makes managing the response to large scale flooding in The Netherlands different from managing the response to other incidents? In this chapter we describe the organizational network involved in managing the response to floods. We argue that emergency management and water management teams on regional and national levels need to be capable and aware of each other's roles and capabilities and need to know how to manage the interfaces between them. These teams need to be aware of the consequences of emerging flood risks for their tasks and need to be aware of the consequences of measures to deal with floods. Compared to flash accidents, flood risks build up over time and can be anticipated to some degree as high water levels on rivers, lakes and sea and dike stability are predicted and monitored. This allows emergency management teams and water management teams to proactively share situation awareness about emerging flood risks and required response measures.

US lesson: think big enough

A responder after Hurricane Katrina: "The problem is that you don't think big enough. Your reference is the last incident. You think I can handle this. You don't think I'm overwhelmed from the get-go. But you don't have enough resources and you can't speed up. You are forced into a reactive and chaotic mode rather than a proactive mode. If the incident controls you it is a disaster."

Large scale floods differ from small scale floods in that the capacity of local emergency management and water management organizations and the threatened or affected community is insufficient to respond to it so as to save all lives; preserve all property; and to maintain social, ecological, economic, and political stability of the region. This means that the threatened community needs an early warning and that a whole of community response is needed to mobilize required response capacities and even then priorities have to be set. Another important question is what The Netherlands can learn about managing the response from lessons identified in other countries, like

the US. It is important to recognize that since the 1953 flood, there has been little experience of responding to large-scale disasters, except for the floods and high water levels on Dutch rivers in the 90's. The recent response to the fire in Moerdijk received a lot of media attention, generated many evaluation reports and pointed out the importance of inter-regional coordination between strategic emergency management teams and coordinated crisis communication. But compared to the 9/11 terrorist attacks (3,000 deaths, damage $ 50-100 billion), the Katrina floods (1,836 deaths, damage $80 billion), the Haiti earthquake (200,000 deaths, damage $8.1 billion) and disasters in Japan (14,755 deaths, damage $200 billion) the disasters in The Netherlands, such as Moerdijk are fortunately relatively small. Small in terms of human loss, economic loss, geographical area involved and small in the number of organizations involved in the response. A flood in The Netherlands however, could be far more serious than the catastrophic events shown. Are we prepared to respond to large-scale disasters and floods in particular? We will look at some lessons learned in the response to Katrina and relate this to the situation in The Netherlands.

Collaborative command and control

Where small local and routine emergencies can be managed by stove-piped organizations, the needs created by large scale disasters require extensive coordination, collaboration and communication between public, private, and non-profit organizations. Immediately after 9-11 for instance the response system was composed of 1,607 organizations: 1,176 non-profit organizations; 149 private / domestic organizations; 77 international organizations and 73 federal agencies (Kapucu, 2006). Also in the response to Hurricane Katrina there was an extraordinarily high degree of heterogeneity in size, experience, knowledge, and capacity among the participating groups, organizations, and jurisdictions involved in disaster response operations for this event (Comfort and Haase, 2006). The response system consisted of 535 organizations: 305 public organizations; 84 non-profit organizations; 143 private organizations and 3 special interests. The public organizations involved in the response consisted of 146 organizations from the sub-regional level (i.e. city, parish, municipal level), 78 state organizations, 1 regional organization, 69 organizations on the national and 11 on the international level. The challenge for organizations was to manage their boundaries with other organizations on multiple levels. Effective management of the response requires public and non-profit managers to recognize that the response system consists of multiple

organizations and agencies with varying bases of authority and partnership characteristics. This creates special demands for managing the response and command and control.

What is command and control? Command and control is about focusing the efforts of a number of entities and resources, including information, toward the achievement of some task, objective, or goal (Alberts and Hayes, 2006). It includes activities like

1. establishing objectives,
2. determining roles, responsibilities, and relationships,
3. establishing rules and constraints on decisions and interactions,
4. inspiring, motivating, and engendering trust,
5. monitoring and assessing the situation,
6. training personnel to create shared situation awareness, coordinate decisions and communicate.

For a timely response, many of these activities can and should be taken in the preparation phase.

US lesson: coordination in EOC's

Large-scale, long-duration disasters demand more resources – personnel, equipment, supplies, commodities, specialized capabilities – than any agency can keep on hand. This makes resource acquisition and management a major function of disaster management. Coordination involves the process of linking requests for resources from first responders to providers of those resources, or "match making," if you will. The process involves receiving a request, prioritizing the request, finding and requesting resources, arranging deliveries, following up on promises, and monitoring results on behalf of the requester.

Establishing objectives

Without objectives or expressions of desired end-states, command and control makes no sense. Command is the exercise of power to attain objectives, that minimize the negative impact of disasters on health, lives and property. Power is defined as the ability to influence entities to do something that they would not have done otherwise, like sharing information or assets or to create synergy in actions. Control is the process of verifying and correcting activities such that the objective is accomplished. Traditionally command is associated to come from a single person, the commander, on the top of the chain of command. The chain of command is the line of authority and responsibility along which objectives are provided downward and situational awareness is shared upward. It's should be noted that during the response phase interaction in the chain of command is limited and definition of response objectives and the influencing of behaviours is for a large part done in the preparation phase.

Determination of roles, responsibilities, and relationships

Determination of roles, responsibilities and relationships is also an activity associated with command and control. The purpose is to enable, encourage, and constrain behaviour of organizational units, in this case those concerned with managing the probability and impact of floods. Monitoring their completeness and whether they are known and understood correctly is important since the activities that are required of teams during disaster response differ from those in their every day work. Most organizations agree that managing relations and coordination is needed during disasters. However, the term "coordination" is neither self-explanatory nor a matter of consensus. Further, it is often thought that coordination implies an additional organization that is doing the coordination. What is coordination and why is it needed? Any group of actors faced with accomplishing a complex task, must resolve two issues: how to divide up the task, and how to coordinate their efforts. Coordination is the task of managing interdependencies between tasks performed by different actors (Malone & Crowston, 1994). Coordination can be done by mutual adjustment, by plan or by direct supervision or a combination. On the one hand, emergency response requires meticulous organization and planning, but on the other hand, it is spontaneous. Response organizations need structure, processes and doctrine on the one hand and creativity, adaptability, improvisation on the other hand (Harrald, 2006). The massive coordination problems encountered by governments and nongovernmental organizations during the international response to the Indian Ocean Tsunami showed that not having minimal common organizational structures, procedures and doctrine, is detrimental for managing the response to floods. All planning and response begins with

the local capabilities and resources that later may be supplemented by extra community and international capabilities and resources. This requires local or regional organizations to be prepared for incoming disaster response capacity. Emergency managers are suddenly required to take on board extra resources from abroad that they may not understand or do not need. Crises are chaotic, even the response to simulated crisis such as in the 2008 exercise Waterproef. After this exercise the Minister of the Interior, then in command of the national emergency management system, said that emergency management should more resemble military command and control. Traditional notions of command and control, however assume a set of predefined hierarchical relationships that, for the most part, are fixed. In a hierarchical organization every entity, except one, is subordinate to a single other entity. Because of unity of command, in which every organizational level has only one leader, duplication, conflicting or missing efforts can be avoided. The distinction between strategic, tactical and operational levels in the hierarchy is made with the idea in mind that the most important decisions need to be made at the highest level. Transferring traditional military chain of command to independent, interdependent and heterogeneous organizations, faced with complex civil problems, without common culture, policy, doctrine, procedures,

training and exercise is a difficult if not impossible process. Many suggest that asking the question "Who is in charge?" is meaningless in emergency situations (Quarantelli, 1997). In the response to disasters roles and relations change as new response demands are identified. Disaster response requires "ad hoc taskforces" in which the roles and capabilities of multiple organizations are needed. It has been argued that the ability of response organizations to build adaptive organizational networks is a key predictor of success (Harrald, 2006). On the one hand roles, responsibilities and relations need to be clearly defined in advance; on the other hand one needs to be flexible in adjusting one's role and relationships.

Establishing rules and constraints

Entities are constantly making sense of the situation based on incomplete and inaccurate information, making decisions and taking actions that they believe will result in desired objectives. Command and control is also about establishing rules and constraints concerning the decision rights of entities, the patterns of interaction and distribution of information among them. Perhaps the most frequent management criticism of the traditional hierarchical organizational model is that decision rights are highly centralized rather than distributed to the edge of the organization slowing the response. In dynamic situations the time-delay that is caused by information going up and down the hierarchy reduces the timeliness and effectiveness of the response.

US lesson: Create interagency relations

Shortly after Hurricane Katrina, Governing magazine correspondent, Jonathan Walters wrote: "Most important to the strength of the inter-governmental chain are solid relationships among those who might be called upon to work together in times of high stress.

Shortly after 9/11: 'You don't want to meet someone for the first time while you're standing around in the rubble,' says Jarrod Bernstein, a spokesman for the New York Office of Emergency Management."

"In environments of high uncertainty, the quality of interpersonal trust is essential for collective action."

Time is not only crucial for early warning, but also for victim survival after a flood has happened. External resources need time to reach local responders. In sudden on-set (natural) disasters such as earthquakes or flash floods, the response time to save lives is measured in hours. However, the vast majority of possible life-saving rescues (90%) occurs within the first 24 hours after a disaster and are mostly accomplished by local personnel (Tsunami Evaluation

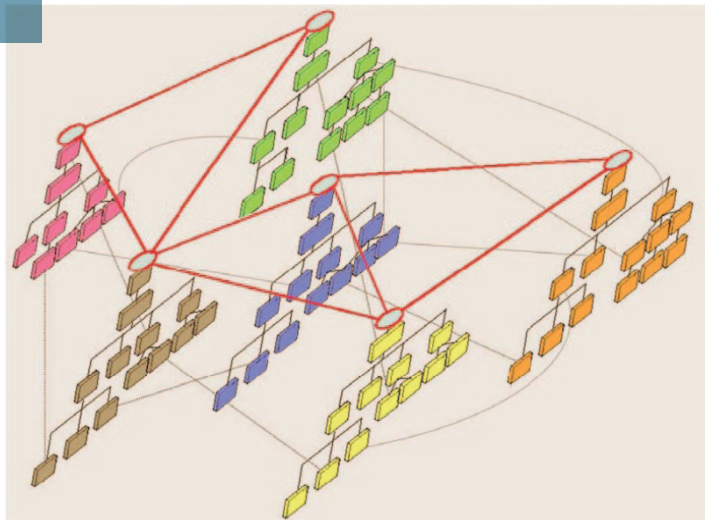
US lesson: information management

" The key function of EOC personnel is to ensure that those who are located on the scene have the resources – personnel, tools, equipment – that they need for the response. The EOC gathers information about the incident and resources from all sources to maintain situational awareness within the EOC. This awareness is shared horizontally and vertically within the National Incident Management System. Simply letting folks know when and what information they should be communicating to whom is a challenge".

Coalition, 2006). It has also been argued that the federal response to Hurricane Katrina was plagued by centralized decision-making processes that failed to address problems along the coast. Officials higher up in the hierarchy contended that the problem was a lack of "situational awareness" because of poor (or nonexistent) communication between Washington and state and local officials (Parker et al. 2009). The essence of the problem with centralized processes is that decisions cannot be made by officials onsite.

Instead, information has to be communicated to decision makers far removed from the disaster scene so that they can make decisions and communicate them back downward. More recently, the importance to allocate decision rights to lower levels in the organization is recognized for speedy responses (i.e. power to the edge). The availability of information technology to share situation awareness between those on the edge of the organization is believed to support unity of effort in addressing the most important and urgent needs. The importance of information flows with entities outside the hierarchical organization is also recognized. As resources to manage the response are scarce locally or regionally, assistance from outside is needed or priorities have to be set. This requires a capacity to manage and disseminate information both vertically and horizontally on multiple levels in multiple

organizations. Inter-organizational interactions do not just occur among the top officials of organizations. Managers, directors, or staff in the lower portion of organizations can contribute inter-organizational communications and partnerships in emergencies. It should be noted that information technology developed for emergency managers often assumes that sharing of information will be restricted to a closed organizational system. As a result, in the case of large-scale disasters this technology can constrain, rather than enable, information and resource sharing and collaboration. Although interaction and information sharing is leading to an increasing number of horizontal technical, informational and social relations crossing many boundaries, these lateral connections seem to overlay the hierarchy of each independent organization (when they have a hierarchy) rather than act as a replacement for them.



From: Kapucu (2003)

Inspiring, motivating, and engendering trust

Not only in involved organizations but also in bodies for inter-agency coordination, decisions and agreements are first and foremost based on consensus, in as much as participating administrators and professionals are partners, not superior – subordinates. In a collaborative context, command means the collaborative exercise of power to attain common and consistent objectives. The degree to which partners are required to mutually adjust their objectives and activities may be formally and legally defined, but the degree to which they are willing and able to do so depends on informal grounds, like familiarity, mutual concern, trust and collaborative capacity. Collaboration can be understood structurally, looking at networks of familiarity, trust and information and resource sharing between actors within and between organizations. It can also be understood organizationally, looking at roles responsible building and maintaining inter-agency collaboration. It can also be studies as a behavioural issue looking at collaborative competencies and behaviours of key figures. The decision to collaborate and actually share information and resources or align activities is more likely when collaborative capacities are well developed. At a minimum there must be some organizational or collaboration awareness. It is doubtful that collaboration will take place among organizations if they are unaware of each other. Bardach's (1998) argues that the potential to engage in collaborative activities depends on "relevant individuals' expectations of others' availability for, and competency at, performing particular collaborative tasks" which are in turn "built around the legitimacy and desirability of collaborative action directed at certain goals, the readiness to act on this belief, and trust in the other persons whose cooperation must be relied on for success" (McGuire, 2009). Part of the common wisdom of emergency management is that collaboration is facilitated by personal familiarity, not just institutional contact. Knowing others personally helps, but knowing their role and (in)capabilities is also important. But representatives

US lesson: whole of community approach

According to FEMA Administrator Craig Fugate, "There's no way government can solve the challenges of a disaster with a government-centric approach. It takes a whole of community approach."

US lesson: organize for collaboration

The Emergency Operations Center: "Where uncomfortable officials meet in unfamiliar surroundings to play unaccustomed roles, making unpopular decisions based on inadequate information, and in much too little time."

Responders told us that the primary mechanism for resolving resource-allocation struggles, the Emergency Operations Center (EOC), is often ineffective. The delegates sent to EOCs are usually liaisons who lack decision-making authority, aren't respected, and/or don't get along with each other.

of public, private, and non-profit organizations do not necessarily have shared interests. Building partnerships and negotiating working agreements can be challenging in calm settings; expanding coordination in the chaotic setting of an extreme event is an exceptionally difficult task when many of the partners in assistance do not know each other well (or at all) and may have concerns about the competence or motives of others. Building partnerships in the preparation phase is important as shown above, but is also perceived to be costly and time-consuming: the mutual benefit of doing this should be clear. When key figures are confronted with large-scale disruptions, they may be faced with a decision about whether to be proactive and externally oriented or to become much more insular, in an effort to shut out external perturbations. The easier others can be brought to mind, the more likely that they will be involved.

Whether done by leaders, liaisons or information managers, the task of boundary spanners is to share situation awareness and objectives across organizational, departmental, jurisdictional, hierarchical, professional or geographical boundaries when required. Unfortunately, communication is the most commonly cited issue in multi-agency response, not only in terms of the interoperability or disruption of communication systems, but also in terms information sharing and creation of interpersonal understanding. Emergency management and transportation officials involved in the Katrina evacuations for instance most often cite a need for better communication and coordination among emergency management, transportation, and law enforcement agencies and the public. Effective communication assumes that those involved know the role and information needs of others and know how to share information with

each other. To determine what information others need, one needs to focus on their role, basic goals and major decisions that others need to make. Because of the low incidence of large-scale disasters (or catastrophes), the high turnover of personnel and dynamic nature of disasters this knowledge is often lacking. It is often found that each person gives priority to the information needs of his own organization. Often persons possessing information do not realize that other persons need it and do not have it. Further often there is no mutual agreement as to who has the responsibility for the collection and dissemination of various types of information and to whom it should be distributed. To professionalize collaborative capacity (information sharing, resource sharing and aligning activities) from an organizational perspective there should be clear point of contact for incoming agency representatives. This point of contact should

1. oversee relevant activities of agency representatives and provide them with information and support
2. obtain intelligence or information that may be useful.

The agency representatives on the other hand should

1. be able to speak for their agency within established limits and facilitate requests to their agency
2. acts as an intermediary between their agency and the emergency management staff
3. advise the staff on capability of their agencies
4. facilitate requests for information, resources or support
5. provide reports to the staff concerning agency activities
6. provide intelligence gathered by their agency

Both the liaison officer and agency representatives need to be sensitive to all kinds of situational, organizational and individual differences. There are cultural barriers (Suits vs. Polo shirts), language barriers (acronyms and terminology) and technological barriers (shared information systems) that need to be bridged. Although the ability to understand and function across boundaries is necessary, this skill does not replace the need for skills required for internal organization.

Monitoring and assessing the situation

Measures of command and control effectiveness need to consider whether changes in circumstances are noted, how quickly they are noted, as well as the appropriateness and timeliness of the response. The New Orleans flood in 2005 showed that the capacity of individuals and organizations to understand the degree of emerging risk to which communities were exposed and to act on that understanding, was problematic. Although in the events leading up to Hurricane Katrina, scientists were aware and accurate in their assessment of the size, direction, severity, and likely impact of the developing storm. The failure was not that information regarding the impending storm was not transmitted (Parker et al. 2009). Key policy makers at the federal, state, parish, county and municipal levels had received warnings by direct telephone calls from the director of the National Weather Service. The problem was that they failed to comprehend the urgency and severity of the threat and its likely consequences. Shared situation awareness requires the capability to extract meaningful activities from information and to share this awareness across the network. Because policymakers missed first-hand experience and only had distant memories of catastrophic storms they were missing the right mental frames to interpreted warnings and found little meaning that could serve as a basis for action. Having a shared understanding of risks (probability and impacts), vulnerabilities and capacities to respond and recover prior to the crisis would have facilitated inter-organizational communication and collective action. It has been argued that overestimation of flood protection and response capacities and underestimation of disaster impact has led to insensitivity to repeated warnings. Some have argued that the National Response Plan (NRP) and other state and local-level plans gave the impression of preparedness and lulled some officials into overconfidence in the respective capabilities of their own and other partner organizations (Parker et al. 2009). Creating a shared understanding of risks and how to cope with them, not only requires information to be shared, it also requires that knowledge to interpret this information is accurate and available. Preparedness is not only about having a plan. It is the ability to monitor and make sense of the situation.

Training situation understanding, decision-making and crisis communication

Making coordinated decisions under time pressure about high impact measures, based on uncertain, incomplete and often conflicting information about the likelihood of threats and the feasibility of measures is the essence of emergency management in the response and immediate recovery phase. A good decision is one that achieves desired response objectives and avoids undesired outcomes as much as possible. Before decisions can be made the severity and urgency of risks must be understood. One can be certain that when a large scale flood happens that it will be a disaster in many respects, one has to cope, however, with the uncertainty about whether it will occur and whether one's measures will turn out to be effective. One has to deal with dilemmas of both overreaction and under-reaction. One wants to avoid incorrectly deciding for an evacuation (over-reaction) and incorrectly not deciding for an evacuation (under-reaction). One has to manage time and uncertainty and the trade-off between increasing certainty for decisions, impact of decisions (costs and benefits) and losing time for executing them. The problem with delaying decisions to acquire information about the likelihood of a flood for instance, is that the number of available evacuation strategies are reduced (e.g. horizontal versus vertical evacuation). The effectiveness of strategies may also be reduced, ,affecting loss of life (Kolen et al, 2010). To deal with uncertainty, those responsible for the decision-making processes need to have good understanding of who needs to be involved in the process. Not only to bring in trusted expertise to reduce uncertainty about flood risks and evacuation strategies, but also to build a shared commitment to a response strategy that is required for the coordinated execution by organizations involved, including crisis communication.

US lesson: don't forget the education and training

We exercise wrong. People don't come to exercises because they're afraid they'll be tested, that they'll make mistakes, and that they'll be embarrassed. We don't train people how to operate first and then test them afterwards. Instead, we throw them in blind, and then tear them apart afterwards. We just expect them to make the decision that we had anticipated and then criticize them when they don't.

In the response to Katrina policy makers and practitioners lacked the cognitive capacity to comprehend the likelihood of high water levels, the failure of flood protection works, the destructive power of the floods and its consequences. In The Netherlands perception by citizens about flood risk and what to expect in case of a flood, is limited (Terpstra, 2009). In flood prone areas in The Netherlands, only a small percentage has ever thought about evacuation in case of a flood. Citizens expect that help of emergency managers will be provided on short notice, not realizing that the demands on the local or regional emergency management systems exceed their response capacity. In the aftermath of Hurricane Katrina the response capabilities of the local jurisdiction (including mutual aid from surrounding jurisdictions and response support from the State) were insufficient and quickly overwhelmed. Local emergency personnel who normally respond to incidents were among those affected and unable to perform their duties. In the response to hurricane Katrina for instance national assistance was provided only 4 days after the levees breached. In The Netherlands people policy lines assume that people can take of themselves for 72 hours. However, it is not known if this 72 hours is sufficient in all cases and if people are prepared for the 72 hours. Furthermore, citizens have no idea of, or underestimate the water levels with which they will be confronted. However coping with 20 cm or 2 meter of water makes a difference. Citizens also tend to overestimate the ability to evacuate by car when floods happen. Also the consequences of the disruption of the critical infrastructure, such as energy, transportation, telecommunications, financial and public health and medical systems is often not realized. Effective risk and crisis communication requires that one thinks from the perspective of citizens, what they know, what they expect and what they need to know. Citizens do want information about

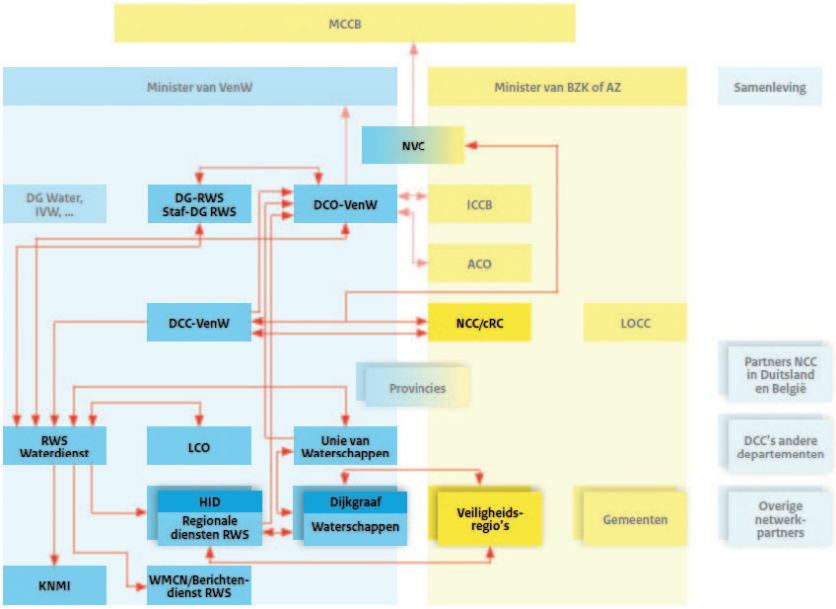
1. uncertain risks,
2. awareness about the nature of the threat,
3. if or when it will occur,
4. it's probable impact,
5. what is to be expected of whom and
6. coping strategies before, during and after a crisis.

The government is not able to physically save all citizens, but is able to provide them with information, so that they can be as self reliant as possible. Collective action requires that citizens in threatened communities, be timely informed by trusted sources, who communicate non- contradicting messages, which are plausible, actionable and convincing. Informing and

activating civilians in the response to a crisis is an important task and information officers need to integrate information

1. about the needs of citizens and media,
2. about emerging flood risk and their consequences and
3. the communication strategy of network partners.

It should be noted that the number of sources that are communicating during a large scale disaster are numerous. Below a subset of the teams between which crisis communication needs to be coordinated during national flood response.



From: Landelijk draaiboek hoogwater en overstromingen (2011)

Dutch flood response system

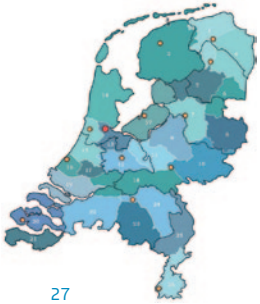
Managing the response to floods in the Netherlands spans multiple geographical, jurisdictional, organizational and hierarchical boundaries is done on regional, national and international levels depending on the scale. Disaster preparedness requires planning, training and exercising (Perry, 2004). In The Netherlands there are flood response plans that describe the role of organizations on the national level, for dike rings, for safety regions, for water boards and regional services of Directorate-General for Public Works and Water management. Below we describe the response organizations on the regional level.

Regional organization

On a regional level the following public organizations can be involved in managing the response to floods: 26 water boards, 10 regional services of the Directorate-General for Public Works and Water management (RWS) and 25 safety regions with emergency services and more than 400 municipalities.

10 regional services

400+



27

12

25 safety

In The Netherlands the mayor is responsible for safety and security within the municipality. The mayor has command over the emergency services and is responsible for prioritizing and for the coordinated response of emergency services. In The Netherlands the responsibility for emergency management is allocated to 25 safety regions. When the effects of an incident exceed the borders of a municipality and when more jurisdictions are involved, a form of unified command is implemented in the safety region. This is done in Regional Operational Teams (ROT) and Regional Policy Teams (RBT). Unified command brings together the "commanders" of all major organizations (municipalities in RBT, emergency services in ROT) involved in the incident in order to coordinate an effective response while at the same time carrying out their own jurisdictional responsibilities. Unified command links the organizations responding to the incident and provides a forum for these entities to make consensus decisions. When no consensus can be reached the chair of the safety region has the authority to decide on the response priorities. When Regional Policy Teams are formed the chair of the safety region is in command of emergency services and responsible for coordinating the emergency management tasks of the municipalities like informing the public and media. The royal commissioner, representing provinces, can give directives concerning collaboration in regional policy team.

The emergency response tasks

Municipality:

1. inform public and media
2. relief and care
3. burial arrangements
4. registration of victims
5. provide primary necessities
6. register and deal with damage
7. environmental care
8. aftercare

Fire department

1. fight fire and the emission of hazardous materials
2. rescue and technical emergency service
3. decontamination of people and animals
4. decontamination of vehicles and infrastructure
5. observing and measuring
6. alarm the people
7. make accessible and clean up.

Emergency medical services

1. somatic medical service
2. preventive public care
3. psychosocial medical service.

Police department

1. vacate and evacuate
2. enclose and shield
3. regulate traffic
4. maintain public and legal order
5. identify victims
6. guidance
7. criminal research.

Defence

is not part of the safety region but has a liaison on operational and policy level that advises about support in preparation and response phases (e.g. exercises, logistics, communication, shelter, surveillance, etc).

Other partners in emergency management are for instance the public prosecutor, Prorail and NS, utility services (electricity, water, gas). Where municipalities and safety regions focus on managing the consequences of floods, water boards and regional services of the Directorate-General for Public Works and Water management (RWS) focus on managing the probability of floods (i.e. water levels and dike strengths). In The Netherlands water management is concerned with

1. keeping dry feet
2. providing sufficient water
3. managing the water quality.

On a regional level this done by water boards. These are financially independent regional government structures that have been reduced from 3500 in 1850 to 27 in 2011. The dike warden is the chairperson of the water board policy team and takes his seat in the regional policy team, in case of serious threats to safety and security. Since the eighteenth century, water management was also centralized and entrusted to what we now know as the Ministry of Infrastructure and Environment and their executive branch the Directorate-General for Public Works and Water management (RWS). At regional level, the Directorate-General for Public Works and Water management is represented in regional services.

In the response to emerging flood risks multiple on scene action teams of water boards and safety regions can be activated. Off-scene coordination of these action teams is done in 'tactical and strategic teams' often at a pre-designated central location, often the headquarters of water boards and safety regions. Coordination involves prioritization and alignment of goals, synchronization of activities and sharing of information and resources (i.e. military support for strengthening dikes). Where in the safety regions Operational Teams (ROT) focuses on meeting current coordination requirements of on-site teams, Regional Policy Teams (RBT) have the task of deciding on dilemma's the operational team encounters, looking more than 12 hours ahead and give strategic direction and to inform citizens about the incident in a way that reduces public and political uncertainty caused by crises, increases trust in the government doing their job and enables citizens to do their part.

When flood risks are serious representatives of water boards and the Directorate-General for Public Works and Water management take a seat in Regional Operational Teams (ROT) and Regional Policy Teams (RBT). Representatives of these autonomous participant organizations make

decisions by consensus. No single person or agency is in charge under unified command. When the actions of regional water managers are unacceptable for the mayor or chairperson of the safety region, they can ask the Royal Commissioner representing the provinces to give directions. If this does not work, the Ministry of Safety and Justice is asked to contact the Ministry of I&M. The Ministry of I&M can direct its regional services. When extraordinary circumstances are declared, extraordinary administrative powers can be invoked and the mayor can give orders to the relevant water manager.

National organization

Whenever an incident requires involvement of a Ministry (i.e. has escalated to the national level) the ministry activates a Departmental Coordination Centre (DCC). The DCC coordinates the departmental response activities. The Departmental Coordination Centre of I&M for instance coordinates the National Water Management Centre (WMCN) and teams like the National Floods Committee (LCO). The National Floods Committee is responsible for the so-called National Situational Picture about flood probability and consequences. When a crisis in a functional chain, for instance water management, affects safety and security of citizens coordination between general and functional chain is required. Where on a regional level coordination is done in the safety region in Regional Operational Teams (ROT) of Regional Policy Teams (RBT) on the national level this is done between Departmental Coordination Centre's and in the National Crisis Centre (NCC) and the National Operational Centre (LOCC, LOS) on behalf of the Ministerial Team of decision makers. On the national level the Ministry of Safety and Justice is responsible for managing the response. When a crisis has direct and far reaching consequences for more departments and when interdepartmental coordination is required, the National Crisis Centre (NCC) is activated. The NCC is the main body that supports inter departmental information-sharing, decision-making and coordination. Floods are not restricted to geographical, jurisdictional or national borders (e.g. Belgium, Germany, UK). Floods can be considered shocks to multiple social, ecological, and physical systems simultaneously—with reverberations that can reach across time and even huge distances. When demand for response capacity exceeds national capacity foreign assistance can be requested. The NCC also informs partners in for instance Germany and Belgium en activates EU mechanisms for international assistance as EU MIC. Safety regions however, also have regional agreements with neighbouring regions in Germany or Belgium that also can be activated (interregional assistance). The Netherlands has limited experience with foreign assistance and large scale crisis on border do not occur often. Looking at international

experience, coordination with (I)NGO's is central to effectiveness of the operation. The National Operational Centre (LOCC) coordinates interregional and international requests for operational support. The National Operations Centre's mission is to coordinate the civil protection assistance during large scale incidents, disasters and events. It provides direction by providing national frameworks for regional emergency management (e.g. destinations and routes for mass evacuation), by providing information and by prioritizing the allocation of scarce national resources. It is responsible for the National Situational Picture. The national operational staff (LOS) gives advice on the feasibility of decisions at policy level (DCC, NCC).

Concluding remarks

An integrated water safety approach, not only requires the ability to reduce flood probability, but also the ability to reduce the consequences of floods when these do happen by human intervention. Since there is little recent experience with managing the response to large scale floods in The Netherlands, we can learn from lessons identified for coordination and command and control elsewhere, like those learned in the response to Hurricane Katrina, to improve effectiveness of planning in The Netherlands. In the response to Hurricane Katrina policymakers missed first-hand experience and only had distant memories of catastrophic storms and were missing the right mental models to interpreted warnings and found little meaning that could serve as a basis for action. To be prepared to manage the response to large scale floods, overestimation of flood protection and flood response capacities and underestimation of disaster impact should be avoided and responders should have the right mental models to interpret what is needed of them.

Managing the response to large scale floods is different from managing the response to other incidents. The organizational network involved in managing the response to floods is different from the network that is required when managing the response to other hazards. Emergency management teams and water management teams need to be able to work together. They need to know their own role and when tasks should be activated. They need to know the role of the teams they depend on and the role of teams that depend on them and need to know how to share and align information, resources and activities.

Compared to flash incidents, flood risks emerge over time and can be anticipated to some degree as changes in water levels and dike stability are

predicted and monitored. This time allows teams to share awareness about emerging flood risks and required response measures and to communicate about the crisis with the public. The government cannot physically save all citizens, but should be able to provide them with information, so that they can be as self-reliant as possible. Citizens want information about uncertain risks, awareness about the nature of the threat, if or when it will occur, its probable impact, what is to be expected of whom and coping strategies before, during and after a crisis. The response to large-scale floods requires collective action and timely activation of this collective action is important. Water management and emergency management teams need to train how to share situation awareness, how to coordinate decision-making, how to communicate about the crisis and how to deal with uncertainty, time pressure and organizational complexity.

When managing the response to large scale floods one needs to think big enough. The size of the response system and the heterogeneity in size, experience, knowledge, and capacity among the participating groups, organizations, and jurisdictions involved in disaster response makes coordination, collaboration and communication rather challenging. Compared to small scale incidents, the social, physical and economic consequences of large scale floods is such that a government-centric approach is not effective. US experience points out that a whole of community approach is required to mobilize the required response capacity. This requires the ability to share and align information, resources and activities across public, private, departmental, jurisdictional, hierarchical, professional, formal and non-formal organizational and geographical boundaries. Responding to large scale floods requires both a distributed and collaborative approach to command and control rather than a centralized and isolated approach. Currently a whole of community doctrine, mind set and involvement in preparation is lacking.

The implications of collaborative command and control and a whole of community approach for the Dutch response organization should be further explored in the future. It is important that lessons identified elsewhere, be translated to the situation in The Netherlands. In translating these lessons, it is important to note that there are no teeth in lessons from someone else's experience and that we do not really learn from others, unless we can really imagine ourselves in that other person's circumstance. Simulated experiences should focus on experiential learning, collaborative learning and collaboration building rather than theory and evaluation.

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5

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Vertical Evacuation: rethinking urban, rural and social space

Is The Netherlands ready to cope with severe floods?

It is widely acknowledged, that The Netherlands has implemented one of the most excellent engineering systems to contain water and gain land. This has resulted in a peculiar reality in which inhabitants feel safe, but at the same time 55% of the territory is prone to flooding. Against this background the Netherlands now knows very vulnerable areas like the area alongside the coast that is protected by the current flood defence system made up of dunes, dikes and storm surge barriers in which over 9 million people work and live and 65% of the Dutch Gross National Product (GNP) is produced.

Increasing engineered safety systems in addition to industrialization, heavy urbanization, and a fast-growing population have changed the face of Dutch vulnerability and today the risk of flooding is considered rather unlikely, but at the same time potentially catastrophic (see the risk assessments in the national security programme, 2008 (BZK, 2008) and 2009 (BZK, 2009).

Even though preventive measures can reduce the probability of flooding, these cannot completely eliminate the risk of flooding. As the USA experience of Katrina clarified to the world, systems fail. To be able to discuss different measures to reduce the flood risk, the Multiple Layer Safety approach has been introduced. The idea is that different measured aimed at either reducing the

probability of flooding and/ or possible impact can be taken into account with regard to the acceptable level of risk.

With regard to ensuring people's safety in times of large scale flooding, preventive (horizontal) evacuation is still the preferred strategy, in spite of its ascertained lack of feasibility for certain areas. Particularly in some coastal areas where less than 20% of the population is expected to be able to evacuate preventive (in an average situation) before the onset of a flood (Maaskant et al., 2009), it is unfeasible and subsequently undesirable to horizontally evacuate all people. Furthermore, decision-makers will be reluctant to actually call for preventive evacuation in such areas due to such a strategy's impact on economic and social processes. Moving people means stopping social and economic routine, which in turn will result in economic losses, as people are not working (Vrijling, 2009).

An alternative for preventive evacuation is vertical evacuation. Although the risk for loss of life might increase in case of vertical evacuation compared to those who succeed in a horizontal evacuation because people remain in the exposed areas, these people will be less vulnerable than those who are exposed in for instance a car, during horizontal evacuation. There are many pros when it comes to this strategy. For example, less time is needed for vertical evacuation thus the decision to call for vertical evacuation can be postponed which will result in less unnecessary evacuations. In addition, the impact on economic and social processes will therefore be less in case of a preventive vertical evacuation.

The Dutch government acknowledges this and therefore does invite increasing flood preparedness efforts. (Ministry of the Interior and Kingdom Relations, 2005, 2006, Remkes, 2006). Thinking of flood as a "highly unlikely" event constitutes an ulterior threat to the Dutch people as the flood risk perception is rather low in the Netherlands (Terpstra, 2009). However it is known that disaster subcultures and broadly speaking, limited risk awareness can affect a community's response. A better understanding of the problem will led to better decisions during a crisis (Helsloot and Ruitenberg, 2004, Tversky and Kahneman, 1974) or measures to reduce the risk.

In light of the above mentioned issues, vertical evacuation has often been discussed as a strategy of last resort in addition to horizontal evacuation in policy documents (Ministry of the Interior and Kingdom Relations, 2008), and related research documents (Kolen et al., 2008, Holterman et al., 2009, Kolen et

al., 2009, Jonkman, 2007) and in innovation programs (Kolen, 2009). Despite this, its implementation and its feasibility have not been discussed. Here, we discuss the feasibility of vertical evacuation. These insights can be used in further discussions about the use of vertical evacuation and to analyze its consequences (loss of life, economic and social damage). We will first present a definition of vertical evacuation as a form of individual protective behaviour and as strategy when planned ahead. Then, we will discuss its feasibility by analyzing political, legal and social implications. In fact, vertical evacuation as a strategic action needs to rethink urban, rural and social space.

Defining vertical evacuation

Through meetings with practitioners, academicians and Dutch citizens it becomes apparent that there is no common agreement on what an evacuation really is. Evacuation is commonly regarded as temporary relocation of people beyond the threat area in order to reduce the risk for loss of life, rather than as a protective behaviour to reduce the risk. This definition might comes from the fact that evacuation is considered a governmental concern, while protective behaviour is typically thought of as an action undertaken at individual level. For instance, in meeting residents from the communities of Borgharen and Itteren we noticed that they termed "evacuee" only those people that had been evacuated by the government (Velotti et al., 2012 a), even though this definition does not mirror the conventional definition of an evacuee, i.e.a person who moves to a (relatively) safe place. This is interesting, because at the end of the day evacuation is not exclusively a governmental issue but rather a form of protective behaviour. In fact, if we focus on the term evacuation as a form of protective behaviour aimed at the achievement of group or individual safety, the range of protective behaviours and therefore ways to evacuate increase.

In figure 8, we attempt to illustrate that evacuation, as a protective measure, can be achieved in different ways and applied at governmental and individual level. The lack of formal recognition of vertical evacuation as an evacuation measure is fuelled by semantics. Evacuation is commonly thought of as the relocation of people beyond the risk area rather than as a protective from of behaviour. Shifting the attention from location towards safest place as the goal of evacuation, allows for different protective behaviours to be highlighted, figure 8 is an example of this. Columns in the figure describe different kinds of movement on the vertical plane (upward movement, no movement and downward movement). Rows show the movement on the horizontal plane as

no movement and movement within and beyond the threat area. The different coloured circles: red, green and yellow refer to different levels of safety. Considering the intersection between upward movement and movement within the risk footprint area, the red circle indicates an unsafe location. The purpose is for evacuees to reach the destination, which is the origin-destination of evacuees. In doing so individuals or groups of people will reach a safer location, (yellow circle), covering a short distance. Finally the desired location will be reached rising up, the green circle.

Figure 8 highlights two main things. First, the same protective behaviour can be achieved in different ways and second, protective behaviour strategies are applied both at governmental and individual level.

In fact, vertical evacuation can be planned in advance from the government or be a spontaneous result of people reacting to a threat. What really characterizes evacuation in general is the different implementation of protective behaviours aimed at reducing the loss of life. These behaviours can be the result of a preplanned strategy or of a more emergent strategy. The distinguishing essence of each strategic protective behaviour is movement

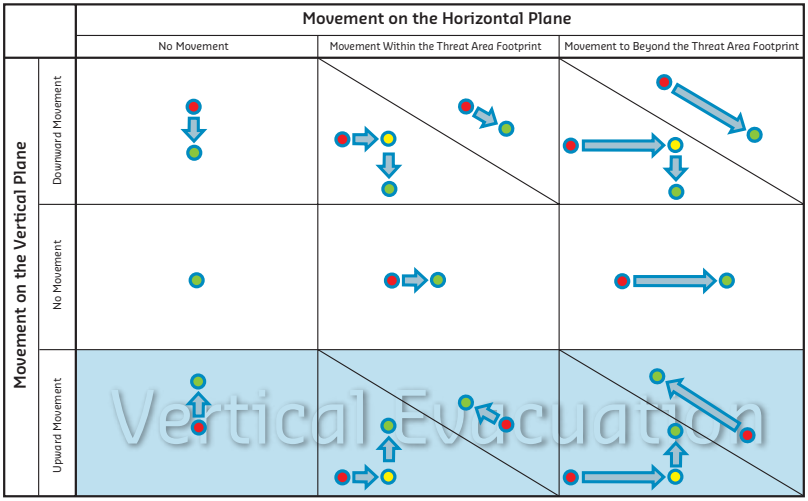

Figure 8 Evacuation as a form of protective behaviour
Source: Velotti et al. (2012b). Vertical evacuation as an emergency manager strategy. (forthcoming)

relative to the threat location along the horizontal and vertical planes. "Movement" is not motion, but rather "absolute movement" with respect to the individual initial location. Defining vertical evacuation only as relocation of people within the threat area having them go up lose of sight other options of vertical evacuation, like the individual behaviour to climb a tree, move to an upper floor or a roof and so on. This distinction is due to the fact that in talking of vertical evacuation we always refer to it as a preplanned strategy and therefore as an action organized by somebody for somebody else. In the specific case, vertical evacuation is seen as a governmental attempt to make people safe.

For instance, part of a preplanned form of vertical evacuation can be the development of educational initiatives aimed at informing the population on how to evacuate vertically, which kind of buildings can or cannot be considered safe and why, what do they need to do be prepared in case of a vertical evacuation, and so on. All these various actions and several others, need to be considered in advance and therefore preplanned. This is particularly true, for those cases in which the implementation of a vertical evacuation has to be done using ex novo buildings. In fact, it might be the case that none of the existing buildings can be used.

An example of the spontaneous reaction of people to a threat is the case of 1999 floods in Veracruz, Mexico. During this event, because of Veracruz morphology, citizens found in vertical evacuation the only resources able to save their lives. In fact, evacuation from their neighbourhoods was impossible. Therefore, people in the flood probe area took shelter in their neighbour's homes (those who had second floors) and nearby public buildings (Aguirre, 2004).

Thus, vertical evacuation, in general terms, should be considered as a form of protective behaviour aimed at reducing the probability of loss of life. In this light, key elements are the upward movement, within or beyond the danger area, with regard to the location of the subject to be evacuated. If we consider vertical evacuation in this way, we can understand that vertical evacuation is already implemented in The Netherlands as a form of emergent strategy and embedded in some flood subcultures.

Planning for vertical evacuation

In the USA, vertical evacuation has been studied in response to two kinds of hazards, hurricanes and tsunami. It has been implemented as an emergent strategy during Hurricane Katrina. In relation to hurricanes, the use of vertical shelters began to be considered after it was noticed that high rise buildings can better withstand high wind speed, compared to lower buildings. Thus, for coastal areas more affected by hurricanes, vertical evacuation was considered as an alternative to horizontal evacuation (Stubb& Sikorsky, 1987).

Another use of vertical evacuation in USA is related to tsunami threat. In 2008 and 2009, the American Federal Emergency Management Agency (FEMA) set out guidelines in order to address problems related to the building of vertical evacuation shelters, from an engineering perspective and to guide public officials in the process of implementing a vertical evacuation strategy. When considering vertical evacuation for tsunami, the main focus in USA is related to the realization of engineering structures and tsunami evacuation building (TSEB) with not much focus on the interaction between human behaviour and use of structures. Planning for vertical evacuation together with the interested communities is a new approach. The project "Safe Haven" is one of these attempts. Here, planning for vertical evacuation is understood as a common effort among public officials, scientists and community through a participatory approach.

Vertical evacuation as a strategy to cope with severe flood, was implemented as an emergent protective behaviour during Hurricane Katrina, when citizens were unable or unwilling to evacuate horizontally. For instance, they booked hotel rooms in high-rise buildings. On the other hand, the governmental version of vertical evacuation was the use of the Superdome as a shelter of last resort. It is evident from this that the huge flood in New Orleans was not foreseen and therefore, vertical evacuation was not implemented with a flood in mind. Since Katrina however, and based on their own and the Superdome experience, hotel owners have started to question the desirability of vertical evacuation due to the additional difficulties in the provision of essential services such as water, electricity, food and health care (Troeh, 2006). This highlights very important issues regarding vertical evacuation as a preplanned strategy, namely issues such as liability, partnerships, stock of food, the possible lack of essential services (water and electricity). For instance, from a structural perspective how much risk are we willing to accept in placing people in such a structure?

Another question would be related to the estimated length of people's stay in shelters or places of refuge. Once established how long citizens are expected to spend there , along with the number of people in need of vertical evacuation, the capacity of vertical evacuation structures, the space needed by occupants within the structure and community topography, it is possible to determine the required number of buildings and the features of each building. For instance, a temporary shelter will need different services and amounts of provisions, than a refuge.

The US does have experience and expertise with regard to vertical evacuation in case of Hurricanes, mainly implemented at citizens and private sector level, and they are now attempting to achieve greater expertise on vertical evacuation in case of a tsunami. However the implementation of vertical evacuation in case of severe flooding, has not been studied yet. The only experience was that of Hurricane Katrina, for which vertical evacuation was not a true preplanned strategy aimed at flooding. Thus, while some very important lessons can be learned from the experience of Katrina, there is a great need for further research, in both the USA and The Netherlands. For instance, in case of river floods or collapsing dams, how deep will the water be? Can we forecast its speed and disruptive power? Can a wave generated by a flood be assumed to be the same as a wave generated by a tsunami? In a nutshell, is vertical evacuation a-one-fits-all strategy?

While The Netherlands might not have much experience of vertical evacuation as a planned evacuation strategy, it does have a history with it. Looking back through history, you will find that until the end of the middle ages, the inhabitants of both Groningen and Friesland (in the north of The Netherlands), would construct artificial mounds for habitation to ensure 'dry feet' in case of high-water. In fact, it is a rather intuitive response to flooding. For some areas it might in fact be the only feasible strategy. One of the most vulnerable areas in The Netherlands is the dike ring 14 area [4]. Even though a horizontal evacuation plan has been drawn up by various local government agencies, everyone that has worked on this document knows that horizontal evacuation is an undesirable strategy for this region. This area is characterized by traffic congestion on a daily basis.If we imagine the traffic situation in case of a

4 In The Netherlands flood prone areas are divided into dike ring areas. These areas are protected against floods by a series of water defences. (Jonkman 2008, 1358). Dike-ring area 14 is the largest dike-ring of The Netherlands and includes major cities like Rotterdam, The Hague and Amsterdam. Approx. 1.3 million people work and live in this area.

large scale flood, everyone would agree that the only real 'solution' is vertical evacuation or moving people to a location within the threatened area, that is higher than the perceived threat. However, such a strategy still needs to be reviewed. Despite the logical nature of vertical evacuation as a strategy, it also raises some concerns that need to be tackled if we are to present it as a desirable strategy. First, in order for individuals to be safe they still have to travel horizontally to reach the vertical shelter. Secondly, while requiredtime for getting people to safety is decreased, once the event strikes the area, people will be in vertical shelter surrounded by water which could render the provision of mass care difficult (and people also need to be rescued). Thirdly, the building must be structurally "safe" to withstand the disaster. Otherwise an even greater disaster may be created.

Then the question arises as to how vertical evacuation should be implemented? Preparing plans to shelter people in case of a disaster, in both The Netherlands and the U.S., is the responsibility of the local government. For both countries it must be considered whether vertical evacuation should be seen as a supplement to other strategies like horizontal evacuation, or as an alternative to or replacement for other strategies aimed at reducing the loss of lives? Thus, vertical evacuation as a complementary approach to horizontal evacuation would involve dividing the risk area into zones, some of which would be evacuated to vertical shelters and some of which would use existing transportation networks to evacuate horizontally. In a supplemental approach for examplethe bulk of the population could be moved horizontally, but with vertical evacuation preparations for those with special needs. Determining which of these is more appropriate, is not a simple task and should be based on careful consideration of the consequences and expected behaviour. Again, the benefits and drawbacks of both approaches should be considered. Investigating, and if desirable, designing and implementing vertical evacuation as a response strategy, will require understanding the various responsibilities, tasks and interests, especially when multiple administrative regions are involved.

Rethinking urban, rural and social space for a pre-planned vertical evacuation

At first glance, vertical evacuation is a logical and sound approach to providing for the publics' safety, particularly in instances where pre-event notification of a hazard is short or particular populations are difficult to move. This solution is a fast and, if well implemented, easy strategy to move people out of harm's way. Here the problem is understanding who the people at risk are, if they are willing to go to a shelter, how many of them are self-reliant and how many have special needs?

The term "special need" has been used widely since Katrina in the USA. The problem however is that few people have thoughtfully considered exactly what this actually means and how the government can support and facilitate the evacuation and sheltering of these people. In reality, it is difficult to determine. Are elderly, physically impaired, mentally impaired, incarcerated populations, people without vehicles, singles, tourists, children, pet owners, etc. special needs? It is important to note that each of these groups is vulnerable for different reasons and planning to meet their

needs may be quite different during horizontal and vertical evacuations. When one considers the mass care needed, after the initial event and the various demands that "stranded" evacuees might have, the importance of considering the reality behind the category becomes apparent. For instance, what kind of services are required in a shelter, or how can the use of existing buildings and personnel be optimized for these special needs populations, in order to minimize costs ?

Time and space are fundamental in every evacuation, so the needs of citizens and their trajectories of geographical movement along time and across space, have to be taken into account. An example of the complexity in planning for vertical evacuation is the simultaneous consideration of multiple factors such as travel time to safety, pertinence of the location and number of sites to be provided. Travel time to shelter must be taken into account, to make structures easily accessible. To do this a walkable distance for the evacuees has to consider the difference in speed paces between able-bodied and disabled people. Underestimation of evacuation times is not uncommon and can depend on simple but important factors, such as waiting in line to use a stairway, the capacity of entry doors, etc. It is important that the many factors associated with site selection are all taken into account.

Choosing the characteristics of a building that will serve as a vertical evacuation shelter is not a simple task, considering that all of these options have benefits and drawbacks. Vertical evacuation buildings can be

1. purpose-built
2. retrofitted existing buildings that are more resistant to specific or more natural hazards
3. existing buildings or structures that are not developed as a shelter, but offer protection and some services and do not require additional investments. They can be
    - single purpose (only a shelter)
    - multipurpose (schools, parking garages, etc.) for which the function of a shelter might not previously have been foreseen. They can be public or private.

Developing an understanding of these choices and how The Netherlands wishes to address them, is of vital importance to a successful implementation. Here it is important that flood safety is tackled through an integrated approach, by including not just engineers, architects and spatial planners, but also social scientists, disaster management professionals and community leaders.

The ability to provide early warning to the population, and the knowledge about possible forms of evacuation, is a critical aspect for the success of an evacuation. However, time is often limited. In this case, the existence of alternatives like that of vertical evacuation is fundamental. In fact, the presence on a given area of vertical shelter can reduce the time needed to bring people to safety (Applied Technology Council, 2008). One of the aims of vertical evacuation is to increase the required lead time of an evacuation, by sheltering the more vulnerable people in vertical structures located on the area that will be affected by disaster. Here, the main question is who counts as a vulnerable person?

Moreover, limited time reflects on travel time to shelters or areas outside flood zones. The latter is generally based on three quantitative traits of crowd movement: density, speed and flow. In order to make structures easily accessible, a walkable distance for the evacuees has to consider the difference in speed paces for able-bodied and disabled people. Underestimations of evacuation times can depend on simple but important factors, such as "waiting to make use of the heavily queued stairs" (Jake, 1994). In addition, the availability of transportation is something to be considered. We have to remember that among the main causes of death during flooding are drowning and car accidents, due to the use of vehicle of transportation, usually personal cars (Jonkman and Kelman, 2005; Alexander, 1988).

Then the question remains as to whether preparation for vertical evacuation should be embedded in legislation, such as the issue of who will pay for building or retrofitting vertical evacuation shelters? The law and the financial issues should be taken into account in order to ensure feasibility of the measures.

Finally, vertical evacuation plans and preparations should not lead people to overstate the "safety" of the interested areas. This is particularly true for coastal areas, and causes people to take risks they otherwise would not take. To do so might lead to pressures from developers to continue to populate areas at risk, such as the coastal regions. It is important to ask how this strategy can make the existing population safer, without serving as a justification for putting additional people at risk.

Conclusions

For various regions in The Netherlands, vertical evacuation is seen as a strategy of last resort or a more realisticstrategy than horizontal evacuation when considering, lead time, population density, transport system and socio-economic characteristics of the hypothetically affected population. Before this can be said, it is necessary to look into vertical evacuation as a strategy. Is it feasible and is it desirable? To do this the above questions (and more) should be addressed by the governments and communities in order to understand what this strategy entails and the preference of the relevant stakeholder groups as well as the likelihood of successful implementation. Experience has for instance shown that even though sheltering people, in case of (a potential) disaster, is a legal responsibility for local governments, it is sometimes extremely difficult to implement. Perhaps even more so when, as in The Netherlands, we cannot rely on our experience of large scale vertical evacuations.

Stakeholders' attitudes towards vertical evacuation also need to be investigated, to if the possibility to vertically evacuate can delay the evacuation on the part of the citizens and significantly delay the issuing of warnings on the part of emergency managers. A survey on their attitudes, perceptions and concerns related to evacuation and vertical evacuation plans would serve two functions. First it would provide some input into the behavioural feasibility of this tactic. In other words are people likely to use it? The second data collection should be aimed at understanding the feasibility of vertical evacuation from an engineering, economic and social perspective. For instance, what would be the requirements of a building, in order to withstand a wave generated by flooding? What are the costs generated by vertical evacuation when compared to those sustained for implementing a preventive evacuation? Who will support these costs?

Finally, worldwide experience of vertical evacuation is available, from countries such as Japan, Indonesia and so on. Collecting the experiences of these countries could be very valuable, especially to help us understand issues related to the implementation of vertical evacuation such asbreakdown of services in a shelter , public behaviour and dealing with shortages of food and water, first responders, medical aid, electricity etc.

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6

Authors Greg Shaw | Jack Harrald

Public/Private Partnerships for Flood and All Hazards Emergency and Disaster Management

The United States Experience - Lessons Learned and Best Practices

Introduction

This chapter focuses on past and ongoing efforts within the United States to develop and sustain public/private partnerships to support all phases of Comprehensive Emergency Management (CEM): Mitigation; Preparedness; Response and Recovery in the context of all hazards including flooding events. Such events do not necessarily need to be catastrophic in nature to require a unified effort involving both the government at all levels and the private sector working together to develop, maintain and employ CEM capabilities to the benefit of their communities. Since the creation of the United States Federal Emergency Management Agency (FEMA) in 1979 and in the preceding years, the private sector has been recognized as a necessary partner in CEM from the community level to the Federal level of government.

Although this chapter is presented in the context of flooding, the United States (US) is a large and geographically diverse nation facing multiple hazards which present widespread threats. Following Hurricane Katrina in 2005, FEMA has championed the Catastrophic Disaster Planning Initiative to develop partnerships involving all members and organizations comprising communities from the local to the Federal level. Planning scenarios for this initiative include a major earthquake in the central US (New Madrid Fault), a hurricane in southern Florida, a cyclone and tsunami in Hawaii, and a pandemic.

As an example, the central US earthquake scenario (Figure 9) will directly impact 8 states and another 14 states indirectly, placing over 12 million people at high risk, causing over $70 Billion (US) in direct damage and hundreds of Billions in cascading economic losses. To prepare for such an event and leading up to the US National Level Exercise for 2011 (the 200th anniversary of the last major New Madrid Fault earthquake), FEMA conducted the NMSZ Catastrophic Earthquake Disaster Response Planning Initiative, involving "partnerships and collaboration with hundreds of government agencies; business, industry and voluntary organizations; and scientific and academic institutions."(Website FEMA a) This initiative included community, state and regional level meetings and exercises, designed to create and refine unified effort through partnerships across all sectors and all levels of government. This three year planning effort recognized that the partnerships must be developed, refined and maintained over time and lesser events, to be effective during times of major disasters.

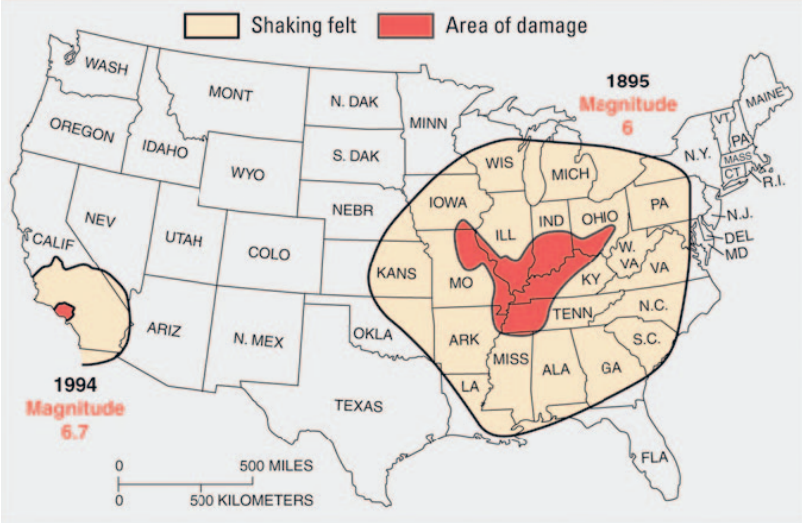

Figure 9 The New Madrid Fault Zone (training.fema.gov)

Background

Floods impact the entire community and demand a coordinated unity of effort to include private sector organizations working with all levels of government. The private sector is the lifeblood of communities, providing employment, services and products, and tax revenue. In turn, the private sector depends on resources and support of the government and the whole community to remain in business and to prosper. The necessary unity of effort must be based on meaningful partnerships which are developed and supported over long periods of time and are continually visited, practiced and refined across the phases of Comprehensive Emergency Management during periods of routine community functioning, through periods of emergency and disaster. As described later in this chapter, a necessary component of such partnerships is trust which is established through mutual respect, open and honest communication, and shared goals and objectives. The US experience over the past two decades consistently supports this need for trust, which is developed and sustained over time and shared experiences.

As a starting point for this chapter, a definition of what is a public/private partnership is required. Many definitions can be found and most include the term collaborate which implies working together. The following definition of collaborative partnerships is selected to highlight the nature of non-contractual relationships which best fit the purpose of public/partnerships supporting all phases of CEM.

> "Collaborative partnerships are non-legal working relationships that often occur between the public and private sectors to meet a common objective or goal. Primarily goodwill gestures, collaborative partnerships are often used to provide knowledge exchange or collective leverage resources for a specified goal." (Website NASCOI)

As described by John Copenhaver, a former Presidential appointee to FEMA and President and CEO of Disaster Recovery Institute International, in his 1997 Disaster Resource Guide article: From a Business Perspective, Government and Business Working Together in Emergency Management, "Much has been said (and written) about the subject of our local, state and Federal Emergency

Management Agencies "partnering" with the nation's business sector in the four areas of emergency management---preparedness, mitigation, response and recovery. In fact, the concept of these partnerships seems to make sense to such an extent that the question comes to mind, "Why haven't we been doing this all along?"(Copenhaver, 1997)

Despite this recognition, the development and sustainability of meaningful public/private partnerships have been largely limited to superficial and failed efforts. The research of the Business Executives for National Security (BENS) Task Force report on the experiences of the Gulf of Mexico hurricane season of 2005, Getting Down to Business (2007), includes the following finding: "The American private sector must be systematically integrated into the nation's response to disasters, natural and man-made alike. Government alone cannot manage major crises nor effectively integrate the private sector after a crisis occurs. The Task Force believes that building public private collaborative partnerships, starting at the state level, is one of the most important steps that can be taken now to prepare the nation for future contingencies. Unfortunately, with few exceptions, durable, collaborative relationships do not today exist."(Business Executives for National Security, 2007) The report goes on to make numerous recommendations to all levels of government, the most relevant of which to this chapter is "creating new ways to institutionalize public-private collaboration at the state and major metropolitan area levels." (Business Executives for National Security, 2007) The March 2011 Presidential Preparedness Directive 8 (PPD 8) updates this recommendation by establishing a National Preparedness System which encourages unity of effort across all sectors from the community to the Federal level (Website FEMA b).

The findings of the BENS' Task Force are somewhat contradicted by the Business Civic Leadership Center (BCLC), a 501(c)(3) affiliate of the U.S. Chamber of Commerce, 2006 report, From Relief to Recovery: The 2005 U.S. Business Response to the Southeast Asia Tsunami and Gulf Coast Hurricanes. The report provides the general statement "U.S. companies proved indispensable during the 2005 hurricane season. Businesses large and small contributed cash, in-kind donations, and expertise to support the relief effort. Americans watched companies deliver supplies, assist with security, and even provide entertainment. In response to Hurricanes Katrina and Rita, the U.S. private sector contributed $1.2 billion in assistance. A total of 254 companies contributed $1 million or more in cash and in-kind giving." (Jordan, 2006) The report lauds the heroic efforts of major companies such as Walmart, Disney, and Office Depot (Figure 10) which can afford such contributions and provides

only minor mention of smaller businesses from the impacted communities. True community level CEM readiness requires local engagement of the private sector through community level public/private partnerships which go far beyond solely response and recovery operations managed primarily from the Federal level.

Figure 10 Walmart Volunteers at Katrina – Walmart Corporate
http://walmartstores.com/pressroom/news/5360.aspx

Several initiatives over the past two decades have attempted to develop and strengthen these partnerships and have helped to identify best practices to sustain meaningful partnerships as described in this chapter. Are these lessons learned and best practices transferable to other countries and cultures? The authors of this chapter have been involved in multiple efforts to develop such partnerships and believe that the US experience can add value to others.

Past Efforts to Understand and Establish Public/Private Partnerships

The Federal Response Plan (FRP) of 1992 and amended in 1999 "outlines how the Federal Government implements the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, to assist State and local governments when a major disaster or emergency overwhelms their ability to respond

effectively to save lives; protect public health, safety, and property; and restore their communities."(U.S. Government, 1992, p. iii) The plan, although only binding on 27 federal agencies and departments including the American Red Cross, clearly recognizes the importance of the private sector as a partner in Comprehensive Emergency Management as reflected in the following statement.

> "Federal agencies are encouraged to take advantage of current partnership relations with the private sector. Businesses, both inside and outside the disaster-affected area, can supply critical resources during response operations, and assist in restoring essential services and rebuilding the economic base during recovery operations." (U.S. Government, 1992, p. 9)

Exactly what is entailed in a meaningful and sustainable partnership and specific instructions to the private sector, are not contained in the 1992 and 1999 versions of the FRP. The task of addressing these omissions thus fell on various efforts and studies to incorporate the private sector as a partner in CEM. One of the first national efforts, Public Private Partnerships 2000 (PPP 2000) - Forums on Public Policy Issues in Natural Disaster Reduction took place between 1998 and 2000 with the stated goal of seeking "new and innovative opportunities for government and nonprofit, private sector organizations to work together to reduce vulnerability to and losses from natural hazards in communities across the Nation." (Website American Geological Institute) Organized and administered by the Subcommittee on Natural Disaster Reduction (SNDR), The Institute for Business and Home Safety (IBHS); and a number of other private sector organizations, the forums identified the following key points supporting meaningful partnerships.

- They are community-based and community-driven;
- They involve strong public/private sector collaboration;
- They are based upon a hazard and risk assessment;
- They recognize the importance of land use planning and building codes as mitigation tools;
- They recognize the role of incentives; and
- They integrate professional training opportunities, public awareness and education for all sectors of the community into the whole process.

In the same time period, Project Impact was formally established in 1997 by FEMA in partnership with seven pilot communities across the nation, to meet the goal of "bringing communities together to take actions that prepare for – and protect themselves against – natural disasters in a collaborative effort." (Federal Emergency Management Agency, 1997) Project Impact guidelines stressed the absolute necessity for disaster preparedness at the community level and the development of public/private partnerships to draw and build upon the resources that exist within each community. Although the meaning of a partnership was not defined, project guidelines set forth in the FEMA publication Building a Disaster Resistant Community: Project Impact included

- Providing motivation
- Identifying membership
- Establishing leadership
- Setting a vision
- Establishing expectations among participants
- Setting goals and objectives

Through 2001, federal funding was provided to over 250 communities throughout the US to promote public/private partnerships and collaboration (Waugh and Tierney, 2007). In 2001, Project Impact was removed from the Federal budget in order to save $25 Million in annual costs (Perkins, 2011). Without dedicated funding for communities to sustain partnerships, new Project Impact communities were not developed and in the following ten years, communities advertising their involvement in Project Impact on community level Web sites have all but disappeared.

Following the September 2001 terrorist attacks in the US, Professor Juliette Kayyem, the Executive Director of the Executive Session on Domestic Preparedness at the Harvard University John F. Kennedy School of Government, and her Research Assistant Patricia Chang, authored the article, Beyond Business Continuity: The Role of the Private Sector in Preparedness Planning, in the Kennedy School publication Perspectives on Preparedness. Professor Kayyem makes the main point that private sector organizations need to go beyond internal self protection in the form of Business Continuity to the fact they are an "essential actor" in partnership with the government for emergency and crisis planning before an event, and that they need to engage with the government to develop homeland security strategies. She specifically points out the benefits to the private sector for partnering to include obtaining

"authoritative government guidance, timely and accurate information and at times, access to the businesses' resources which are restricted by the nature of an event." (Kayvem and Chang, 2002) Professor Kayvem summarizes her analysis by stating that "The need for public-private partnerships is vital for many reasons. Research by a public-private commission, government assistance in issuing threat and risk assessments, and the utilization of policy instruments will likely benefit not only the public sector, but the nation as a whole." (Kayvem and Chang, 2002, p. 13)

Current US Guidance for Public/Private Partnerships

In 2003, President George W. Bush issued Homeland Security Presidential Directive 5 (HSPD-5), Management of Domestic Incidents, (HSPD -5) with the stated purpose of enhancing "the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system." (Department of Homeland Security, 2003) HSPD -5 also mandated the development of a National Response Plan (NRP) and the companion National Incident Management System (NIMS) to meet this purpose. The two documents, published in 2004, superseded the existing FRP described above, and specifically include the private sector as a partner for a coordinated, effective national response. Amended after Hurricane Katrina in 2005, and superseded by the National Response Framework (NRF) in 2008, this Federal level guidance assigns the following specific responsibilities to the private sector, but is non-binding short of the financial incentive of Federal funds to states and localities for compliance.

- Planning for the protection of employees, infrastructure, and facilities.
- Planning for the protection of information and the continuity of business operations.
- Planning for responding to and recovering from incidents that impact their own infrastructure and facilities.
- Collaborating with emergency management personnel before an incident occurs to ascertain what assistance may be necessary and how they can help.
- Developing and exercising emergency plans before an incident occurs.
- Where appropriate, establishing mutual aid and assistance agreements to provide specific response capabilities.
- Providing assistance (including volunteers) to support local emergency management and public awareness during response and throughout the recovery process (Department of Homeland Security, 2008a).

The NIMS document, which was also updated in 2008, calls for government, nongovernmental organizations, and the private sector to work together seamlessly in all phases of CEM to manage incidents and directs "Governments at all levels should work with the private sector to establish a common set of expectations consistent with Federal, State, tribal, and local roles, responsibilities, and methods of operations. These expectations should be widely disseminated and the necessary training and practical exercises conducted so that they are thoroughly understood in advance of an actual incident." (Department of Homeland Security, 2008b)

Considering the documented recognition that public/private partnerships are essential components of CEM from the community to the national level and the lack of sustained progress described above, raises several questions (listed below) that were investigated by the US National Research Council (NRC) at the request of, and with the financial support of the Department of Homeland Security, in a series of workshops (2009 – 2010) to assess the current states of the art and practice in private-public sector collaboration dedicated to strengthening community disaster resilience.

The report of the NRC, Private-Public Sector Collaboration to Enhance Community Disaster Resilience, introduces the term resilience to the discussion of public/private partnerships and makes the observation that the generally accepted definition of resilience in many academic circles set forth by Norris and others in the 2008 article Community Resilience as a Metaphor provided the guidance for the workshop participants. This definition is summarized as "ability of groups (such as communities or cities) to withstand shock such as disaster."(National Research Council, 2010, p. 18) Other definitions of resilience are widely distributed in academic and commercial literature and government documents to include the Department of Homeland Security Risk Lexicon definition "ability to adapt to changing conditions and prepare for, withstand, and rapidly recover from disruption."(Department of Homeland Security, 2010) In the authors' of this chapter's opinion, the current definitions of resilience are all acceptable and primarily state a goal for communities that is achieved through the proper balance of collaborative partnerships, resources and capabilities across all sectors of the community, all hazards, and all phases of CEM.

The workshop investigated several questions which are summarized as follows and presents the findings for each question in the workshop report which is available free of charge on the National Academies Press Web Site at: http://www.nap.edu/catalog.php?record_id=12864#description.

- Why hasn't there been more progress made in developing and sustaining public/private partnerships in the US?
- What are the necessary incentives (motivators) for these partnerships?
- What stands in the way (barriers) to these partnerships?
- What are the best practices for developing and sustaining public/private partnerships?

Chapter 3 of the workshop report focuses on the identified challenges and barriers to sustainable partnerships and notes that "government and private sectors are not natural allies and that the United States has developed legal, cultural, and regulatory barriers that may discourage private-public sector collaboration." (National Research Council, 2010, p. 41) Specific barriers identified include

- Jurisdictional challenges at and between all levels of government from local to state to Federal.
- The fear of increased government oversight of private enterprise interests in the form of new programs, regulations, and mandates associated with partnerships.
- The potential for legal liability when the private sector organizations and individuals provide assistance.
- Ineffective and inconsistent leadership within the partnership.
- Different terminology that is not understood by all partnership members.
- Insufficient human and financial resources to support partnership administration and operations.

  and inherent in all of the above barriers, and arguably the necessary foundation for any meaningful partnership.

- **A lack of trust between** and amongst partnership individual and organization members.

Chapter 3 of the workshop report concludes with the assessment that "A social environment conducive to building community resilience from the ground up, needs to support organic growth, flexibility and the needs of all community stakeholders. The environment would allow relationships to be built on trust."(National Research Council, 2010, p. 52) A tested and proven model for developing and maintaining the necessary level of trust based upon a collaborative approach to public/private partnerships is proposed as a best practices' model for moving forward in the United States and can be considered for application within the Netherlands. The model, developed by the Michigan State University, Critical Incident Protocol – Community Facilitation Program, has been tested, refined and implemented in 24 states and 50 communities for the purpose of enhancing public/private sector partnerships, for community crisis and emergency management following an all hazards approach (Website Michigan State University). Through the six steps listed below, the Critical Incident Protocol attempts to address sector

and organizational benefits for partnerships and provides a logical and proven framework to develop and sustain meaningful partnerships. Complete resources related to the Critical Incident protocol are available free of charge at: http://www.cip.msu.edu/index.html.

1. Identify public and private sector stakeholders to co-share leadership.
2. Ask leaders to bring others to the table.
3. Identify common issues on emergency preparedness for collaboration.
4. Identify new resources in the community to mitigate the impact of critical incidents.
5. Determine the challenges that participating organizations encounter.
6. Create sustainability in the partnership by conducting a needs assessment, setting goals, and task performance (Website Michigan State University).

To these steps, the authors of this chapter add two suggestions which are informed by experience with public/private partnerships over the past 15 years. First, step 3 should go beyond identifying common issues to identify where different roles, motivations and constraints for partners lead to areas of departure where common goals and priorities cannot be agreed upon. Recognizing and understanding these areas of departure are essential to setting and maintaining the boundaries of any partnership.

Step six calls for sustainability of partnerships. As the decline in activity following the termination of Project Impact funding demonstrated, resources are needed to sustain a partnership and it is recommended that a funded position be established and resourced to accomplish the administrative tasks associated with partnership maintenance. This may be the most difficult step to achieve, particularly in a constrained economic environment and achieving consensus of who contributes what to maintain the partnership, but it should be considered a necessary component of sustainability.

Conclusions

As FEMA Administrator Craig Fugate stated at the first National Conference on Building Resilience through Public-Private Partnerships, held in Washington, DC in August 2011, "We cannot separate out and segment one sector in isolation; the interdependencies are too great.... We want the private sector to be part of the team and we want to be in the situation where we work as a team and not compete with each other."(Administrator Fugate, 2011) There is general agreement that public/private partnerships are important at all levels of government and community, and to answer John Copenhaver's statement and question from the introduction to this chapter -- "In fact, the concept of these partnerships seems to make sense to such an extent that the question comes to mind, "Why haven't we been doing this all along?" -- the authors of this chapter reply that we have been trying, but have not made the progress hoped for over the past two decades and need to do better. There are, however, many excellent ideas available to move forward and efforts such as the Michigan State University Critical Incident Protocol model provides a proven framework for at least getting the process moving.

The necessity of a whole of community approach to CEM is a primary focus of the Federal Emergency Management Agency and is being emphasized to the community level throughout the nation. The FEMA document, A Whole Community Approach to Emergency Management: Principles, Themes, and Pathways for Action was published in December 2011 and provides additional resources and guides for meaningful partnerships at from the Federal to the local level. This document is available free of charge at: http://www.fema.gov/library/viewRecord.do?id=4941 .

The importance of public/private partnerships at all levels of government is clearly recognized at the Federal level and is there are many examples of progress throughout the nation. With the support of leadership and the availability of resources, hopefully the newly revived interest and progress will continue to support unity of effort within and between all levels of community, the private sector, and government.

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7

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Mitigating and Managing the Health Impacts For a Catastrophic Coastal Flooding Scenario in the Netherlands

Public Health as a Critical Element of Resilience

Introduction

Catastrophic events have shown that the resilience of the public health sector is critical in the response to, and recovery from disasters. The ability to meet public health requirements following an extreme event is directly related to public health resilience. Recognizing that numerous definitions and interpretations of resilience exist, (see Mileti, 1999, TISP, 2008; Norris et al, 2008; Allenby and Fink, 2005; Flynn, 2008) this chapter will employ a broad, overarching definition of resilience: the systems ability to resist degradation, to absorb impact and to effectively restore functionality following a significant event. The event chosen for discussion is a catastrophic coastal flooding scenario in The Netherlands based on the scenarios developed for the recent Taskforce Management Flooding (TMO) and Waterproof exercises. The objective of this chapter is to identify and analyze the effects of both pre and post disaster interventions for increasing public health resiliency, in a scenario where two large populations are deprived of normal and emergency services. The first population are those who choose to evacuate to host areas that are not flooded and have not suffered infrastructure damage. However, they do not have capacity or capabilities to deliver the required health services to evacuees. The second population consists of those individuals and groups unable or unwilling to leave their homes. They remain in the flooded areas,

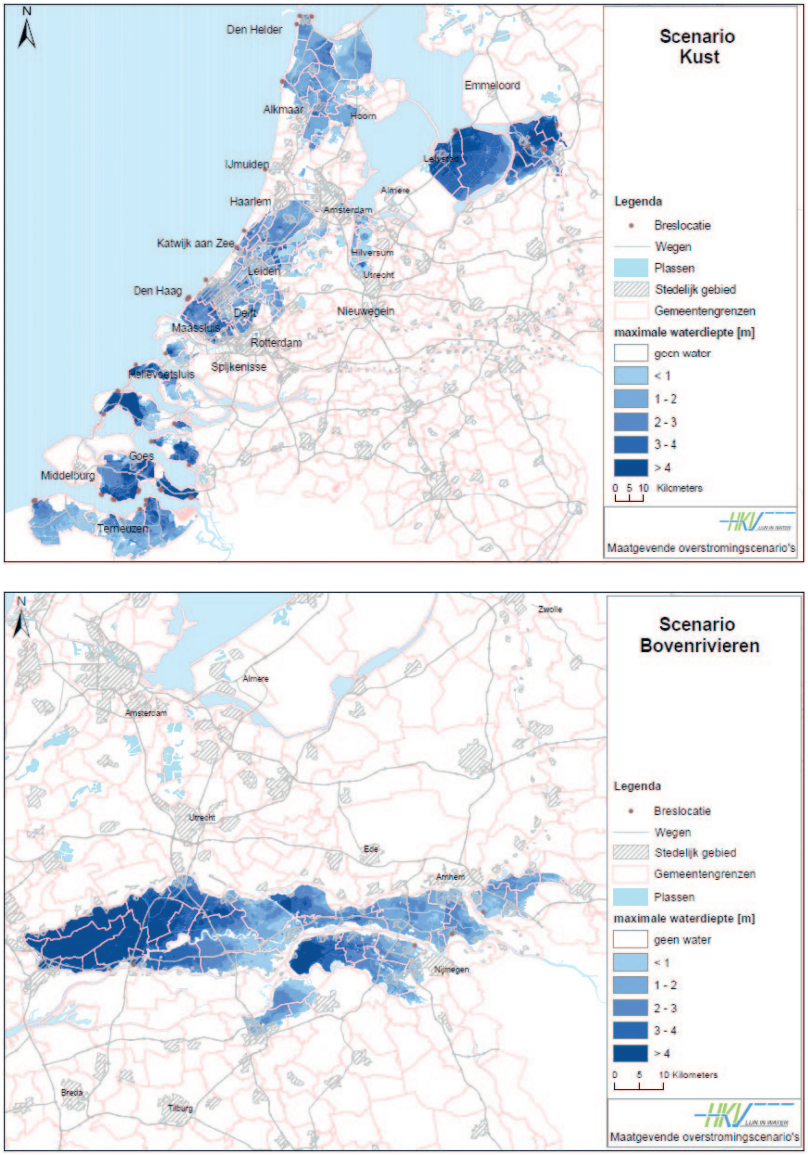

Figure 11 Maximum water depth and flooded area in case of a worst credible flood for the western coast (above) or river area (below).

without critical infrastructure or access to basic life sustaining services and health services that must be delivered under extreme conditions.

General Dutch preparations on flooding

The National Security Strategy (2007) of the Dutch Government grew out of a perceived need to fully understand the nature and the severity of the threats facing The Netherlands and to know whether the nation has the capacity to prevent such threats or to respond to them. Part of the National Security Strategy is the National Risk Assessment. This is an instrument that allows the government to identify and measure different kinds of disaster and crisis scenarios against common parameters. The Minister of the Interior and Royal Relations is responsible for implementing the National Security Strategy as well as the National Risk Assessment. This task is shared with the other Ministries, the business community, research institutes and planning offices. One of the identified treats that The Netherlands faces is flooding. Based on the results of the National Risk Assessment, the flooding risks are of a low probability, but serious to the impact of the catastrophe. Analysis shows that Flood Risk Management is indispensable to strengthening national security.

As an important first step in raising awareness of and initiating preparedness for catastrophic flooding, the Ministry of the Interior and Royal Relations and the Ministry of Transport, Public Works and Water Management (now the Ministry of Infrastructure and Environment) launched the Taskforce Management Flooding (TMO). As TMO stated in its final report (2009), the US experiences have been of great importance in demonstrating how to deal with the preparations for flooding as well as determining how to deal with the organization of the Waterproef exercise in 2008. The Waterproef exercise, based on the worst possible flooding scenarios was the biggest exercise ever held in The Netherlands, with more than 10,000 participants from almost all ministries, safety regions and water board authorities.

In June 2009, the reaction of the Cabinet to the final TMO report was sent to the House of Representatives (June 2009, 2009-0000290701). In this letter, the Cabinet subscribed to the basic results and recommendations of TMO. In addition, the Cabinet announced that its policy on water emergency management will focus on a few specific topics. One of these topics is the necessity for regional as well the national flood planning. Almost all safety regions have a basic plan for flooding. These plans have to be fully developed, tested and, coordinated with other regional, national and international plans. At the national level, the primary focus will be on a National Evacuation Plan and the National Crisis Plan.

Evacuation plans

The short term aftercare consists of caring for victims after an evacuation. This is the responsibility of the local government or –in case of a flood- the safety region(s). Based on the worst case scenarios used in the Waterproef exercise for coastal flooding, it will not be possible to evacuate a significant portion of the population in the threatened area in time. In the worst case river flooding scenario, there should be sufficient time for large scale evacuation. Both scenarios will have their own challenges. Essential research should focus on the coastal flooding issues, since it presents the challenge of delivering services to both the evacuated population and the population unable or unwilling to evacuate the impacted area. Although the issue of taking care of the victims in the aftermath is being addressed by the Dutch government and the safety regions, the primary focus is on the psychological aftercare of the victims, claims settlement and information management. The long term perspective is focused on the aspect of reducing the water level and rebuilding. The Dutch organization IMPACT (see Modelplan Nafase, 2008) and COT (see Leidraad Nafase, 2005) have already done useful work. Medical care in general is also identified as a planning requirement. However, the issue of meeting healthcare needs after an evacuation has not been adequately defined or addressed and should be addressed through research.

Community Emergency Response Team Members in action transporting an injured individual to field level medical care.
http://www.citizencorps.gov/cert/

Post Disaster Health Needs

Ensuring that public health requirements are met, is a primary goal of disaster planning and preparedness activities (PAHO, 2000, IOM/NRC, 2005). Often, this includes estimating the population that will be directly impacted by the event and the resulting medical requirements. However, planning for the care of the impacted population with chronic illnesses is frequently overlooked (Aldrich and Benson, 2008; Shrestha et al., 2009). Figure 12 shows the location of hospitals in The Netherlands and the number of beds in these hospitals. Taking into account that a couple of days before the dikes are breached, the threatened area is even larger because the location of the breaches cannot be defined in advance. Comparing the location of the hospitals with the flood zone, taking uncertainty into account, it can be concluded that multiple health care facilities are threatened at the same time and the whole structure of the health care system is put under pressure or could fail.

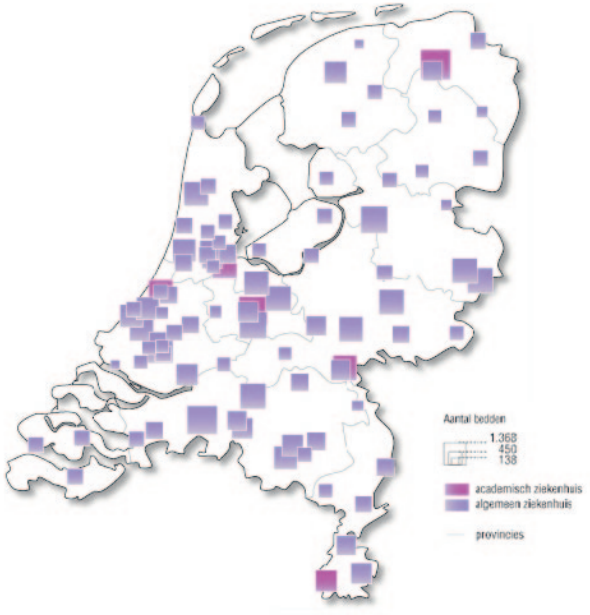

Figure 12 Location and number of beds in hospitals (HHS Uitgeverij 2008)

During a disaster, access to health care, personal support and medication is reduced. This leaves people with chronic medical conditions at risk of serious medical complications - even to the point of death. Following Hurricane Katrina in 2005, more than 200,000 people with chronic medical conditions were displaced by the storm or isolated by the flooding. These individuals were left without access to their usual medication and sources of care (World Bank, 2006). It is important for planners to take the needs of this vulnerable section of the population into account. Another important consideration is the functionality of existing medical care centres, specifically hospitals and urgent care clinics. The ability of a hospital to function, depends not only on the type and/or amount of damage the facility may have incurred but also on the status of the supporting infrastructure (i.e. power systems, water systems) (FEMA, 2007; TISP, 2006, Vale, 2005). It is understood that these two factors, damage and infrastructure, are extremely important when determining the functionality of medical facilities. However, this relationship is not clearly defined.

Hospital staff and family members prepare to move patients from the Tulane University Hospital parking garage to a makeshift heliport. Courtesy Eliot Fagley

For the public health system to be able to function well after a disaster, it must to be able to respond to disaster generated public health requirements. There are three major categories of post disaster public health requirements:

1. those resulting from medical needs such as injuries or chronic illnesses;
2. those resulting from loss of infrastructure such as loss of energy systems, loss of portable water systems;
3. loss of private medical and health care infrastructure such as damage to hospitals, loss of pharmaceutical distribution capability (adapted from Noji, 1997, pp 14-15; Aldrich and Benson, 2008).

Post disaster public health requirements include the following elements of the three perspectives:

A. Public Health requirements due to medical needs
(see Noji, 1997, PAHO 2000, IOM/NRC 2005, Shrestha et al., 2009)

I. **Immediate demands**
injuries caused by disaster and other immediate impacts. Typically there will be crush injuries, wounds and burns. Following an earthquake the majority of injuries and deaths are caused by structural collapse, fire and traffic accidents.

II. **Demands resulting from pre-disaster physical disabilities:**
these demands would include those already receiving outpatient care (e.g. kidney dialysis) and those on home care (oxygen for congestive heart failure, home respirators, etc).

III. **Demands resulting from health needs of socially vulnerable populations**
those with chronic conditions – needing treatment and/or medications – for diseases such as diabetes, heart disease, HIV, etc. those with mental illnesses, those with age-related and gender conditions – elderly, expectant mothers, nursing infants

IV. **Demands resulting from new illnesses directly related to the post-disaster environment**
respiratory and other infections caused from dust from collapsed buildings and smoke from fires, widespread viruses from temporary mass care shelter, diarrheal disease and dysentery due to water contamination.
- Type I demands will present during the immediate response, 0-3 days
- Type II demands will begin presenting themselves around day 2, will peak around week 2 as persons receive treatment
- Type III & IV demands will start to present after about a week, and will continue to increase throughout the response period.

B. Public Health requirements due to loss of infrastructure:

- Loss of potable water supply system
- Loss of sewage system
- Loss of energy (electricity/gas/oil),
- Inability to boil water
- Inability to deliver/administer home care

C. Public Health demands due to loss of private medical and health care infrastructure

- Damage to hospitals
- Damage to primary care facilities
- Damage to nursing homes/assisted living facilities
- Loss of home care capability
- Loss of pharmaceutical distribution capability

Models for analysis

The modeling process and outcomes derived from a recently completed FEMA funded project, 'The Effects of a New Madrid Catastrophic Earthquake', which was part of a large FEMA Catastrophic Planning Programme, provide a model for analysis of potential health impacts in the Netherlands (MAE Center 2008, 2009). The goal of the FEMA funded, New Madrid Seismic Zone Catastrophic Planning Project was to increase national readiness for a catastrophic earthquake in the New Madrid Seismic Zone (NMSZ), based upon the identification of resilience building requirements across all phases of Comprehensive Emergency Management: Preparedness, Mitigation, Response and Recovery. This multi-year, multi-agency initiative is the largest planning effort ever undertaken in United States History. This project focuses on using essential scientific and technical modelling results to predict the effects of a NMSZ event on the 8-state region (Alabama, Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee). The Catastrophic Disaster Modelling Process from the New Madrid Earthquake project is directly applicable to The Netherlands Catastrophic flooding scenarios and provides a strong foundation of experience and lessons learned for The Netherlands project.

Steps of this similar analysis that would support public health and medical preparedness would include:

1. Estimate the public health and medical needs following a catastrophic event in The Netherlands based on available reports, data and expert interviews.
2. Determine the post disaster functionality and capability of public health and medical facilities; their ability to care for existing patients and to receive new patients.
3. Determine public health and medical response requirements by modifying and applying modelling techniques developed in the United States to estimate public health and medical requirements.
4. Identify and evaluate potential pre and post event interventions that will build public health resilience by minimizing health and medical impacts and improving recovery capability.

Reflection on The Netherlands

The Netherlands national risk assessments show that the size and consequences of a flood by far exceed other disaster scenarios. A catastrophic coastal or riverine flood would dramatically impact both the demand for and the supply of medical and health services. Mass evacuation of complete health care systems (not only the hospital but suppliers, personnel and equipment) would make healthcare unavailable in affected regions. Emergency planning in health care institutions in The Netherlands typically focuses on evacuation to other (undamaged) parts of a building or complex, for example. The unresolved problem is how to deliver medical and healthcare services when, as in New Orleans, critical facilities must be completely abandoned and citizens lose the ability to acquire necessary medicines or home care support.

Alternatives for meeting the increased health care demand should be examined in planning for potential catastrophic flooding. These alternatives could include making the physical infrastructure of health care more robust, by ensuring undamaged facilities will be supported with necessary fuel and supplies and that damaged facilities will support vertical evacuation and the continuation of services. This would enable the care of special needs patients who cannot evacuate and provide services to those who chose not to evacuate. Other alternatives include the provision of enhanced medical services in congregant evacuation shelters, to care for those who evacuate and the establishment of well equipped, self supporting medical and public health response teams that can deploy to the affected area to provide health care. Emergency preparedness efforts and evacuation plans will reduce the number of casualties directly caused by a flooding event. Needless pain and suffering could occur after such an event, however, if the medical and public health system is unable to sustain the ability to deliver the necessary care.

Conclusion

National resilience has emerged as the organizing concept for disaster prevention/mitigation, preparedness, response and recovery in the United States (see the proposed FEMA resilience based vision and goals at: http://www.fema.gov/pdf/prepared/npg.pdf).

The ability to prepare for and manage post disaster health and medical requirements, is a critical element of resilience and deserves the attention, resources and research necessary to develop and maintain an acceptable level of competence, capability and capacity to meet the requirements of the affected populations.

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8

Authors Karen Engel | Liesel A. Ritchie | Brandi R. Gilbert | Alexandra E. Jordan

Evaluation: enriching (flood) emergency preparedness in The Netherlands

Introduction

Disaster preparedness, response, and recovery are complex processes. No single policy can outline the proper way to manage these activities and promise success in every situation, particularly from country to country. The settings vary and often involve players with diverse backgrounds, from different countries–comprising an international context. Events such as the Balkan crisis and Rwandan Genocide in the early 1990s, Darfur ten years later, 9-11 in the United States, the Indian Ocean tsunami, hurricanes Katrina, Rita, and Gustav, earthquakes in northwest Pakistan and Kashmir, cyclones in Sidr (Bangladesh) and Nargis (Myanmar), recurring emergencies in Haiti, and the tsunami in Japan have drawn increased international attention to disaster and emergency management.

In these diverse contexts, issues of preparedness, response, recovery, and resilience are being scrutinized more closely from a variety of perspectives–highlighting a critical need for increased transparency, accountability, and learning in disaster and emergency management evaluation. Systematic evaluation efforts offer an important way to do just that. A comprehensive evaluation can inform both practice and policy. However, this is not an easy task and stakeholders need to be continuously reassessing their evaluation approaches and, more specifically, their effectiveness in providing information.

When doing so, it can be valuable to look at evaluation practices from abroad, as well as the experiences from Dutch crisis and emergency management. Particularly in The Netherlands, the perceived limited effects of evaluations, requires attention and it might be time to reassess and reconsider current evaluation practices, to establish how learning can be realized as effectively as possible. When doing so, it can be beneficial to go beyond one's borders and inform oneself with available international experience, knowledge, and expertise.

In this chapter we first present a framework for considering key dimensions of evaluation in disaster and emergency management. Next, we discuss recent and current evaluation efforts in the Dutch context of flood exercises and highlight vulnerabilities associated with flood preparedness as part of flood risk management in The Netherlands. This is followed by a summary of an evaluation of the "NL 2008 Waterproef activities" as a case study. We conclude by providing recommendations for next steps and future opportunities to support learning and improvement in the Dutch context.

Evaluating Disaster and Emergency Management: An International Perspective[5]

Four Key Dimensions of Evaluation to Consider

Conceptualizing the complexity of disaster and emergency management evaluation requires consideration of its various dimensions. One way to organize these elements is through a multidimensional framework. As illustrated in Figure 13, some of the components likely to affect outcomes include what happens during the different phases of disaster, the intended use of evaluation findings, the decision to use particular evaluation strategies, and the multifaceted context in which these decisions take place.

Despite the importance of all aspects of the framework, it is the last-named factor that is perhaps most salient to this discussion. Contextual factors may include, but are not limited to, social, geographic, demographic, cultural, political, environmental, legal, economic, and technological (Ritchie & MacDonald, 2010). Without taking these into consideration, those performing

5 Information in this section is from the scholarly article, "Enhancing Disaster and Emergency Preparedness, Response, and Recovery through Evaluation," by Liesel Ritchie and Wayne MacDonald, featured in the Summer 2010 edition of New Directions for Evaluation.

the evaluation risk obtaining results of little use or results considered insignificant by key stakeholders. However, it is only with the addition of the remaining attributes that a comprehensive model takes shape. Each is interrelated with the other and consequently important in conceptualizing the complexity of evaluation and identifying noteworthy issues.

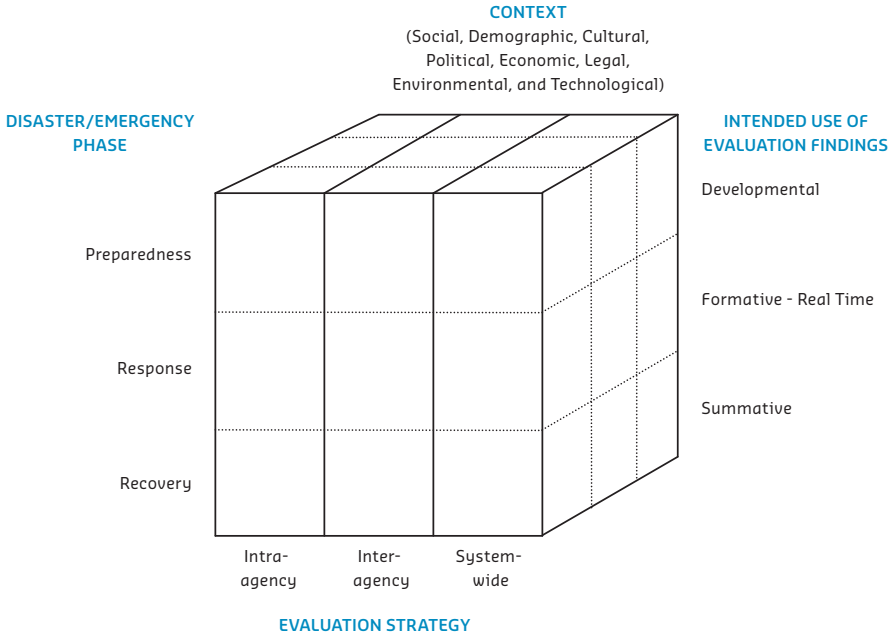

Figure 13 Conceptual Framework of Disaster and Emergency Management Evaluation
(as seen in Ritchie and MacDonald, 2010)

Have Some Standards! International Issues in Disaster and Emergency Management

In consideration of this framework, here are some of the challenges that evaluators face in highly charged, disaster environments:

- Establishing Community Ties
  Practitioners and researchers are increasingly noting the need to include affected (or potentially affected) populations before, during, and after disasters and throughout the evaluation processes.
- Using Existing Evaluation Codes to Build Standards
  Current standards should be used to help frame evaluation activities both internationally and within nations, with the goal of achieving a more seamless and logical approach.
- Recognizing Methodological Limitations
  Methodological challenges associated with conducting evaluations in the emergency and disaster arena must be recognized, and their implications closely examined in order to improve evaluation design and implementation.
- Looking toward the Future
  Research and practice must continue to urge the accessibility of evaluation findings and reports; the analysis of evaluations with policy and programming aims in mind; and the examination of evaluation products to ensure technical quality through meta-evaluation efforts.

The Dutch Context: Are We Learning from Evaluations?

In The Netherlands, evaluations of both real-life incidents and preparatory exercises are common and even embedded in legislature. Examples of major evaluations that have taken place in the past few years include the evaluations of the 'Strandrellen van Hoek van Holland' and the Crash of Turkish Airlines (Poldercrash). Although the size, scope, and intended use of evaluations differed in each case, most aimed to enhance future capacities to effectively deal with crisis situations.

Increasingly, crisis management professionals are compelled to conduct evaluations in order to better prepare for, respond to, and recover from emergencies. As in the rest of the world, in The Netherlands this pressure is driven by a number of factors, such as the need to professionalize and perform tasks and responsibilities better, increasing reports of emergency management failures by the global media, and public demands for aid providers to "do better!" (Ritchie & MacDonald 2010).

Interestingly enough, despite myriad efforts to evaluate crisis management in The Netherlands, disaster management researchers and professionals feel that organizational learning is limited and that few evaluations are substantively shaping standards, policy, and practice: "It seems like all evaluations result in the same recommendations and crisis organizations don't seem to visibly improve" (Cens2, 2009).

With respect to flood preparedness, learning from evaluations is particularly difficult since there have been very few large-scale flood events. Therefore, in The Netherlands, most learning for flood crises has been derived from preparative activities such as the Waterproef exercise and FloodEx activities which provided important but rare opportunities to examine flood preparedness and response capabilities. For example, the primary objective of FloodEx, a command post and field exercise conducted to test the coordination of international assistance from the EU was clear—"to improve and train in practice, existing procedures for alerting, mobilising and dispatching international emergency services." (Koninkrijksrelaties, 2010; LOCC, 2009)

Learning from Waterproef: A Case Studyof the Value of Evaluation[6]

Waterproef

Waterproef was a week-long Dutch flood-exercise in November 2008 organized by the Flood Management Taskforce (TMO, Taskforce Management Overstromingen). As a part of its Learning from a large scale flood exercise in The Netherlands project, the COT Institute for Safety, Security, and Crisis Management (COT) in cooperation with the Disaster Research Center (DRC) at University of Delaware and the Institute for Crisis, Disaster and Risk Management (ICDRM) at George Washington University developed background knowledge for, participated as observers in, and derived lessons learned from Waterproef. The added value of a US-NL team was the external perspective that provided the team with insightful findings that could not have been attained through Dutch eyes alone. Both the exercise and the project provided valuable opportunities to exchange knowledge regarding key processes, best practices, and complexities of flood disaster management in The Netherlands.[7]

The research team reflected on the findings from their knowledge and expertise, particularly from the Dutch perspective and context, in order to position interesting opportunities for future learning throughout The Netherlands. The findings detailed below focus on opportunities for future learning, both from a Dutch and U.S. point of view. In some cases, these opportunities may be used as discussion points for practitioners. However, some of these opportunities require further research, for example within the NUWCReN project or in other international projects.

The topics highlighted here are not intended to criticize the Waterproef exercise, but to stimulate the exchange of knowledge and experiences. For the official evaluation see the report of Cappelleveen and van der Ven (2009). Throughout the exercise the research team encountered individuals who were aware of many of these issues. The challenge is translating the knowledge, information and lessons learned into formats that will be useful to the diverse groups involved in crisis preparedness, response and recovery.

6 Information presented in this section is from " Opportunities for future learning: Learning from a large scale flood exercise in the Netherlands" by Engel and Zannoni (2009).

7 Over the course of the Learning from a large scale flood exercise in the Netherlands project the COT research team wrote the following pieces: (1) Four working papers on relevant literature and US experience; (2) A white paper on crisis management and water management in The Netherlands; (3) A observation report on Waterproef; (4) A paper on the findings form additional Dutch interviews with Waterproef key players; and (5) A report on the results from an expert meeting in Rotterdam.

Evaluation Methods

The project was divided into three phases, namely
phase 1 'Literature Review and Preparation',
phase 2 'Observation of the exercise', and
phase 3 'Lessons learned'.

In the first phase our American colleagues were introduced into the Dutch 'water reality'. On the basis of this a number of papers were produced[8].

In phase 2, the team traveled throughout The Netherlands to observe the flood-exercise. Also they participated in various reflection sessions and informative meetings. The team documented and reflected on their observations. In addition to the observations, COT interviewed key participants. These interviews allowed for additional and more detailed findings. A discussion-paper based on the interviews was developed. Finally, in phase 3 a number of lessons learned relevant for The Netherlands were formulated.

Overview of Key Observations and Evaluation Findings

Doctrine and structure

The US National Response Framework "The National Response Framework establishes national policy and doctrine for preparedness, response and recovery and assigns responsibilities to federal agencies and non government organizations. The NRF is intended to ensure that the government approaches all hazards and threats in a consistent manner and to provide the basis for developing the capability and capacity to do so." Having a Dutch version of a national response framework could enable The Netherlands to ensure consistent approaches to various hazards and threats, including low probability/ high impact risks that will most likely result in a national disaster if not a catastrophe. Having adequate doctrine and structure can enable one to ensure a comprehensive, consistent and solid base for (joint) activities if the practical implications are sufficiently taken into consideration. It is important to note however, that the plans in which doctrine and structure

8 Best Practices in Incident Management, John R. Harrald, Ph.D. and DilekOzceylan, George Washington University, Institute for Crisis, Disaster, and Risk Management; Best Practices in Using Information Technology in Disaster Management, by DilekOzcelylan and John R. Harrald, Ph.D, Institute for Crisis, Disaster, and Risk Management, The George Washington University; A Brief Summary of Search and Rescue Literature, Joseph Trainor, Disaster Research Center, University of Delaware; A Brief Summary of Social Science Warning and Response Literature, Joseph Trainor, Disaster Research Center, University of Delaware; "The Netherlands: Crisis Management and Water Management".

are described and subsequently established have practical implications. Plans imply capabilities, capacities, materials, necessary time lines, etc. at various levels (local, regional, and national) to effectively be carried out when necessary. The current Dutch doctrine and structure seems to have limited insights into the practical implications of the system (how will it work when executed, what capabilities and capacities are necessary to execute it effectively, what major decisions will have to be made, etc. This seems to be especially the case in times of interregional and national crises events. The main responsibilities and structures might be established by law, but the practical implications are insufficiently identified and taken care off. When planning, the plan should not become the objective. Planning processes, especially joint planning efforts, can enable greater risk awareness, knowledge and stakeholder appreciation. The planning process is therefore central to adequate crisis management. This does however mean that individuals having to execute the plans, have to be involved throughout the planning process. Furthermore, the process of planning should not be discontinued when plans have been developed. Plans should be living documents; continuously changing documents according to newly acquired knowledge, lessons learned and a changing environment, both physical and social. Lastly, plans should be comprehensive and represent a comprehensive framework representing a comprehensive risk management strategy, i.e. entailing mitigation, preparation, response and the after phase, as these various phases are intertwined.

Human factors

The safety paradox The Netherlands experiences makes planning, and particularly the planning process, an essential learning and capacity building mechanism. Learning throughout these processes, particularly regarding large scale events that are not often experienced, demands looking abroad and learning from other country's experiences. As such, The Netherlands has learned a lot from New Orleans and introduced various lessons from New Orleans into their system. While international learning is of great importance two issues should be taken into account by Dutch practitioners:

1. The Dutch reality (history, culture, language, demography, et cetera) is different from other countries' realities. As a result, lessons should be translated into Dutch reality before including them into the Dutch system.
2. Learning through planning can lead to the bureaucratization of human factors during a disaster response. When responding one should reach out to the factual reality outside and not to facts and numbers taken from books or reports.

Lastly it is important to note that in actuality, in times of catastrophes and crises, crisis management organizations become social service organizations.

Special Needs

Throughout the Waterproef exercise it became apparent to the observers that the rhetoric of 'special needs populations' has become so dominant in emergency management that it has become a must attend to issue. It is important for responders to remember that the label 'special needs' is simply meant to provide a column that sensitizes us to those groups of people that will need more help than the 'normal person'. There seemed to be little awareness of what precisely special need meant, the complexities of these populations, and what might be done to provide additional assistance. Although the social disparity is not of the same scale as in the USA it is important to remember that The Netherlands does have some level of cultural, educational, and experiential diversity that must be taken into account when planning social services during disasters. In addition to understanding the notion of 'special needs populations' it is important to be able to translate disaster caused needs, to required response capacities. Response requires the mobilization of resources of adequate capability and capacity and people with adequate competence. It seems that often responders grossly underestimate the scale and scope of the events being envisioned. US experience could be interesting for Dutch professionals, nationally and regionally. This concerns methods of estimating physical and social vulnerability and development of models that will identify areas where high vulnerability coincide with areas of high impact.

Situational awareness

During the exercise it appeared very difficult for participants to attain an adequate situational awareness, particularly with respect to a 1 in the 100 000 year storm. There was no real understanding of the consequences, particularly physical effects, of such a storm and decision making individuals were subsequently hardly concerned with important questions that arise as a result of such a great storm. The scalability in time and space of a crisis is a challenge in The Netherlands.

Evacuation

During Waterproef, evacuation was one of the main topics. This was mostly focused on the decision making process, especially the National versus Regional context. As US experience has showed, it is crucial to focus on the implications of an evacuation. What does it require in terms of capacity? Is the capacity available? How long will it take for regional mutual-assistance or national assistance? How time consuming are measures or activities? What will be the situation on the roads, trains, etc.? This was not part of the exercise but it was part of some of the planning that has been done on a national and regional level. Decision makers must be aware of what the implications of decisions are, for example if the mayor

decides to postpone the evacuation decision for a few hours or days, etc. This requires more awareness and preparation.

During the exercise, there was talk about vertical versus horizontal evacuation. While the horizontal evacuation strategy received increasing attention, vertical evacuation did not. Even though for some areas like one of the most vulnerable areas dike ring 14 area vertical evacuation might be more desirable than horizontal evacuation. For realistic strategies to be attained, both strategies need to be reviewed. Furthermore, when reviewing such strategies the consequences of the strategies should be taken into account. Practitioners should be careful not to underestimate these evacuation issues, neither in exercises, disaster plans or real life situations. The consequences of evacuation should be analyzed and taken into account throughout preparation efforts. Will evacuation be long or short term? How will capacity for long-term evacuation be ensured? Who will provide long-term shelter and relief? Which funds and capacities will be used for such long-term shelter and relief?

International cooperation

The effects of a large-scale event such as a flood are catastrophic. Within the context of a globalization, and more specific for The Netherlands, Europeanization, The Netherlands cannot be seen as separate from the Dutch context. A large scale flood in The Netherlands will mean that other countries will be affected, either by flooding or by the effects of flooding. Measures such as evacuation will necessitate cooperation with other European countries. The Netherlands will need the support of neighboring countries and will have to compete with the demands and interests of other countries afflicted. Furthermore, attaining foreign assistance necessitates a specific logistical endeavor for which we might not be prepared and which could frustrate the effectiveness and potential of the Dutch disaster response.

Estimating needed capacity

While we observed in many areas that the Dutch responders had the capability to engage in technical procedures, there were very serious reasons to believe that responders grossly underestimated the scale and scope of the events being envisioned. They often made the assumption that resources such as man-power and equipment would simply be in ready supply. There are a number of complex logistics issues that were not addressed sufficiently to suggest that the capability existed to engage in such a large scale operation for a sustained period of time. Some examples include nursing home evacuation, water rescue, and dyke wrapping procedures. For the most part we saw limited focus on the long term and

little attention on the complexities of support functions. Overall there was little attention to spatial and temporal connections. Furthermore, these capacities were not part of the strategic decision-making process. It is our perspective that strategic level decisions should be made with a level of awareness of the capability of organizations to successfully complete operations. This level of information allows for more informed decision-making and in the end better results.

Utilizing societal assets

One of the questions that remains, regards the utilization and integration of societal assets in disaster management structures. For example, the public. Disaster management is meant to safeguard and protect people. Discussion regarding public communication strategies and public awareness are therefore important. Lack of strategic and well thought thorough communication to the public can be very dangerous. These types of situations often generate a great deal of uncertainty in the public and it will be of great importance that public officials engage in open and honest communication with the public. The absence of information often leads to rumor transmission that can become very difficult to control. Furthermore, open communication will also facilitate trust that can be vital when attempting to get public compliance with governmental requests.

Another issue that should be underlined for the Dutch context, primarily because it does not attain the attention it requires, is the role of societal organizations throughout a response. Volunteer and emergency groups are of critical importance. They for example accomplish most initial SAR activities. Search and rescue activities are undertaken by a number of different types of actors including unaffiliated volunteers, organizational volunteers, and formal organizations. Measures should be taken to most effectively utilize all of these resources.

Large scale exercises

Large scale exercises are appreciated. Especially the preparation phase is perceived as increasingly valuable because it allows for learning, increased risk awareness and stakeholder appreciation. The large scale exercise is developed based on the recognition that there is a real potential for a catastrophic event in The Netherlands. Particularly in a society that has historically placed so much attention on mitigation and the provision of safety, the willingness of high level decision-makers to engage in the process of defining an event and orchestrating a meaningful exercise is an admirable goal. It is often extremely challenging to convince people of the need for catastrophic planning. Having engaged in this process has likely made The Netherlands a safer place. The Dutch should be commended for taking on this serious and important task.

Designing a large scale exercise is complex. One should take into account that it can become too complex and too simplistic at the same time. Lack of experience with catastrophic events makes it difficult for individuals to envision and understand such events and makes people interpret the scenario either as implausible, thus simply ignore the realistic nature of the scenario, or too complex and become discouraged.

Warning processes as social processes

Contrary to media depictions and other's perceptions of the public that suggest animal-like, irrational, or antisocial behaviour it is important that we begin this discussion knowing that people typically "rise to the occasion" during disasters and go through rational decision making processes. Additionally, it's important to realize that contrary to what officials might belief, warning response is not simply an 'individual' decision. Such a view is simplistic, poorly conceptualized, and ignores years of research. Subsequently, warning processes should target groups and families rather than individuals and messages should be tailored to specific sub-populations interests.

Warning processes are driven by various factors varying from age, language and culture to gender and economical situation. Many of these forces are social and involve interaction, communication, and collective definition. Additionally, pre-existing social structures and emergent behaviours play a role in shaping warning response and evacuation behavior.

The large scale exercise in The Netherlands was a worthwhile effort that has enabled not just a learning process, but also an effective assessment and planning trajectory of the Dutch current disaster management system. As the Flood Management Taskforce ended, however, many fear that the lessons and gains from their effort will disappear into a report and finally into a drawer. This would be a waste . The exercise might not have been perfect, but it generated valuable results that can enable practitioners and scientists to enhance the disaster management system that is currently in place. The will is there, but will the political and administrative arena, necessary for creating the window of opportunity to continue learning with respect to floods and disaster management, be there to support that will and allow for learning trajectories to be continued? Many issues remain and should be elaborated upon in order for the Dutch system to be enhanced when it comes to floods. Floods are a real threat that hold the potential for catastrophic impacts and we should limit the possibility of flooding becoming a creeping disaster by taking a proactive stance and limit 'failures of insight'.

Final Thoughts and Recommendations

For a country such as The Netherlands, motivated to enhance crisis preparedness for rare but possibly catastrophic events such as flooding, tapping from the vast amount of experience and knowledge available internationally can be helpful to attain high quality evaluation practices. Because if we consider evaluation experience in this arena as being on a continuum—with the most experience at one end and the least experience at the opposite end—there is currently much distance between those operating internationally and those working exclusively within a national context. This is becoming apparent not just in The Netherlands, but also in the US. In the U.S., evaluation lessons following Hurricane Katrina (not to mention preparedness and response lessons) could have been better informed by previous work in the global context. This is not to say that those operating in the international arena have mastered every issue; rather, they have faced many methodological (and other) challenges and are intensely aware of potential pitfalls and solutions.

Aside from learning for evaluations internationally, we should also try to learn from evaluations internationally. A lot of emergency management lessons are generic as crises are often characterized by patterns and regularities. Lastly, we would like to underline that learning cannot just be attained through evaluations. Learning requires effective and comprehensive learning infrastructures in which qualitative evaluations are embedded.

As Van Duin (2011) argues, the evaluation loses value when there is no will and commitment to learning. Will and commitment should be there at all levels of an organization. It is not enough for practitioners to want to learn, if management levels don't show commitment by providing time and resources for practitioners to learn. Also the evaluation loses its learning potential when the focus of the evaluation is not learning, but rather accountability. This is something we see more and more in The Netherlands. Throughout The Netherlands the will to learn is there. However, as evaluations are embedded and legislature and therefore have to be done, they seem to become mechanisms of accountability rather than means for learning. Often, time and resources available for learning are scarce. Policy-makers, decision-makers, practitioners, and professionals have various responsibilities and tasks and are often given very limited time to learn. The extensive evaluations that are currently being produced are subsequently not the most effective tools to ensure learning (Van Duin, 2011).

In conclusion we would like to present 5 to the point recommendations that could and should enable learning from evaluations, whether evaluations from exercises or real-life events:

1. Learn from international evaluation experiences. Internationally there are numerous organizations working on enhancing evaluation methods and ensuring increasing learning through evaluation. So instead of re-discovering the wheel, go out there, share experience, knowledge, and expertise. Find organizations dealing with similar issues and challenges and find joint ways to continuously enhance evaluation methods directed at learning. While doing this, always ensure that the context in which one is working is adequately taken into account and that lessons and/or best practices are adequately translated to match the local reality. Methods and approaches as well as lessons need to make sense to the people having to work with them.
2. To learn from an evaluation the evaluation should be designed as a learning evaluation. If an evaluation is designed to serve accountability objectives, it will not result in any learning. Therefore, ensure that learning is the primary objective in design and reality.
3. Use similar evaluation methods for both exercises and real-life events. Often evaluation methods for exercises are different to evaluation methods for real-life events. Allow for real-life experience to be a real-life exercise and transform exercises into practice by utilizing similar evaluation methods and criteria. This ensures a more continuous learning and evaluation process.
4. Learning should be a continuous process. This is possible even when resources are scarce by embedding evaluation moments regularly and continuously throughout practice. Learning evaluations don't have to be extensive, but they should result in some form of learning. If this is attained by having smaller evaluations, more often, this is what should be done.
5. With respect to flood preparedness, it is important to realize that the current flood protection approach, particularly the "'safety assumption' has seriously limited disaster response development and responder experience" (Engel & Trainor, 2010). However, the risk is a high consequence one for which response capacities will be crucial. This is why capacity building and learning aimed at enhancing flood preparedness should be engendered as much as possible even if this can only be done through theoretical exercises. As Sutton and Tierney (2006) state, "[l]imited resources require communities to prioritize among the events for which they will plan, but at the same time communities should not neglect to plan for low probability events, including catastrophic and near-catastrophic disasters." (Sutton & Tierney, 2006).

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9

Conclusions and recommendations

The need to learn about flood response

The Netherlands is one of the safest deltas in the world. The flood defense system has reduced the frequency of flooding. As most are aware, the safety standards of the flood defense system have been developed using a risk-based approach, taking into account the probability of flooding and the consequences, primarily damage and loss of life. This approach was adopted after the flood of 1953. Since then there has been no major flooding of so-called dike ring areas.

Even though the probability of flooding has been reduced, there remains a residual risk. The risk of flooding can never be completely eliminated. This makes it imperative to ensure that Dutch society is able to cope with the situation as effectively as possible when things do go wrong. This is complicated further by the fact that the reduced frequency of flooding has also led to reduced flood risk awareness among the public and among decision makers involved in emergency preparation. Low public awareness makes it difficult for decision-makers to prioritize emergency planning and develop an appropriate emergency management system.

We believe this booklet has illustrated a number of ways that US and Dutch knowledge can come together to provide a basis for emergency planning in the Netherlands. In the US floods are more common events and recently they have

even experienced a catastrophic event when Katrina triggered major flooding in New Orleans. These experiences with flooding, but also with other hazards, as well as the US disaster research tradition, have engendered a great pool of knowledge and expertise that can be tapped into whenever possible and desirable. The transfer and implementation of experience from other countries to the Netherlands is however a delicate process. Cultural, geographical and organizational differences are important to understand, in order to effectively transfer experiences to another reality.

While preparing for a flood in the Netherlands it should be noted that risk assessments show that the consequences of a large scale flood event by far exceed other potential adverse events even if the probability is low. This combination is what many analysts refer to as a low probability/ high impact event. This class of hazards is particularly difficult to motivate organizations to adequately prepare for. Other factors in addition to the high impact that increase complexity for flood preparedness are:

- A flood is a threat-driven disaster. In case of a possible event because of high discharges on rivers or storm surges combined with high tide forecasts can estimate the probability extreme water levels, for dike breaches a flood, and the possible impact of flood. However, these remain highly uncertain.
- Because of the extreme consequences, preventative actions such as evacuation, should in theory be initiated before the occurrence of a flood. We must recognize however that mass evacuations such as those that would be necessary to protect the Dutch population have almost never actually been done.
- Furthermore, there are legitimate questions as to whether decision-makers will be willing to recommend and implement such evacuations. This is the case because in order to be successful in protecting the public they would need to be started at a time when uncertainty on whether the events will actually materialize will be high. In reality decision-makers will be left in a situation where they must choose between uncertain alternatives where a clear choice is not evident and being wrong could come at significant costs in one scenario to loss of life in the other in terms of unnecessary and costly disruptions to economic and social process.
- The capacities of emergency services, equipment and infrastructure will be, by far, insufficient because of the enormous consequences and the number of people and properties that are affected.

Because of the limited experience with flood response in the Netherlands, preparation is approached through emergency planning activities, training and exercises, some communication to the public, research, modeling, and the development of scenarios. These actions however remain largely theoretical. Therefore it is important that the Netherlands looks at other nations that have experienced flooding in order to gather lessons learned. This booklet is but one example of how this kind of knowledge might be integrated into Dutch practice.

Conclusions:
Flood preparation as an add on to an all hazard approach

The emergency response system in The Netherlands is to some degree similar to that of the US in that it has been designed with an all hazards approach in mind. It is evident however that flooding and the risks associated with floods are significant for The Netherlands. One might even conclude that, unlike the US hazardscape, which is highly diverse, the Netherlands have good reason to provide focused attention on hazard specific planning for floods. This is particularly important given the fact that a significant flood event here would be almost unimaginably catastrophic and would far exceed other threats. Because a flood can be forecasted in most cases human intervention during the lead time can also influence the consequences (positive but also negative). In the occurrence of such an event , the standard approach of developing emergency service capabilities equipped to manage for example once in ten year events is insufficient.

Important questions must be raised then on how we increase the capacity of the nation while also keeping in mind the real limitations of capacity and budget in emergency management agencies. It is also important to consider the effectiveness of investment in other layers such as prevention and land use planning to reduce flood risk (these measures are taken by other stakeholders but also aim to reduce flood risk and are funded by tax payers or local communities).

One possible avenue for considering which interventions to adopt could be to extend the existing cost benefit approaches that are commonly used, to make choices about measures to reduce flood risk. Such an approach would call for extensive evaluation and consideration of the most cost effective mix of measures in prevention, spatial planning and emergency management.

This approach has considerable merit and should be explored and developed. Another approach however is to expand the vision for who can and should be involved in responding to such events. In truth, a catastrophic flood event in the Netherlands would likely dwarf other significant global disaster events such as those used as reference points in this booklet. In such an instance governmental resources, no matter how efficiently utilized, will be inadequate. Such contexts cannot be "managed" in the manner we are accustomed to thinking about them. Instead, concerted responses to these kinds of events will require innovative government planning and interaction between authorities and citizens and business. We propose that further exploration and implementation of the interventions highlighted in the chapters on vertical evacuation, evaluation, health impacts and command and control would be a good start in considering additional planned emergency management activities. If these types of approaches are coupled with extended engagement with other sectors not always considered central to emergency management, including the general public and the private sector would be vital. This planning should also take into account that the full capacity of the system will only be activated once in a couple of hundred or thousand years. Therefore the question remains how much to invest in this planning. The risk based approach can be used to show the costs and benefits and define the optimal mix of measures as input for decision making. However when a decision needs to be made about safety, other factors beyond costs and benefits are also important.In the chapters of this booklet we have attempted to provide some insight into both kinds of activities in the hope that we can contribute to the strengthening of existing approaches to emergency management and can also challenge stakeholders in The Netherlands to think about unique approaches to their safety. More detail on each of these sections is provided below.

Chapter 3 about self-reliance and community involvement in Dutch flood response provides an overview of the Dutch population's risk perception, actual disaster response and collaboration with aid professionals. It also reviews the Dutch government campaign to increase the self-reliance of the Dutch population. Dutch citizens place great trust in their government, are not afraid of flooding and, though perhaps aware of some residual risk, remain generally unprepared, counting on the government to help them out when disaster strikes. Current government campaigns and efforts have not (yet) led to perceptible changes in preparedness or attitude.Nevertheless, in case of a real emergency the Dutch public has shown to act professionally. They do take initiative and save and rescue disaster victims often before

professional responders have arrived. Though US and some Dutch experience show that citizens' response can limit the possibilities for other aid providers due to infrastructure overload, advantages of public involvement clearly outweigh the disadvantages. Experiences from the United States also show that community involvement can reduce disaster impact, because emergency services and infrastructure might be used in a more focused and effective manner, reducing the demand on professional emergency services. Though Dutch professional emergency agencies initially found it difficult to get accustomed to the involvement of citizens, as of recent a more positive attitude is emerging. Professionals are clearly aware of the advantages, especially in terms of expanded capacity and timeliness. There remain a number of issues that require a solution, including structured collaboration and coordination between professionals and citizens, recognition and after-care of citizen responders, and citizen involvement in training and exercises. It can be recommended that The Netherlands overcomes its traditional reliance on professional disaster management by opening the domain for citizens' involvement. The individualised approach of the government self-reliance campaigns have, moreover, overlooked the role of social organisations that may provide the missing link between government and citizens. A more long-term, collective, social learning-based and adaptive resilience approach may be more successful in achieving effective citizen-based solutions. It is recommended to conduct further research on the (possible) role of civil society organisations, something which has been hardly studied in the Netherlands, unlike the US.

Chapter 4 describes the demands of managing the responseto large floods on command and control and collaborative capacity. Managing the response is defined as the reduction of the consequences of a flood by early warning, crisis communication and mobilization of the necessary emergency services and first responders in the disaster area and is based on existing emergency management organizational systems, processes, plans, equipment, training and exercising). Existing command and control structures in The Netherlands are mainly designed and used for managing the response to local, small and sudden onset events, such as fires or traffic accidents. However, in case of flooding, multiple authorities are confronted with devastating consequences at once. Using forecasts and early warnings, measures can be taken to activate the society to reduce the consequences in case of a flood. The decision to do this is very complex. One can be certain that when a large scale flood happens that it will be a disaster in many respects. One has to cope, however, with the uncertainty about whether a flood will occur and whether response

measures will be effective. There are dilemmas of both overreaction and under-reaction. In the response to Hurricane Katrina policy makers did not have first-hand experience and only had distant memories of catastrophic storms. It has been argued that they were missing the right mental models to interpret warnings and found little meaning that could serve as a basis for action. How will our decision makers react? When managing the response to large scale floods one needs to think big enough. The size of the response system and the heterogeneity in size, experience, knowledge, and capacity among the participating groups, organizations, and jurisdictions involved in disaster response makes coordination, collaboration and communication rather challenging. In The Netherlands, the responsibility to manage the response to floods is distributed over multiple national, regional and local organizations (and citizens). Because of the low frequency of flooding in The Netherlands, plans and structures and required human action and interaction is hardly ever tested in reality. Therefore, it is very valuable to use experiences from the United States - with flooding and other mass events like 9/11 or Deep Bleu Horizon - to reflect on structures and plans on the one hand and on the capacity to improvise and collaborate on the other. Compared to small scale incidents, the social, physical and economic consequences of large scale floods is such that a government-centric approach is not effective. US experience highlights that a whole community approach is required to mobilize the required response capacity. This requires the ability to share and align information, resources and activities across public, private, departmental, jurisdictional, hierarchical, professional, formal and non-formal organizational and geographical boundaries. This chapter highlights the importance of developing the required collaborative capacity of those involved in responding to large scale floods.

In Chapter 5, vertical evacuation is presented as an optional or complementary strategy for those areas such as Dike ring 14 in which road congestion and population density make preventive (horizontal) evacuation not feasible. The USA experience of vertical evacuation is limited to the use of vertical evacuation in case of hurricane and tsunami. In particular, the idea of using vertical evacuation in case of tsunami is still in development. A lot has been done from an engineering point of view aimed at understanding the optimal solution in term of building structure. However, internationally more needs to be done to integrate engineering aspects to social aspects. Last, it is useful to clarify that vertical evacuation for tsunamis and hurricanes is definitely not the same as for floods. Therefore, the feasibility and/or desirability of vertical evacuation for the Netherlands need further investigations

for example if people are willing to evacuate vertical and also to estimate the consequences of vertical evacuation (loss of life, economic and social processes) to compare the effectiveness of vertical evacuation to other strategies as horizontal evacuation. To this aim, a comprehensive approach to vertical evacuation should be the result of academicians, emergency managers, engineers and citizens.

Chapter 6, describes public-private partnerships for flood and all hazards risk management. Private parties are also confronted with flooding. The experience in the US already shows the complexity to get them involved with emergency planning. The need for national programs (and in these programs leadership and the availability of resources to make them work) is shown to make public private partnerships work. This also requires a long-term strategy and commitment. The relevance however to be involved has to be recognized by the private sector. Therefore, the impact of an incident, in this case a flood, has to be known by the company. It can be questioned if an all hazard approach is sufficient for extreme events. Compared to the US the number of catastrophic events in the Netherlands is limited. Because the impact of several incidents outside this private business itself and effectiveness of measures strongly depends on the type of incident. To get insight in the consequences of possible flooding, risk assessments can be developed. These assessments describe the impact of the event to the property, but also describe the impact of the response of the business (or failure of it) to the environment. Also, several scenarios have to be taken into account because the capability to implement measures depends on time and size. For example when enough time is available with regard to the lead time and level of impact measures can be taken without consequences. However, when only limited time is available (which is also a realistic scenario) a shutdown of the continuity process can cause risk for safety of human and environment.

Chapter 7 presents the topic of mitigation and management of health impacts for a catastrophic flood. Health care facilities and home services are critical for those who depend on the offered care. Because of flooding and evacuation, the need for care will increase both in the affected area and in locations where evacuees are located.. Pressure on facilities and personnel will rise, also because some institutions have to be evacuated and capacity to deliver health care will be diminished. An institution itself can prepare how to offer maximum care during extreme circumstances when some services which are provided during a normal situation cannot be provided any more

due to loss of health care capability and capacity. Specific preparation can be done to evacuate complete facilities preventive and to maintain structures and logistics for health care. Also preparation can be done in such a way that citizens and institutions can become more resilient for a few days (extra personal, emergency power and medicines at facilities, individual supplies of medications etc.) while they are not evacuated. This kind of preparation can also be effective in other large scale incidents to ensure that necessary health and medical services can be maintained during the emergency phase of the disaster A resilient health system will prevent unnecessary movements and suffering. US protocols for planning and experience with hospital evacuation can be used to optimize these of capacities.

Chapter 8 describes evaluation practices of exercises and events. The lack of experience makes learning from evaluations a more or less theoretical exercise. It is however possible, if one wants to learn. To ensure effective evaluations it is possible to learn from international experience, not just experience with similar events but also experience with evaluation practice. Furthermore it is important to ensure that when evaluating for learning, learning is in theory and practice the objective to be attained. Often learning is said to be the goal, but instead evaluations are used for accountability. This diminishes the learning potential of an evaluation. Another point that is made is the importance of using similar evaluation methods for both exercises and real-life events. This makes coherence and continuity of learning possible. Learning should furthermore be a continuous process rather than an ad hoc once a year event. Take as many evaluation moments as possible and try to see what could be learned. This will enhance evaluation and learning capacities. Lastly, the chapter underlines that it is important to ensure that low probability, high impact events are not neglected when prioritizing events to plan for. In the Netherlands flooding is a rare but potentially catastrophic event for which they, particularly communities and their local emergency management professionals, should be prepared as much as possible. We need to make sure that these stakeholders are included in planning activities and evaluation practices.

Lessons from other countries about real flood response experience can be transferred and translated to the Netherlands to support realistic planning. The ideas contained in these chapters can be used within the Dutch context multiple layer safety strategy to define safety standards for emergency planning for flooding. These standards can be used to develop all kind of activities in the field of emergency preparedness for flooding and define

available budget and requirements. Activities for emergency preparedness for flooding can be planned on top of an all hazard approach to maximize the use of human intervention in case of a flood event. Possible activities are:

- Early warning procedures between authorities but also to the public and businesses
- Emergency planning such as planning for extreme water levels, flooding and evacuation, information management and flood risk assessments
- Continuous education, training and exercise programs for professionals, decision makers and citizens
- Building (or increase) local awareness and resilience in communities
- If we are to consider citizens as partners in safety, it is critical that governments engage openly with the public on such matters by making citizens more aware of the threat.

However the format and ambitions of safety standards for flood response planning and what risk level is acceptable, is a political choice. We suggest a public debate involving stakeholders about these standards and required activities taking into account costs and benefits. If we are to consider citizens as partners in safety, it is critical that governments engage openly with the public on such matters by making citizens more aware of the threat.

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Pauline T. Veldhuis-Beem

Prior to her temporary move to the U.S. in October 2008, Pauline Veldhuis was acting head of the Administration and Organization Division of the Department of the Interior and Kingdom Relations in the Netherlands. She has more than 17 years of experience in the field of emergency management. She worked for the municipality of Den Helder; the Den Helder Regional Fire Service in the province of Noord-Holland; and in several positions at the Department of the Interior and Kingdom Relations. Since moving to the U.S. she works one a week for the Department of Security and Justice. Between October 2009 and June 2011, Pauline was a senior research fellow at Virginia Tech with research activities conducted as part of the research agenda of the Netherlands-United States Water Crisis Research Network (NUWCReN). In the last two years, she has written several articles (in Dutch) for the Magazine National Safety & Security and Crisis Management of the Ministry, some of them as co-author. She is pursuing a PhD at the Radboud University in the Netherlands. Pauline holds a master's degree in Dutch Law (LL.M) earned at the University of Leiden in the Netherlands.

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Lucia earned a PhD in Public management from the University of Salerno, Italy where she discussed her dissertation on Network performance focusing on the case of waste management crisis in Campania Region, Italy. She is currently enrolled in the PhD program at the School of Public Policy and Administration focusing on Disaster Management. She joined the Disaster Research Center as research assistant as well as NUWCREN in 2009. Since then, she has been involved and proactively proposed and implemented new research. Her international research experiences are related to understanding the feasibility of vertical evacuation in partnerships with Japanese and Dutch scholars, and the impact of disaster subcultures on emergency management in the Netherlands. She has also been part of the field work research assessing the impact in Haiti in the aftermath of the January 12, 2010 earthquake. In the U.S context she is working at the "Collaborative Adaptive Sensing of the Atmosphere (CASA) Technology, Weather Forecasts, and Warnings: Integrating the End User Community" project and on the "Perception of the August 23, 2011 Virginia earthquake on the universities campuses in Virginia, Delaware and New York" where she is investigating warning systems related to different kinds of hazard, (tornado and earthquake) for which warning times vary. Within this framework she is also currently investigating how to enhance people's resilience trough a more comprehensive approach aimed at involving the whole community. Her research interests are vertical evacuation, disaster subcultures, warning systems, human behavior in disaster, flood management, network performance and public private partnerships.

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Hanneke is senior advisor Disaster Management for HKV Consultants. She is projectleader on several projects, related with flooding and safety. She organised and participated in several national and international network exchange meetings, workshops and flood exercises. Within the Flood Control 2015 programme she developed the Flood Warning Communicator, a tool for crisis communication with uncertain information during flood threats. She develops rules concerning integrating uncertainty in forecasts into crisis management procedures. With stakeholders she collects knowledge describing a probabilistic method to define procedures to alert, warning and alarm professionals and public, based on a cost benefit approach.

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Jeroen is assistant professor of climate, disaster and development at Wageningen University's Disaster Studies group, where he also gained his PhD on a thesis entitled The politics of flood insecurity. Framing river interventions. Warner directed a research project on multi-stakeholder participation in water management in four continents. This project led to the co-edited volume Multi-Stakeholder Platforms for Integrated Water Management that was published in 2007 by Routledge and the book Conflictos y Participación published by Nordan in 2004. In 2010 he published the book 'Water Politics' with Routledge (co-authored with Kai Wegerich) and in 2011 a commercial version of his dissertation, Flood Planning, with IB Tauris. Warner published in a variety of academic journals, including International Negotiation, Water International, Water Policy, Water Alternatives, Agriculture and Human Values and Disasters.

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Bart is a Disaster Studies research assistant at Wageningen University, where he completed his MSc in International Development Studies in 2011. During his studies, he conducted research on municipal cooperation in post-conflict areas and fragile states at IKV Pax Christi, and co-authored the publication Peace building – Democratization – Infrastructure (in Dutch). His Master thesis dealt with community formation in the Somali diaspora in the Netherlands. As research assistant, with Georg Frerks and Jeroen Warner, he did research on citizens and flood risk in the Netherlands, resulting in the NUWCReN reports Citizens and Flooding in the Netherlands, and The Politics of Vulnerability and Resilience. With Thea Hilhorst, he researched and wrote Livelihoods, basic services and social protection in the Democratic Republic of the Congo, for the Secure Livelihoods Research Consortium. Currently, he is involved in an article on what the Netherlands can learn from 'the South' in flood disaster risk reduction, as well as the evaluation of the impact of the Dutch MFS2 subsidies in DRC.

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Karolina Wojciechowska works at HKV lijn in water as a researcher/advisor. In 2007, she graduated at the University of Zielona Góra in Poland (Theoretical Mathematics) and the Delft University of Technology in the Netherlands (Applied Mathematics). Her interests are: probabilistic dike safety assessment, reliability calculation techniques, decision models and probability forecasting. Karolina partly works on a Ph.D. research "Solution methods to decision models", which main objective is to study decision-making models and to indicate their possible usability for decision-making in an operational flood risk context. Such decision-making is driven by many uncertainties; however, the uncertainties are usually not explicitly (i.e., mathematically) taken into account. Decision theory offers a variety of tools, which can be applied to decision-making under uncertainty. The main focus of the research is the concept of operational dike failure probabilities and models that support decision-making under uncertainty.

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