



Knowledge
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Integrated, transboundary climate-adaptation governance

Exploring essential steps for the development of a cross-border and integrated climate-adaptation strategy



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Integrated, transboundary climate-adaptation governance

Exploring essential steps for the development of a cross-border and integrated climate-adaptation strategy

Marjolein van Eerd, Mark Wiering and Sander Meijerink¹

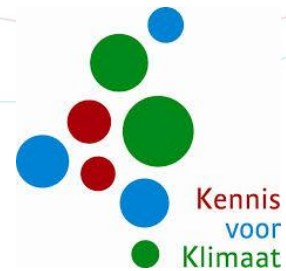
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1. Samenvatting

Dit rapport is het einddocument van het Kennis voor Klimaat onderzoek HSGR 3.3 uitgevoerd door de Radboud Universiteit Nijmegen – in samenwerking met ISIS (Institute for Science, Innovation and Society). In dit rapport wordt onderzoek gedaan naar de benodigde eerste stappen en afwegingen voor de ontwikkeling van een geïntegreerde en grensoverschrijdende aanpak van klimaatverandering in het perspectief van de Europese Klimaatadaptatie Strategie.

Het is duidelijk dat de effecten van klimaatverandering gevolgen zullen hebben voor verschillende sectoren in de maatschappij en dat deze effecten bovendien niet zullen stoppen bij regionale of nationale grenzen – een voor de hand liggend voorbeeld is dat overstromingen niet zullen stoppen bij landsgrenzen en dat deze van invloed zijn op bijvoorbeeld transport, leefbaarheid, natuur en landbouw. Aanpassing aan klimaatverandering (klimaat adaptatie) vraagt daarom om een geïntegreerde en grensoverschrijdende benadering. Op dit moment is het Deltaprogramma het belangrijkste onderdeel van klimaatadaptatie in Nederland en dit programma is voornamelijk toegespitst op water vraagstukken – hoogwaterbescherming en zoet water voorziening- en klimaat aanpassing in het stedelijk gebied. Daarnaast heeft Nederlandse overheid een Klimaatagenda ontwikkeld in 2013, waarbij ingegaan wordt op mogelijkheden voor mitigatie en adaptatie. België en Duitsland hanteren – in vergelijking met Nederland – een bredere aanpak van klimaatadaptatie. (In de praktijk blijken zij echter ook meestal sectorale methoden te gebruiken). Het belang van de ontwikkeling van een omvangrijke klimaatadaptatie strategie op lidstaatniveau, waarbij grensoverschrijdende aspecten mee genomen worden, wordt benadrukt in de Europese Klimaat Adaptatie Strategie (2013). Naar aanleiding hiervan zullen de lidstaten een geïntegreerde nationale klimaat adaptatie strategie moeten ontwikkelen voor 2017 en heeft het Nederlandse Ministerie van Infrastructuur en Milieu gevraagd om een onderzoek naar de benodigde bouwstenen voor de ontwikkeling van een geïntegreerde, grensoverschrijdende klimaat adaptatie strategie. Doel van dit onderzoek is om de eerste stappen voor de ontwikkeling van een dergelijke strategie in kaart te brengen. Dit is gedaan met behulp van een literatuur studie naar de noodzaak en mogelijkheden voor een grensoverschrijdende en geïntegreerde aanpak van klimaatverandering, een analyse van de methoden van ‘best practices’ op het gebied van klimaatadaptatie en een inventarisatie van kansrijke grensgebieden voor de ontwikkeling van een dergelijke strategie op regionaal niveau. Wij concluderen dat er op dit moment geen voorbeeld is van een holistische, grensoverschrijdende en geïntegreerde aanpak van klimaatverandering, dat verschillende grensregio’s potentie hebben voor de ontwikkeling van een klimaat adaptatie strategie en dat de karakteristieken van klimaatverandering vragen om het heroverwegen van bestuurlijke keuzes omtrent klimaatadaptatie in Nederland. Het Deltaprogramma en de Klimaat Agenda kunnen echter wel als basis dienen. Vervolgens zijn drie concrete cases geanalyseerd – de grensoverschrijdende dijkkring 48, Rijnstrangen en het project ‘Dijken voor de toekomst’ – die tezamen verschillende aspecten omvatten van grensoverschrijdende en geïntegreerde klimaat adaptatie. Het rapport is gestructureerd met behulp van de bestuurlijke keuzes die worden onderscheiden door Jordan et al. (2010). Hierbij gaat het om probleem perceptie, schaalniveau, een sectorale aanpak of een geïntegreerde aanpak, timing, wijze van bestuur en instrumenten, kosten en baten, implementatie en handhaving.

Wij concluderen dat er voor de eerste bestuurlijke keuze – probleem perceptie- gestreefd moet worden naar het creëren van een gemeenschappelijk begrip van het probleem en de noodzaak tot klimaatadaptatie. Hierbij is van belang om begrip te creëren voor verschillende visies, normen en methoden van actoren, met name wanneer er meerdere landen betrokken zijn. Gezamenlijke kennisvergaring en het organiseren van bijeenkomsten, workshops, klimaat ateliers et cetera zullen bijdragen aan begrip en een gedeelde kennisbasis. Kennisontwikkeling en het delen van kennis is met name belangrijk voor een complex probleem, zoals klimaatverandering dat omgeven is door onzekerheden. Bovendien is het belangrijk om meer bewustzijn te creëren voor klimaatadaptatie, door het onderwerp transparanter en tastbaarder te maken (bijvoorbeeld via workshops, apps, map tables en voorbeeld projecten). Positieve framing van klimaatadaptatie zal leiden tot een grotere betrokkenheid van actoren en de creatie van win-win situaties. Policy entrepreneurs kunnen daarnaast zorgen voor de noodzakelijke verbindingen en agendering.

Voor wat betreft het schaalniveau voor klimaat adaptatie, blijkt dat een aanpak op meerdere levels noodzakelijk is. Zo bestaan er op internationaal niveau verschillende samenwerkingsverbanden (multilateraal en bilateraal niveau) en deze kunnen ook gebruikt worden –als startpunt - voor samenwerking met betrekking tot klimaat adaptatie. Het nationale overheidsniveau is verantwoordelijk voor de ontwikkeling van een nationale adaptatie strategie en de afstemming op internationaal niveau. Op dit niveau spelen ook het Deltaprogramma en de bestaande Klimaatagenda een grote rol, welke een solide start kunnen vormen voor de ontwikkeling van een strategie in het perspectief van de Europese Klimaat Adaptatie Strategie. Daarnaast zullen de effecten van klimaatverandering het meest tastbaar zijn op regionaal en lokaal niveau, dus betrokkenheid van actoren op dit niveau is eveneens noodzakelijk – bijvoorbeeld participatie van waterschappen, provincies en gemeenten. Wij concluderen dat provincies – vanwege hun bevoegdheden op het gebied van ruimtelijke planning en milieu en hun positie in de regio- een trekker en coördinator kunnen zijn voor de ontwikkeling van een adaptatie strategie.

Daarnaast zal er gekozen moeten worden voor een sectorale of geïntegreerde aanpak van klimaat verandering. Op dit moment hanteert Nederland een overwegende sectorale aanpak, met veel prioriteit voor water management en deze focus stimuleert daadkrachtig handelen – bijvoorbeeld doordat actoren en middelen gebundeld zijn in het Deltaprogramma. In de Klimaat Agenda worden eerste stappen gezet om ook andere sectoren aan te pakken, zoals hittestress, steden en vitale netwerken. Echter, de Europese Klimaat Adaptatie Strategie verplicht Nederland om een uitgebreide klimaat adaptatie strategie te ontwikkelen, bovendien zal deze verplichte integratie van sectoren in theorie leiden tot gunstigere uitkomsten. Aan de andere kant zal de ontwikkeling van een geïntegreerde strategie een langduriger en stroperig besluitvormingsproces veroorzaken, waarbij voorkomen moet worden dat uiteindelijk besloten wordt tot een marginale verandering of handhaving van de status quo. Het koppelen van partijen en sectoren kan leiden tot financiële voordelen en win-win situaties. Kosten en baten moeten tijdig bediscussieerd worden tijdens het ontwikkelingsproces, omdat klimaatadaptatie kan leiden tot winnaars en verliezers, welke mogelijk gecompenseerd moeten worden. Daarnaast kunnen diverse externe financieringsmogelijkheden overwogen worden (o.a. op Europees niveau).

Voor wat betreft de timing van handelen is er nu een goed momentum voor de ontwikkeling van een strategie – met name door de start van de implementatie van het Deltaprogramma, de verplichtingen uit de Europese Adaptatie Strategie en het aanwezige besef met betrekking tot klimaatadaptatie in de maatschappij. Klimaat adaptatie maatregelen kunnen verweven worden in lopende ontwikkelingen, programma's en plannen. Het tijdig betrekken van (buitenlandse) actoren is noodzakelijk voor (maatschappelijk) draagvlak evenals het plannen van klimaatadaptatie acties op de korte, middellange en lange termijn. Een 'zooming in and out' aanpak kan gehanteerd worden; een lange termijn strategie als stip op de horizon met verschillende korte termijn (pilot) projecten voor directe en zichtbare actie. Het focussen op de lange termijn kan leiden tot kostenbesparingen.

Dit onderzoek laat duidelijk zien dat er geen blauwdruk bestaat voor klimaatadaptatie, dat rekening gehouden moet worden met regionale karakteristieken en dat een combinatie van bestuurlijke methoden en instrumenten nodig is – bijvoorbeeld een koppeling van individuele en collectieve, publieke en private adaptatie. Bovendien is een flexibele en robuuste strategie gewenst in verband met de toekomstige onzekerheden omtrent klimaatverandering. De ontwikkeling van een strategie kan voortbouwen op verschillende programma's en instrumenten, zoals de Adaptieve Delta Management en regio processen van het Deltaprogramma, de inzichten uit de Klimaatagenda, instrumenten en kennis voortkomend uit het onderzoeksproject Kennis voor Klimaat, ervaring uit het Waalweelde programma enzovoorts.

Ook over de implementatie van een klimaatstrategie moet al tijdig nagedacht worden. Zo moeten discussies gaan over de haalbaarheid van de strategie. Bovendien zal duidelijk afgestemd moeten worden over verantwoordelijkheden wanneer meerdere actoren op meerdere niveaus betrokken zijn bij klimaatadaptatie. Concluderend, de karakteristieken van klimaatverandering vragen om het heroverwegen van de huidige klimaat adaptatie aanpak in Nederland, met name met betrekking tot de aspecten van grensoverschrijdende samenwerking en integratie. Dit rapport geeft inzichten in de (on)mogelijkheden voor het ontwikkelen van een dergelijke strategie.

2. Zusammenfassung

Das vorliegende Dokument ist der Abschlussbericht der 'Kennis voor Klimaat' Forschung (HSGR 3.3), geleitet durch die Radboud Universität Nijmegen – in Zusammenarbeit mit ISIS (Institute for Science, Innovation and Society). Diese Studie hat die notwendigen Schritte und Abwägungen zur Entwicklung einer integrierten und grenzüberschreitenden Klimawandelanpassungsstrategie in Bezug zur Europäischen Klimawandelanpassungsstrategie untersucht.

Da einige Probleme (z.B. Wasser, Transport, Umwelt) nicht an der Grenze stoppen, kann Klimawandel auch als trans-nationales Problem gesehen werden. Neben dem grenzüberschreitenden Gesichtspunkt erfordert Klimawandelanpassung auch die integrale Betrachtung von verschiedenen Themen, wie Wasserqualität und –quantität, Transport, Natur und so weiter. Deshalb erfordert Anpassung an den Klimawandel einen integrierten und grenzüberschreitenden Ansatz. Zurzeit ist das 'Deltaprogram' das wichtigste Instrument zur Anpassung an den Klimawandel in den Niederlanden. Dieses Programm konzentriert sich vor allem auf die Wasserproblematik – Hochwasserschutz und Frischwasserversorgung – und Klimaanpassung im Stadtgebiet. Und in die Klima Agenda (2013) setzt die niederländische Regierung erste Schritte in Richtung eines umfassenderen Ansatzes. Belgien und Deutschland verwenden – im Vergleich mit den Niederlanden – einen ganzheitlichen Ansatz zur Anpassung an den Klimawandel. In der Praxis sind ihre Methoden oftmals auch auf Sektoren konzentriert. Die Europäische Union hat die Bedeutung dieser grenzüberschreitenden Zusammenarbeit und Integrierung der Themen beim Klimaschutz in einer europäischen Anpassungsstrategie (April 2013) hervorgehoben. Jeder Mitgliedsstaat soll bis 2017 eine nationale Klimaanpassungsstrategie entwickeln. Dafür ist die Koordinierung und Angleichung der Strategien zwischen den verschiedenen Mitgliedsstaaten erforderlich.

Das niederländische Ministerium hat uns beauftragt, zu erkunden, wie eine integrierte, grenzüberschreitende Klimawandelanpassungsstrategie entwickelt werden kann. Ziel dieser Studie ist die Identifizierung von Bausteinen für die Entwicklung einer grenzüberschreitenden, integrierten Klimaanpassungsstrategie. Für diese Studie haben wir zuerst den Nutzen und die Notwendigkeit einer integrierten und grenzüberschreitenden Klimaanpassungsstrategie untersucht. Danach erarbeiteten wir eine Bestandsaufnahme der aktuellen Methoden (à la best practices) für integrierte und/oder grenzüberschreitende Zusammenarbeit. Für diese Studie identifizierten wir auch interessante und vielversprechende Grenzgebiete. Wir haben Rijnstrangen (in den Niederlanden), das Project 'Deiche für die Zukunft' und den grenzüberschreitenden Deichring 48 als Fallbeispiel gewählt, um das Potential für integrale, grenzüberschreitende Klimawandelanpassungsstrategien zu untersuchen. Wir schließen daraus, dass es derzeit kein Beispiel eines ganzheitlichen, grenzüberschreitenden und integrierten Ansatzes für Klimawandelanpassung gibt, dass mehrere Grenzregionen Potenzial für die Entwicklung einer Klimaanpassungsstrategie haben und dass die Eigenschaften von Klimawandel ein Überdenken der Verwaltung erfordern.

Dieser Bericht wurde mit Hilfe der administrativen Entscheidungen von Jordan et al. (2010) strukturiert. Dies beinhaltet die Problemwahrnehmung, Maßstab, einen sektoralen Ansatz oder einen integrierten Ansatz, Zeitpunkt, Art der Verabreichung und Instrumente, Kosten und Nutzen, Anwendung und Durchsetzung. Wir schließen daraus, dass zuerst die Problemwahrnehmung, d.h. ein gemeinsames Verständnis des Problems und die Notwendigkeit für Klimaanpassung erstellt werden müssen. Es ist wichtig Verständnis über verschiedene Ansichten, Normen und Methoden der betroffenen Parteien, insbesondere wenn mehrere Staaten beteiligt sind, zu schaffen. Wissensentwicklung und Austausch von Erkenntnissen ist besonders wichtig, um ein komplexes Problem wie den Klimawandel gemeinsam anzugehen. Austausch von Informationen, Organisierung von Tagungen, Klima-Workshops etc., werden zum gemeinsamen Verständnis beitragen. Positive Gestaltung der Anpassung an den Klimawandel führt zu einer größeren Beteiligung der Akteure und die Schaffung von mehr Win-Win-Situationen.

Im Hinblick auf die Skala für Klimaanpassung scheint es, dass Klimawandel auf mehreren Ebenen notwendig ist. So gibt es mehrere Partnerschaften auf internationaler Ebene (multilaterale und bilaterale), die als Ausgangspunkt für Klimawandelanpassung dienen können. Die nationalen Regierungen sind verantwortlich für die Entwicklung einer nationalen Anpassungsstrategie und Koordinierung auf der internationalen

Ebene. In den Niederlanden wurde das Deltaprogramm auf dieser Ebene entwickelt, was ein solider Start für die Entwicklung einer Strategie sein kann. Die Folgen des Klimawandels werden vor allem auf lokaler und regionaler Ebene spürbar sein, deshalb ist die Einbeziehung der Akteure auf dieser Ebene notwendig – z.B. Länder, Städte, Bezirksregierungen und Deich- und Wasserverbände. In den Niederlanden können die Provinzen, aufgrund ihrer Verantwortung für Raumplanung und Umwelt, ein Koordinator für die Entwicklung dieser Strategie sein.

Es sollte ein sektoraler oder integrierter Ansatz gewählt werden. Die Niederlande unterhält derzeit einen meist sektoralen Ansatz, mit einer hohen Priorität für Wassermanagement. Dieser Fokus fördert entschlossenes Handeln – z.B. Akteure und Mittel sind konzentriert im Deltaprogramm. Die europäische Anpassungsstrategie allerdings, verpflichtet die Niederlande, eine umfassende Klimaanpassungsstrategie zu entwickeln. Auch die Fachliteratur bestätigt, dass die Integration von Sektoren zu positiveren Ergebnissen führt. Andererseits, bei der Entwicklung einer integrierten Strategie werden Entscheidungswege und -dauer verlängert. Kosten und Nutzen sollten während des Entwicklungsprozesses rechtzeitig besprochen werden, da die Anpassung an den Klimawandel zu Gewinnern und Verlierern führt. Außerdem können verschiedene externe Finanzierungsquellen in Betracht gezogen werden (z.B. auf europäischer Ebene).

Diese Studie zeigt deutlich, dass kein eindeutiger Plan für die Anpassung vorhanden ist, dass eine Strategie die regionalen Besonderheiten berücksichtigen muss, dass eine Kombination von verschiedenen Verwaltungsverfahren und Werkzeugen benötigt wird – zum Beispiel eine Kombination von individueller und kollektiver, öffentlicher und privater Anpassung. Auf Grund der zukünftigen Unsicherheiten in Verbindung mit dem Klimawandel, wird eine flexible und robuste Strategie benötigt.

Die Entwicklung einer Strategie kann auf verschiedene Programme und Instrumente aufbauen, z.B. Deltaprogramm, Erfahrungen von Kennis voor Klimaat, dem Waalweelde Programm und mehr.

Auch über die Umsetzung einer Klimastrategie sollte bereits frühzeitig nachgedacht werden. Deshalb sollten sich die Diskussionen auf die Durchführbarkeit der Strategie konzentrieren. Außerdem sollten Verantwortlichkeiten von Akteuren auf mehreren Ebenen verknüpft werden.

Abschließend, die Eigenschaften des Klimawandels fragen nach einem Überdenken der heutigen Klimaanpassungsstrategie in den Niederlanden, vor allem Aspekte im Bezug auf grenzüberschreitende Zusammenarbeit und Integration von Sektoren sind dringend und sollten berücksichtigt werden. Dieses Dokument gibt Einblicke in die (Un-)Möglichkeiten für die Entwicklung einer solchen Strategie.

3. Introduction

This research report is the final outcome of phase two of the Knowledge for Climate HSGR 3.3 research project, realised by the Radboud University Nijmegen – supported by ISIS (Institute for Science, Innovation and Society). This research was requested by of the Ministry of Infrastructure and Environment (henceforth I&M). [Phase one of this Knowledge for Climate research project was published in June 2014 and focused on the [transboundary aspects of water safety](#) – an assessment of the state of the art of cross-border cooperation on water safety in the Rhine and Meuse catchments.] This is an interactive report; by clicking on the hyperlinks (blue and underlined) readers will gain more in-depth knowledge via videos, websites or documents.

3.1 Climate change and shifting challenges at the border

Reports of the Intergovernmental Panel on Climate Change (henceforth IPCC) suggest clear evidence of climate-change impacts (IPCC, 2007; 2013). Rising greenhouse-gas concentrations from human activities are causing large-scale changes to the Earth's climate system (Cooley et al., 2009). Climate change is likely to exacerbate existing pressures (Roberts and Sanchez, 2014). Examples of the effects of climate change could be changing variabilities around the availability and quality of fresh water, a rise of the global average air and ocean temperatures leading to melting ice and snow and rising sea levels, more extreme weather events (e.g. flooding, heat waves and cyclones are becoming more frequent), shifting precipitation patterns etc. (Cooley et al., 2009; Drieschova et al., 2009; Roberts and Sanchez, 2014). Thus, global hydrologic and ecological systems are changing. Climate-change effects will impact the liveability of urban and rural areas, water management, agriculture, nature, as well as mobility. For instance, longer and hotter summer periods could lead to 'heat islands' in urban areas, leading to health issues (especially for vulnerable groups such as the elderly) (KNMI, 2014; Ligtvoet et al., 2013; Nijhuis, 2011). Climate change poses significant challenges to traditional modes of planning and governance, as it has the potential to act as a threat multiplier on current spatial, social and environmental challenges (Gasper, Blohm and Ruth, 2011). Other challenges are that climate change will affect multiple sectors and levels of society (Lim et al., 2004) and the effects of climate change will not stop at man-made, historical or territorial borders. Adaptation to climate-change effects is defined by the IPCC as '*adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*' (IPCC, 2007, p.869). Policies for adapting to climate-change effects, in short 'climate adaptation', consist of initiatives and measures that reduce the vulnerability of natural and human systems to climate-change effects. Adaptation is a process by which individuals, communities and countries seek to cope with the consequences of climate change, overcoming future costs and damages. Adaptation processes are not new; throughout history people have always been adapting to changing climatic conditions. The new aspect of today's climate adaptation is the idea of incorporating future climate risks into policy-making and thus dealing with ambiguities and uncertainties (Ligtvoet et al., 2013; Lim et al., 2004; Steele et al., 2014). In this study, we often refer to climate-adaptation governance, whereby governance is defined as '*the patterns that emerge from the governing activities of social, political and administrative actors*' (Kooiman, 1993, p.2). Climate adaptation is related to mitigation, the latter meaning an intervention to reduce the causes of climate change (IPCC, 2014). Mitigation is important, but not sufficient, as it will be impossible to reduce all climate-change effects quickly enough. Even though this report focuses on climate adaptation, it should be recognised that the linking of adaptation and mitigation measures could lead to new opportunities.

3.2 Climate-adaptation governance in the Netherlands

The Delta Programme is the key element in Dutch climate-adaptation policies, focusing particularly on water safety, fresh water supply and the climate-proofing of urbanised areas. This programme was created for adapting to climate change and originated from an advice of the so-called Second State Delta Commit-

tee, which investigated the expected effects of climate change on the Dutch water household. The nationwide Delta Programme is developed by the national government, provinces, municipalities, water boards and private actors that participate in this programme to protect the country from flooding and to ensure adequate fresh water supplies. The programme is under the coordination of the Delta Commissioner and supported by a Delta Act and Delta Funding. The programme proclaims a 'down-to-earth' realistic approach, often named 'adaptive delta management'. Also unique is the combination of top-down and bottom-up governance and the role of regional processes and provinces. In 2014, five Delta decisions were taken on the topics of flood risks, fresh water, spatial adaptation, the Rhine-Meuse river delta and water levels in Lake IJssel (Deltacommissaris, 2011; Deltaprogramma, 2013; van Eerd et al., 2014; PBL, 2014; Veerman, 2008; Verduijn et al., 2012). An important Dutch research project concerned with climate change is the Knowledge for Climate research programme (Climate Adapt, 2014c). Another aspect of Dutch climate adaptation governance is the Climate Agenda, developed in 2013 by the Dutch Ministry of Infrastructure and Environment, providing insights in the possibilities for climate mitigation and adaptation. The Climate Agenda consists of ambitions, objectives and actions to prevent and adapt to climate change in order to reach a sustainable society. This Agenda will be combined with aspects of the Delta Programme to draw a national climate adaptation strategy by 2017 (see section 3.4.1) (Ministerie I&M, 2013; Rijksoverheid, 2014d).

At present, the framing of climate adaptation is predominantly restricted to water management and therein specifically flood safety and high water issues, with all other interests, however important, coming second (van Eerd et al., 2014; Steenhuisen et al., 2007). This focus leads to some advantages, as resources and actors are concentrated and decisive action is stimulated. The framing of adaptation was less restricted during the development of the first Dutch policy plans on climate adaptation. For instance, the '*Klimaat voor Ruimte*' programme (2004) announced a broad, integrated, climate-proofing programme, dealing with different policy fields, such as water management, nature conservation, agriculture and spatial planning, and even included climate-mitigation policies. The national adaptation strategy of 2006, the so-called ARK Programma (*Adaptatieplan Ruimte en Klimaat*), was a common framework for climate-change adaptation, focusing on four themes (Biesbroek et al., 2013; van Eerd et al., 2014; VROM, 2007). Thus, the framing of climate adaptation changed over time, from an ecosystem-based and spatially oriented 'water accommodation' story line ('room for the river' discourses of the 1990s and 2000s), towards a more integrated, ecologically and spatial relevant 'climate-proof' story line (e.g. the National Adaptation Strategy and ARK programme), to a 'safe delta' story line, existing of the almost exclusively water sector-based framing of climate-change and adaptation issues in the Delta Programme (van Eerd et al., 2014; van den Berg, 2013). This gradual framing shift can be explained by several factors, such as the historical dominance of water management in the Netherlands, the financial crisis that caused a step back from ambitious long-term plans and the election of a right wing government, leading to the disappearance of climate change on the political agenda (Crabbé et al., *accepted*). The almost exclusive water sector-based framing of climate adaptation is heavily criticised by the Dutch Court of Auditors, stating that the Delta Programme is not a follow-up of the national adaptation strategy of 2007, since this programme is not coherent and encompassing enough (Algemene Rekenkamer, 2012). As a result, the Climate Agenda of the Ministry of I&M was developed in 2013, focussing also on health issues, agriculture, cities and vital infrastructural networks (Ministerie I&M, 2013). Another conclusion of the Dutch Court of Auditors is that the adaptation plan of 2007 did not lead to significant results (NRC, 2012).

3.3 Climate-adaptation governance in neighbouring countries

Understanding today's climate-adaptation approaches in neighbouring countries is of significant relevance for the development of a joint, cross-border climate-adaptation strategy in the future. Therefore, this section summarises climate-adaptation policies in Belgium and Germany.

3.3.1 Climate adaptation governance in Belgium

Two important actors for climate-change policy in Belgium at the national level are the National Climate Commission (NCC) for domestic issues and the Coordinating Committee for International Environmental Policy (CCIEP). The first [National Climate Plan](#) was adopted in 2008 and ran from 2009 until 2012, also containing a section on climate adaptation. In 2010 the NCC adopted the [National Adaptation Strategy](#), describing the main climate-change impacts, present adaptation responses, a roadmap to a future National Adaptation Plan (NAP) and policy guidelines. The future NAP will be based on a bottom-up approach, consisting of input from the four Belgium governmental levels. Each federal governmental level has adopted regional plans (Flanders adopted the [Flemish Climate Policy Plan](#) 2013–2020 in 2013 and Walloon and Brussels' action plans will be finalised in 2014). Adaptation plans and programmes in Belgium cover a wide range of issues and themes, such as agriculture, forestry, mobility, nature and water management. Climate-change research is stimulated via the KLIMOS platform, which works on climate-change adaptation and mitigation in development aid (Climate-Adapt, 2014a).

3.3.2 Climate adaptation governance in Germany

In 2008 the German federal government adopted the DAS ([German Strategy for Adaptation to Climate Change](#)), which became the foundation for a medium-term process to identify the effects of climate change, assess the risks and develop and implement adaptation measures. The DAS deduces options for action in 15 fields with regards to nature, economy and society. Yet, in practice, those themes are often addressed via a sectoral instead of integrated approach. The DAS was followed up by an [Adaptation Action Plan](#) (APA) in 2011, committing to concrete steps. Also the sub-national governmental level (Länder) has adopted climate-adaptation strategies; for instance [North Rhine-Westphalia](#) established a strategy. Important actors dealing with climate-change issues are the German National Meteorological Service, German Climate Atlas, the Federal Institute of Hydrology, the KLIWAS research programme, the Climate Service Centre and KomPass. Also diverse local actions were started, such as DynaKlim and individual cities' actions (Climate-Adapt, 2014b).

3.3.3 Concluding remarks

In comparison to the Dutch climate-adaptation approach, neighbouring countries apply a broader, cross-sectoral climate-adaptation approach. For instance, the DAS is a prominent example of a comprehensive, multi-sectoral adaptation strategy. Against the trend of developing comprehensive strategies through Europe, the Netherlands has pursued climate-change adaptation mainly through a sectorally focused approach (Bauer and Steurer, 2014). Research of Bauer and Steurer clarifies that both approaches appear to resemble alternatives, having strengths and weaknesses and that a combination holds to compensate for each other's weaknesses. Advantages of the Dutch sectoral focus are for instance that resources and actors are concentrated, decisive action is stimulated and the successful water management approach could inspire other sectors to work on climate-adaptation as well. Nevertheless, the European Climate Adaptation Strategy, established in 2013, requires the development of a comprehensive, national adaptation strategy in each member state (which is explained in section 3.4). The Dutch PBL (*Planbureau voor de Leefomgeving*) stated in a research report of 2013 that more insights are necessary with regard to climate-change risks for the issues of energy supply, transport, infrastructure, ICT, health and nature in order to be able to draw a comprehensive national adaptation strategy for climate-proofing the Netherlands (Ligtvoet et al., 2013; PBL, 2014). The PBL currently studies the risks and chances of climate-change effects in the Netherlands from different levels of scale (Vonk, 2014). Thus, a shift in the framing of and approach to address climate adaptation in the Netherlands is required.

3.4 The European context with regard to climate adaptation

Throughout its history, the EU has had an important role in climate-adaptation governance; it can be concluded that nowhere has the political debate on climate adaptation been more dynamic and advanced

than on this governmental level. A few examples are that, in the late 1980s, the EU was a front-runner for the establishment of the Kyoto Protocol, and by the mid-2000s the European Commission claimed that tackling climate change was the central, overriding policy challenge facing Europe in the twenty-first century. In 2008, a complex package of climate and energy measures was adopted. Several reasons for this proactive role can be identified, e.g. that the EU is a relatively large emitter of greenhouse gases (Jordan et al., 2010). At the Durban 2011 Conference of the Parties, Europe played an important leader and mediator role to put the climate-change negotiations back on track (Bäckstrand and Elgström, 2013). Europe's role with regards to dealing with climate change strongly influences national policies, as important aspects of domestic policies, administrations and politics have become 'Europeanised' (Jordan and Liefferink, 2004). Therefore, the development of a Dutch (national and/or regional) climate-adaptation strategy will be affected by developments in the European area, the latest being explained in the next paragraph.

3.4.1 The European Climate Adaptation Strategy

In 2009, the European White Paper on adaptation to climate change was launched, leading to several actions, such as the European Climate Adaptation Platform, the adoption of national adaptation strategies in 15 member states and joint adaptation projects between EU countries or cities. Based on those developments and initiatives, the EU launched an adaptation strategy to deepen experiences, exchange best practices and to cover the whole community. Other important steps leading to the development of this strategy are the Blueprint to Safeguard Europe's Water Resources, the Green and White Book for Climate Adaptation (European Commission 2007; 2009) and EU legislation not directly concerned with climate-adaptation issues, such as Natura 2000, the Birds (Directive 79/406/EEC) and Habitat Directives (Directive 92/43/EEC) (both focusing on the conservation of natural habitats and wild flora, fauna and birds), the Floods (Directive 60/EC/2007) and Water Framework Directives (WFD) (Directive 2000/60/EC) (addressing water quantity and quality issues).

On April 16th 2013 the EU established a strategy for adaptation to climate-change effects, also called the [EU Adaptation Strategy](#), aiming to make Europe more climate-resilient by taking a coherent approach and providing improved coordination to enhance the preparedness and capacity of all governmental levels that should respond to the impacts of climate change (Climate-Adapt, 2014d; European Commission, 2013; 2014a; b). The EU states in this strategy that their role is important when climate-change impacts transcend state borders and solidarity among member states should be ensured (European Commission, 2014a). The strategy focuses on three key objectives, particularly promoting action by member states (e.g. each state is required to adopt a comprehensive adaptation strategy by 2017), 'climate-proofing' action at the EU level, especially for vulnerable sectors (e.g. agriculture and infrastructure) and, lastly, better-informed decision-making by addressing knowledge gaps and developing the European climate-adaptation platform (Climate-ADAPT) (Climate-Adapt, 2014d; European Commission, 2014b). In 2017, the European Commission will report about the state of the implementation of the strategy and propose its review if needed (European Commission, 2013). This strategy provides possibilities also for funding of climate-adaptation projects (funding will be addressed in more detail in section 8 and appendix 4). Two important aspects gain attention in this strategy: the need for cooperation across national borders and the need for a comprehensive adaptation strategy. For instance, the European Commission mentions that *'priority will be given to adaptation flagship projects that address key cross-sectoral, trans-regional and/or cross-border issues'* (European Commission, 2013, p.5), underlining the necessity of a transboundary climate-adaptation strategy that integrates themes and issues. Cross-border cooperation is stimulated, because the Commission supports the exchange of good practice between member states, regions and other stakeholders.

Thus, the EU Adaptation Strategy sets out a framework and mechanisms to improve the EU's preparedness for the current and future impacts of climate change. Based on this strategy – and specifically the obligation for member states to establish a comprehensive national adaptation strategy in 2017 – the secretary of the Ministry of I&M promised to set up an integrated climate adaptation and mitigation agenda

(PBL, 2014). This explains why the Ministry of I&M requested this study concerning the first steps needed for an integrated and cross-border climate-adaptation strategy.

3.5 Research objectives, scope and methods

This study aims to provide the Ministry of I&M an agenda with recommendations consisting of first steps that could be taken towards a cross-border, integrated spatial approach in the light of the EU Adaptation Strategy. The objectives of this research are to a) emphasise the need and usefulness of, as well as opportunities for, an integrated, transboundary climate-adaptation strategy, b) address gaps in the current Dutch climate-adaptation approach, c) find opportunities to overcome barriers and challenges and d) provide recommendations for the development of a cross-border, integrated climate-adaptation strategy. The main research question that will be answered in this report is: *Which (first) steps could be taken to establish an integrated and transboundary strategy for climate adaptation in the border region, based on the EU climate adaptation's perspective?*

To answer the research question appropriately the following research steps will be taken (see figure 1). First, a wide-ranging research perspective will be used to study the theoretical background of transboundary, integrated climate adaptation, focusing on the urgency and usefulness, as well as the opportunities and challenges for, such a strategy. This theoretical background will be based on literature research. The second research step will consist of analysing best practices of existing transboundary and/or integrated climate-adaptation policies, projects or programmes in the Netherlands, as well as in other countries. This broad research perspective will also be applied to identify potential border regions for the application of such a strategy or a related pilot project in the Netherlands in the third research step. Both steps will consist of a combination of desk research, interviews and the input from a workshop with experts and stakeholders (an overview of interviewees and a summary of the workshops are presented in appendix 1 and 2). After that, an in-depth case-study analysis will be executed to study three concrete and specific cases that deal with (aspects of) cross-border and/or integrated climate-adaptation issues. This research step will have a more specific and regional research focus. The case-study research is based on input from the workshop, experiences from an excursion in the region, as well as information from semi-structured interviews, literature and document research. The three studied cases are Rijnstrangen, transboundary dike ring 48 and 'Levees for the Future' project (detailed information on those cases can be found in section 7). All projects are located in the Dutch-German border region (more specifically, the province of Gelderland and the Länder North Rhine-Westphalia), which has been chosen for its relative long history of 'successful' collaboration and because this is the point where the Rhine river crosses the state border. The structural and theoretical approach applied to analyse the case studies is clarified in section 4. In the last research step, the researchers will again apply a broad research perspective to set up an agenda for the establishment of a cross-border, integrated climate-adaptation strategy. This agenda will provide building blocks to develop a national climate-adaptation strategy. This report could be used as inspiration, which is strengthened by the insertion of hyperlinks in this report (please click on the blue and underlined words to gain more in-depth information on that particular subject via documents, videos etc.).

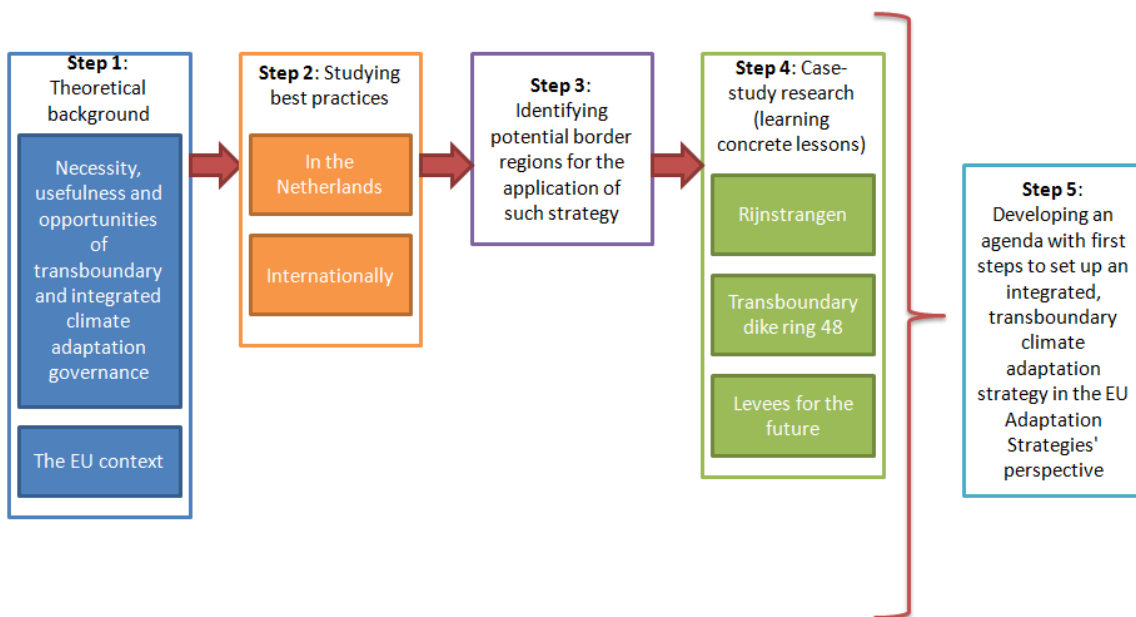


Figure 1: The research framework.

3.6 Report's outline

The next section describes the usefulness, urgency, opportunities and challenges for an integrated, transboundary climate-adaptation strategy based on existing, scientific knowledge. After that, section 5 summarises the lessons learned from best practices and section 6 provides the results of an explorative study of promising border regions for the application of a transboundary and integrated climate-adaptation strategy. Section 7 presents the results of the three case studies and the last section, section 8, elaborates upon our conclusions and recommendations, summarised in an agenda with first steps towards an integrated, transnational climate-adaptation strategy.

4. A theoretical background on transboundary, integrated climate-adaptation governance

This section provides a theoretical background on climate-change adaptation; particularly the urgency to develop a transboundary and integrated climate-adaptation strategy is addressed, as well as the opportunities and challenges of such a strategy, based on a review of the scientific literature.

4.1 The urgency of transboundary climate-adaptation governance

Climate-change effects will not stop at man-made, historical, geographical and territorial borders and can be seen as a global issue (Roberts and Sanchez, 2014). For instance, floods do not stop at the state border, nor do species or nature areas. Striking examples that stress this urgency are the transboundary dike rings – where standardisation differs based on national norms even though it concerns one dike. And second, the *kierbesluit* - an agreement concerning the opening of the Dutch Haringvlietsluizen during periods of calm and low water, which enables upstream fish migration – and third, the Dutch-Flemish border Meuse region – where the border runs for about 50 kilometres through the river and domestic actions will directly affect the neighbouring region. Thus, the impacts of climate change do not adhere to conventional governance boundaries, considering the challenges to existing and often deeply embedded governance frameworks (Hannah, 2009; Steele et al., 2014). The transboundary nature of climate change means that risks and challenges are shared and that adaptation solutions should be coordinated (Barchiesi et al., 2014). So far, experts claim that climate-mitigation efforts are successfully tackled at the national and supranational level, while on the other hand climate adaptation requires actions at the regional and local level by actors directly affected by the issue (Bulkeley and Betsill, 2003; Rayner and Jordan, 2010; Trouwborst, 2011). An example is that regional cooperation is expected to be essential for reaching habitat connectivity (COP, 2006). Yet, the local scope and capacity for climate adaptation is constrained by the support and resources required and the cross-border nature of climate change itself (Steele et al., 2014). Thus, a guiding governance framework for climate adaptation should be provided by national and supranational governmental institutions (Rayner and Jordan, 2010), such as an overarching plan for ecological networks across borders (Pechini, 2014). Some scholars state that internationally coordinated responses towards climate change have significant cost savings compared to a system of climate adaptation that solely unfolds at a country level (Hannah, 2009). Another example of a beneficial outcome is that international cooperation for climate adaptation could lead to positive sum outcomes (e.g. sharing of knowledge, data and information) (Drieschova et al., 2009). So far, most treaties and international agreements fail to have adequate mechanisms for addressing changing social, economic and climate conditions and adapting to climate change will require changes in international institutions and policies (Cooley et al., 2009).

4.2 The urgency for an integrated climate-adaptation approach

Adaptation is made up of actions throughout society, by individuals, groups and governments, and thus should be addressed by multi-level governance on the local, national and international level. Thus the scale of action and actors applying adaptation is not isolated from other decisions (Adger et al., 2005). In addition, climate-change effects will impact various aspects of society that are often governed by sectoral policies, plans and programmes. For instance, themes such as nature, water, recreation and transport are often addressed separately. Regularly, there is cohesion between those separated themes, for instance flood risks could affect the public transport system or dry periods could affect a nature area and the yield of farmers. Water management could affect biodiversity in multiple ways – floods could spread seeds or could make species migration more difficult (Kieft, 2014). Another example is that the main causes of negative impacts on the water status are interlinked, including climate change, land use, economic activities (energy production, industry, agriculture etc.), urban development and demographic change. Subsequently polluted water affects other themes and sectors as well, e.g. economic activities could be harmed (e.g. tourism), just as the livability of the region, as well as nature, will be damaged (COM/2012/673).

Thus, climate change is a multi-disciplinary problem that requires multiple linked solutions (Howden et al., 2007). Scholars argue that a successful response to climate change should focus on an integration of issues, themes and solutions (Schipper and Pelling, 2006). Combining themes and measures could lead to more effective and efficient governance, yet requires flexibility and creativity (Driessen et al., 2011). Thus, adaptation to climate-change effects should also be managed in an integrated manner. Integrated means in this study the linking of themes and issues in order to create more efficient and effective win-win situations. Integration could also have disadvantages, as it could lead to more complex decision-making and implementation processes, since multiple actors and sectors are involved. Besides, advantages of a sectoral approach are that actors and resources are concentrated, responsibilities are often more clear and decisive action is stimulated.

Illustrating for the urgency of integration is the case of the Rhine basin. This basin is vitally important for the economy of Western Europe, being the most important river for inland shipping. On the other hand, transport via roads or rails could be affected by this river – for instance floods could flow over the Betuwe rails or A12, important transport routes that cross borders. Also power plants and industries rely (e.g. for cooling capacities) on the Rhine water. Moreover, up to 20 million inhabitants are dependent on this river for the adequate availability of good quality water for household and drinking water supply, recreation and tourism, as is the agricultural sector that uses the water for irrigation. Extreme changes in the Rhine’s water flows, such as water shortages or high waters that are expected to occur more frequently and to a more extreme extent due to climate change, could affect the (shipping) economy, fresh water supply, agricultural and tourism sector significantly. Besides, the quality and biodiversity of the ecological system is highly dependent on water discharges as well, and changes in the Rhine regime over the past decades have already led to a loss of natural landscape buffers (Provincie Gelderland, 2014a). Next to dealing with climate change, other societal issues are addressed that could be linked to adaptation. For instance, (transboundary) nature conservation and challenges for biodiversity could be addressed via the establishment of robust ecological networks, having a buffer function towards climate change as well, which increases the adaptive capacity of the ecosystem (COP, 2010) Thus, climate adaptation could be linked to ongoing trends, for instance the energy transition, water management in the Delta Programme, ambitions of the Dutch Climate Agenda of 2013, planned transport projects etc. Also the European Adaptation Strategy underlines the necessity of a comprehensive climate-adaptation approach and provides the example of dealing with climate adaptation in cities via spatial planning measures (European Commission, 2013). Besides, an integrated and flexible strategy will provide more adaptive capacity to deal with uncertainties related to climate change.

4.3 Opportunities and challenges for an integrated and transboundary climate-adaptation strategy

To our knowledge, there is currently no comprehensive, cross-border climate-adaptation strategy studied by scholars, yet various lessons could be learned from scientific research in this field. Scholars agree that the development of a comprehensive, transboundary climate-adaptation strategy needs to overcome various challenges, yet that there are also multiple opportunities. Based on literature, different challenges and opportunities for climate-adaptation governance could be identified, which are summarised in table 1. Most authors base their conclusions on practical lessons learned on the regional or local level, yet there is still a major disconnect with the up-scaling of climate adaptation to higher governmental levels (Barchiesi et al., 2014).

Lessons learned from scientific knowledge	
Opportunities for integrated, cross-border climate-adaptation governance	Challenges for integrated, cross-border climate-adaptation governance
- Improving the (societal and economic) attractiveness of regions (Scheraga and	- Working across jurisdictions (Barchiesi et al., 2014; Steele et al., 2014; Wilder et al., 2010).

<p>Grambsch, 1998).</p> <ul style="list-style-type: none"> - Multi-functional use of land (Hommes, 2010). - Exchange Dutch knowledge on climate-proofing a delta region to other countries (export product) (e.g. about horticulture, agriculture, water management) (PBL, 2014). - Knowledge transmission and robust interlinkages between science and policy are required for the development of sustainable climate-adaptation policies (Wilder et al., 2010). - Spatial planning could enhance integration between sectors (e.g. housing, transport, energy, agriculture, industry) and thus the establishment of an integrated climate-adaptation strategy (Barchiesi et al., 2014). - Linking of adaptation measures to (ongoing) climate mitigation programmes, projects and policies. Climate adaptation and mitigation should be balanced and could be complementary (Smit et al., 2000). - Cross-border cooperation stimulates innovations in the (often peripheral) border region, enables experience exchange, increases the regions international attractiveness and leads to competitive advantages (OECD, 2013). - Collaboration between organisations that regularly work within their own sector field leads to opportunities as this stimulate to 'think outside the box' (Smit et al., 2000). - Stakeholder participation, from non-state actors also, is crucial and will lead to more dynamic systems that can more flexibly respond to uncertainties, focus on 'learning by doing' and more societal support (Smit et al., 2000). - Lessons can be learned from ongoing transboundary cooperation mechanisms that address aspects of climate adaptation (Driesschova et al., 2009; Steele et al., 2014). 	<ul style="list-style-type: none"> - Incorporating all (views and interests) of key stakeholders in the development process of climate-adaptation governance (Barchiesi et al., 2014; Steele et al., 2014; Wilder et al., 2010). - Dealing with state sovereignty (Barchiesi et al., 2014; Steele et al., 2014; Wilder et al., 2010) - Dealing with different cultures, views, traditions and perceptions that exist between regions/organisations/states (Barchiesi et al., 2014; Smit et al., 2000; Steele et al., 2014; Wilder et al., 2010). - Climate adaptation requires the linking of short-term actions to long-term objectives (Smit et al., 2000). - Integrated climate adaptation leads to complex processes of multi-level governance (Smit et al., 2000).
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Table 1: Overview of opportunities and challenges for climate-adaptation governance based on a literature review.

4.4 Climate-adaptation governance choices

In conclusion, climate change and adaptation are international challenges asking for a transboundary approach, but equally important are national (long-term) visions and coordination, as well as interventions and support on the regional and local level. Besides, the last sections have clarified that climate-change effects will impact a large diversity of sectors that are interlinked, underlining the necessity to deal with climate adaptation from a broad, holistic and integrated perspective as well. Thus, climate adaptation

should be addressed from a system-based and integral perspective, incorporating the interlinked functions of a system – such as a catchment area. Zooming in and out on the comprehensive system could be applied by using a multi-level governance approach; addressing aspects of climate adaptation on the most appropriate, efficient and effective level. Additionally, it became clear that developing an adaptive response is not a straightforward process (Roberts and Joshi, 2014) and that various governance choices should be made for the establishment of such a strategy. This section describes some of those governance choices via a structural approach. This structure will be used to identify the necessary steps for the development of a cross-border, integrated climate-adaptation strategy in the upcoming sections.

Governing any policy problem requires actors to make policy choices between alternative courses of action, which often entail governance dilemmas. Jordan et al. (2010a, b) identify six types of governance dilemmas for climate-change policy in the EU. In this study we describe Jordan's dilemmas as governance choices, as we think that these are steps that should be taken to establish climate-adaptation policies. More specifically, at specific moments in time, choices should be made about the aims and objectives of a policy, the selection of policy instruments and so on. We apply this list of (moments of) choices to analyse the climate-adaptation governing methods applied in the case studies, to understand what kinds of choices should be made and how this is done in practice and to develop an agenda for dealing with adaptation. The theoretical background of the governance dilemmas is elaborated upon in the upcoming text.

The first dilemma identified by Jordan et al. (2010) is related to the **problem perception**; what is exactly the problem to be confronted? How is the problem framed by different actors involved? Aspects related to this dilemma are the (lack of) available knowledge – governors do not always have access to sufficient knowledge and the causal interrelationships between them, the 'framing' of the problem (by different actors that are seeking to govern) and 'agenda-setting' of the problem – policy attention will be attracted by focusing events (Jordan et al., 2010a, b). This dilemma will affect the others, for instance the characterisation of a problem will define who is deemed responsible. The second choice governors have to deal with is to decide at which **level or scale** to act, which is often presented as decentralisation (acting locally) versus acting at higher (governmental) levels (e.g. regionally, nationally or internationally). This might not be an entirely open choice, as some governors could have stronger legal competences. In practice, the choice between levels is seldom a binary one: action may be required at several levels simultaneously. The latter is especially important for this study as we strive for the development of a comprehensive, cross-border strategy for dealing with climate change, requiring a combination of levels for action (multi-level governance), including the transboundary governmental level. Besides, not only public actors are important for a holistic and integrated climate-adaptation strategy; therefore we consider multiple types of actors as well. Embedded in the level and scale-related choices are associated values such as flexibility, accountability and transparency (each of them are possibly easier to achieve at the local governmental level) (Jordan et al., 2010a, b). The third dilemma concerns **timing and sequence**, as governors should decide when and in what sequence to act. Questions arise such as: when do you have conclusive proof that a problem is causing harm, before the problem becomes irrecoverable? Dealing with this dilemma means coping with issues such as sense of urgency, optimisation of welfare, risk-taking, legitimacy, precaution, competitiveness, 'first-mover' advantage etc. (Jordan et al., 2010a, b). For the development of a climate-adaptation strategy, considerations with regard to short-term actions versus a long-term vision (or a combination) are also of importance. Governance should also decide upon how to act, leading to **mode and instrument** dilemmas. Traditional governance modes focus on hierarchies (top-down governing) and markets. A third mode focuses on networks and coordination. Governing is primarily concerned with choosing the most appropriate mix of governance modes. Another choice confronting governors concerns the kinds of **costs and benefits** that will be taken into account and how to allocate them across different groups, leading to winners and losers. A related choice is whether and how any losers will be compensated. Judgments on costs and benefits are intimately tied to considerations on policy effectiveness, fairness and legitimacy. A basic distinction between different distributions of costs and benefits can be drawn between distributive, regulatory and redistributive policies (Jordan et al., 2010b). The **implementation and enforcement** –

choosing on how to deliver policy results – could lead to more dilemmas for governors (Jordan et al., 2010b).

Based on the importance of the integration of themes and issues for the development of a climate-adaptation strategy, the researchers have decided to add the choice between a sectoral governance approach versus a **multi-sector approach** (integrated governance) to the list of Jordan et al., even though it could be argued that this choice is included in the level and scale dilemma.

Jordan et al. (2010b) mention that the identified choices and dilemmas may appear in different sequences and could be interrelated. For instance, the framing of a problem could shape the perception of scale as well. All possible choices are listed in table 2, and the analysis of cases and best practices in the upcoming sections is structured by this list of dilemmas.

'Moments of choice' for climate-adaptation governance
1. Problem perception
2. Level and scale
3. Multi-sector or sector-based governance
4. Timing and sequence
5. Mode(s) and instrument(s)
6. Costs and benefits
7. Implementation and enforcement

Table 2: Governance choices and dilemmas based on Jordan et al. (2010).

5. Learning lessons from ‘best practices’ of climate-adaptation governance

As far as this study has been examining, no holistic integrated and transboundary approach for adapting to the effects of climate change exists from which lessons can be learned. Still, much is going on in the field of climate-adaptation policies that could provide interesting insights and inspiration for our research. So, for this study, we have analysed the methodologies of 19 international and Dutch projects, plans or programmes, which could be seen as ‘best practices’ for the criteria of transboundary climate-adaptation governance, integrated climate-adaptation governance or both. The 19 studied ‘best practices’ are visualised in figure 2. Lessons learned from those exemplary cases are described in this section, following the analyses structure of governance choices and are summarised in table 3. A detailed explanation of the 19 selected ‘best practices’ can be found in appendix 3.

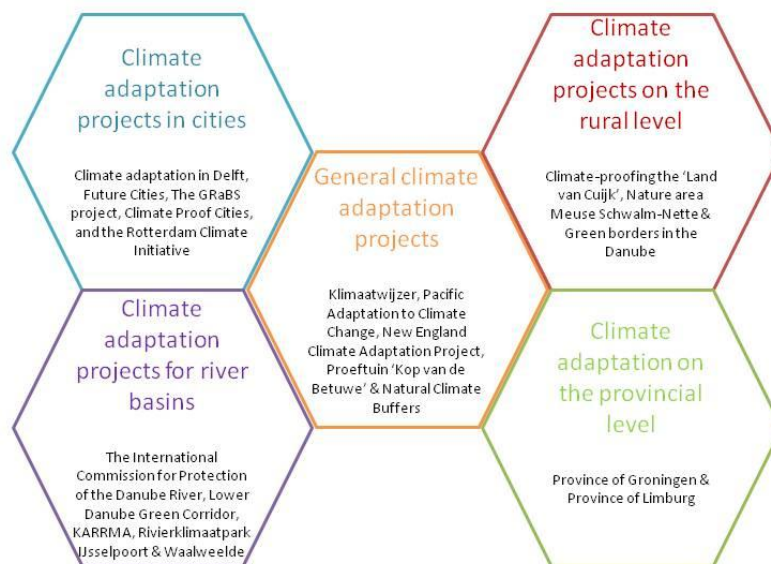


Figure 2: Visual presentation of the 19 studied ‘best practices’ of climate-adaptation governance (*structured by type of project: cities, river basins, rural, provincial or general, even though there might be overlap*).

5.1 Problem perception

With regard to the problem perception choice, various projects focus on the gaining and exchange of knowledge and experiences. Also projects that are further advanced show the importance of **knowledge as a basis for collaboration**, such as the adaptation strategy of the International Commission for Protection of the Danube that follows up an extensive study. The need for participation of knowledge institutions, universities etc. was often identified as a prerequisite. This could be explained since joint knowledge could enable the formulation of common visions and ambitions. Furthermore, a research project could help to place the issue on the agenda.

It appears of importance that actors **frame solutions and problems** with regard to climate adaptation in a **largely similar** way. For instance, it was important for the progress of the Rivierklimaatpark IJsselpoort project that all actors involved recognised the need for adapting to climate change via joint forces on multiple themes. Also in the Waalweelde project, the common recognition of addressing more challenges

than particularly high water and safety measures was the start of a successful and comprehensive programme. This project also shows that **reaching a common main vision** amongst actors involved is necessary for a successful governance approach, thus acting upon the common interest. A success factor for the Rotterdam Climate Initiative was to translate the common ambition into ten attractive sustainability tasks, inspiring and stimulating actors involved. Furthermore, a **focus on the strengths of the region** appears to be successful for climate-proofing the 'Land van Cuijk'.

Leadership appeared to bring parties together and to establish common objectives in the Lower Danube Green Corridor Project. The establishment of an adaptation strategy by the International Commission for the Protection of the Danube (ICPD) clarifies that a leader should take the initiative and have influence and prestige, just as the lead country Germany had. Also 'Dutch best practices' underline the need for leadership: for instance the province of Gelderland governed the establishment of the Waalweelde programme and its implementation. Yet, a significant condition is that other actors should support this role. The different examples show that a leader should be chosen on the **most appropriate governmental level**. In the south of the Netherlands, the regional coordinating role of the province of Limburg is necessary to keep the climate-adaptation issue on the agenda. Leadership does not necessarily have to be filled by public actors; for instance a consultancy stimulates and guides the climate-proofing of the 'Land van Cuijk'.

5.2 Level and scale

It is interesting that most analysed best practices focus on (a part of) a river basin, a city or historical region – thus an **identifiable and delineated area**.

Another lesson learned is that the major challenges of adaptation should be dealt with at **multiple scales** (from the very local to international level, both institutionally and geographically). Zooming in and out appeared to be necessary for a comprehensive climate-adaptation approach in the KARMA project, as each river system requires area-specific adaptation actions based on its structure, land use etc. Also the Climate Proof Cities programme showed that measures for adaptation are necessary on different levels, such as for buildings, streets and regions.

Cooperation on the transboundary level (with actors from the other side of the border) is often even more experienced as a challenge. The nature area of Meuse Schwalm-Nette has dealt with this issue through the establishment of a **project office**, acting as a transboundary interface and mediator. Cross-border projects are often stimulated by **EU legislation or funding** (e.g. the Green Borders Danube project is based on nature conservation rooted in EU Natura 2000 legislation and the GRaBS project, the future cities project and nature conservation in the area of Meuse Schwalm-Nette are financed via Interreg). Existing links with neighbouring regions could be used as a starting point for a transboundary climate-adaptation approach, such as transport connections (e.g. Proeftuin 'Kop van de Betuwe'). The **twining of international actors** on specific projects was successful in the future cities programme. And the need to recognise **shared responsibilities** for climate adaptation was of significant importance in the best practice of the Lower Danube Green Corridor project.

5.3 Multi-sector or sector-based governance

Regarding this policy choice, it could be concluded that most 'best practices' were addressing more than one theme or issue (**multi-sector governance**). Those best practices clarified that coherence between themes and issues could be reached by intertwining the multiple actors involved, which creates broader support for the developed climate-adaptation approach.

It is interesting that most projects addressed **one main theme** (often water and safety management or spatial planning), which was connected to the challenges of other sectors (e.g. Proeftuin 'Kop van de Betuwe'). The best practices showed that integration of themes leads to opportunities, more support and **win-win situations**. An example is the Rivierklimaatpark IJsselpoort, where spatial developments in flood plains are used to adapt to the consequences of climate change via an integrated vision. Another lesson is

that climate adaptation should not always have to be the primary objective, yet could be **linked to ongoing** (spatial) **developments**, issues and programmes, leading to important benefits for adaptation as well. An example is the Lower Danube Green Corridor project, aiming to restore floodplains, which increased the regions adaptive capacity at the same time. Also the linking of possibilities for living, recreation, business etc. to nature conservation creates the necessary societal and political support required for climate-proofing the Netherlands via climate buffers (Natural Climate Buffer project). Also the provinces of Limburg and Groningen integrate climate adaptation in ongoing (large-scale) developments and projects. Via the Rotterdam Climate Initiative adapting to climate-change effects was linked to issues such as air quality and noise problems. Climate adaptation could also be linked to historical and cultural aspects, which is done in the climate-proofing 'Land van Cuijk' project. Thus, analysing the best practices gave insights into the multiple possibilities for linking climate adaptation to other issues and opportunities.

5.4 Timing and sequence

Analysing the best practices shows that many climate-adaptation projects were established because other issues were requiring it. Ongoing or new projects could be seen as the opportunity and momentum to integrate the issue of climate change as well. The best practices also show that awareness concerning the effects of climate change is growing as well as public and societal support, creating a momentum for the development of climate-adaptation policies.

Another commonality among the studied 'best practices' is the **establishment of a common** (and often long-term) **vision or strategy** for the whole region and the application of practical pilot projects that increase the visibility of climate adaptation. A successful example is the establishment of a vision for the Rivierklimaatpark IJsselpoort for the upcoming 15 years to sustainably develop the flood plains of the IJssel. Next to long-term visions, **short-term, visible and concrete (pilot) projects** are necessary to raise awareness and hold attention towards the issue of climate adaptation. For example, green roofs and facades were used in the 'Land van Cuijk' to raise attention and to establish a collaboration network.

In conclusion, a combination of actions and plans on the short, middle and long term is necessary to appropriately deal with climate adaptation.

5.5 Mode and instrument

In most best practices a **mixture of top-down, bottom-up and public-private governance modes** are used for stimulation of integrated climate-adaptation governance (e.g. combination of public and private actors in the Rotterdam Climate Initiative and GRaBS project). A mixture of actors stimulates innovation, co-creation, support, (lay) knowledge and experiences, and so on. Best practices show that engagement of stakeholders could be stimulated via (international) conferences, working sessions, round tables, workshops etc. And this participation should **start** at the beginning of the strategies' development. Also communication towards citizens is recognised as an important aspect for climate-adaptation strategies (e.g. New England Climate Adaptation Project where citizens are informed via role-play stimulations). The Waalweelde project is an exemplary case of developing a bottom-up approach (with interest groups, companies, officials and administrators) for dealing with an integration of themes to improve a river basin's spatial quality. Also the role of **knowledge actors** (universities and research institutions) was important in various projects, as climate change and adaptation are inherently interwoven with ambiguities and uncertainties (e.g. in Waalweelde). Finding know-how partners and the establishment of (transnational) expert teams during the projects' development appear to be good methods. Gathered knowledge could be used in practice via pilot projects. **Non-state actors** could contribute to a strategy as well; good examples are actions of the WWF in the Lower Danube Green Corridor project. The involvement of multiple actors requires a **clear organisational structure and leadership**.

Climate adaptation will affect a broad range of people within society, and dealing with climate adaptation should therefore be based on a combination of **different types of instruments**. For example, the International Commission for Protection of the Danube focuses on preparatory measures, ecosystem-based

measures, behavioural measures, technological measures and policy approaches. Besides, most ‘best practices’ were stimulated by the establishment of an agreement, vision or legislation. Especially, working across borders requires clear arrangements. A challenge for the establishment of an integrated approach is to **find coherence between activities and instruments**.

5.6 Costs and benefits

During the development of a climate-adaptation approach, a thorough **cost–benefit analysis** could be useful (e.g. Proeftuin ‘Kop van de Betuwe’). Because the **funding** of climate-adaptation projects, especially when they cross (administrative and/or state) boundaries seems to be an important challenge. The Lower Danube Green Corridor overcomes this challenge via the funding of multiple actors involved (WWF, national governments, the EU and corporate actors), and also the Green Borders project in the Danube is based on **EU support** (Life). For cross-border cooperation in the nature area of Meuse Schwalme-Nette, a project office was established to search for funding opportunities. And dealing with financial issues was arranged in the Waalweelde project via the establishment of an investment programme. Best practices from non-EU countries also used **funding from external actors**, such as the Global Environment Facility that supports the Pacific Adaptation to Climate Change project. The **benefits** of a climate-adaptation programme or strategy – and thus political and societal support – could increase via the **linking of issues, themes and the creation of win-win situations**. An example is that the city district Amsterdam-West (GRaBS project) has connected the challenge of a growing multi-cultural population to becoming the ‘greenest’ district and thus raising the cities’ livability. The United Nations Development Programme also underlines this in their Adaptation Policy Framework: the integration of adaptation should flow into the broader goals of national development. Besides, the Dutch government has stated the need and possibilities to integrate climate change in planning (Klimaatwijzer report). Another example of creating beneficial outcomes is that water management and nature conservation goals were linked to creating an attractive business climate and improving recreation possibilities via the establishment of a tea garden, farm shops etc. (Rivierklimaatpark IJsselpoort). Also projects within the nature area Meuse Schwalme-Nette were realised from the viewpoint of touristic and recreational opportunities. And the city of Rotterdam links their sustainable ambitions to the creation of a strong economy by becoming the most sustainable world port city. Furthermore, it is important to identify what the gains are for each actor in order to create support and stimulate participation, for instance deepening of the river Waal simultaneously led to the extraction of gravel.

Thus, funding appears a challenge for climate adaptation, yet the EU seems to offer various solutions (appendix 4). Besides, climate-adaptation governance could become beneficial by creating win-win solutions via the development of an integrated approach.

5.7 Implementation and enforcement

Since most ‘best practices’ are in an early stage of climate-adaptation governance, not many lessons could be learned on this policy choice. Yet, a conclusion is that successful implementation **requires leadership**, such as the province of Gelderland in fulfilling the Waalweelde project. Another example is that the implementation for the Pacific Adaptation to Climate Change project is under coordination of the United Nations Development Programme, as 14 pacific countries collaborate in pilot projects. Another lesson is that legislation or **agreements** signed by bordering countries stimulates the implementation of cross-border climate-adaptation governance, such as in the nature area of Meuse Schwalme-Nette. Another best method to ensure interlinkages between the short-term and long-term plans and for staying on the right track was the development of an **implementation agenda** by Rivierklimaatpark IJsselpoort.

5.8 Concluding remarks

Lessons learned from the 19 ‘best practices’ for integrated and/or transboundary climate-adaptation governance are summarised in table 3.

‘Moments of Choice’	Learning lessons from best practices of climate-adaptation governance
Problem perception	<ul style="list-style-type: none"> • Joint knowledge production and exchange of knowledge places the issue on the agenda, is the basis for cooperation and enables the formulation of common visions and objectives. • Common framing and urgency is required, as is the establishment of a common vision. • Focus on positive aspects and strengths of the region. • Leadership on the most appropriate level is required for reaching a common understanding.
Level and scale	<ul style="list-style-type: none"> • Climate adaptation often focuses on identifiable areas. • Climate adaptation should be dealt with at multiple scales. • Cooperation on the transnational scale is challenging, yet could be stimulated via the establishment of a project office, via EU funding and legislation and the twining of international actors in (pilot) projects.
Multi-sector or sector-based governance	<ul style="list-style-type: none"> • Majority of best practices applied multi-sector climate-adaptation governance. • Often, one key theme (e.g. water management or spatial planning) is the starting point for climate-adaptation governance. • Integration of themes leads to opportunities, support and win-win situations. • Climate adaptation could be linked to ongoing developments.
Timing and sequence	<ul style="list-style-type: none"> • Momentum for climate adaptation: many ongoing developments in other fields and sectors and growing awareness for climate change. • Need for a combination of actions on the short and middle term (concrete pilot projects) and a vision or strategy in the long term.
Mode and instrument	<ul style="list-style-type: none"> • A mixture of governance modes is required (top-down, bottom-up, public and private). • Actors should be engaged from the start. • Important role for knowledge actors. • Multiple modes of governance require a clear organisational structure and leadership. • Integrated climate adaptation requires the use of different instruments that are interlinked.
Costs and benefits	<ul style="list-style-type: none"> • Climate adaptation is expensive and finding funding is challenging, yet funding of external actors could be used, such as EU funding. • Climate-adaptation measures could be linked to other developments, issues and actions to create win-win situations.
Implementation and enforcement	<ul style="list-style-type: none"> • Leadership is required during the implementation. • Implementation across borders is stimulated by an agreement signed by actors from both sides of the border. • An implementation agenda or strategy developed at the start of the process enables implementation.

Table 3: Summary of lessons learned from Dutch and international ‘best practices’ in cross-border and/or integrated climate-adaptation governance.

6. Promising border regions for the application of a climate-adaptation strategy

As stated in the EU climate-adaptation strategy, priority will be given to climate-adaptation flagship projects that address significant cross-sectoral, transregional and/or cross-border issues. The European Commission will support collaboration and exchange of best practice between regions, countries and cities in vulnerable regions to address climate-adaptation issues (European Commission, 2013). This section identifies four border regions in the Netherlands that have the potential for becoming a flagship project in the light of the EU climate-adaptation strategy. This overview is not intended to be complete and comprehensive, yet the aim is to show that multiple border regions are suitable for the application of a climate-adaptation strategy and to provide an explorative overview of opportunities for flagship projects.

6.1 De Gelderse Poort



Figure 3: Position of De Gelderse Poort
Source: AHN (2014).



Figure 4: De Gelderse Poort
Source: Oog voor Natuur (2014).

6.1.1 Description of the region

An important nature conservation project on the Dutch–German border is the *Gelderse Poort* (figures 3 and 4), being part of the Natura 2000 network that will by 2015 be 3,000 hectares in the Netherlands and 2,000 in Germany. This area is located nearby the cities of Arnhem, Kleve, Emmerich and Nijmegen. The project was started by several actors, such as nature organisations (WWF, Staatsbosbeheer and Stichting ARK) and public organisations (e.g. municipalities and the province of Gelderland). In this region, the Rhine flows into the Netherlands and splits into a number of branches – the rivers Waal, lower Rhine and IJssel. The initial goal of this project was large-scale protection and development of nature. Floodplains and agricultural land are given back to nature via the concept of ‘giving space to nature’, allowing river dynamics. The region became a paradise for fish, bird species and insects (Bekhuis et al., 2002; De Jong, 2000; GS Gelderland, 2007; Provincie Gelderland, 2008; Radboud Universiteit Nijmegen, 2014; Staatsbosbeheer, 2014). The creation of the Gelderse Poort was embedded in the policies of the national and provincial governments, while regional and local actors were responsible for its implementation. One of the triggers within this region were the possibilities for the extraction of materials, such as gravel and clay (economic incentive). In conclusion, the area of the Gelderse Poort is used for several functions; ecological and nature conservation having priority, next to agricultural, recreation and tourism. The Gelderse Poort also contains historical and cultural objects, such as the fortresses of *Pannerden* and *Beneden Lent*. Also economic functions, such as shipping, transport and agriculture, could be found in this region, which also contains urbanised area (Bekhuis et al., 2002; GS Gelderland, 2007).

6.1.2 Cross-border cooperation

The initiative for transboundary cooperation for this nature area was taken by the Province of Gelderland (De Jong, 2000). Since 1993, German authorities became officially involved via the creation of an international steering committee for the Gelderse Poort. Still, each country elaborated its own plans and cooperation only took place on an ad hoc basis (De Jong and Van Tatenhove, 1998). The international steering committee was dissolved, transboundary interactions were insufficient with regard their regularity and quality and currently the contact between the two parts of the Gelderse Poort region is realised in an informal way (De Jong, 2000; Pechini, 2014).

6.1.3 Challenges

Both challenges for the criteria of integration and transboundary governance can be distinguished. For the latter, differences between regions could be hampering cross-border cooperation. For instance, actors involved in collaboration were confronted with different discourses on nature conservation on each side of the border (the Dutch 'nature development' culture versus the German wish to maintain the historical, cultural landscape), as well as differences in the institutional organisation (De Jong, 2000; GS Gelderland, 2007; Provincie Gelderland, 2008; Radboud Universiteit Nijmegen, 2014; Staatsbosbeheer, 2014). Differences are not bridged due to a lack of familiarity with the different policies and discourses of bordering regions and a limited mutual understanding (Pechini, 2014). This hinders cross-border cooperation and currently there is little transboundary collaboration. Also the integration of the multiple functions of this region seems to be challenging; lots is happening on a sectoral level.

6.1.4 The region's potential

The Gelderse Poort has a long history of transboundary governance for nature issues and water management, related to the region's unique landscape characteristics and its status as a national landscape, which has been recognised by both public and private parties. A trigger for collaboration in the Gelderse Poort were the linkages with economic incentives, such as the winning of materials. Thus, cross-border cooperation has so far focused on nature conservation, yet the intensity of cooperation has decreased and other important functions could be subject of collaboration as well. For instance, this area could be seen as the gateway to the European hinterland for shipping and provides opportunities for recreation and tourism. However, transport routes from the Netherlands to Germany (e.g. new infrastructure of the A15 and the Betuwelijn) affect the landscape. Also urbanisation takes place in this region, for instance in the nearby located cities of Nijmegen and Arnhem. Consideration for dealing with climate-change effects, such as heat islands or droughts, should be made. Also the function of agriculture on each side of the borders plays an important role. Besides, the Rhine enters the Netherlands at Lobith, located in the centre of the Gelderse Poort area and, therefore, this region is also concerned with transboundary issues concerning water quantity (low and high waters) as well as water quality. Some functions are already addressed, for instance flood risks are managed via the (future) retention areas of Rijnstrangen and the Ooijpolder and the Room for the River projects. All functions described are interrelated and influence each other; therefore they should be connected in policies to ensure a sustainable and climate-proof Gelderse Poort region. Thus, the Gelderse Poort region provides multiple opportunities to establish and implement a climate-adaptation vision that integrates the variety of opportunities and gives a boost to cross-border cooperation.

6.2 Maastricht-Liège and the Euregio Meuse-Rhine



Figure 5: Euregio Meuse-Rhine Source: GoEast (2014).

6.2.1 Description of the region

The border region in the south of the Netherlands (Maastricht-Liège) and its neighbouring regions (figure 5) is characterised by cities and cultural and natural diversity. This border region has cooperated since 1976 with the Euregio Meuse-Rhine, having a combined population of almost 4 million people and providing important functions for employment, living, education and health care. The Maastricht-Liège region brings cultures and three languages together and is a candidate for the cultural capital of 2018. This region already has international, infrastructural connections: there are several highways, high-speed rail connections and three international airports all within an hour's journey, as well as the nearby large ports of Antwerp and Rotterdam (Euregio Meuse-Rhine, 2014a; Gemeente Maastricht, 2014; Provincie Limburg, 2012; Stadt Aachen, 2014). The economic and technological potential of this region is high, especially in the urban agglomerations where industries emerge and develop (approximately 250,000 companies are located in this region) and where important (international) universities are located, such as the universities of Aachen, Liège and Maastricht. Until the 70s the region of Maastricht was an important mining area; following the closure of the mines, service provision, knowledge and high quality materials and life sciences industries were established, based on the Brainport 2020 vision (e.g. two research parks and two innovations parks were established) (Gemeente Maastricht, 2014; Ministerie Economische Zaken, 2007; Stadt Aachen, 2014). Today the Gross Regional Product of the Euregio Meuse-Rhine is 100 billion euro annually. Furthermore, the region is popular for recreation and tourism, since it has also open, peaceful and quite natural areas (Gemeente Maastricht, 2014). The Meuse river flows through this region. It is classed as a rain-fed river, having little storage capacity to buffer precipitation fluctuations, leading to a high sensitivity with regard to floods. This catchment and its river are used for drinking water supply, navigation and agricultural purposes. In conclusion, the area is an open, multi-lingual and innovative society, full of vitality (Gemeente Maastricht, 2014).

6.2.2 Cross-border cooperation

This region has a long history of cooperation established via multiple projects on different themes.

- Cooperation within the Euregio Meuse-Rhine focuses on nine different fields, underlying the diversity and high potential of this border region: economy and innovation, employment and education, culture and tourism, health care, safety, mobility and infrastructure, sustainable development, territorial analysis and regional marketing (Euregio Meuse-Rhine, 2014a; Stadt Aachen, 2014).

- Another example of cross-border cooperation was the 'Limburg-Experimenteer regio' route (2009–2011) focusing on decreasing barriers for transboundary mobility or cooperation. Actors on all governmental levels were involved (Provincie Limburg, 2012).
- Also some Interreg projects were executed in this region, for instance AMICE. AMICE was a transnational project concerning adaptation of the Meuse and its basin to the impact of floods and low water from climate change (AMICE, 2014).
- Other examples of cooperation agreements are between the academic hospitals of Maastricht, Aachen and Tongeren, collaboration between emergency services, a special 'Euregio ticket' for travelling across borders, the joint bachelor and master programmes of the University of Hasselt and Maastricht via the Limburg transnational university, the Open University having centres in the Netherlands and Flanders, as well as the ROC preparation of working across borders and primary schools in the border region that pay extra attention to languages (Provincie Limburg, 2012).
- Other cooperation platforms focusing on the Meuse river basin, yet integrating themes such as water quantity and quality management, are the International Meuse Commission and the Flemish-Dutch Bilateral Meuse Commission.

6.2.3 Challenges

Concerning cross-border cooperation, a challenge will be the complex cooperation process between multiple partners from three countries that have different views on, interests in and apply different approaches to climate change. Also challenges related to climate change itself could be distinguished, as the expected climate-change effects – wetter winters and drier summers in the Meuse basin – could lead to peak flows, resulting in more frequent and intensive occurring of droughts as well as flood events. Furthermore, water temperatures are expected to increase, as are water quality issues (Ministerie V&W, VROM and LNV, 2009; Van Vliet et al., 2008; De Wit et al., 2007). Climate-change effects in the Meuse basin, and particularly for the region of Maastricht-Liège, put at risk the assets of the catchment, including the infrastructure, industries, historical and ecological heritage, as well as the urbanised region.

6.2.4 The region's potential

This region is characterised by a combination of urbanised, industrial and natural aspects. Due to its unique, geographical location in the heart of Europe – connecting Belgium, the Netherlands and Germany – the region enjoys excellent connections and opportunities, offering great advantages for business and citizens. The need for adaptation to climate change is high in this regional border region, for instance with regard to the impacts on the river Meuse, as well as the possible heat islands in the urbanised areas, directly affecting society and its inhabitants. Unique potentials of this region are the existing knowledge base and network, as well as the economic and technical opportunities. Based on the AMICE outcomes and existing network – cooperation within the Dutch-Flemish Bilateral Meuse Commission and the International Meuse Commission – first talks and steps towards a climate-adaptation strategy for the Meuse river basin (and thus the region of Maastricht-Liège) are made.

6.3 The Ems-Dollart region



Figure 6: The Ems-Dollart region Source: EU Interact (2014).

6.3.1 Description of the region

The Ems-Dollart region is a unique border area, located in the northern part of the Netherlands, near Groningen (figure 6). The Dutch–German border runs through this river, yet is not exactly agreed upon and thus this border region could be seen as a shared district. The Ems river originates in Senne (Teutoburger Woud in Germany) and flows, via the Dollart river, into the North Sea. The river basin of the Ems and Dollart could be seen as one ecological system and Natura 2000 area that is connected across man-made border. (Natuur en Milieu federatie Groningen, 2014a; Rijksoverheid, 2014a). This region has different functions; for example, the Ems is an important shipping route and harbour region, having significant economic and employment functions. Due to increasing shipping and bigger vessels, the Ems has been widened and straightened several times, leading to ecological decays. An example is that the Ems delta is now more affected by sea tides and salt water and that sludge does not sink (Eems Dollard Regio, 2014; Smits, 2014a; Natuur en Milieu federatie Groningen, 2014a; Rijksoverheid, 2014a). Water quality significantly decreased in this estuarial area; formerly it was an important breeding zone for fish and bird species (Natuur en Milieufederatie Groningen, 2014g). Other themes being discussed in this region are energy, maritime activity, tourism, culture, aging and employment problems and the bio-based economy (Eems Dollard Regio, 2014; Kerkhof, 2014; De Weerd, 2013).

6.3.2 Cross-border cooperation

Various Dutch–German cross-border projects are distinguished in this region, often aiming to stop ecological deterioration and to conform to European legislation (particularly Natura 2000 and the WFD) (Rijksoverheid, 2014a).

- An important cooperation platform, the ‘Ems Dollart Region’, was established on February 28th 1977. Dutch and German actors meet each other during transboundary meetings, activities and projects. Approximately 100 public and private organisations have joined this platform, pointing towards the importance of transboundary interests with regards to spatial planning, infrastructure regional economy and culture (Eems Dollard Regio, 2014).
- Since 2010, German and Dutch governmental actors have jointly formulated an integrated management plan for this region – based on a German planning method that does not have a legal binding status (*Integrierter Bewirtschaftungsplan*). This collaboration is stimulated by the WFD and Natura 2000 legislation and is made by a joint steering group that connects national plans (Eemsdelta, 2014; Natuur en Milieu federatie Groningen, 2014b). The integrated

management plan provides a vision on how to combine economic development and nature protection and rehabilitation (Rijksoverheid, 2014a).

- In 2010, six nature and environment groups, two energy companies and Groningen Seaports signed an intention for sustainable development of (industry in) the Ems delta area, called E-pact, leading to agreements concerning nature and environmental quality improvements for the Ems delta and harbour region. The Dutch national government and the province of Groningen also participated in this project. Issues such as rehabilitation of the ecological quality of the estuaries, reduction of CO² emissions and the increase of renewable energy are addressed (Natuur en Milieu federatie Groningen, 2014c).
- The same year, a project to balance ecology and economy was started, being a collaboration between Dutch actors – the province of Groningen, municipalities, ministries, nature organisations and companies. This project focused on economic development of the Ems and Delfzijl harbour, taking into consideration the ecological aspects and interests of nature and the environment (Natuur en Milieufederatie Groningen, 2014d). In 2012 an intention agreement was signed concerning the themes of ecology and economy. The intention of Rijkswaterstaat to widen the connection between the Ems harbour and the North Sea again in 2014 was the motivation for the ‘balancing of ecology and economy partners’ to establish further agreements for nature recovery and economic development by guaranteeing the safe accessibility of the harbour and to increase employment (Eemsdelta, 2014; Smits, 2014a).
- German actors cooperate in this region via a project called ‘*Perspective Lebendige Unterems*’, which started in 2010 for the recovery of the Ems basin via a dialogue with local stakeholders (Natuur en Milieufederatie Groningen, 2014e).
- In 2009 the programme ‘Towards a rich Waddensea’ started, incorporating only Dutch actors. The project was initiated by Gerda Verburg (former minister of Agriculture, Nature and Food Quality) and strives for a resilient and strong Wadden region by nature recovery and sustainable usage of the area (Natuur en Milieufederatie Groningen, 2014f).

6.3.3 Challenges

It appears that the balancing of the region’s economic functions (e.g. shipping and accessibility for the harbour) with the region’s ecological values (e.g. Natura 2000 region) is a challenge. Various dialogue processes and platforms have been established to deal with this issue. Climate-change effects will put more pressure on existing challenges in this region. Additionally, steps could be taken with regard to transnational cooperation, as some collaboration projects do not include actors from the other side of the border. Even though, there is a clear urgency for cross-border cooperation.

6.3.4 The region’s potential

The unique bordering situation of the river Ems underlines the need for transboundary governance in this region. In the light of a changing climate, adaptation is required in this region, for instance the effects of a rising sea level could impact the accessibility to the harbour region. The short overview of the Ems-Dollart region clarifies that multiple cross-border projects exist that focus on a high variety of issues, particularly with regards to shipping, ecology, energy, maritime issues, tourism, culture, and employment. The combination of functions in this region provides an opportunity for cooperation between multiple actors on multiple themes, consequently leading to the chance to develop an integrated vision to adapt to climate change. This region provides opportunities to link measures towards EU legislation, e.g. via Natura 2000. Besides, this area already has experience with combining issues and themes via cross-border cooperation, for instance in the Integrated Management Plan.

6.4 The Scheldt catchment

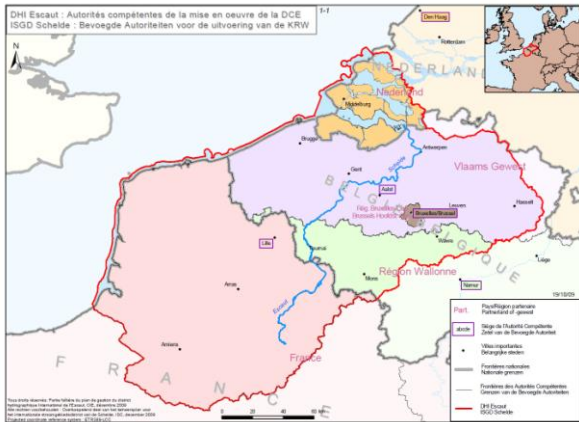


Figure 7: The Scheldt river basin Source: TIDE (2014).

6.4.1 Description of the region

The Scheldt river basin (figure 7) has a surface area of approximately 21,863km². The Scheldt is a relatively small international river and flows 355km through France, Flanders, Wallonia and via the Netherlands into the North Sea. This region has several functions: it is a living area for approximately 10 million inhabitants, it has an important agricultural function, navigational functions, and for some parts consists of urbanised area with businesses, industries and transport. Also tourism and recreation are important for this delta region that enables water sports, fishing and other activities. The Scheldt delta is an area consisting of rich chemical, hydrological and morphological gradients, leading to a unique ecological, estuarial region for flora and fauna species. In recent years, water quality has improved by means of the countering of pollution problems. Still water quality issues play an important role, just as do large-scale water abstractions and the strengthening of the tide in the estuaries due to changes to the river system. This could lead to ecological damage in this unique nature region (van Ast, 2001; De Delta, 2014; Meijerink, 2008).

6.4.2 Cross-border cooperation

Cross-border cooperation with regard to water issues has a relative long history in this region, for example via the Permanent Commission for Monitoring of the Scheldt Canal, the Technical Scheldt Commission, the Dutch-Flemish Scheldt Commission and the International Scheldt Commission. Those commissions are based on different treaties, such as the Helsinki Treaty (1992) and the Treaty for Protection of the Scheldt (1994), and have resulted in important outcomes, such as a Scheldt Action Programme – a long-term vision for the Scheldt in 2030 (van Ast, 2001; Seys and Beyst, 2003). Also nature and environmental groups cooperate via the ‘Grenzeloze Schelde’ platform and strive for recovery of the Scheldt ecosystem and water courses in the basin (Seys and Beyst, 2003). Other cross-border projects are:

- EURES Scheldemond, focusing on employees and jobseekers in the border region of Antwerp, Flanders, and the provinces of Noord-Brabant and Zeeland. The purpose is to promote labour mobility by information exchange and advice, and the establishment of a network for employment services (EURES, 2014).
- The Euregio Scheldemond focuses on cooperation between the province of Zeeland, East and West Flanders in relation to employment, health care and enterprises (Provincie Zeeland, 2014).
- Another platform is the Rhine-Scheldt Delta, which is an open network for private and public partners in the delta region of the Meuse, Scheldt and Rhine basin. Focus points for cooperation are challenges and opportunities for the economy, mobility, ecology, culture, tourism

and recreation. Outcomes include a landscape manifest (Rijn-Schelde Delta, 2007; Rijn-Schelde Delta, 2014).

- Since 2000, Flemish and Dutch public and nature organisations and businesses cooperate via the Scheldt Fund, striving for the sustainable development of the Scheldt catchment by focusing on industry (Seys and Beyst, 2003).
- In April 2014, the 'Schelderaad' was established by the Dutch Minister of I&M and the Flemish Minister of Mobility and Public Works, as the official platform for the management of the Scheldt estuary. Using this platform, governments, ports, employers and agricultural and nature organisations can contribute towards future decision-making processes with regard to shipping, flood and nature issues (Benelux, 2014; Rijksoverheid, 2014b & c).

6.4.3 Challenges

Important policy issues in this estuary are access to the port of Antwerp, water and sediment pollution and estuarine and ecological rehabilitation (Meijerink, 2008). Those issues will increase due to climate change. Dealing with the impact of climate change in the vulnerable Scheldt estuary will be a challenge – such as protection of the coast from floods and the management of water quality levels, and protection of the ecosystem in relation to the development of other (economic) functions (e.g. shipping, agriculture and urbanisation).

6.4.4 The region's potential

Climate-change effects will impact the vulnerable estuary of the Scheldt, for instance via the rising sea level and the increase of salt-water infiltration. Dutch and Belgium actors both have an interest in cooperation, the Dutch being the downstream partner that is dependent with regards to water quality and quantity issues, while Flanders is dependent on Dutch actions for the improvement and maintenance of the navigational access. This region provides opportunities to integrate the themes of nature and ecosystem management, water governance and transport (particularly with regard to navigation) into one cross-border climate-adaptation strategy. Existing networks of collaboration might stimulate transboundary cooperation in this region. Other issues addressed by existing projects and platforms, such as tourism, culture, recreation, mobility, industry and employment, could be integrated into a common vision as well. Those combinations could create win-win situations for the Scheldt region.

7. Focusing on three case studies

The final sections describe the possibilities, challenges and requirements for an integrated, cross-border climate-adaptation approach from quite abstract perspectives. To be able to develop concrete recommendations, the researchers have focused on three regions – in the Dutch–German Rhine border region – that already address (aspects of) climate-adaptation governance or are expected to do so in the future. By selecting the cases of Rijnstrangen, the transboundary dike ring 48 and the ‘Levees for the Future’ project, both the criteria of integrated and cross-border climate-adaptation governance are covered. As the cases are quite different – one project, one region and one dike ring – it is not the researchers’ purpose to compare them, yet they could be used complementary: to gain a more complete and in-depth overview of climate adaptation possibilities in the Dutch border region.

7.1 Transboundary dike ring 48

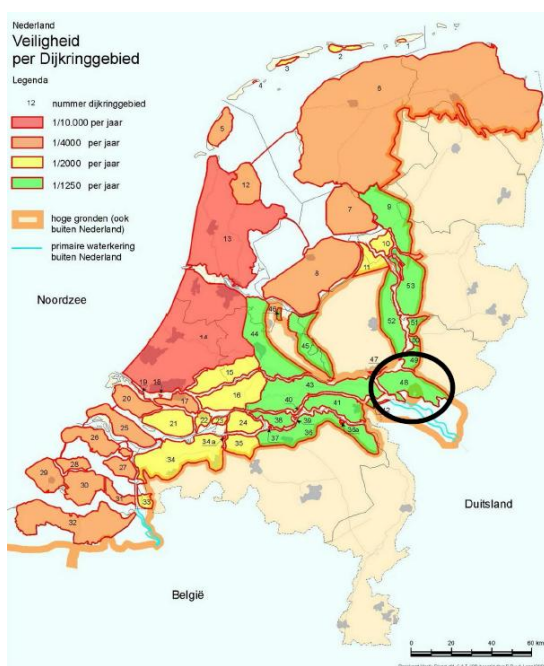


Figure 8: Situation of the transboundary dike rings
Source: Jansen (2014).

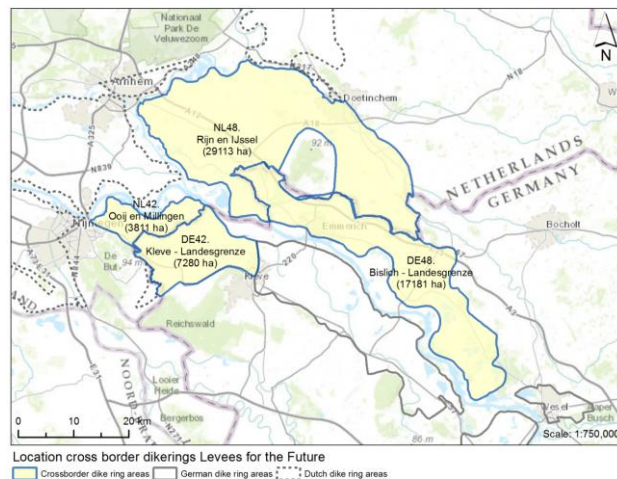


Figure 9: Dike rings 42 and 48
Maps based on data source: Viking (2014).

7.1.1 Characterisation of transboundary dike ring 48

Fluvial floods do not stop at state boundaries, which becomes particularly evident on the German–Dutch border, where two transboundary dike rings are located (numbers 42 and 48) (figure 8 and 9). Both dike rings are enclosed by flood defences and higher grounds and are situated on both Dutch and German soil. What is unique is that in the case of a flood both countries will probably be affected (Silva et al., 2009). This study focuses on dike ring 48, covering a total area of 532km², from which 70% belongs to the Netherlands and 30% to Germany – yet 90% of the flood risk rests on the Netherlands (Graafsma, 2014; Silva, 2009; VNRgemeenten, 2014). Based on the sloping nature of the area – from south-east to north-west, with a difference of about 10m during times of high water, a flood further downstream will lead to a smaller flooded area (Silva et al., 2009). Besides, an [extreme flood](#) in this dike ring could have cascade effects for the downstream located regions (Jansen, 2014; Silva et al., 2009; Terpstra et al., 2013). Dike ring 48 is located in the province of Gelderland and the state of North Rhine-Westphalia, 20% of the region is urbanised, e.g. the cities of Lobith, Doetichem, Zevenaar, Emmerich and Rees. About 240,000 people live in this region and 70% is used for agricultural purposes. In the Netherlands, the regional water authority

Rijn en IJssel is responsible for the maintenance of the dike ring and in Germany this is the responsibility of Diechverband Bislich-Landesgrenze (Provincie Gelderland, 2011; Silva et al., 2009). Standardisation of the dikes, modelling methods and visions on safety are different between the two countries. An example is that the water level of the Rhine increases by about 70cm at the Dutch border based on Dutch models in comparison with German models. Studies showed that in general, German weirs are more fragile than the Dutch. For example, 0.5km of Dutch weirs and about 15km of German weirs in this region did not conform to the standards in 2011 (especially the dike area between Emmerich and Rees). The expectation is that, through the planned realisation of a levee remediation programme, the relocation of dikes and retention measures in North Rhine-Westphalia and the Room for the River programme and actions in the Netherlands, flood risks will reduce significantly in this region by 2015 (Bosch, 2014; Provincie Gelderland, 2011; Silva et al., 2009). New insights with regard to the issue of piping, the new standardisation methods of the Dutch Delta Programme and the slow pace of dike reinforcements at the German side lead to the fact that this reduction of flood risks by 2015 will not be sufficient in the future (Graafsma, 2014). International collaboration for this dike ring is considered on the multilateral and bilateral governmental level, for instance via the Arbeitsgruppe that focuses on research with regards to flood risks and enables alignment between actions and measures on both sides of the border. For instance, the VIKING programme focused on dealing with different modelling and standardisation methods. During the spring of 2014, transnational risks in the dike ring were put in the spotlight via the media. Cross-border risks and a possible cascade effect were already known before, yet the new standardisation methods of the Delta Programme again focused attention on the discussion of dealing with differences between Dutch and German flood risk management. At present, a new, transboundary study on risks in the cross-border dike rings is started (Graafsma, 2014). Central questions in this case are: how is water governance arranged at the other side of the border and what could we expect for the upcoming years? How should (climate-adaptation) governance between Dutch and German actors be arranged?

7.1.2 Analysis of transboundary dike ring 48

Analysis of this case is based on input from the expert workshop and interviews of Bein (2014), Bosch (2014), Friedrich (2014), Graafsma (2014), de Hartog et al. (2014), Seuren (2014), te Nijenhuis (2014) and on the following documents: Jansen (2014), Provincie Gelderland (2011), Silva et al. (2009), Terpstra et al. (2013).

'Moments of Choice'	Transboundary dike ring 48
Problem perception	<p>Dike ring 48 is shared by two states, leading to challenges for this first policy choice; for instance standardisation and monitoring methods for levees differ between the Netherlands and Germany (e.g. Germany applies a flood standard of 1/500 year for this dike ring, while the Netherlands currently applies a standard of 1/1,250 year for the dike ring, which will increase towards 1/30,000 – for the levee from the border to Westervoort – and 1/10,000 - from Westervoort to Doetinchem- in 2017). Having one standard for the complete dike ring would be an ideal situation, yet this is the competence of the national governmental level (related to the principle of sovereignty). Furthermore, actors from both sides of the border frame flood-risk management slightly different, leading to different views on the problems and issues of the cross-border dike ring. (For instance, German actors criticise the future discharge assumptions – 18.000 m³ – of the Dutch Delta Programme.)</p> <p>It appears that mutual understanding between actors involved is important for cooperation in this dike ring, especially since water management is addressed differently on the domestic level (e.g. German water management is more hierarchic, flood management is seen as less urgent and no long-term plan is established). Related is that actors could have other purposes for collaboration (e.g. German ac-</p>



	<p>tors are willing to learn from Dutch approaches, while the Dutch are willing to improve national safety through collaboration). Mutual understanding could increase via joint fact-finding, which is done in research projects of the Arbeitsgruppe. Uncertainties concerning risks and approaches on the other side of the border are a central issue; for instance Dutch actors worry about the velocity of dike reinforcements on the German side (German regional water authorities still wait for authorisation of higher governmental levels concerning these planned dike reinforcements). Albeit there is international cooperation (e.g. via the Arbeitsgruppe), many aspects of water management on the other side of the border are still unclear.</p> <p>Flood-risk management in this dike ring is on the political agenda in both countries, yet is perceived as more urgent in the Netherlands. Via international fora and direct contacts, Dutch actors are trying to raise attention towards this issue.</p>
<p>Level and scale</p>	<p>Governing issues in the dike ring are done at multiple governmental levels – regional, national and international. On both sides of the border various actors are involved with international cooperation, leading to ambiguities about responsibilities and competences. Yet regional actors are most important for the daily management of the dike ring. Therefore, direct (regional) collaboration is important. A difficulty for collaboration is that Dutch regional water authorities have more competences, while German regional water authorities are smaller and more dependent on higher (and more) levels of governmental actors (e.g. for orders, permits, agreement and financing). Organisational structures between both border regions differ. National governmental levels are responsible for standardisation. Cross-border cooperation for water management on the Dutch–German border is mainly organised via the Arbeitsgruppe, especially focusing on information exchange. Particularly, information on the current status of levees and planned measures is exchanged, yet future development is often unknown to the bordering parties. Even though this group collaborates on a more abstract level, studies on standardisation and flood risks are executed for both dike rings. Recently, a study (initiated by Dutch actors) on how to deal with different standards between both states and the new standard of the Delta Programme in the transboundary dike rings was started. Next to the abstract level, the Arbeitsgruppe focuses mainly on flood issues. It is questionable if the Arbeitsgruppe is the most appropriate platform for integrated climate-adaptation governance. However, it might be a starting point as it is an existing network. Besides, this group has no decision-making power, as states are sovereign. Also the supra-national level affects this case, for instance European legislation (e.g. the Floods Directive) and requirements stimulate cross-border cooperation in general. Yet, EU legislation provides few concrete tools for daily management, for the establishment of joint standardisation, vision etc. Furthermore, this case shows that each state or organisation should have a clear approach before they contact other (foreign) parties for collaboration. And that organisational and political differences should be recognised before collaboration can be successful.</p>
<p>Multi-sector or sector-based governance</p>	<p>In this case, the focus is mainly on flood risk and safety management, whereby the Dutch are often the requesting actor due to their downstream location and dependencies. Yet, water management could affect other sectors as well, such as agriculture, transport possibilities and living. Yet, as far as we know, no attempts are made for more integration and cooperation, because the issue of safety gets priority. Another difficulty that appears is that Dutch regional water authorities address integrated water management, while in Germany water management is diffused among actors involved (Deichverbände, Bezirksregierung, Kreise etc.). Overcoming the upstream–downstream issue could be reached by zooming out</p>

	towards the complete system and to arrange exchanges for more themes and issues, in order to create win-win situations. However, bringing different themes together might be difficult, due to dissimilar responsibilities of the actors involved.
Timing and sequence	The period of water-management planning is another obvious dilemma in this case, as the Dutch focus on the long term (2100 in the Delta Programme), while German water management is committed up to 2025. This discrepancy could lead to a complex process for the establishment of a joint plan. Another issue for this case is the alignment of the Delta Programme; various actors argue that the Dutch have provided too little opportunities for discussion, leading to criticism from German actors. Cross-border collaboration in this region has a long history, yet there are a few reasons why the present time could be the moment to boost transboundary governance. First, the Dutch Delta Programme and the new standardisation require alignment with German actors. The momentum of the Delta Programme could be used as a boost for the development of a more comprehensive climate-adaptation strategy. And even though, the Delta Programme does not deal with all aspects of climate adaptation, it might provide a tremendous start for the development of a climate-adaptation strategy in the light of EU legislation. Second, the transboundary dike ring and its risks recently got media attention in the Netherlands. And third, in Germany there is a trend towards more political attention to flood-risk management (including financing) due to recent floods (e.g. in the Elbe). And attention towards dike improvements should be raised according to the national government. At present, a research project of the Arbeitsgruppe has been started in order to gain a better understanding of the status of the dike ring, based on the new standardisation of the Delta Programme. After that, more regional collaboration is required.
Mode and instrument	Governance in this case mainly focuses on water management and for both regions public actors particularly are participating; thus a public governance mode is dominant. Yet, knowledge institutions could play a significant role as well. Dike ring 48 is shared by two states, leading to challenges for existing (domestic) modes of governance . An ideal situation would be joint governing across borders of regional water authorities in the Netherlands and Germany. So far, cooperation mainly focuses on the exchange of knowledge and information, yet translation into action and formal agreements is complex. Examples of collaboration across borders in this dike ring are: formal meetings (Arbeitsgruppe), bilateral and regional meetings (e.g. between regional water authorities), joint research programmes, field work and pilot projects. Perhaps a new collaboration platform fitting the boundaries of this dike ring should be established to address area-specific problems. Such a platform could focus on management, policy development, advocacy of interests and agenda-setting.
Costs and benefits	Dike ring 48 clarifies the interdependencies between the Dutch and German states on a regional level, having impacts on the cost-effectiveness of water management. For example, dike improvements in both countries are more effective for decreasing flood risks than taking measures in only one state. Thus, collaboration could lead to more winners than individual action , yet actors need to realise their individual benefits before they are willing to cooperate. Also the financing of flood risk-reduction measures on the other side of the border might be more effective, yet is challenging. Even though this case focuses on flood safety, flood risk-reducing measures could be linked to nature and recreation functions in order to create an attractive region. Since this dike ring is of importance for the countries' water safety, the national government will pay a share.
Implementation and	Increasing the synergy of the area could lead to the establishment of one vision

enforcement	and standardisation system. More synergy could be reached via joint projects , such as the development of the area's recreational function and transport possibilities.
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Table 4: Analysis of the transboundary dike ring 48 case study.

7.1.3 Concluding remarks

Studying this case clarifies the fact that transboundary governance aspects are currently the biggest challenge in the transboundary dike rings. The Arbeitsgruppe appears to be a well-established collaboration platform, yet direct regional contact and the reaching of one water-management approach for the region should get a boost as well, for instance via the establishment of a platform for the operational management of the dike ring. Furthermore, collaboration should be broadened more from (information) exchange towards joint agreements and from high-water management to integrated climate-adaptation governance. Linking of issues leads to greater cost-effectiveness, win-win situations and a more attractive region. Yet, this case also shows that climate-adaptation governance and cross-border cooperation are both challenges for existing (domestic) modes of governance. Dealing with those challenges requires mutual understanding between the actors involved and societal support. There is the possibility that EU legislation could be used more to stimulate cross-border cooperation. Prior to the development of a cross-border, integrated climate-adaptation strategy in this region, the actors involved should agree upon basic issues, such as standardisation, modeling and monitoring methods, water discharge levels etc. More mutual understanding could be reached via joint pilot projects, conferences and round tables.

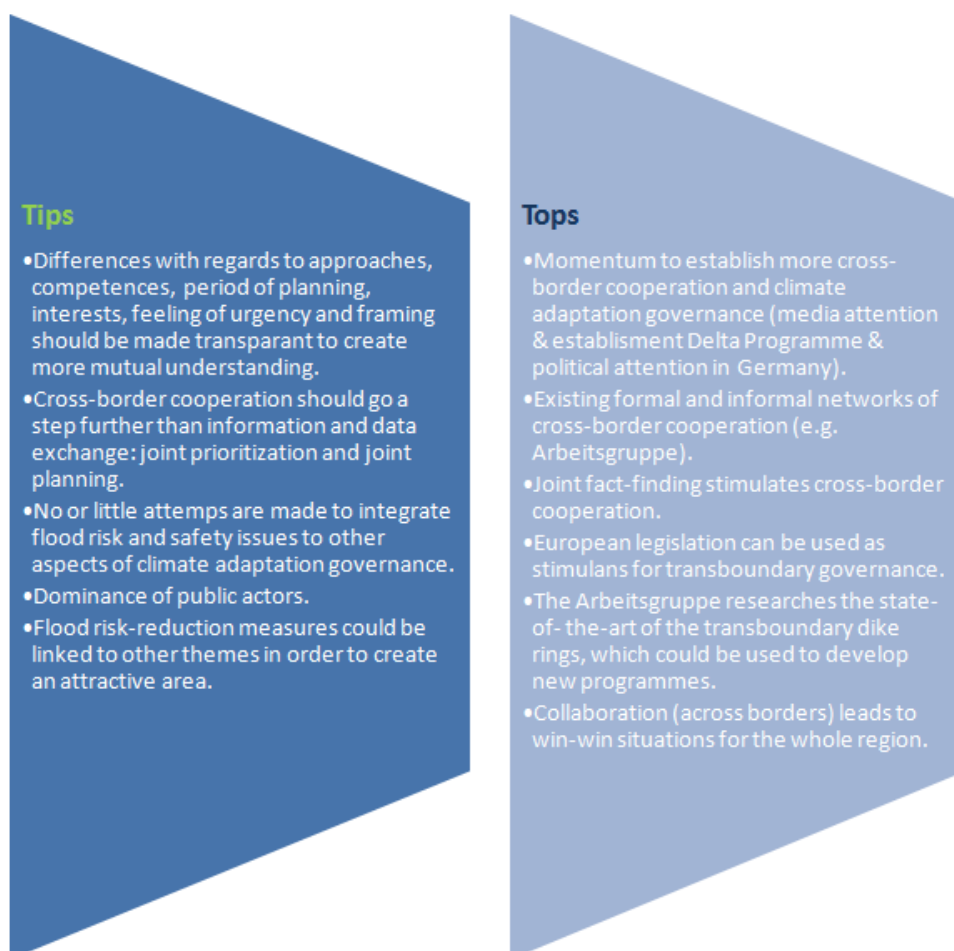


Figure 10: Tips (aspects open for improvement) and Tops (positive aspects) of Rijnstrangen.

7.2 Rijnstrangen



Figure 11: Rijnstrangen Source: Rijnstrangen (2014).

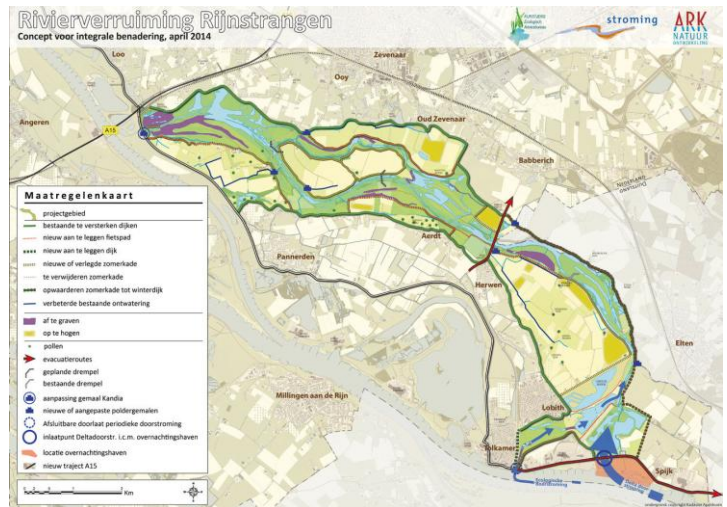


Figure 12: Potential future spatial planning for Rijnstrangen Source: ARK (2014).

7.2.1 Characterisation of Rijnstrangen

The area of Rijnstrangen is located at the point where the river Rhine flows into the Netherlands and the water is distributed (figures 11 and 12) (ARK, 2014). Rijnstrangen is bounded in between the Upper Rhine, the Bijlandsch channel, the Pannerdens channel and the lower Rhine (Witteveen en Bos, 2007). Until 1960, Rijnstrangen was part of the river system – during high waters, the water in Rijnstrangen streamed along the river; but the Kandiakade has now enclosed the river. Construction of this pumping station (shared by Dutch and German actors) had different reasons, for instance to improve water safety and agricultural opportunities in this region (Deltaprogramma Rivieren, 2014; Seuren, 2014; Sloot, 2014). The unique characteristics of this region are the old river streams, the alternation between nature and agriculture, the reed marshes and more. Rijnstrangen is identified as a Natura 2000 region – European legislation to protect flora, fauna and their habitats (ARK, 2014; Witteveen en Bos, 2007). Based on the PkB Ruimte voor de Rivier (2006), Rijnstrangen was reserved as a retention region for long-term river widening. Currently, in the strategies of the Dutch Delta Programme, the region of Rijnstrangen has once again been reserved for retention to ensure water safety between 2050 and 2100. A retention area stores water, particularly the top of a high water flow, to relieve discharges towards downstream regions. Around 2050 it will become clear if Rijnstrangen indeed will be used as a retention area during periods of high water. This long-term reservation is made based on the following arguments: the societal impact, required alignment with Germany; the amount of investment; and the technical fact that this measures will only be effective when the rest of the river system is in order (Deltaprogramma Rivieren, 2014; Diermanse, 2002; Rijkswaterstaat, 2014; Te Nijenhuis, 2014; Waterschap Rijn en IJssel, 2013). Besides the long-term reservation in the Delta Programme, other tasks in this area are nature conservation and compensation (e.g. Natura 2000), the construction of an overnight port and a highway (A15) (ARK, 2014). Thus, Rijnstrangen is characterised by large spatial dynamics consisting of challenges for the themes of nature, water and agriculture – about which there is much debate. Additionally, Rijnstrangen entails a large potential for tourism and recreation (van Hemmen et al., 2011).

7.2.2 Analysis of Rijnstrangen

Analysis of this case is based on input from the expert workshop and interviews of Bekhuis (2014), Bosch (2014), Graafsma (2014), de Hartog et al. (2014), Kieft (2014), Köning-Wipfer (2014), Seuren (2014), Slood (2014), Te Neijenhuis (2014) and Verhoeven (2014). And on the following documents: ARK (2014), Provincie Gelderland (2014b).

'Moments of Choice'	Rijnstrangen
Problem perception	<p>Rijnstrangen is a dynamic region and will deal with various developments in the upcoming years, such as the development of an overnight port, the construction of a highway (A15) and the establishment of nature (compensation).</p> <p>The first half of 2014 was used for an exploration of the cooperation ('verkenning Rijnstrangen') between the actors involved and the possibility of linking issues and themes was conducted on behalf of the province of Gelderland. Since different groups of actors are concerned, interests and visions with regards to the regions development differ as well. Particularly local actors perceive spatial development processes in Rijnstrangen (of the last 20 years) as slow, constraining and confusing. The area conference and other meetings of this 'Verkenning Rijnstrangen' helped to gain a common understanding of Rijnstrangen's challenges, opportunities, the interests and needs of the actors involved.</p> <p>Next to those short-term challenges, Rijnstrangen is seen as a possible, future retention area in the Delta Programme. This leads to ambiguities among inhabitants and businesses.</p> <p>Also German actors were present at those meetings, because some are vigilant of Rijnstrangen's developments and the impact of those plans on their region and interests. They view developments in Rijnstrangen more from a (conservative) agricultural perspective, transport interests and as a discharge basin. Also the framing of nature conservation differs greatly between the Netherlands and Germany.</p>
Level and scale	<p>Multiple challenges could be identified in this region, leading to the participation of a high variety of actors on different governmental levels, such as water managers (Rijkswaterstaat and regional water authority), the Ministry of I&M (since Rijnstrangen could become of significant importance for national water safety) and regional actors (province and municipalities, farmers, local inhabitants and interest groups). The 'Verkenning Rijnstrangen' clarified the cohesion between today's and the future's challenges in Rijnstrangen and the need for collaboration between the actors involved.</p> <p>So far, the province of Gelderland steers the developments in Rijnstrangen. This is valued positively by the actors involved, based on the province's regional and relatively holistic focus, leading to more integrated programmes.</p> <p>Rijnstrangen mainly focuses on the Netherlands, yet German actors could be willing to participate when common benefits can be found – the issues of recreation and tourism perhaps could be connecting themes, just as cross-border retention or nature development. For collaboration, existing networks could be used, such as the Arbeitsgruppe or direct bilateral collaboration between municipalities or water authorities.</p>
Multi-sector or sector-based governance	<p>The multitude of tasks in this region (Natura 2000, overnight harbour, highway, water retention) provide plenty of opportunities for integration. This could be linked to the historical and cultural background of the region as well. The 'Verkenning Rijnstrangen' clarified the cohesion between today's and future's challenges. Currently, cooperation is established with regard to some crucial aspects, such as land acquisition, realisation of 'new' nature and for anticipating socio-economic opportunities. Yet, integration could go further, for instance water safety meas-</p>

	<p>ures should take the historical landscape into consideration, such as the old (17th century) dikes and the old homes located around them. The cultural heritage of Rijnstrangen is anchored in the ancient river relics and other landscape elements. The cultural heritage could inspire new developments with regard to climate adaptation and might be the cohesive factor between the dynamic challenges in Rijnstrangen. Besides, water-safety measures could be linked to improving the area's spatial quality, which is done in the Room for the River projects. Nature development in Rijnstrangen could be linked to the over-coupling nature area 'De Gelderse Poort'.</p> <p>The involvement of multiple sectors leads to conflicts as well, for instance agriculture plays a central role in this region, yet could conflict with the interests of nature. For instance, the water authorities should take measures for changes in the water levels for the realisation of nature, yet those changing levels could heavily impact the agricultural sector. The possibilities for combinations should be studied; as ARK (2014) states, tasks for water retention and nature could be combined in the low-lying part of Rijnstrangen, allowing agriculture to be located on higher grounds – overcoming water-logging issues. Other opportunities are to improve the production and sale of local products, amongst others, as an opportunity for multi-functional agriculture and tourism, which is stimulated by the 'Liemers Trots' commission (a collaboration of 35 businesses). Yet, regional products could not be seen as a replacement for existing agriculture.</p>
<p>Timing and sequence</p>	<p>The different developments within Rijnstrangen have different time frames (e.g. short term the development of the harbour and highway (2017 and 2019) with strict deadlines and budgets for Rijkswaterstaat, in the middle long term the development of nature based on EU legislation and in the long term the possible retention area (>2050)). Even though it is unclear if Rijnstrangen will ever become a retention area, most actors are already willing to prepare for this possibility. Present spatial planning could consider future developments. A staged approach seems to be preferred in order to create support amongst inhabitants and to avoid future costs. Different parties aim to connect a long-term vision with short(er)-term goals. So far, a lesson learned from Rijnstrangen is the need for in-time participation of regional actors in order to be able to anticipate the needs of the region.</p>
<p>Mode and instrument</p>	<p>Different actors state that appropriate process management is required for the linking of functions and issues and eventually also for the implementation of climate-adaptation policies. The province could be the process manager, based on their holistic view over the area and the spatial impact of today's and future developments. During the 'Verkenning Rijnstrangen' it became clear that more attention should be given to communication with the region. The region of Rijnstrangen already deals with uncertainties for a longer period of time, for instance about the possible retention and the impact of the reservation for inhabitants and businesses (experienced as '<i>the shadow over the region</i>'), bringing more clarity should be a first priority. Clarity could be established by formulating a long-term vision with the actors involved and via communication about the reservations' consequences. For instance, farmers might be willing to switch to other crops when they know this well in advance. At present, a pilot project has been started to gain insights into the implications of the area's reservation for inhabitants, farmers and businesses. Within this long-term vision, short-term measures could be planned, incorporating already possible future developments. Municipalities address the importance of local initiatives, increasing the regions social-economic status, enabling the recovering of confidence and the dialogue between governmental organisations and citizens.</p>

Costs and benefits	<p>The developments within Rijnstrangen are very demanding for the region, therefore financial aspects will play a significant role and the region should be able to gain as well. For instance, the retention is in the interests of the safety of the whole country, while the burdens are for the local area. Getting this in balance requires the linking of functions, as the coupling of themes could lead to a greater cost-effectiveness of a climate-adaptation strategy, such as the need to show the benefits for all actors involved. For instance, Rijnstrangen’s potential for tourism and recreation could boost the region’s economic situation. And thus measures should be taken with regard to the perception, facilities in and accessibility of the area (e.g. cross-border walking and cycling routes). Another example is that the costs for water-safety measures are high – such as for a retention measure – even though there is a chance that it will not be used or only sporadically. Yet, such measures could provide opportunities as well. Linking spatial quality to a high water safety measure could solve this issue; the costs will increase slightly, yet the increased attractiveness and livability of the region will be an everyday value. Positive examples could be found in the Room for the River projects, such as Nijmegen Lent. Also compensation for parties that suffer losses by the developments, for instance farmers, should be arranged. Farmers should get more clarity on possible developments and the impact on their economic prospects.</p> <p>Also other funding possibilities should be found, such as the idea that inhabitants of an urbanised region could invest in a nature area close by. Also funding possibilities could be found at the European level (Natura 2000, Interreg, etc.) and at the national governmental level (Delta Programme).</p>
Implementation and enforcement	<p>At present, establishing administrative arrangements concerning the tasks within Rijnstrangen is the priority. After that, the implementation could start. The implementation should focus on creating an attractive area.</p>

Table 5: Analysis of the Rijnstrangen case study.

7.2.3 Concluding remarks

So far, various developments within the Rijnstrangen case have been identified, yet most dynamics do not focus on climate adaptation per se. Nevertheless, climate adaptation could be linked to ongoing and planned spatial developments in this region. Functions within and the strengths of this region could be coupled to a climate-adaptation strategy, for instance with regards to agriculture and water management. Focusing on strengths could be done via the promotion of local products or via the stimulation of tourism. For the region of Rijnstrangen, clarity about upcoming developments and possibilities (also in relation to the reservation as a retention area) is of significant importance. Clarity could be given via the development of a long-term vision for the region. ‘De verkenning Rijnstrangen’ shows that the willingness for collaboration exists when actors are brought together and the common gains are clarified. The engagement and awareness of multiple stakeholders is necessary for climate-adaptation governance, recognising the need for bottom-up, regional processes. The role of a leader and appropriate process management becomes clear as well. So far, it appears that the province is the most suitable actor for this role, based on their competences concerning spatial and nature development. Even though, Rijnstrangen might become a retention area and current developments could already be anticipating. At present, developments in Rijnstrangen have a national focus, yet the bordering German region could provide opportunities for linkages as well, for instance, with regards to nature across borders, the start-up project of a bio-based economy in Emmerich, tourism across borders, etc.

Tips

- Clarity about the implications of the retention reservation should be given. Importance of communication.
- Rijnstrangen's challenges could be connected to cross-border cooperation, e.g. via recreation, nature and tourism functions. (mutual benefits are needed)
- Multiple tasks in upcoming years provide opportunities for integration.
- Formulate a long term vision amongst the short term projects and goals.
- Consider the possible retention function in today's developments.
- Benefits for the country should be balanced with gains and losses for the region.
- Need for compensation.

Tops

- Rijnstrangen has unique characteristics that could be linked to climate adaptation.
- Ongoing spatial developments in Rijnstrangen could be linked to climate adaptation governance.
- Process management by the province steers the process and could link issues, actors and themes.
- Meetings and the area conference helped to gain a common understanding
- Multiple challenges lead to the need to involve multiple actors
- Timely participation of actors

Figure 13: Tips and tops of Rijnstrangen.

7.3 The 'Levees for the Future' project

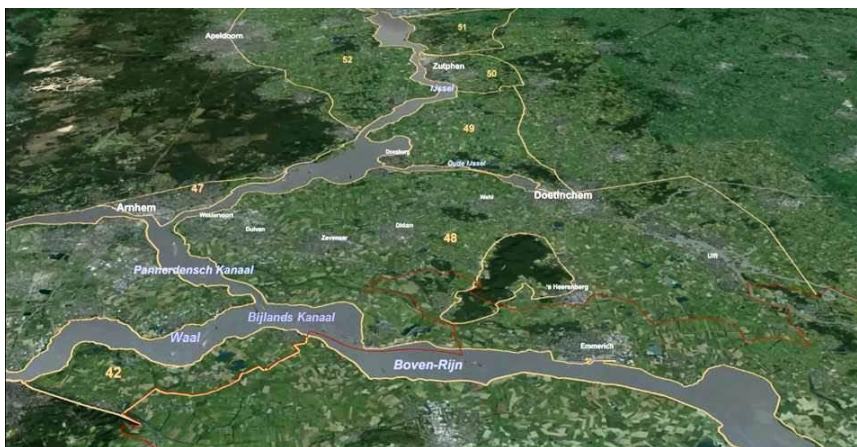


Figure 14: Rhine, Bijlands channel, Pannerdensch channel, dike ring 48 (centre), dike ring 42. Source: Waterschap Rijn en IJssel (2014).

7.3.1 Characterisation of the ‘Levees for the Future’ project

The primary focus of this case is on the north dike along river Rhine, ‘Bijlands’ channel and ‘Pannerdensch’ channel (figures 9 and 14). Levees for the Future is a Dutch–German collaboration to develop innovative structures and management strategies for the levees, flood plains and protected areas. On the German side Deichverband Bislich-Landesgreze is the administrator of the dike and they experience problems with stability and biodiversity of the dike skin, especially in the renovated dikes. The vegetation dries and loses diversity, even if the old revetment is preserved and laid back after renovation. There is still a challenge to replace approximately 20km dike. There is much debate about nature conservation and the agricultural use of dikes and their immediate environment in combination with the responsibility of the Deichverband for flood protection. Climate change will bring more droughts, more intense rainfall, frequent low and high tide, which will increase the stress to the vegetation on the dike. On the Dutch side, there is also interest in the climate resilience of the dikes in relation to shared land use and management. Here, the safety issue is important because the dike along the Rhine and the Bijlands / Pannerdens channels will prove ineffective according to the new standards of the Delta Programme and should be strengthened. In this context the differences in safety standards and strengths of the German and Dutch dikes are relevant (see section 7.1). On both sides of the border, there is interest in the use of sensors in the dike and remote sensing for monitoring the stability of the dikes and ecological quality. This can help to reduce management costs and can provide more insight into the effects of shared use and management strategies in the area. Also, the involvement of government, professionals and citizens in the choices for design and land use are important for the development of a broad and secure management concept.

7.3.2 Analysis of the ‘Levees for the Future’ project

Analysis of this case is based on the insights of the project’s initiators, Toine Smits (ISIS RU Nijmegen) and Erik Opdam (NC Advies).

‘Moments of Choice’	Rijnstrangen
<p>Problem perception</p>	<p>Vegetation on renovated levees in Germany seems poorly resistant to sun and drought. The ecological value of the dike vegetation decreases and the stability of the dike may be at risk. Transboundary ecological connections do not function adequately. There are questions about the combination of safety with shared use by agriculture and recreation and with nature. Especially in Germany there is regularly fierce debate between the dike manager and nature conservation organisations on development and management. Dutch and German dike managers are interested in stress tests on levees (flood, overflow) and monitoring (sensors, remote sensing). The presumption is that the vegetation and erosion problems are associated with the construction of the dike (homogeneous clay or clay-sand-clay) and orientation to sun and water), management strategy (fertilising, mowing, grazing, shared use) and transitions (grass-stone, grass-asphalt). Dike managers search for the optimal combination of vegetation, given the existing structure. There is confidence in monitoring techniques (sensors, remote sensing); the questions are around how to combine these measurements with traditional dike surveillance and monitoring.</p> <p>German dike managers are primarily focused on the dike vegetation and (remote) sensing of stability. On the Dutch side, there is more demand for achieving proper cooperation between the water boards and Deichverbände and to governance issues (see also section 7.1). Involving businesses and citizens in decisions on environmental management is sometimes seen as a risk (at least in this part of Germany) because safety will then be weighed against nature, land use and public experience. In the Netherlands, governments are more willing and experienced in this aspect. On the other hand, in Germany the connection of the people to their own dike and Deichverband is much closer than for the larger Dutch water boards. In both countries, there is interest in a combination of safety and ecology and the</p>

	<p>opportunities for shared management. Also both sides are interested in modelling and decision support. The problem is of actual interest in both countries. In the Netherlands recently the Delta Programme was published, based on those new safety standards, the Dutch part of the dike will prove ineffective. In Germany, the renovation of the dike is on the agenda of the general political bodies that provide the money, but with less urgency for rapid implementation. The discussion about safety in relation to nature in both countries is on the social agenda, albeit somewhat limited to nature organisations and regional interest groups.</p>
Level and scale	<p>The regional level is the most important in this case, as dike associations and regional water boards are responsible for the maintenance and management of the dikes. The scale of operation in Germany is smaller (one dike ring) than those in the Netherlands. Besides them, there is a responsibility by local authorities (in Germany also Kreis, Bezirk), Province and Länder, and the national government (in the Netherlands Rijkswaterstaat as an executive agency), with different responsibilities for flood protection, nature conservation, land-use destinations. Nationally recommended research institutes and universities are interested in conducting research on the (remote) sensing, developing innovations and the involvement of citizens and businesses in the decision. The area can become a 'living laboratory' for construction, operation, safety, ecology, monitoring and decision-making. In addition to the dike managers, other government agencies and research institutions, there are the users, residents and property owners in the area who need to make choices and develop a management strategy. The dike is usually government property, but the surrounding grounds are often in private hands (residents, businesses) or in the ownership or control of land-keeping (nature) organisations. With the exception of private property, the areas are usually open to the public for traffic functions and recreation. This complex ownership situation requires good governance. Flood safety is a policy issue on an international and national, or better, on a system level (water basin) and an operational issue on regional and local level. Nature and ecology has a similar distribution with European legislation (Natura 2000) to regional and local management. Neither nature nor water know geographical boundaries. Choices for environmental management are very closely linked and require alignment across the border (actions upstream affect the situation downstream, same for left and right banks, space for water provides opportunities for nature and recreation, nature influences the drainage and flow rate, etc.).</p>
Multi-sector or sector-based governance	<p>The case involves several sectors, in any case: safety, regional economics, agriculture, recreation, environment and technology. Safety is hierarchically above the other functions.</p>
Timing and sequence	<p>Existing dike management conforms to a certain extent with current safety objectives and to a lesser extent with the goals for other functions. There are large economic interests in safety, so that – even at great expenses– it will be preserved. Improvements in decision-making, construction and management can be tested on a small scale and can be aggregated to a larger scale in the medium and long term. Decisions on the higher scale will affect the potential on a lower level. As long as safety is guaranteed, there may be possibilities for experiments and pilots. A better integration of safety, nature, land use and exploitation is desirable in the long term and is being pursued at various levels. Research into existing dike vegetation in relation to the dike construction, tests with other vegetation mixes, deployment and development of monitoring systems for the stability and ecology, development and deployment of decision support systems can be started in the near future and will deliver results for applications on longer-term and larger scale. First steps will be: Inventory of existing data, research, field and laboratory tests.</p>

	Also designating a pilot region or several pilot sites for experiments (also possible outside the border region itself, as long as the results can be applied there) and a management pilot (in the border region, preferably cross-border).
Mode and instrument	<p>There is a mix of top-down and bottom-up and desired public-private and market control. For the issues of water-safety and nature conservation, European directives are in force, which should be implemented (top-down) on national and regional level. Governments are responsible for the establishment, maintenance and management of the dikes; regional and local governments and nature conservation organisations and individual owners are responsible for maintenance. Network management, or a combination of top-down and bottom-up management, is needed. Research is usually a bottom-up activity for which consent is required to get financial support and where the authorities decide on the application of the results.</p> <p>Governments tender activities for construction and maintenance publicly or they are performed in public-private partnerships. Decision-making on planning, management and exploitation are usually outcomes of interactive processes, where joint planning, scenario development and decision-support systems (modelling, discussion forums, online consultations, meetings, etc.) can be utilised. The realisation usually is a private matter, for which governments provide subsidies, guidelines, drafts, or give directions and commands.</p>
Costs and benefits	<p>Costs for dike management are borne by the government because of the importance of water safety. The costs of investigations and experiments can be recouped over time by savings on maintenance and management and a more effective decision-making process. Nature conservation organisations will benefit from the improved integration of safety and ecology. In exchange they can support studies and experiments ('in kind' or with money).</p> <p>A better design of dike and environment can lead to a more attractive area, which stimulates tourism and recreation. For a number of municipalities in the region (e.g. the border municipality in the Netherlands) river-related tourism is an important source of income. The area management costs are also redeemable by winning biomass opportunities. There are possibilities in combining dike renovation and vegetation management with cleaning up tree planting in some dikes and with channel management by winning the sediment.</p>
Implementation and enforcement	In the next 4 to 5 years the project – when it is honoured by Interreg – will regularly deliver the results of experiments and surveys, which can be realised together with the measures already programmed for the development and management of the area or that will be planned in the near future. Implementation is also possible in other areas along the Rhine and other rivers. Implementation and enforcement will primarily take place by the dike and water managers, in collaboration with the owners and land managers in the area. Separate attention is focused on making the innovations applicable in other European border regions.

Table 6: Analysis of the 'Levees for the Future' project.

7.3.3 Concluding remarks

It should be noted that the case is in development and that implementation is pending approval and funding by Interreg V and the co-financiers. The conclusions are based on work carried out for the design and development of the project in 2014. It is interesting that this case focuses on the dike itself, the importance of water safety, monitoring erosion and vegetation because of the German interest in these topics. The governance aspects, participation and opportunities for experiments and research are more important for the Dutch partners. The challenge is to arrive at a comprehensive regional approach despite these differences. From the process of the 'Levees for the Future' project so far, the following lessons can be

learned for the development of a climate-adaptation strategy across borders. First, that attention should be paid to the differences in the division of responsibilities between units of government in both countries. In Germany, responsibility seems to be divided between hierarchical organisations (Deichverband, Gemeinde, District, Land) whereas in the Netherlands organisations are working in parallel on different issues (Province, Water, department of Rijkswaterstaat) or responsibilities are divided between departments within an organisation (e.g. water quantity and nature within water boards and Rijkswaterstaat). Second, we should be aware of the differences in scale between the Netherlands and Germany (e.g. between relatively small German dyke associations and the merged water boards in the Netherlands). And also, third, the way research is organised varies. For example, in Germany, direct bilateral agreements between research institution and public service are common, whereas in the Netherlands studies are usually performed by special research centres such as Deltares, IJkdijk. Fourth, that there are both on the operational and policy levels good, frequent and long-term contacts between the actors involved (e.g. between the water and dike managers achieving exchange of information and cooperation in practice). And lastly, that the differences between the countries offer interesting opportunities for mutual learning; for example, the smaller scale of organisation of the German dike associations and the individual responsibility of residents and owners. The larger scale of organisation of the water policy and practice in the Netherlands (Rijkswaterstaat, water boards) provide research opportunities and a wide application of innovations. The German research approach seems to provide more chances for local experiments.

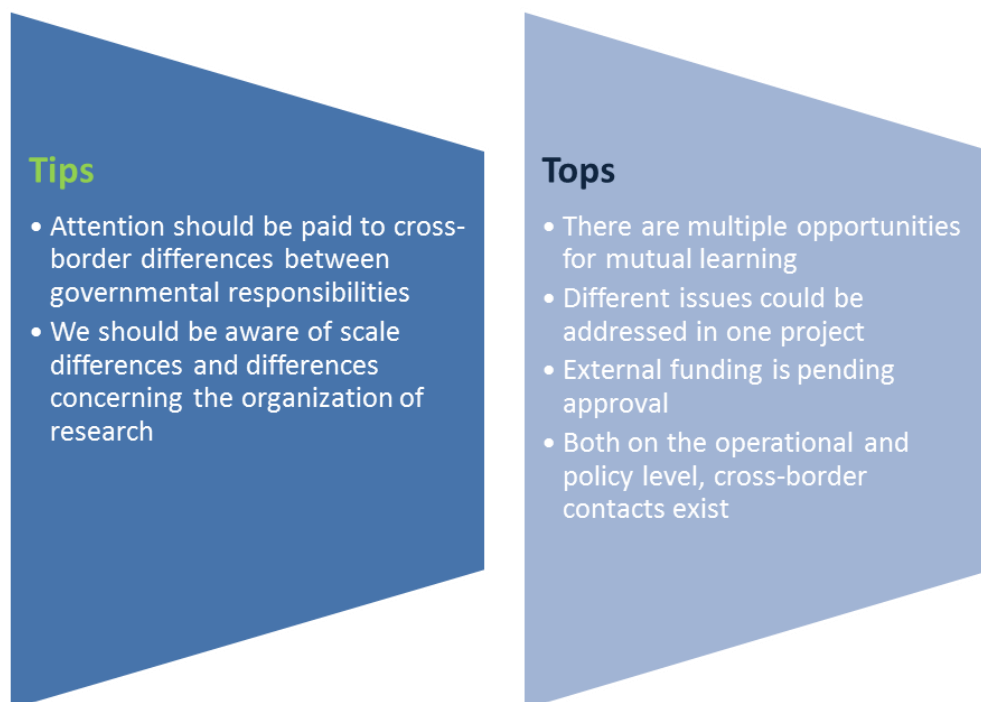


Figure 15: Tips and tops 'Levees for the Future' project.

8. Conclusions: An agenda for the development of an integrated and transboundary climate-adaptation strategy

This report has clarified that climate change is a global issue, as the effects of climate change are crossing borders and therefore deserve to be considered at a transnational level. This means that the Netherlands should consider the transboundary aspects of climate adaptation while developing a national adaptation strategy. Outcomes of [phase one](#) of this research project provide insights in the multiple, existing collaboration platforms focusing on water management issues in the Rhine and Meuse basin, which could be used as a starting point to develop cross-border climate adaptation governance. Furthermore, this study has clarified the urgency to integrate themes, issues, and sectors, as climate change will impact interrelated parts of society – e.g. floods will impact agriculture, mobility and living. The urgency of both aspects of climate-adaptation governance are underlined by the EU, for instance in the EU Climate Adaptation Strategy. Whereas current Dutch climate adaptation focuses primarily on water-management issues, the Netherlands should by 2017 have developed a more comprehensive national adaptation strategy that considers the cross-border aspects of climate adaptation.

Several Dutch border regions have the potential for the development and application of a cross-border (regional) climate-adaptation strategy. Lessons learned from three in-depth case studies, the exploration of promising border regions, the analysis of ‘best practices’, such as the input from interviews and the expert workshops (appendix 2) are used to draw conclusions about the upcoming steps needed to develop an integrated, cross-border climate-adaptation strategy. This report was structured along the governance choices identified by Jordan et al. (2010) – problem perception, level and scale, multi-sector or sector-based governance, timing and sequence, mode and instruments, costs and benefits, implementation and enforcement – and those choices will structure the conclusions as well. Those concluding remarks provide grips for further climate adaptation actions as well as for further research projects.

8.1 Problem perception

The first steps that should be taken to develop a cross-border climate-adaptation strategy are to create a common understanding and framing of the problems at stake. For this we need to make an inventory of existing data, jointly collect data, and set the problem on the societal and political agenda. This step is particularly important for developing climate-adaptation governance in a transboundary context. It is interesting to see that, although most West European countries frame climate adaptation as a technocratic problem, there are different foci. The Dutch address climate adaptation predominantly as a water-management issue, while the Germans approach climate change from a broader perspective. Creating a thorough understanding of other actors’ or countries’ perceptions, views, standards and approaches is crucial for the development of a joint strategy. Differences in climate-adaptation governance based on traditions, cultures, socio-economic aspects and history should be respected. In practice, facts and data accepted by all actors involved – preferably gained via co-creation and joint-fact-finding – enable the reaching of joint views, objectives and strategies. Just as the organising of meetings, climate workshops, round-tables and (area) conferences help to enhance mutual understanding and to create a joint knowledge base. Usually, boundary agents or policy entrepreneurs play an important role in this as they help to bridge concepts, for framing discrepancies and to bring actors together. These could be organisations or enthusiastic individuals (both public and private, such as the provincial level or an environmental interest group).

As climate-change adaptation needs to deal with long-term uncertainties, (scientific) knowledge and expertise will play an important role in the development of a strategy, particular during the first stages of a cross-border cooperation process. Knowledge production should be stimulated on diverse levels, via the

creation of expertise coalitions across borders – e.g. Dutch universities or research institutes could cooperate with knowledge actors such as Hochschule Rhein-Waal and the University of Duisberg-Essen² or by actively linking the Knowledge for Climate research programme to the German Klimzug programme. Such crucial coalitions could boost the establishment of a joint climate-adaptation strategy. A [knowledge portal on spatial adaptation](#) – established on behalf of Knowledge for Climate and the Delta Programme – brings together many tools and guidelines that have been developed to support local adaptation planning and action. Also more intensive cooperation between Dutch and foreign professionals (e.g. from regional water authorities) will improve mutual understanding and help to overcome cultural differences and language barriers. Climate adaptation should be made transparent and more tangible, for instance via workshops using a touch table, via apps, websites and pilot projects. Another example is to use a Climate Atlas to visualise the impacts of climate change in a region (KvK theme 8, 2014). In this way awareness and attention regarding the necessity and possibilities of climate adaptation will increase and the issue will stay on the (political and societal) agenda. A positive framing of adaptation – e.g. by focusing on area-based solutions, opportunities and strengths of the region – will help to get and keep actors on board.

8.2 Level and scale

Another important step in the start-up phase is to decide at which level or scale to act. Based on the European Adaptation Strategy, the Netherlands should develop a national strategy. Yet the governing of climate-change adaptation is a complex multi-level challenge. Thus dealing with climate adaptation should be done at multiple levels, which ideally complement and strengthen each other. We can give a few examples.

As can be concluded based on phase one of this research project, many forums for transboundary cooperation exist on the international level, covering a broad range of actors, governmental levels, issues and themes. Examples on the multilateral level that are relevant for the Netherlands are the International Commission for Protection of the Rhine – currently developing a climate-adaptation strategy for the Rhine basin – and the International Meuse Commission – working on climate adaptation via [AMICE](#). On the bilateral level, examples are the Permanent Borders Waters Commission, the Dutch–German Working Group on High Water and the Flemish–Dutch Bilateral Meuse Commission (more information about the opportunities for [transboundary cooperation](#) can be found by following this link). Those platforms could be used for the exchange of experiences and knowledge, joint knowledge creation and for the realisation of joint adaptation programmes and projects across borders. It appears that most platforms are broadening their substantive scope of cooperation towards climate change and adaptation issues as well. Next to those formal platforms, the importance of informal cross-border cooperation networks is identified. Short projects could also enable the creation of such networks (e.g. via Interreg projects). Thus, present cross-border cooperation platforms provide multiple opportunities for the development of a cross-border climate adaptation strategy.

The national governmental level is responsible for the development of a national climate-adaptation strategy and for international coordination of adaptation approaches. Because this governmental level is also responsible for the Delta Programme, connections between the national adaptation strategy and the Delta Programme would be obvious. Recently, the responsible Ministry of Infrastructure and Environment already developed a Climate Agenda (2013), from which insights could be used as well. Furthermore, the national government could fund and enable the implementation of climate-adaptation measures.

² The University of Duisburg-Essen and the Radboud University Nijmegen already organise the international master ‘Transnational Ecosystem-based Water Management’.

The effects of climate change will be most tangible at the regional and local scale, and thus actions on this governmental level are essential as well. Provinces, regional water authorities and municipalities all work on (aspects of) climate-adaptation issues. On the Dutch side, because of their formal, overarching competencies in the domains of spatial and environmental planning, the provinces probably are best able to lead the development of a cross-border adaptation strategy. They could manage the process and involve the relevant stakeholders, including private parties and NGOs. In doing so, they should coordinate across the levels of government discussed above. Still, backing of the European and national governmental level is urgent.

8.3 Multi-sector or sector-based governance

As climate change affects multiple sectors, we argue that a climate-adaptation strategy should have an integrated perspective both content-wise (issues should be linked) and governance-wise (responsibilities should be connected). The linking of issues and themes involves trade-offs and a more integrated approach inherently leads to the involvement of multiple actors, leading to more complex and prolonged cooperation processes. Even though a sectoral approach is not sufficient for a comprehensive climate adaptation strategy, several advantages could be distinguished: such as the concentration of actors and resources and the possibilities for resolute action. At the moment, climate-adaptation governance in the Netherlands is predominantly concerned with water management, which could be related to history and a great feeling of urgency – e.g. floods are seen as a threat towards society. Successful application of climate-adaptation in the field of water management could inspire other sectors as well. Awareness concerning the other aspects of climate change should increase among politicians and citizens. Establishing a trend towards integration could be reached by clarifying the opportunities of a broader scope, for instance via successful pilot projects.

8.4 Timing and sequence

The next step would be to decide on when and in what sequence to act. Currently, there appears to be a momentum for the development of a national climate-adaptation strategy, because of the finalising of the Delta Programme, the growing public and societal support and awareness for addressing climate issues and the agenda-setting from a European perspective. Finalising a comprehensive and cross-border climate-adaptation strategy in close collaboration with stakeholders before 2017 requires action today. Close collaboration during the development stage is needed, as adaptation should not be imposed on stakeholders. And also the involvement of actors from the other side of the border requires a timely start. For now, climate-adaptation actions could already be integrated and mainstreamed in ongoing dynamics and planned developments that primarily focus on addressing other issues. Implementing (bottom-up) pilot projects that specifically focus on climate adaptation at the regional and local level will make its opportunities more tangible, increase transparency with regard to adaptation and will raise awareness on this issue. Those pilot projects could lead to a snowball effect. For pilot projects, hot spots could be designated that are vulnerable to climate change – e.g. vulnerable cities, industrial regions, river catchments and nature areas. Next to short-term and small-scale projects, a joint, long-term vision should be developed focusing on the complete system. This joint vision should be translated into direct actions and tasks and should link diverse measures, sectors, actions and projects – a route map could clarify the linkages of projects needed to reach the long-term vision. Climate adaptation requires a ‘zooming in and out’ approach, with a focus goal on the horizon (e.g. becoming climate resilient) and then again projects and actions that could start today and that will have immediate or mid-term results in the direction of the final objective (figure 16). Thus, a combination of adaptation actions on the short, middle and long term is necessary. A difficulty might be to connect diverging planning periods and investment agendas of sectors affected by climate change.

8.5 Modes and instruments

Another choice that should be made concerns the question of how to act? E.g. which (combination of) governance modes and instruments could be used to address climate adaptation?

There is no 'one-size-fits-all' solution or strategy to address climate adaptation as technologies applied, histories, attitudes and paradigms towards climate change are different in various regions. We think that a combination of governance modes is required for a comprehensive approach towards climate adaptation; both public and private actors, as well as bottom-up and top-down governance are needed. Participation of multiple actors leads to a broader support for climate adaptation.

So far, climate adaptation (and water management) has been mainly a governmental issue, yet the contribution of society, NGOs, interest groups and businesses is relevant as well (e.g. for innovative ideas, practical and inside knowledge and because they will have to cope with climate-change effects in the future). A collective response towards climate change is needed; hence individuals should adapt to climate change as well, which should be stimulated in a national climate-adaptation strategy. Examples of possibilities are the flood-proofing and isolation of houses, the establishment of green roofs (together with solar panels) or by buying local food products. A climate-adaptation strategy could provide possibilities for individual adaptation – e.g. via funding, communication or by arranging knowledge exchange between those individuals. Yet, we should not rely too much on private autonomous adaptation, as studies show that individuals often struggle to build long-term adaptive capacity and that permanent physical measures, acceptance of new responsibilities and behavioural changes are unlikely to happen autonomously without further financial or government support (Dessai et al., 2014).

Since climate change is characterised by uncertainties and ambiguity, a flexible, robust and adaptive approach is needed to overcome lock-ins and irreducible costs. There are different approaches for supporting decision-making under uncertain global and regional changes, such as Adaptation Pathways, Adaptive Policy Making, the Dynamic Adaptive Policy Pathways (Haasnoot et al., 2013) and a robustness analysis (KvK theme 8, 2014). An example of such an approach is [Adaptive Delta Management](#) (ADM), used by the Delta Programme. By using ADM, long-term changes could be incorporated in short-term decisions, flexible measures could be found and future options will be kept open by applying adaptation pathways instead of end-goals and investment agendas could be linked. Thus, ADM provides better explanations for short-term investment decisions, helps to incorporate uncertainties and the future into decision-making (Rijke, 2014). In this way, the long-term vision could be linked to short-term actions.

Scientific backing of a climate-adaptation strategy is needed as well. Just as multiple instruments should be used, yet most important is that coherence should be found between instruments to reach a certain level of climate-adaptation integration. And tools should be tailored to the regional context (KvK theme 8, 2014). Establishing a climate-adaptation strategy in the Netherlands does not have to start from scratch, as multiple programmes and instruments have already been applied. Examples are the Delta Programme, the Climate Agenda, the Rotterdam Climate Initiative, tools developed by Knowledge for Climate and the Waalweelde programme.

8.6 Costs and benefits

Also the financing of climate adaptation should be discussed at an early stage, particularly when various parties and sectors are responsible for adaptation, as they will have different investment agendas. Climate-adaptation measures are relatively expensive and benefits will return over a longer period of time, therefore opportunities for coupling and integration should be found. External integration – combining climate adaptation to other issues addressed – and internal integration – combining themes and sectors affected by climate change – will create win-win situations, mutual benefits and opportunities to spread costs amongst actors. Making the benefits of climate adaptation transparent will lead to more participation; this could be done via visible pilot projects – e.g. green roofs and facades, visible water in towns, city gardens and playgrounds in nature areas. However, climate adaptation could also lead to damages and

losses, which should be compensated. Balances between gains and losses, winners and losers should be found and described in a climate-adaptation strategy.

The development of a joint adaptation agenda for the future should start from an idea from which all actors could benefit and to which all could contribute, such as the improvement of recreation and tourism in a region that could be linked to the livability of an area, socio-economic benefits, water management, multi-functional agriculture, spatial planning, nature conservation, or for improving the region's transport system. Coupling of opportunities and investing in the region's future (e.g. via investments in education) should lead to cost savings in the long term. EU financial support could be used, for instance via LIFE, Interreg or Horizon 2020 support (detailed information on the possibilities of EU funding can be found in appendix 4).

8.7 Implementation and enforcement

With regard to the implementation of climate-adaptation measures and plans, discussions should start early, preferably already during the development stage of a climate-adaptation strategy. Discussions should consider for instance the technical feasibility and governability of the plans, as barriers for implementation are often institutional, socio-cultural or governance related. Implementation in an early phase could be done by using the [Implementation Canvas](#) – a tool developed by Deltares to improve and develop a (shared) implementation strategy of a proposed (climate-adaptation) measure. This tool will also stimulate multi-stakeholder dialogue and could reveal critical factors for implementation, by addressing problems and solutions, costs and benefits, stakeholders and context, actions and conditions (Van der Brugge et al., 2014). The division of responsibilities for (cross-border) climate adaptation is often unclear, particularly when multiple actors on multiple scales are involved. Thus clear and transparent agreements on responsibilities should be made. Another essential point for implementation is societal support, which may increase through the engagement of stakeholders during the entire process and via communication towards society. Lacking or unclear communication about possible future developments could lead to anxiety amongst inhabitants and companies. Besides, a new climate-adaptation strategy should be linked to an (existing) legal framework, particularly for working across borders and jurisdictions – e.g. EU legislation could be used as the official frame for the establishment of such strategy.

8.8 Concluding remarks

In conclusion, the characteristics of climate change and the requirements of the European Climate Adaptation Strategy ask for a reconsideration of today's climate-adaptation governance in the Netherlands, as the aspects of cross-border cooperation and integration of sectors are urgent and should be considered. Based on existing knowledge, expertise and ongoing developments (e.g. from the Delta Programme and the Climate Agenda), the Netherlands can become a frontrunner for integrated and cross-border climate adaptation governance. This report gave insights into the (im)possibilities for the development of such a (national) strategy and this concluding section provides an overview of choices that could be made during the establishment process. It is urgent to determine the specific impacts of climate change in the Netherlands in different fields and to find coherence between them, to formulate a long-term vision on climate-adaptation governance in the Netherlands and to set up (small) projects and actions that will bring Dutch climate adaptation in that long-term direction (figure 16). Next to that, coordination with climate adaptation governance in neighbouring regions is essential.

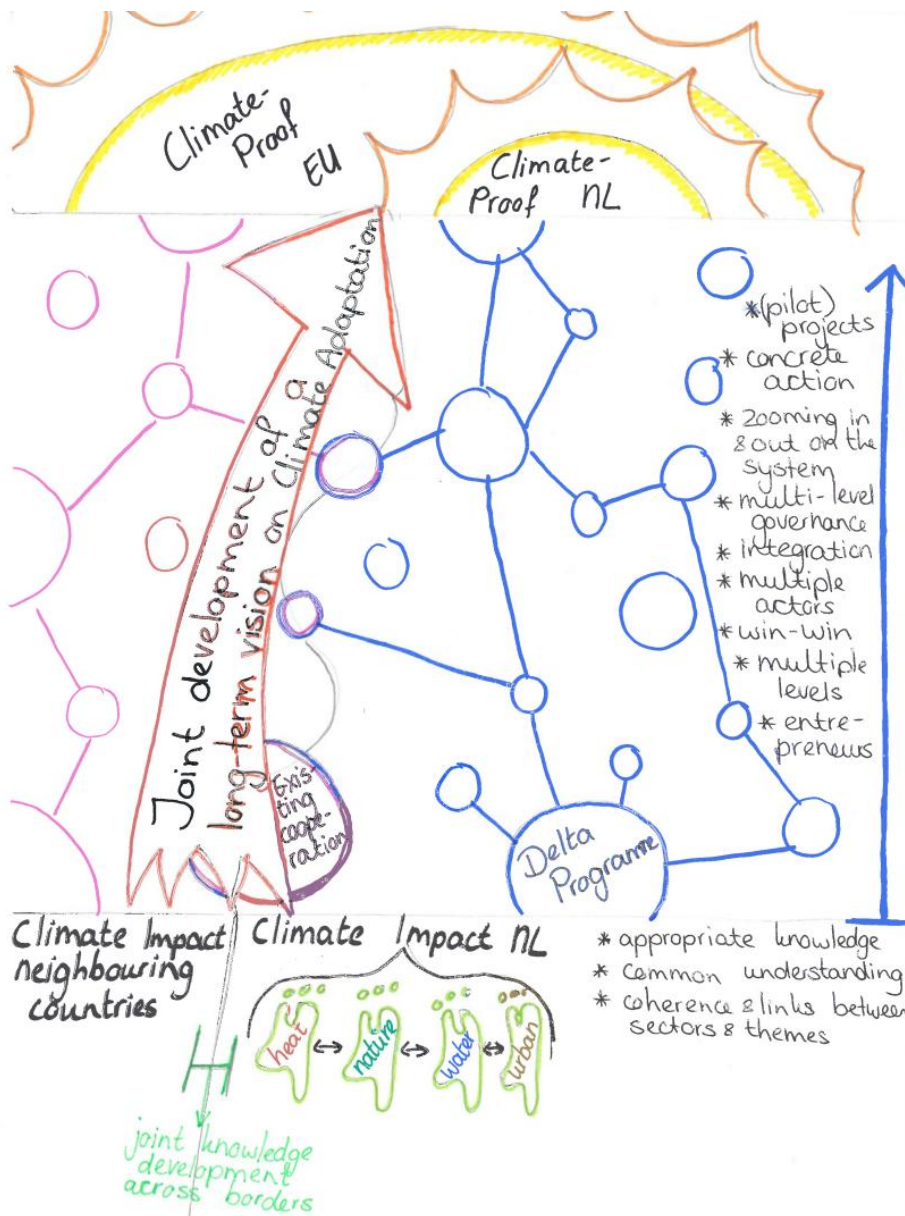


Figure 16: Developing a long term strategy for climate-proofing the Netherlands, based on a thorough climate impact assessment, stimulated by short and middle-term projects in the right direction, considering possibilities for cross-border cooperation.

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Appendix

1. Interviews overview

Organisation	Interviewee(s)	Date	Subject
Stichting ARK	Johan Bekhuis	03-09-2014 Telephone	Rijnstrangen
ECNC (European Center for Nature Conservation)	Johan Kieft	11-09-2014 Schenkenschanz	Nature conservation and climate adaptation around the Dutch–German border region
Deichverband Bislich-Landesgrenze	Holger Friedrich	10-09-2014 Emmerich am Rhein	Dijkkring 48, transboundary cooperation
Liemers Trots	Christine Köning-Wipfler	22-09-2014, Telephone	Rijnstrangen
LTO (division Liemers)	Alwin Sloot	11-09-2014 Herwen	Rijnstrangen
Ministry of Infrastructure and Environment	Anouk te Nijenhuis	11-09-2014 Telephone	Dijkkring 48 and Rijnstrangen
Municipality of Rijnwaarden	Hans Bosch	09-09-2014 Telephone	Rijnstrangen Dijkkring 48
Province of Gelderland	Sonja Seuren	18-06-2014 Arnhem 19-08-2014 Telephone	Rijnstrangen
Province of Gelderland	Bram Vreugdenhil	29-07-2014 Nijmegen	Integrated, cross-border cooperation The Rhine corridor
Province of Gelderland	Henk de Hartog Erik Thoonen Nathalie Hoppenbrouwers Eveline de Groot	26-08-2014 Arnhem	Transboundary cooperation Rijnstrangen Dijkkring 48 Waalweelde
Regional Water Authority Rijn en IJssel	Ysbrand Graafsma	27-05-2014 Doetinchem 25-08-2014 Telephone	Rijnstrangen Dijkkring 48
Rijkswaterstaat Oost	Daniëlle Verhoeven	17-09-2014 Arnhem	Rijnstrangen, dijkkring 48
Staatsbosbeheer	Gerben Ekemans	18-09-2014 Telephone	Rijnstrangen
Stadt Emmerich	Julia Bein	04-09-2014 Telephone	Transboundary dike ring 48 Climate adaptation in Emmerich

2. Lessons learned from the expert workshops

For this study, two workshops with experts in the field of climate-adaptation governance were organised^{3,4}. Results of those workshops and insights derived from interviews with key experts in the climate-adaptation governance field are summarised in this table.

'Moments of Choice'	Learning lessons from best practices of climate-adaptation governance
Problem perception	<ul style="list-style-type: none"> • Governance structures and actors' interests on both sides of the border should become clear before a collaboration process could start. In this way, win-win situations could be created for all actors involved. • Discrepancies are highlighted often when it comes to cross-border cooperation. Overcoming this barrier could be reached by creating understanding with regard to each other's perceptions and approaches. • Focus on solutions instead of barriers. • Facts and data are of significant importance for the formulation of the objectives and the start of collaboration projects.
Level and scale	<ul style="list-style-type: none"> • The trend of mainstreaming climate-adaptation governance on the European governmental level is expected to increase (e.g. via the Water Framework Directive, Floods Directive and Natura 2000 legislation). European legislation could be used for the development of an integrated, cross-border climate-adaptation strategy. • Experts recognise the importance of informal cross-border cooperation networks. • Lessons learned from the successful multi-level governance approach of the Delta Programme could be applied for alignment between transboundary platforms as well. • Strong leadership is required to tackle climate adaptation in practice. This role could also be fulfilled by enthusiastic individuals. • A climate-adaptation approach should be addressed via a bottom-up approach. • Cooperation with multiple actors and across borders requires to consider differences in participation traditions, organisational and political cultures, socio-economic aspects and the framing of issues. • Climate-adaptation actions should not be imposed on stakeholders, but must be developed in close collaboration. Actors should be involved from the start of the process.
Multi-sector or sector-based governance	<ul style="list-style-type: none"> • Integrated climate-adaptation governance is related to two tracks: 1. Content-wise (issues should be fathomed) 2. Governance-wise (related to responsibilities). • Linking of issues and themes is related to weighing of trade-offs. Besides, this inherently leads to a need for a mixture of actors to cooperate, leading to a more complex process.

³ Workshop: Grensoverschrijdende aspecten van hoogwater in de Rijn en Maas, 07 May 2014, Utrecht.

⁴ Workshop: Searching for integrated and transboundary climate adaptation strategies, 20 June 2014, Nijmegen.

	<ul style="list-style-type: none"> • So far, the high water issues are differently assessed than the theme of low water and droughts. This could be related to the feeling of urgency, as floods are seen as a threat to society, while periods of low water will mainly impact some specific sectors, such as shipping.
Timing and sequence	<ul style="list-style-type: none"> • A timely start of collaboration with neighbouring regions is of importance.
Mode and instrument	<ul style="list-style-type: none"> • Multiple programmes and instruments with regard to (aspects of) climate adaptation already exist; a new strategy could build on this (e.g. the Delta Programme). • Deciding upon the type of process and needs for process management should be tailored to the region's requests. • A focus on hot-spots could ease the start of climate adaptation. • This common vision could focus on the whole system and has a long-term focus (helicopter view). This could take place via a river basin commission. Yet, on the lower governmental level this could be fulfilled via area specific measures and opportunities for cooperation – the importance of zooming in and out. Examples are climate-adaptation strategies of municipalities, provinces and water boards. • Identifying a common vision and goal is important for a climate-adaptation process, since multiple actors (on both sides of the border) are participating. • Related to the bottom-up start of climate-adaptation governance is the need to show specific (and successful) examples (pilot projects) of climate adaptation (at the local governmental level). Climate adaptation starts on a small scale in order to make climate adaptation more transparent. Specific initiatives could be linked on higher levels.
Costs and benefits	<ul style="list-style-type: none"> • The importance of considering the gains for everyone during the development of a climate-adaptation strategy. • The importance of investing in the future (of the region) for instance via investments in education. • Spatial developments and climate-adaptation governance should be linked to economic opportunities for the region.
Implementation and enforcement	<ul style="list-style-type: none"> • Responsibilities division for cross-border cooperation (national to regional) is often unclear. • Societal support is essential for the implementation of a cross-border climate-adaptation strategy. Support will increase via the engagement of stakeholders during the complete decision-making and planning process. • The legal framework for cross-border climate adaptation should be studied. A possibility might be to use European legislation as a legal framework for the establishment of such a strategy. • To overcome implementation difficulties, existing structures within a region should be considered during the development of a climate-adaptation strategy.

3. International and Dutch 'best practices' for integrated and/or cross-border climate-adaptation governance

Section 5 of this research report describes lessons learned from methodologies applied for climate-adaptation governance. Those 19 cases were chosen as they could be seen as 'best practices' in the field of integrated and/or climate-adaptation governance in the Netherlands or in other regions of the world.

This appendix provides more detailed information with regard to those cases, which are presented in alphabetical order.

3.1 Climate adaptation in Delft

The municipality of Delft works on climate adaptation via **collaboration** and **future-oriented planning** and a climate-adaptation **strategy**. Collaboration takes place with the region 'Haaglanden' via the 'Waterkader Haaglanden', aiming to find **innovative solutions** for **water, spatial and economic** issues. This is a collaboration project of **private and public actors**, for example the municipality, knowledge institutions and companies. **Knowledge** is aggregated, shared and **put in practice via pilot projects**. A project example is linking climate adaptation to the restructuring of Delft Southeast. Lessons learned are that climate adaptation requires **intensive input and cooperation of diverse stakeholders, finding of joint interests and coherence between activities**. This is stimulated by a 'Climate Game', **climate workshops** with experts, inhabitants and other stakeholders and the establishment of a **knowledge consortium** (Municipality Delft, 2014).

3.2 Climate adaptation on the provincial governmental level

Provinces have also developed climate-adaptation programmes. This section gives examples of action programmes for climate adaptation from the Province of Limburg and the Province of Groningen. Increasing awareness with regards to the possible effects of climate change on safety along the river Meuse, potential nuisances for the agriculture, cities and villages, as well as the possible impacts on nature was the starting point for the development of the [Action programme for Climate Adaptation](#) in Limburg in 2009. The central idea is to **integrate climate adaptation in large-scale developments**. The **regional coordinating role of provinces** is seen as necessary for keeping the issue on the agenda. Objectives are divided into actions currently being addressed and actions that are necessary in the **short or middle or long term**. Various themes are addressed, such as agriculture, nature, water, health, recreation. The programme describes several programmes and measures, such as the development of a taskforce on Climate and Health, educational programmes, Deltaplan Hoge Zandgronden and a landscape fund (Provincie Limburg, 2010). The [programme of the province of Groningen](#) is also focused on **integrating climate adaptation in the provinces' key developing regions and ongoing projects**. The programme aims to **increase awareness** on climate change among inhabitants. Jointly with the province of Friesland and Drenthe a long-term climate-adaptation vision has been developed (Provincie Groningen, 2011). The province of Groningen's [Climate Action Programme of 2013](#) formulates specific activities to address climate change (Provincie Groningen, 2012).

3.3 Climate Proof Cities

The Climate Proof Cities research programme (one of the four themes of the Knowledge for Climate research project) aims to **produce knowledge to contribute to informed decision-making** with regards to adjustments towards climate change. This programme focuses on **the topics of heat stress and pluvial floods in cities**. Outcomes are that heat-stress will become an important problem in cities during the upcoming decade affecting for instance the elderly and that pluvial floods will also lead to economic damage and societal risks. **Several measures** for adapting to climate change are necessary on **different levels**, such as for buildings, streets, neighborhoods and regions, which could best be implemented by a **mixture of actors**, such as municipalities, citizens and housing associations (Rovers et al., 2013).

3.4 Climate-proofing the 'Land van Cuijk'

Another interesting 'in progress' project is climate-proofing the Land van Cuijk. **Five (rural) municipalities**, such as Boxmeer, Cuijk and Grave –**stimulated and guided by the consultancy** of 'Voorelkaarkrijgen' and the Omgevingsdienst Brabant Noord-Oost – **cooperate to integrate climate adaptation in their spatial plans**. The first project of those actors focused on green roofs and facades in the urban areas, which **raised attention** towards the issues of climate adaptation, created a **collaboration network and visualised climate-adaptation projects** in practice. For this project also the regional water authority Aa en

Maas was participating. During a [climate workshop](#) – the closure of the green roofs and facades project – regional actors (municipalities, the province and regional water authority) were brainstorming on broadening the project towards climate adaptation and a climate-proof region. Based on this workshop a **route map** has been developed to reach a climate-proof region by 2030, covering issues such as flooding, droughts, health issues and heat-stress. Success factors were the **bottom-up approach**, the focus on **improving** the municipalities' **attractiveness and appreciation**; thus the **focus on opportunities of such vision**. Furthermore, the approach focused on the **strengths of the public space, linking opportunities and interests**. Ideas for practical applications are the development of nature playgrounds (recreation function) also having an educational function, and linkages with water management (small retention basin) and ecology could also be an opportunity. For such projects collaboration between municipalities, nature organisations, regional water authorities, private companies and schools are imaginable. This project also clarified that **citizen participation, livability and social cohesion issues** could be linked to climate-adaptation **projects, such as the coupling of regional, cultural and historical aspects** to a climate-adaptation vision (Brabants Groen, 2014a; b; Langenhoff, 2014; OBDN/Voorelkaarkrijgen, 2014).



3.5 Future Cities

Future Cities was an **EU Interreg** programme (2008–2012) guided by the German regional water authority Lippeverband to prepare Northwest European urban areas for climate change. The project was funded by the **European Regional Development Fund**. In the Netherlands, the urban regions of [Nijmegen, Tiel and Arnhem](#) are involved. The aim of this programme is to **exchange and develop international knowledge and experiences** and **translate those into practical and pragmatic applications**. The programme focuses on a **combination of green in the city, water and urban morphology**, such as **sustainable energy use and production**. **International conferences and workshops** in the participating countries were stimulating co-operation and raised awareness amongst local stakeholders as well. Other success factors were the **involvement of specific know-how partners in the transnational teams** (e.g. research institutions and universities), the **practical application of activities**, the **'twinning' of transnational partners** for specific projects and the development of **strategies**. An interesting outcome is the [Adaptation Compass](#) (a tool for developing climate-proof cities). The Future Cities programme still continues; for instance new activities focus on the **activation of stakeholders**, financing adaptation measures with **public and private budgets** (Eureka, 2010; Future Cities, 2014).

3.6 The GRaBS project: Green and Blue Space Adaptation for Urban Areas and Eco Towns

The GRaBS project (Green and Blue Space Adaptation for Urban Areas and Eco Towns) is a **network of European organisations** involved in integrated climate adaptation with regards to regional and local development and spatial planning. This project is financed by **Interreg IVC**. 14 partners from 8 EU member states participate in this project (e.g. in the Netherlands this is the city district of Amsterdam Nieuw-West). This project studies how green and blue infrastructure could be applied in existing urban areas and for new building projects. The lesson learned from this study is that the **participation of citizens, society and businesses is significant**, since cities' inhabitants will deal with the effects of climate change in their daily practices (GRaBS, 2014; Holstein, 2011). In the Amsterdam city district of Nieuw-West challenges concerning the growing multicultural population are linked to becoming the 'greenest' district encompassing large open spaces and water reservoirs, a wealth of parks and conservation areas and low-rise building (GRaBS, 2014).

3.7 Green borders in the Danube

Another interesting project in the Danube region, started in 2009 by the **WWF**, implementing a **LIFE** Nature project, is called 'Cross-border conservation of *Phalacrocorax pygmaeus* and *Aythya nyroca* in key sites in Romania and Bulgaria'. This Green Border project creates a **framework for cross-border conservation for 11 Natura 2000 sites** along the Lower Danube, aiming to maintain high biodiversity while provid-

ing valuable ecosystem services to local communities. An important lesson learned is that such projects should be based on **stakeholder engagement** (WWF, 2010b).

3.8 The International Commission for the Protection of the Danube River

The International Commission for the Protection of the Danube River (ICPDR) also focuses on climate-adaptation issues. In 2012, the countries of the Danube river basin have agreed upon an **adaptation strategy for climate change**. This strategy includes future changes in temperature and participation that could affect water usage in different sectors; it includes a thorough assessment of the possible impacts of climate change and suggests means to adapt to those effects. This strategy follows up a study convened through **lead country** Germany. Examples of adaptation measures are focusing on preparatory measures, ecosystem-based measures (e.g. implementation of green infrastructure, protection and restoration of water-retention areas), behavioural measures (e.g. educational support), technological measures and policy approaches (ICPDR, 2014)

3.9 Klimaatwijzer

The Dutch national government has developed a [Klimaatwijzer](#) for integrating climate change in Dutch planning, covering building, water management (fresh water and floods), the usage of climate knowledge, agriculture, nature and urbanised area. This report provides 11 steps to ensure area-specific plans that are climate proof, starting with an **inventarisation of the regions' characteristics and vulnerabilities**. After that, which **climate-change effects could be relevant** for the specific region and for the **current spatial challenges** should be analysed. After that, **climate-adaptation tasks** should be explored and spatial **guidance models** should be developed. Step six concerns the bringing forward of potential measures, followed by the selection of a **policy package of measures**, the **development of plans and agreements**. Afterwards those plans should be realised and later on **monitored and evaluated** with the latest climate-change knowledge. This report also discusses instruments that could be used by actors to develop a vision on climate adaptation, such as the Watertoets, Milieueffectrapportage, cost-benefit analysis, the climate effect atlas and an adaptation scan (Rijksoverheid, 2011).

3.10 Lower Danube Green Corridor



Figure 3.10: The Lower Danube Green Corridor, WWF 2010.

An example of ecosystem-based adaptation is an ecosystem restoration project in the Lower Danube Corridor, initiated by the **WWF** in 2000 –the most ambitious wetland protection and restoration initiative in Europe. This project aims to restore 2,238km² of floodplains, to effectively protect 1 million ha of wetlands and to promote sustainable use and development along the lower Danube, in order to reduce flooding, improve water quality, restore biodiversity and enhance local livelihoods. Although, **adaptation to climate change was not the primary objective, it had important adaptation benefits**. In 2008 the first objectives were delivered, for instance 469km² of flood plains were created, water quality in lake Katlabuh was improved and the opportunities for reed-cutting, fishing and tourism were established. For this project in 2000 a **Lower Danube Green Corridor Declaration was signed by four countries** (Romania, Bul-

garia, Ukraine and Moldova), **recognising the need and shared responsibility** for the sustainable protection of one of the most outstanding biodiversity regions in the world. Besides, this region has **other important functions**, being a drinking water supply for 29 million people, recreation possibilities, islands being elements of the Danube migration corridor, ecosystem function with important flora and fauna. Lessons learned from this project are that major challenges facing adaptation need to work at **multiple scales** (very local to international, both institutionally and geographically), that **funding often adds to the challenges**, that **effective leadership is vital** in bringing together different parties and ensuring common objectives. In the Lower Danube Corridor project, the leadership role was fulfilled by the EU (Palutikof et al., 2013; WWF, 2010a; WWF, 2014). In 2010, the level of achievement was higher than expected, 1.4 million ha was brought under protection, yet the task for wetland restoration was running behind target (WWF, 2014). Examples of current projects are meander restoration in Bulgaria and the protection of floodplain forests, a pilot project for integrated management of floodplain forests, nature conservation and the sustainable use of natural resources in Romania, and in Moldova a new management plan has been implemented at Lake Beleu, jointly established with the local community (WWF, 2014).

3.11 KARRMA (*Klimaat Adaptatie in der Regio Rijn en Maas*)

Due to an increasing awareness concerning the expected climate-change effects (e.g. adapting to extreme weather) and the European Commission's Blueprint to Safeguard Europe's Water Resources, the province of Gelderland has explored the possibility of a collaboration project on the Dutch–German border region for a timely adaptation towards climate change. The main focus is to adapt boundary streams to climate-proof stream systems. The project would focus on measures for surface waters, agriculture, nature and forestry. Lessons that could be learned from this project are that each river system requires **area-specific adaptation actions**, because each basin varies concerning its structure and land use. This project strives for a cross-border application due to the presence of collective interests, European policy objectives, bundling of knowledge and experiences and the possibility to apply for EU co-financing (Provincie Gelderland, 2013; Vreugdenhil, 2014a;b)

natuurlijke klimaatbuffers

3.12 *Natural climate buffers*

A **collaboration coalition of 7 nature organisations** ([coalitie Natuurlijke Klimaatbuffers](#)) realises the establishment of **climate buffers** in the Netherlands to make the country safer and more attractive. The nature organisations also formulated a **vision for climate-proofing the Netherlands**. Climate buffers could be seen as a reaction towards the effects of climate change, focusing on safety, the economy and nature. Collaboration started via a campaign by [HIER](#), consisting of 40 societal organisations. The objective of the Climate Buffer programme is to give **space to natural processes** and water. In this way, areas have a **sponge function** (for droughts, floods, storms and more) and to become more resilient towards the effects of climate change. This is **combined with other benefits**, for instance the areas could stimulate biodiversity and ecology, such as creating possibilities for living, business, recreation etc., which is necessary for societal and political support (Natuurlijke Klimaatbuffers, 2006; 2014; Royal Haskoning, 2007; Vogelbescherming, 2014).

3.13 Nature area Meuse Schwalm-Nette



Figure 3.13: Map of nature area Meuse Schwalm-Nette Source: Naturpark Maas-Schwalm-Nette, 2014.

The Meuse Swalm Nette is a nature reserve located between the Dutch province of Limburg and the German State of North Rhine-Westphalia, and is based on the premise that nature does not recognise borders, covering an area of 10,000ha between the triangle of cities of Roermond, Venlo and Mönchengladbach. After the industrialisation, in 1965, an association of German governmental actors initiated the creation of this nature park. The German authorities invited the Dutch to engage in this park from the viewpoint of **touristic and recreational opportunities** across borders. In 1976, the cross-border nature park was created via an **official agreement** and actors from both sides of the borders have been engaged in establishing a grid of path and information centres for recreation and tourism. A **project office** was created to act as the **transboundary interface, as mediator** and for searching for funding opportunities. A **joint strategy for nature conservation** was developed. Success factors of this cross-border nature park are the existence of legislation signed by both countries, the establishment of a transboundary project office, the perspective to boost tourist opportunities and **funding from European programmes** (e.g. Interreg) (BMUB, 2000; Naturpark Schwalm-Nette, 2014; Pechini, 2014).

3.14 New England Climate-Adaptation Project

Four at-risk coastal communities in New England are collaborating from May 2013 until August 2014 to assess local climate-change risks, identify key challenges and opportunities for climate adaptation and test the use of role-play simulations as mean to educate the public about climate change and explore ways of decreasing their vulnerability and enhancing their resilience to climate-change impacts. Lessons learned from this study are the **need for participation of knowledge institutions and stakeholder assessments** (NECAP, 2014).

3.15 Pacific Adaptation to Climate Change

Lessons could also be learned from the first major climate-change adaptation initiative in the Pacific region – the Pacific Adaptation to Climate Change (PACC) Programme. This was started in 2009 and **funded** by the Global Environment Facility and the Australian government, aiming to make Pacific communities more resilient for dealing with climate variabilities. Fourteen Pacific island countries collaborate, whereby best-practice adaptation for coastal zone management, food security and food production and water resource management are demonstrated and each country is hosting a **pilot project**. Furthermore, this programme promotes mainstreaming of climate adaptation at each level and generates knowledge for a sound base for adaptation to climate-change effects. The United Nations Development Programme acts as the implementation agency. Examples of pilot projects are climate-proof roads, climate resilient harbours, shoreline management plans, new reservoirs that increase water security, improving crop resilience and testing drought-resistant crops. Thus, the PACC programme integrates climate adaptation with

regard to coastal zone management, food security and food production, as well as water resources management (PACC, 2014).

3.16 Proeftuin Kop van de Betuwe

The ‘Proeftuin Kop van de Betuwe’ is a good example of a **pilot project** that applies an **integrated, climate-adaptation approach** within the Netherlands. This pilot project is established via the Delta Programme (and the new construction and restructuring sub-programme), whereby the aim is to gain experiences for the **coupling of spatial planning and the Delta Programme’s challenges** (mainly high water and safety management, fresh water supply and climate-proof cities). Important aspects in this pilot project are the urban network, the present clusters of top sectors for life sciences and health, international transport connections (e.g. train, water, highway), the river basin and its landscape characteristics and nature areas. The pilot project connects economic improvements, the strengthening of corridors and the issue of water safety – the latter was used as the starting point for collaboration. For this pilot project, first an **exploration** of expected climate-change effects and possible strategies (and alternatives) was started, including a thorough cost-benefit and risks analysis. Eventually, this pilot project provided an integrated overview of today’s and future challenges in this region and provided **building blocks** for the region’s spatial development until 2065. Using a **‘calculating and drawing’ approach**, the organising of **work sessions** where multiple actors were participating – that normally do not cooperate – and the development of an **integrated vision for the region** was useful and provides the starting points for the future. This pilot project shows the **successful possibilities of integrating themes** such as heat islands, water safety and economic development. Planning of the strategies’ implementation is the follow-up step that should be taken (Broersma & Kramer, 2014; Broersma et al., 2013; Grontmij, 2014).

3.17 Rivierklimaatpark IJsselpoort

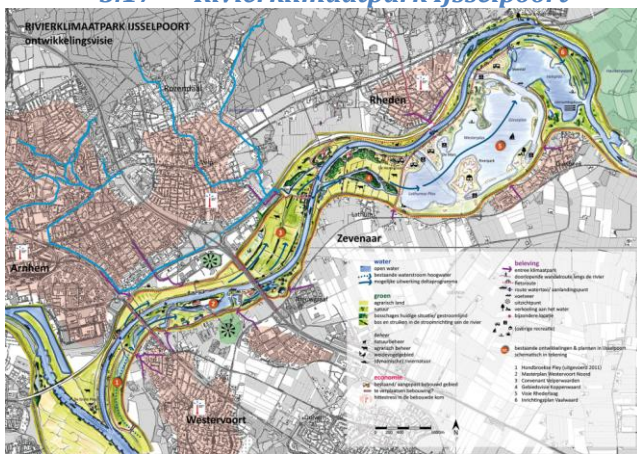


Figure 3.17: Map of the Rivierklimaatpark IJsselpoort Source: Rivier Klimaatpark IJsselpoort (2014).

A recent, Dutch example, where **public and private actors** plan spatial developments to adapt to the consequences of climate change via an **integrated vision** is *Rivierklimaatpark IJsselpoort*. Natuurmonumenten, Staatsbosbeheer and the municipalities of Arnhem, Westervoort, Rheden and Zevenaar developed a vision in 2013 for the upcoming 15 years in order to sustainably develop the floodplains of the IJssel, focussing on a **safe living and working area**, **better accessible floodplains**, **green corridors** for flora and fauna and on **stimulating business**. The key to this **vision** is the conception that dealing with climate-change effects asks for **joint forces on multiple themes**. This vision is based on the **pillars of green** (nature conservation, development and the linking of nature areas), **water** management (both focussing on high and low water solutions and thus creating a flexible water system), **economy** (creation of a safe and attractive business climate) and **experiences** (such as improving recreation possibilities, via facilities like a tea garden and farm shop and a network of walking and cycling routes). **Round table meetings** were used

to develop this vision, since representatives of citizens, businesses and organisations could present their ideas. In the upcoming years, this vision will be **translated into concrete projects and an implementation agenda** (Goedhart, 2013; Rivier Klimaatpark IJsselpoort, 2014). This region is also identified as one of the climate buffer regions 2.0 (Natuurlijke Klimaatbuffers, 2014).



3.18 The Rotterdam Climate Initiative

The climate-proofing of the city of Rotterdam is seen as a successful example by the European Commission ([PEER City in 2012](#)) and the experiences are used by other cities and ports from all over the world. Rotterdam, the most low-lying delta city and at the same time the largest international port of Europe, has a strong need to adapt to climate change. The aim of the [Rotterdam Climate Initiative](#) is to **link sustainable ambitions to a strong economy and to become the most sustainable world port city for the benefit of people, the environment and economy**. A crucial factor is that this programme was **initiated by both public and private actors**, such as the municipality, the Port of Rotterdam, an employers' organisation and the Environmental Protection Agency Rijnmond. Also citizens, companies and knowledge institutes participated. **Decisiveness, Innovation and Co-creation** were central concepts applied. The ambition was translated into **ten attractive sustainability tasks** for Rotterdam, such as reducing CO₂ emissions by 50%, more green and public transport in the city, becoming 100% climate proof and strengthening the city's economy. **Adapting to climate-change effects was linked to other issues** in the city like air quality and noise problems, leading to an integrated approach that appeals to many actors. Another success factor could be the **international cooperation** of the city of Rotterdam via the Clinton Climate Initiative (CCI) the C40 (Large Cities Climate Leadership Group), via Delta Cities Connections and the 100 Resilient Cities Challenge of the Rockefeller Foundation. Some examples of outcomes are the Sustainability Monitor of Rotterdam 2012, the development of a regional climate-[adaptation strategy for Rotterdam](#), 130,000 m² of green roofs (subsidised by the municipality), floating houses, underground water retention. Specific examples of the linking of themes and issues are the development of a rowing course (combining recreation, water retention and professional sports), the multi-functional [Benthemplein](#) (combining living, recreation and water-retention functions), underground car parks (combining parking and water retention) (Rotterdam, 2014; Rotterdam Climate Initiative, 2014).



3.19 Waalweelde

Around 2006 an initiating movement was established called [Waalweelde](#), being a reaction to the 'Room for the River' programme. At the start of the implementation of 'Room for the River' the measures were still open for discussion and some stakeholders in this region were starting to alternate the technical actions for spatial measures. An interesting organisation of **4 B's** was started (**Interest groups, companies, officials and administrators**), because those actors recognised that more challenges should be addressed in the region around the river Waal besides the Room for the River tasks (particularly high water and safety measures), such as for nature (Natura 2000, EHS), business, living, recreation and tourism, culture and landscape issues. The main objective of this initiative was to **link all issues and interests along the river Waal**. Also the Radboud University Nijmegen cooperated. The **Waalweelde programme was developed** focusing on seven themes (safety, nature, business, living, recreation and tourism, culture and history, energy and climate) that are addressed to reach the **common main vision**: improving the spatial quality near the Waal. The main issues addressed in this vision still concern high water and nature. Besides this vision, a **spatial development and investment programme** was established. Since 2008, the province of Gelderland has been the director of the Waalweelde programme, playing an important role to

govern the process of the programme's establishment and implementation. The fact that other actors were standing behind the provinces' role stimulated the process. The main challenges were finding the coherence between and linking of themes and stakeholders. The success factors are the **organisational structure (clear leader, robust board, an advising group and programme team)**, the division of the whole river basin area into clusters, yet that the vision and programme **focus on the interest of the whole river basin** and that each actor was willing to act upon the **common interest**. Lessons learned from the Waalweelde process are that the **integrated approach increases the (societal and political) support** for interventions, that (political and financial) **support of the national government is required** for regional projects. Currently, the Province of Gelderland is considering how to continue with Waalweelde, how other themes could be linked as well and win-win situations could be created and how this approach could be applied for all the rivers within the region of Gelderland (de Hartog, 2014; Provincie Gelderland, 2014a; Waalweelde, 2014).

4. Funding possibilities in the EU context

The Commission emphasises that funding will be a critical factor in building a climate-resilient Europe (European Commission, 2013). The EU Adaptation Strategy specifically points towards financial support for adaptation through the LIFE instrument, including a climate action sub-programme (European Commission, 2013; Slothouwer-van Schipstal, 2014). Earlier LIFE programmes focused on the environment; this round a new aspect is the climate sub-programme, focusing on priority areas for climate mitigation, climate adaptation and climate governance and information. LIFE 2014–2020 has a budget of 3.445 billion euro and focuses on a resource-efficient, low-carbon and climate-resilient economy, the environment, biodiversity, ecosystems and the Natura 2000 network, environmental and climate policy, governance and legislation, integrating and mainstreaming environmental and climate objectives in the Union and the implementation of the 7th Environment Action Programme. Traditional projects should be submitted in October 2014 and integrated projects should submit a concept version at the same time and a full proposal in April 2015 (Martens, 2014). The Commission states in the EU Adaptation Strategy that *'LIFE funding for adaptation action will be particularly promoted in vulnerable areas, such as for the cross-border management of floods (based on the EU Floods Directive), transboundary coastal management and for mainstreaming adaptation in urban land use planning'* (European Commission, 2013, p.6).

Next to the proposed LIFE instrument, also Interreg 2014+ could provide opportunities for cross-border cooperation for climate adaptation in the European context. Interreg, also called European Territorial Cooperation, is one of the most influential European programmes that stimulate cross-border cooperation. In the Dutch–German border region, approximately 440 million euro will be invested in transboundary governance under the subsidy programme of Interreg 2014–2020, semi funded by the EU (Van der Giesen, 2014; Interreg Deutschland Nederland, 2014). Interreg is a subsidy programme focusing on three strands: interregional cooperation, cross-border cooperation and transnational cooperation (Van der Giezen, 2014; Slothouwer-van Schipstal, 2014). In the new, 5th Interreg period – starting in the autumn of 2014 and ending in 2020 – there will be a limited choice of four thematic objectives, which should be chosen beforehand and an approach to meet those objectives should also be included. This will enable to set priorities and also the degree of co-financing will increase. It is possible and encouraged to involve private parties and under certain conditions also non-EU partners (Schenk, 2014).

Horizon 2020 is another EU funding programme, the next phase thereof will run from 2014 until 2020 and will consist of circa 70 billion euro. Horizon 2020 will consist of three pillars: excellent science, industrial leadership and societal challenges (Slothouwer-van Schipstal, 2014). This funding programme is mentioned in the EU Adaptation Strategy as well. The Commission states that this programme could contribute to a solid knowledge base, as Horizon 2020 will contain research and innovation that addresses climate-change adaptation through its 'societal challenges'. Also the need for better interfaces between science, policy-making and business is mentioned (European Commission, 2013).

Furthermore, the EU Adaptation Strategy stresses that the European Structural Investment funds (e.g. the Cohesion fund, the European Regional Development fund, the European Social fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries fund) will provide significant support to member states, regions and cities for investing in programmes and projects on adaptation (European Commission, 2013). Also, several EU institutions could support adaptation measures, such as the European Investment Bank and the European Bank for Reconstruction and Development (European Commission, 2013).

In conclusion, each (funding) programme in the European context has its own denominator, e.g. Interreg focuses on territorial aspects, while LIFE has environmental and biological aspects as focal point and for HORIZON 2020 the research facet is the central point. for the choice of funding approaches will thus be based on a consideration of objectives, interests and the expected approach.

Not only could European financing projects form an opportunity; Dutch instruments could also be a chance to start up a (cross-border) climate-adaptation strategy. Examples are financing of the Ministry of Foreign Affairs (Sustainable Water Fund (FDW), Facility for Infrastructure Development (ORIO)) or financing via the existing Euregio programmes (Euregio Rhein-Waal, 2014; Slothouwer-van Schipstal, 2014).



To develop the scientific and applied knowledge required for climate-proofing the Netherlands and to create a sustainable knowledge infrastructure for managing climate change

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