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▶ **To cite this version:**

Mathilde Gralepois, Corinne Larrue, Mark Wiering, Ann Crabbé, Sue Tapsell, et al.. Is flood defense changing in nature? Shifts in the flood defense strategy in six European countries. Ecology and Society, 2016. halshs-02284223

HAL Id: halshs-02284223
https://shs.hal.science/halshs-02284223

Submitted on 11 Sep 2019

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Gralepois, M., C. Larrue, M. Wiering, A. Crabbé, S. Tapsell, H. Mees, K. Ek, and M. Szwed. 2016. Is flood defense changing in nature? Shifts in the flood defense strategy in six European countries. *Ecology and Society* 21(4):37. https://doi.org/10.5751/ES-08907-210437

Research, part of a Special Feature on Toward More Resilient Flood Risk Governance

Is flood defense changing in nature? Shifts in the flood defense strategy in six European countries

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ABSTRACT. In many countries, flood defense has historically formed the core of flood risk management but this strategy is now evolving with the changing approach to risk management. This paper focuses on the neglected analysis of institutional changes within the flood defense strategies formulated and implemented in six European countries (Belgium, England, France, the Netherlands, Poland, and Sweden). The evolutions within the defense strategy over the last 30 years have been analyzed with the help of three mainstream institutional theories: a policy dynamics-oriented framework, a structure-oriented institutional theory on path dependency, and a policy actors-oriented analysis called the advocacy coalitions framework. We characterize the stability and evolution of the trends that affect the defense strategy in the six countries through four dimensions of a policy arrangement approach: actors, rules, resources, and discourses. We ask whether the strategy itself is changing radically, i.e., toward a discontinuous situation, and whether the processes of change are more incremental or radical. Our findings indicate that in the European countries studied, the position of defense strategy is continuous, as the classical role of flood defense remains dominant. With changing approaches to risk, integrated risk management, climate change, urban growth, participation in governance, and socioeconomic challenges, the flood defense strategy is increasingly under pressure to change. However, these changes can be defined as part of an adaptation of the defense strategy rather than as a real change in the nature of flood risk management.

Key Words: *change in policy; defense strategy; flood management; institutional theory; path dependence*

INTRODUCTION

It is a core expectation of European societies that they are able to protect themselves from disasters. Consequently, where flood risks pose serious threats, defense has been a central pillar of resistance. By "flood defense," we mean a specific strategy that aims to decrease the likelihood and/or the magnitude of flooding by keeping water away from people: infrastructural works that aim to resist water, such as dikes, dams, barriers, embankments and weirs, upstream retention, or the provision of more space for the water outside of protected areas (Hegger et al. 2013). With their embankments, dikes, or others fortifications, cities have been symbols of protection (Mumford 1961). Among the different flood risk management (FRM) strategies, e.g., prevention, mitigation, or preparation, flood defense could perhaps be said to best suit the conception of the "society of resistance."

However, the place of defense is changing. According to Beck (1992, 2006), today no European society can be described as completely resistant because it faces the risk of not being able to cope with a disaster. We can argue that the concept of a zero risk society has been superseded. According to Luhmann, societies become modern when they stop considering risk as something outside their control, i.e., fate and the past, which determines the future; instead it becomes a probability that must be faced (Luhmann 1993). Rather than merely building higher and higher levels of protection, with increasingly improving safety standards, modern societies must accept the possibility of defense failure.

This acceptance of the possible failure of defense and, with it, the idea of full protection, is accompanied by new policy concepts in the field of FRM. In the contemporary social and political science literature, we speak of vulnerability models (November 1994, 2004), especially in complex urban environments (d'Ercole et al. 1994, De Sherbinin et al. 2007, d'Ercole and Metzger 2009). The concept of vulnerability aims to evaluate the possibility of the disruption or interruption of the functioning and development of a territory. In the 2000s, the resilience concept, especially the part relating to the capacity to absorb, recover, and adapt, advanced a new approach in FRM. Hence, the vulnerability concept has been superseded by the resilience concept. Relating to the notions of social-ecological and evolutionary resilience (Folke 2006, Brand and Jax 2007, Folke et al. 2010, Hegger et al. 2014), the more holistic and overarching concept of resilience introduces the need to cope with risk, adapting human behaviors, and transforming urban societies, leading to the promotion of a variety of strategies for FRM. There is growing recognition of the need for change in the flood defense strategy stemming either from institutional and political discourses, or from the evolving social and economic needs of a resilient society. In this new paradigm, the flood defense strategy is no longer the only solution (European Union 2007).

Despite this changing nature, the specific evolution of flood defense as a strategy has received little analysis from either a social science perspective nor from a comparative study perspective. The majority of the literature on flood defense consists of articles from fields such as civil engineering, geology, or physical geography and is essentially concerned with managing the hazard, the statistical analysis of the risk, or of the (non)robustness of infrastructure, etc. (Hu et al. 2014, Cheetham et al. 2015, Van

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Table 1. Flood defense measures in the six selected countries.

Belgium	England	France	Netherlands	Poland	Sweden
Dike elevations Watercourse maintenance Water code Defense planning	Barriers including tidal surge barriers Embankments Flood walls Sluices Demountable defenses Conveyance engineering (e.g., dredging)	Compartment dikes Quay walls Retention basins outside the area to be protected Watercourse maintenance Weirs and dams, dikes	Compartment dikes Dikes, dunes Erosion prevention measures Nonprimary structures Polders Protection works Quay walls Retention basins outside the area to be protected Watercourse maintenance Weirs Widening, deepening, dredging Winter beds	Compartment dikes Quay walls Weirs Winter beds Watercourse maintenance	Dams (mainly nonpurpose) Temporary measures (sandbags, pumps) Dredging, ditches and embankments Wetlands (mainly nonpurpose)

From Alexander et al. 2015, Ek et al. 2015, Kaufmann et al. 2015, Larrue et al. 2015, Matczak et al. 2015, Mees et al. 2015.

Veelen et al. 2015). From a social science perspective, some authors have highlighted the technocratic paradigm that has long pervaded flood management institutions (Brown and Damery 2002) and have explored the evolution toward a more socio-technical variety of FRM alongside more traditional, centrally managed structural and technical measures (Nye et al. 2011). Taking an empirical and a comparative perspective, we aim to highlight institutional changes and pose the following questions. Has the defense strategy been replaced by other strategies or forced to adapt? To what extent are institutions in charge of flood defense ready to change flood defense as a strategy? Does it mean that the flood defense strategy has become less dominant among the FRM strategies or that a new approach within the flood defense strategy has appeared?

To address this knowledge gap, we propose to examine specific shifts in flood defense and the result of those changes through an institutional framework. The study presents a comparative analysis of the evolution of the defense strategy in six European countries relying on legal and bureaucratic systems: Belgium, England, France, the Netherlands, Poland, and Sweden.

DATA COLLECTION AND METHODS

The FRM strategies in the six countries were studied within the comparative data collection of the three-year research project, STAR-FLOOD, funded by the European Commission. To be able to compare the changes that have occurred within the flood defense strategy of the six countries, we organized our data collection around the four dimensions of the policy arrangement approach (PAA; Van Tatenhove et al. 2000, Wiering and Arts 2006, Wiering and Crabbé 2006). This allows us to evaluate if change has occurred or not in four interwoven or interrelated dimensions of a policy arrangement: actors and coalitions, rules, resources, and discourses. The actor dimension refers to the actors and their coalitions involved in the policy domain. The division of resources between them can lead to differences in their ability to influence policy outcomes. The rules dimension refers to the formal and informal procedures for decision making and routine interactions. The policy discourses entail views and narratives, norms, values, and problem definitions.

The six selected northern European countries (Belgium, England, France, the Netherlands, Poland, and Sweden) represent a variety of flood types. Although we do not aim to evaluate hydrological change exactly and specifically, we state that, facing a global increase in frequency, magnitude, and spatial distribution of floods, the six countries all are influenced by climatic and socioeconomic change; however they do not react similarly. The changes with regard to the flood defense strategy are also due to others factors. We study specifically internal institutional factors. The six selected countries also represent a variety of flood policies implemented from the 1980s to the 2010s. Whereas they have long-implemented defense strategies, and generally a common legal tradition and bureaucratic authority, the six countries' policies are based on different types of measures and different responsibilities for state, market, and civil society (see Table 1).

The empirical data used in this paper are based on the country and case study reports written in the STAR-FLOOD research project. Within this project, the researchers of the consortium have based their analysis on extensive interviews with stakeholders (50 interviews per country on average), observations, policy and legal document analysis, and workshops with practitioners. Because of length restrictions, the paper cannot elaborate on all the specificities of country and case study analyses on which it is based. No graphical or statistical presentation of results from interviews will be provided. However, we will make ample use of concrete illustrations from our extensive research. A more detailed presentation of the analysis can be found in the six publicly available project reports (Alexander et al. 2015, Ek et al. 2015, Kaufmann et al. 2015, Larrue et al. 2015, Matczak et al. 2015, Mees et al. 2015).

Based on the fieldwork of social scientists and legal scholars, the authors reflected together on how the defense strategy is implemented in their own country. The time period taken into account in the analysis for each country is approximately the last 30-35 years, depending upon the specific flood policy milestones. Taking into account these periods allows observation of patterns of change, and also stability, in the defense strategies within the countries through an empirical, inductive, and comparative

research approach structured on the four PAA dimensions (actors, rules, resources, and discourses).

CONCEPTUAL FRAMEWORK: HOW TO EXPLAIN INSTITUTIONAL CHANGE?

Studying change in the defense strategy is particularly interesting because it is often earmarked as the oldest, strongest, most institutionalized, and mostly dominant strategy for FRM in Europe and somewhat resistant to change. Until now, there has been no theoretical social science paper to systematically evaluate the degree of institutional changes in flood risk governance across a range of countries, by looking at the core dimensions of institutions (actors-coalitions, rules of the game, division of resources, and discourses).

The body of literature on which we draw our conceptual framework is institutional change theories. Such theories aim to clarify (lack of) societal evolution with arguments on the importance and complexity of institutions. For the purpose of this paper, we have selected one particular theory on institutional change, completed with two others, considering that they form a mainstream strand of literature. First, the long-term policy dynamics-oriented framework on institutional change by Streeck and Thelen (2005) will provide a general framework for explaining institutional change and stability. Further, we add to this framework a more structure-oriented institutional theory on institutional path dependency (North 1994, Levi 1997, Pierson 2000, Greener 2002) and a more policy actors-oriented analysis called the Advocacy Coalitions Framework (Sabatier and Weible 2007). Because the Policy Arrangement Approach combines attention for both actor and structure-related theories of change and offers a practical analytical framework for describing policy arrangements, we use the PAA to both assess and explain the changes or stability that have occurred in flood defense strategy in each country. In that context, we will refer to the four interrelated dimensions of policy arrangements, presented above: actors, rules, resources, and discourses (Van Tatenhove et al. 2000).

Streeck and Thelen (2005) developed a model aimed at analyzing institutional change through a typology of the results and processes of that change. This model enables assessment of the process of change (either incremental or abrupt) and the result of change, presented as continuity or discontinuity. For these authors, substantial change is defined as either temporary turmoil or as a relatively complete, radical, abrupt, and rapid change. The authors assume that abrupt changes often stem from exogenous factors, for instance, a catastrophic flood event, but can also come from endogenous factors, e.g., type of government, new legal law, etc. Nonsubstantial changes are minor, incremental, or adaptive. The two variables are important in light of the research goal: the process of change (abrupt or gradual) and the result of change, because they explicitly stress how the nature of changes can lead to different results. Related to the results of such changes, they are defined as either further development of a traditional pattern (continuous) or an (abrupt or steady) transformation of the policy domain (discontinuous). According to Streeck and Thelen's framework, amendments, additions, or revisions to existing sets of institutions characterize continuity in change, whereas discontinuity occurs when institutions either face breakdown, replacement, or more invisibly but substantially transform ("creeping change"). Highly visible, brutal change often leads to discontinuity, however, the authors teach us to be aware of other paces and other combinations of change trajectories. Table 2 presents all of the options.

Table 2. The process and result of change typology.

		Result of change	
		Continuity	Discontinuity
Process of change	Incremental	Reproduction by adaptation	Gradual transformation
	Abrupt	Survival and return	Breakdown and replacement

From Streeck and Thelen (2005).

Following the framework of Streeck and Thelen (2005), we first analyze the dynamics of change, i.e., incremental or abrupt, within the flood defense strategy in each of the six countries under study in the last 30-35 years to assess the result of change, i.e., continuity or discontinuity. This analysis is developed for each of the four PAA dimensions presented above. The framework of Streeck and Thelen is stimulating, concrete, and simple enough to address the comparison on flood management strategy. Therefore, it is well suited for in-depth empirical case studies. Moreover, it allows us to test all the options such as "radical change can lead to a continuous situation," but also "minor change to discontinuity."

The second theory that composes the Streeck and Thelen framework is the path dependency approach (North 1990, Pierson 1993, 2000). This refers to policies in which the "preceding steps in a particular direction induce further movement in the same direction" (Pierson 2000:252). This is especially important with regard to flood risk defense because this strategy is dependent on long-term investments in flood infrastructure (dams, dikes, embankments) and their technical and institutional management, including the security of technical expertise embedded in organizations and protected by rules of the game. This leads to high fixed costs and long-term increasing returns, which fosters stability. The path dependency model helps us explain more precisely how and why past decisions encourage policy continuity. Also, Streeck and Thelen (2005) explicitly refer to path dependency, explaining that continuity can come from radical but also minor changes. The historical development of technical flood infrastructure and engineering solutions for flood defense, with their high-cost investments, can make it difficult for policy makers to withdraw from this dominant strategy. As a result of path dependency it is generally difficult to change policies because institutions are resistant to change and actors may protect the existing model, even if it is suboptimal (Greener 2002). In the pattern of the general Streeck and Thelen framework, path dependency provides explanatory factors created by the legacy of flood defense, which may act to resist change.

The third theoretical analytical approach that deals with change focuses on the role of actors and coalitions: the advocacy coalition framework (ACF; Sabatier and Weible 2007). This framework suggests that certain advocacy coalitions (of politicians, civil servants, scientists, journalists, CEOs, NGOs, etc.) group around

a specific set of core beliefs where causations and values on the topic (floods) and in policy (risk management) are shared. These coalitions are formed because different policy relevant actors and different interests are linked to them. Policy change can be explained through the interactions between events in the external environment of a policy domain, for instance, economic crises, and the full translation of new ideas within the coalitions (developing new forms of FRM strategies. The inclusion of this final approach is considered to be important because the role of actor coalitions was found to be significant during the different case study analysis.

Specifically, in the case of the flood defense strategy, we evaluate first the result of transformation (discontinuity or continuity) by preferentially analyzing the factors calling for a more radical change and by observing whether those changes are present in all or some of the dimensions of the PAA. Then, we assess the nature of change (abrupt or incremental). The Streeck and Thelen double-entry framework allows us, in a first step, to consider if the position of the defense strategy is continuous or discontinuous, and then to assess the nature of change occurring in flood defense strategy. We address the question of how these changes can be described and if they lead to a continuous or discontinuous situation. The central proposition of this qualitative assessment is that the result of change should affect most, if not all, the four dimensions of the PAA. In a second step, we consider the explanatory factors that lie behind these dynamics of change, and analyze how these changes can be explained.

DYNAMICS REGARDING THE FLOOD DEFENSE STRATEGY IN SIX EUROPEAN COUNTRIES

Changes within the actor dimension

Flood defense is principally in the hands of governmental actors at the national or local level. In all of the countries studied, the national ministries and agencies belonging to the domains of the environment and/or public works are heavily involved in flood defense by setting rules and providing guidance regarding, e.g., dam safety. However, how flood defense is implemented in practice differs across the countries: from the domination of the national level in Poland and France, to responsibilities spread over a number of organizations in a layered structure in the Netherlands, Belgium, and England. In the Netherlands this is combined with a strong sector-based governance, e.g., a specific governmental layer for water management. Sweden is the only country in which flood defense measures are primarily managed and financed at the local level, e.g., municipalities, firms, individuals, or combinations thereof, depending upon to whom the land belongs and who needs to be protected.

From centralized to decentralized governance

Decentralization is a general trend in governance in Europe, and it is also observable in the management of flood defense. Particularly in England, responsibility for flood defense implementation are redistributed to include local governments. To a certain extent, in France, there is a transfer of responsibility. National-level authorities can delegate the management of defense infrastructures (especially minor fluvial dikes) when they are not highly prioritized in the national defense strategy. The decentralization trend is, however, less observable in Sweden, Belgium, and Poland. In Sweden, the responsibility of providing flood defense was already in the hands of municipalities at the very beginning of our study period. In Poland, flood defense responsibilities continue to be based at the national level. Belgium forms a somewhat specific case, given that it has undergone an intensive federalization process in the period of analysis. Flood defense responsibilities have been transferred from the national level to the regional level, but this transfer recentralized responsibilities at the regional level (Flanders, Wallonia, Brussels Capital).

Increased public participation

Flood defense is traditionally based on technocratic decision-making processes, and although this assertion still holds true today, a broadening of the actors in decision making can be observed. In each country, examples can be found of flood defense planning that include nongovernmental actors in decision making, e.g., the involvement of a nature conservation NGO in the development of the Sigma Plan in Belgium, cooperation with the World Wide Fund for flood risk mapping in Poland, and many examples in England where the involvement of nongovernmental actors is now the norm. With the exception of England, in most countries, this engagement mainly involves organized stakeholder groups without intensive forms of citizen participation.

From agricultural to environmental interest groups

Over the past 30 years, societal needs and activities have changed considerably, impacting the governance structure of flood defense. In most countries in our research, flood management has long been driven by agricultural interests, except in France, where flood defense has been implemented to ensure urban development. In England, flood defense in certain areas has also been performed by regional internal drainage boards whose major focus lies in the optimization of land for agricultural purposes. Similarly, in Belgium, the water management of non-navigable watercourses was in the hands of the Ministry of Agriculture (Crabbé 2008). Socioeconomic developments and the sustainability discourse led to a decrease in agricultural interests and an increase in environmental concerns. Consequently, reforms to the water management structure shifted the responsibilities in most countries under study toward environmental departments or were integrated under larger umbrella groupings (spatial development, infrastructure, and environment).

Changes within the rules dimension

Two changes can be observed in the transformation of the decision-making processes within the six countries concerning the formal and informal rules that guide the defense strategy, i.e., an evolution toward a more multirule system and the diffusion of responsibilities.

Toward a multirule approach

The evolution shows a shift from a legal requirement for defense infrastructures, essentially from the state and based on safety standards, to a broadening of legal requirements, i.e., the environment, preparation, or urban planning, stemming from different public authorities (multisector). The introduction of a risk-based approach in FRM leads to increased attention to spatial planning, preparedness planning, and emergency management. As a result, flood risk responsibilities are partially shared in different strategies and partially transferred to other

government departments. In particular, this evolution occurs in France and Belgium. In England, spatial planning and emergency management have already been playing a larger role in FRM for some time. In Sweden, where FRM is not a distinct policy area in itself, flood prevention has recently been explicitly incorporated in local legislation because, in Sweden, both spatial planning and flood preparation are primarily a concern for the local level. In the Netherlands, flood risk responsibilities remain primarily with the water sector, which is similar than in Poland.

The multiplication of the above requirements leads to an unclear situation, especially with regard to the safety standards for flood defense measures and also with the emergence of the concept of integrated systemic flood policy. Ambitious national safety standards for defense infrastructures are legally prescribed in the Netherlands and Poland. In the other countries, the defense infrastructure authority or the water managers determine the most appropriate protection level. In France, the rules on legal safety standards can change, depending on the local authorities in charge of the defense structures, and in Sweden, the local rules may define the requirements necessary to obtain a permit for water operations, which includes flood defense.

Furthermore, we observed a change in rules because of the emergence of a more systemic approach to water management and an increasing role of more diverse risk-based approaches relating to floods that lead to integration of strategies. In England, a holistic approach has been taken, while in Flanders (Belgium) and the Netherlands a multilayered safety approach has been adopted, although this remains at the pilot stage. To date, England is the only country to have legally integrated such diversified policies.

Diffusion of responsibilities

The broadening of the policy domains and the range of actors involved leads to a redistribution of the responsibilities concerning who is responsible for providing protection. Flood protection in the Netherlands and Poland remains a statutory duty of the state. The decentralization process in England shifts responsibilities to lower government levels such as Lead Local Flood Authorities, although (arguably) power continues to be centralized and authorities remain dependent on Local Government Finance Arrangements and must adhere to national FRM policy and project appraisal (Penning-Rowsell and Johnson 2015). In Belgium and France, clear responsibilities remain undefined, as though in a liminal position between the central and the local authorities. In Sweden, municipalities have responsibilities to ensure that citizens are safe.

Flood risk responsibilities are also increasingly shifting toward actors outside the government, i.e., the insurance sector and the citizens. A special change with regard to citizens' legal responsibility is occurring. In the past decade, in most countries, governmental actors have taken actions to make citizens responsible. This process involves both soft (awareness campaigns, etc.) and hard rules (legislation). In France, for example, the revised Act on Civil Security of 2004 states that citizens are responsible for their own safety. The authorities in England and Sweden mainly have permissive powers to provide flood defense, whereas citizens bear responsibility for their own safety.

Changes in the distribution of resources

Toward new allocation strategies for flood defense investments

Both investments in and the maintenance of flood defense infrastructure, place a large financial burden on FRM. However, flood events often tempt policy makers to claim that security has no price. This claim is especially observable in the Netherlands, where the Delta Program is investing 1 billion Euro a year mainly in flood defense measures such as dike enhancements. In other countries, however, investments in flood defense appear highly sensitive to the economic situation and other external factors. In England, the FRM budget, which had been on the rise since 2004, faced significant cuts following the elections of 2010 as a response to the global financial crisis (Bubeck et al. 2013). Between 2015 and 2021, the government plans to invest £2.3 billion in more than 1500 projects to reduce the risks of flooding or coastal erosion across England to more than 300,000 households (Defra 2016). However, there has been criticism of the government being reactive rather than proactive following recent flood events and a report by the House of Commons Environmental Audit Committee (2016) is sceptical that the Government will reach these targets. In turn, in Sweden, budgets for flood defense have decreased in recent years.

Consequently, we observe a change in the distribution of funding. In Poland and France, resources for flood defense remain fully funded by governmental levels. Since 2012, the defense infrastructure in England has been partly financed through partnership funding, whereby local authorities, businesses, and other nongovernmental actors at the local level cofinance investments. Flood defense in Sweden is financed by the municipality, the local property owner, or combinations of both.

An important issue in the allocation of flood defense spending is how to decide which areas are most worth investing in. These decisions are partly based on the ability of local actors to lobby for defense structures. In England, investments are, in part, based on the local capacity for partnership funding. A growing number of countries now pay increased attention to the use of cost-benefit analysis (CBA) to support investment decisions. Although CBA is already a common practice in England, it is now also emerging in the Netherlands, the Flemish region of Belgium, and Sweden. In the Netherlands, CBA sometimes has broadened the scope for flood defense measures, e.g., with side channels and dike relocations as at the time of Room for the River, but mostly CBA ends up supporting well-known measures such as dike enforcement. Interestingly, and in contrast, in Flanders (Belgium), the use of CBA is a catalyst in introducing a new approach in flood defense: no longer are large infrastructural works the norm; instead, a combination of local, small-scale defense construction and mitigation measures are being adopted.

New sources of expertise

Overall, in the six selected countries, flood defense is characterized as a highly technocratic strategy, primarily based on expert decision making and technical solutions. For example, knowledge of flood defense in the Netherlands is highly centralized because of the coordination and support from the national government. However, in recent decades, and in most countries selected, the expertise underpinning the flood defense strategy has also originated from different sources. Many national water managers now host internal knowledge institutions and are also supported

by a number of external partners, such as universities, consultancy firms, and civil society actors. Most water managers have undergone a shift in their staff composition; whereas they were previously bastions of hydro-technical engineers, new disciplines find their way into risk management, e.g., bioengineers, IT experts, biologists, public administration scholars, or social scientists.

"Defense is not the only solution": a new discourse?

As the fourth dimension of the PAA, the change in discourse is mainly related to a common trend toward a more encompassing management of flood risk that includes the consideration of socially and environmentally sustainable solutions, such as nature-based protection measures (Defra and Environmental Agency 2014).

Despite the rise of the risk-based approach and calls for prevention, mitigation, and preparation measures in the discourse, in practice, flood defense in most countries remains the cornerstone of FRM among the actor, rules, and power dimensions. Whether it is a statutory duty, citizens and public actors expect the government to protect them from flooding through structural protection measures, i.e., infrastructure. However, in the discourse and in all of the countries, it is clear that flood defense has changed in nature; the strategy is now (to greater or lesser degrees) increasingly embedded within a multisectoral flood risk management policy. Whereas in the past flood defense was focused on a limited set of technical measures and engineering options, today the actors in charge have connections to policy fields relating to prevention, mitigation, and preparation. Examples include the use of local diking structures accompanied by flood retention zones and building restrictions in less inhabited areas.

An overview of the four dimensions of the PAA on flood defense policy changes

Between 1980 and 2015, flood defense developed from a strategy that was based on a limited set of governmental actors, infrastructural measures, technocratic expertise, and investment strategies to the cornerstone of an integrated framework for FRM. It now shares responsibilities with other actors; adopts alternative solutions; and diversifies the requirements of the legislative framework and partnerships for funding. Interestingly, this evolution is observed in all of the different countries under study, although the process and the result of change differ significantly among them (Table 3).

In reference to Streeck and Thelen's typology, we generally assess the changes observed with the help of the four dimensions (in brief: actors, rules, resources, and discourses). The changes in the actor dimension are external. Decentralization and public participation are generalized in Europe, crossing many different public policies in the fields of ecology and environment. The change in the interests taken into account within the strategy, from agricultural to environmental actor coalitions, refers to a more internal change. In comparing the countries, even when we observe a discontinuous situation in Belgium and The Netherlands, the result of changes that are occurring maintain continuity with the previous situation in most cases.

The processes of change observed in the rules dimension of the flood defense strategy are also characterized as incremental and the general result of change shows a mostly continuous situation. In the Netherlands and Poland, there are marginal changes, e.g., further integrating water legislation, but no substantial changes in the nature or role of those rules. In both Belgium and France, first, a transfer from the national authority to other government departments has occurred, potentially using multiple and different legal sources. Second, there is a diffusion of responsibilities toward local authorities and citizens. However, to date, the transfer of legal responsibility has not seemed to lead to radical changes in the legal framework. In Sweden and England, the multiple-rules approach, which integrates and connects to different policy domains at various levels of governance (in Sweden, essentially local authorities), has existed throughout the time period studied.

The changes observed in the resources dimension also occur in a continuous mode, but a shift to decentralized levels is important almost everywhere. In Sweden and England, we observe a decrease in financial resources. In all of the countries, we observe at least a need for the introduction of new financial resources coming from local authorities, businesses, or nongovernmental actors. The implication is that, consequently, in Belgium and Sweden, new expertise on flood defense has for some time been fragmented over different governmental institutions. However, the flood defense strategy is more puzzling. Flood defense remains highly based on closed and expert-led decision making, where the introduction of new expertise does not imply a discontinuity in the defense policy trend, England being an exception here.

In most countries, we witnessed new discourses on flood risk management, but this does not always affect the core of flood defense strategy. Thus, the result of changes in discourses can be characterized as discontinuous, slightly in the case of Poland and heavily in the Netherlands, Belgium, and France, where a more integrative discourse on defense strategy is a new and strong phenomenon. In Sweden and England, the discourses on alternatives and changes from a predominant strategy on defense have been in existence for a long period of time and do not appear as a change. All in all, even when we observe all the processes of changes in the six countries, the result of change is more continuous than discontinuous.

EXPLAINING CONTINUITY AND DISCONTINUITY: AN INCREMENTAL AND PATH DEPENDENT CHANGE IN NATURE

We analyze the nature of change presented above through the lens of institutional theories and to analyze whether they are a change "in nature," i.e., real changes that have major and substantial effects in the policy dimensions. We refer to Streeck and Thelen's (2005) definition of an "abrupt change" as a complete and rapid change.

The combination of the general model with the two specific approaches stemming from institutional theories gives us a way to interpret the dynamics in flood defense that have emerged from the empirical material as presented above. Thanks to the conceptual insights and the analytical study from the authors of the path dependency literature, we observe two types of policy lock-in effects in the flood defense strategy: increasing returns effects, which are related to the financial crisis, and the stickiness of the institutional pattern, which is related to issues pertaining to the environment and climate change. From the ACF, we then

Table 3. Main outcomes from the dynamics of change for each country.

Type of change: continuity or discontinuity?	Actors	Rules	Resources	Discourses	Result of change
Belgium	Discontinuity: Integration of new actors	Discontinuity: Integration of several rules (environment, climate change, safety, etc.) / Transfer of ownership to local authorities	Continuity: Regional financial resources / Stability in financial resources / Entry of multiexpertise	Discontinuity: Toward an integrative multilayered strategy	Discontinuous situation
England	Continuity: Existing presence of multilayered strategy and integration of new actors	Continuity: Existing presence of multiple rules (environment, climate change, safety, etc.)	Continuity: Decrease in financial resources / Multipartnership financial resources / Existing presence of multiexpertise	Continuity: Existing presence of integrative defense strategy	Stable situation
France	Continuity: Predominance of national powers	Discontinuity: Transfer of ownership to local authorities	Continuity: National financial resources / Stability in financial resources / Entry of multiexpertise	Continuity: Predominance of beliefs in protection even with the introduction of an integrative perspective	Stable situation
Netherlands	Discontinuity: Integration of new actors	Continuity: Regional and national rules	Continuity: National financial resources / Stability in financial resources / National expertise	Continuity: Toward an integrative multilayered strategy	Stable situation
Poland	Continuity: Predominance of national powers	Continuity: National rules	Continuity: National financial resources / Stability in financial resources / National expertise	Continuity: Predominance of beliefs in protection even with the introduction of an integrative perspective	Stable situation
Sweden	Continuity: Existing presence of a local actor system	Continuity: National rules	Continuity: Decrease in financial resources / Local financial resources / Existing presence of multiexpertise	Continuity: No real discourse on the purpose of defense	Stable situation

learn how to explain the role of the core beliefs of the public administration coalition to elucidate the stability related to societal demand.

The increasing returns effects influencing the stability of the financial crisis context

For most of the countries, the availability of funding remains important in flood defense. As expected from the power of increasing returns (North 1990), we found that, despite the financial crisis, countries continue to spend money on flood defense. However, we can observe a trend of seeking alternative and less expensive nonstructural measures in a few countries (Flanders-Belgium and England). In general, there is strong continuity in development. For instance, in France, although the local Program for Action for Flood Prevention is meant to include different flood management strategies, defense infrastructures still account for more than half of the budget. Furthermore, in the countries that have most recently joined the European Union (EU), such as Poland in 2004, when there has not been sufficient investment from national governments, the EU has provided additional funds to the flood defense sector. In Poland, the problem focuses on the most sensible and effective manner in which the funds should be used. Unfortunately, as an effect of prolonged investments and procedures associated with the division of central or EU funds, money must be spent in a short period of time to be eligible for the next tranche of funding. This situation does not help in making innovative decisions in flood management. Additionally, it leads to the further entrenchment of well-known strategies, such as defense, and provides less opportunity to experience emerging strategies, such as mitigation. In other cases, however, EU investments have had the opposite effect. For instance, in Belgium and England, EU LIFE-projects have allowed innovative approaches that combine FRM and nature conservation.

In short, reductions in investments and the focus of funding still available for defense infrastructure can, in some countries, partially contribute to the mechanisms of path dependency. Past investments in infrastructures (dikes, levees, etc.) currently imply continuous investments at least to maintain their efficacy in the Netherlands. With the exception of England and Belgium, the limited degree of radical change within the flood defense strategy can be explained by reductions in investments, the concentration of resources in well-known solutions to address the short-term requirements of funders, and the strong coalitions of public authorities or technocratic expert-based knowledge. These create an increasing returns effect that, to date, does not allow a change in the nature of flood defense.

The stickiness of institutional design minimizing the environmental challenge and climate change issues

Pierson (1993, 2000) suggests that, once policies have been designed, they are change-resistant. Their designers have often built them on a pattern of "no alternative," particularly to avoid changes from their successors. Institutions are designed not only to be difficult to reverse in the future but also unattractive to reform. Changes in institutional patterns are very costly both for individuals and within the institutions themselves. We can observe a strong policy lock-in effect within the defense strategy, even if in each country the environmental discourse is increasingly influenced by concerns related to the hydrological impact of climate change and calls for an adaptation of defense strategy.

In Europe, it is clear that the geographical and meteorological context is changing and, consequently, the physical drivers of flooding are both reinforcing the calls for diversification of FRM strategies. The role of flood as a shock event is a factor of change. For instance, in Sweden, the national commission on risk and vulnerabilities with regard to climate change, finalized in 2007, contributed to placing the expected consequences of climate change, such as increased flood risks, on the agenda. Although past flood events assist in leading to changes in the flood risk policy, by acting as internal shocks, more often they are facilitating events, or "windows of opportunity" (Kingdon 1995), that enable the policy to be changed rather than act as an absolute driver for change. In the case studies, the increase of hydrological events does not result in a radical turn of FRM, but gradually transforms it toward fewer structural protection measures and toward a more integrative nonstructural strategy.

There is a spirit of change toward a more system-based approach because of the growing importance of sustainability, environmental values, and the possibilities of creating solutions by working with nature (Defra 2014, Wilkinson et al. 2014). In England, the Making Space for Water policy (2004) aimed to develop such a comprehensive, integrated, and forward-thinking strategy for managing future flood risk and integrating these activities into an overall approach to managing flooding more generally. The same tendency exists in the Netherlands with the Room for the River policy. Even if awareness of climate change and the value of environmentally friendly approaches are increasing as a response to the consequences of flooding, the engineered infrastructure of protection remains a dominant response. In The Netherlands, the strong tendency toward nature-friendly measures and room for the river projects has, over the last few years, died down again and recent governmental priorities are back to "safety first." In general, we observe a strong path dependency in the choices of flood management for the traditional defense strategy. The gap between the national institutional discourses, through expertise or influential reports, and local implementation in terms of distribution of resources and rules, explains that even if the process of change seems radical, the result of change is mostly continuous. For instance, in England, an influential Institution of Civil Engineers report (2001) suggested that the country should no longer continue to rely solely on flood defense and that natural processes could be better used to manage flood risk. The report reinforced the continued move toward the desire for a more sustainable flood risk management that can only be achieved by better working with the natural system. It represented an acceptance of the fact that floods cannot be prevented and that communities at flood risk must learn to live with flooding. Nevertheless, in the English Hull case study, where past flood events include the 1953 and 2007 floods, the physical setting has been a key factor in shaping the approach to land drainage and hard-engineered defenses, without which development in the area would not have been possible. In many cases, the argument of the local reality in terms of the need for development, specific geographical patterns, increased awareness of risk among local stakeholders could not influence the change toward a system-based approach.

The stickiness of flood defense is explained by the levee effect (Burby 2000) or the escalator effect (Parker 1995). Investments in defense infrastructure stimulate human spatial development in flood-prone zones, which in turn forces water managers to continuously invest in the maintenance and further development of this defense infrastructure (White 1945, Bubeck et al. 2013). This levee effect also appears as a significant explanatory factor in the case studies investigated in this research.

The core beliefs of the technocratic expertise coalition

The advocacy coalition framework explains that actors involved in policy gather in coalitions joined by specific normative and scientific core beliefs and policy beliefs (Sabatier and Jenkins-Smith 1993) that want to influence the political and policy order. In general, flood defense doctrine and strategy depend entirely on state administrations or agencies. It is a highly expert-based strategy and government-driven policy. The core beliefs are especially strong because, as fundamental reasons to be committed to in policy, they are very unlikely to change (Sabatier and Weible 2007, Sabatier 2014). The flood defense strategy is traditionally framed by public administration, and especially by the national level. Except in the cases of Sweden (the importance of the local administration) and England (the multiactor system), in each of the countries under study, the national administration is predominant in expertise. Traditional actors in flood defense share a common core belief system with regard to the importance of technocratic expertise. This helps to explain the stickiness of the technocentric policy regime and indicates why this is a small transition in power. Even when the spectrum of actors is increasing, there remains not only a lack of integration of the external needs from other government departments, e.g., spatial planning or emergency response, but also a lack of civil society involvement in many countries.

The actor coalition organized around a focus on technocratic expertise gives little room for a window of integration for nongovernmental actors such as NGOs or private companies, public consultation, and participation in decision-making processes in flood defense. We interpret this limit of integration as an explanation of the resistance to change. For example, flood defense investments in Poland sometimes involve public participation procedures, but more often, they result in controversies and protests. The protests advocate NIMBY (Not In My Backyard) sentiments, and projects disregard peoples' interests because of the tradition that decisions should be undertaken by experts. Environmental NGOs attempt to fill this gap in public participation; however, they are perceived by the state administration and services as brakes on all action. In those countries where there is little openness in the decision-making process, the dominant position of the defense strategy is robust

and explains the resistance to change. Countries where there is more openness of the political system and less dominance of flood defense show interesting examples of public participation, and illustrations of more radical changes. For example, in the northern England town of Pickering a project to address local flood risk involved the formation of local focus (competency) groups. The project demonstrated enhanced stakeholder participation through introducing the concept of collaborative coproduction of knowledge (Lane et al. 2011). In 2007 the coproduction of knowledge model was practically tested in the town, the output of which was so successful that it resulted in implementation of viable local solutions to flooding (Whatmore and Landström 2011).

CONCLUSION

Changes in risk perceptions, hydrological impacts from climate change, growing urban expansion, and participation challenges have increasingly put pressure on the traditional flood defense strategy. This paper explores and compares the changes the flood defense strategy has undergone in six European countries. We ask whether the strategy is shifting toward a discontinuous situation or not, and whether the process of change is in nature more incremental or radical.

In each country, the defense strategy is an outcome of governance arrangements, which are characterized by a specific set of ingredients that consist of actors, power and resources, rules, and discourses. These arrangements are challenged by a number of developments: administrative decentralization, financial constraints, the democratic deficit, and environmental, developmental, and spatial challenges. This dynamic influences the defense strategy, which, in all countries, is somehow becoming much broader and more open, creating more room for local, private, and individual responsibilities (as opposed to concentrating power and resources in technocratic state hands) and promoting a discourse of more diverse modes of protection.

However, we indicate that changes within the flood defense strategy are very heterogeneous among and within countries. Some of the countries observed have in the last 30–35 years clearly been moving toward a path of change in terms of actors, rules, discourses, and resources (Belgium or England), whereas others are shifting in one or two of these dimensions only (Sweden, the Netherlands, France, Poland). In all countries, the change taking place in the flood defense strategy has not led to a discontinuity in FRM but has occurred incrementally. Defense measures remain a founding principle of FRM in every country and the first method of protecting populations and human activities. With the exception of England, which has for a long time diversified FRM, the defense strategy remains dominant. However, it is complemented by other measures to provide a more efficient and effective policy, e.g., spatial planning measures and disaster management. Hence, we can conclude that the rise of the FRM discourse has not led to a replacement of flood defense as a dominant strategy. Rather, it has shifted its position from a solo strategy to a central strategy within the FRM framework.

The stickiness of the flood defense strategy can be explained by factors of path dependency. This path dependency can be found both in the actors, rules, and resources dimensions. Strongly established actor coalitions, a solid institutional design centered around flood defense, and sunk costs of flood defense investments made in the past, hamper a radical shift toward new flood risk strategies.

In conclusion, we assert that the classical role of flood defense remains dominant at a general level; at the least, it is a cornerstone in flood management. However, the position of flood defense is very gradually shifting. Changes can be defined as part of an adaptive strategy of "resilience as resistance" rather than as a real change in nature toward diversified flood risk management, given that it is often promoted in a broader understanding of resilience and integrated flood management.

Responses to this article can be read online at:
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