

nordwest2050

International Conference on Regional Climate  
Adaption and Resilience towards Climate  
Adapted and Resilient Regions

## CLARR 2014

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econtur gGmbH  
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28195 Bremen  
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Bremen, March 2014

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# I. Preface

One of the important parts of the final conference of 'nordwest2050' has been the scientific exchange sessions in the House of Science and the Industryclub Bremen. Contributions were based upon a call for papers from October 2013. The scientific committee received almost 100 abstracts where 36 were chosen for oral presentations and 15 for poster presentations (see overview tables below).

Four main topics were discussed in parallel workshops:

- Analysing Impacts and Assessing Vulnerabilities
- Designing and Testing Solutions for Regional Climate Adaptation and Resilience
- Implementing Climate Adaptation and Paths to a Resilient Future
- Resilience for Business: Climate Adaptation Challenge and Strategies of Sectors and Companies

All abstracts are documented on the following pages.

We would like to thank all participants for joining our conference and special thanks to the scientific organizing team of 'nordwest2050':

- Dr. Torsten Grothmann, Carl von Ossietzky University of Oldenburg
- Dr. Stefan Gößling-Reisemann, University of Bremen
- Dr. Jakob Wachmuth, University of Bremen

They have done a tremendous job in getting all contributions in time and in the right order and they chaired most of the sessions as well.

## i.Scientific Sessions Overview

Date: Monday, 24/Feb/2014			
11:00am -	<b>Poster 1: Poster Presentation Town Hall - Lower Hall</b> Location: <b>Town Hall - Lower Hall</b>		
6:00pm	The poster session will be open on both days of the conference		
2:30pm -	<b>Business 1: Resilience for Business: Climate Adaptation Challenges and Strategies of Sectors and Companies 1</b> Location: <b>Industryclub</b> Chair: <b>Klaus Fichter</b> Keynote: Andrew Griffiths <i>Beyond Adaptation: Resilience for Business in Light of Climate Change and Weather Extremes</i> <b>Andrew Griffiths</b>		<b>Keynotes: Scientific Keynote Session</b> Location: <b>House of Science - Grand Conference Room 2.11, 2. Floor</b> Chair: <b>Torsten Grothmann</b> Keynotes: Jochen Hinkel   Katrien Termeer   Roger Street <i>Vulnerability, Impacts and Adaptation: From Problem-Oriented to Solution-Oriented Approaches</i> <b>Jochen Hinkel</b>
4:00pm	<i>Advancing Private Sector Adaptation to Climate Change</i> <b>Tina Schneider   Klaus Fichter</b>		<i>Designing and Testing Solutions for Regional Climate Adaptation and Resilience</i> <b>Katrien Termeer</b>
	<i>Serious Gaming Improves Flood Disaster Communication</i> <b>Nikeh Booister   Darja Tretjakova</b>		<i>Learning from Experience: Implementing Climate Adaptation</i> <b>Roger Street</b>
4:20pm -	<b>Business 2: Resilience for Business: Climate Adaptation Challenges and Strategies of Sectors and Companies 2</b> Location: <b>Industryclub</b> Chair: <b>Klaus Fichter</b> <i>Feasibility Study of Drought Index Insurance in Shandong Province, China</i> <b>Wen Chen   Roman Hohl   Lee Kong Tiong</b> <i>Resilient Electricity Generating Infrastructures – Enhancing Climate Action Plans</i> <b>Jeanette Sieber</b>	<b>4:30pm -</b> <b>6:15pm</b> <b>Analysis 1: Analysing Impacts and Assessing Vulnerabilities 1</b> Location: <b>House of Science Conference Room 2. Floor</b> Chair: <b>Jochen Hinkel</b> <i>Climate Change Risk Analysis as a Basis for Adaptation: Case Study of Aargau/CH</i> <b>Niels Holthausen   Pamela Köllner-Heck   Michael Bründl   Peter Locher   Marco Pütz   Lillian Blaser   Sabine Perch-Nielsen   Martina Zoller   Thomas Probst   Roland Hohmann</b> <i>Implication of Local Knowledge in Framing Coastal Resilience Assessment Indicators: Case Study from Indi-</i>	<b>Designing 1: Designing and Testing Solutions for Regional Climate Adaptation and Resilience 1</b> Location: <b>House of Science Small Conference Room, 2. Floor</b> Chair: <b>Katrien Termeer</b> <i>Lessons Learned in Adaptation: Application of the "Stadtbakasten"-Toolkit for Kiel</i> <b>Hinnerk Ries   Steffen Bender   Markus Groth   Jörg Cortekar</b> <i>Same, Same, but very Different: Discussing the Transferability of Adaptation Solutions Developed in 'nordwest2050'</i>
5:00pm			<b>Implementation 1: Implementing Climate Adaptation and Paths to a Resilient Future 1</b> Location: <b>House of Science Grand Conference Room 2.11, 2. Floor</b> Chair: <b>Roger Street</b> <i>Extension of Regional Governance in the Emscher-Lippe-Region by the Roadmap 2020 "Regional Adaptation to Climate Change"</i> <b>Jürgen Schultze   Jens Hasse   Michael Kohlgrueber   Nicole Rauscher</b> <i>Successfully Adapted with Regional Governance? The Case of the KLIM-ZUG-Project 'nordwest2050'</i>

<p>5:20pm - 6:00pm</p>	<p><b>Business 3: Resilience for Business: Climate Adaptation Challenges and Strategies of Sectors and Companies 3</b> Location: <b>Industryclub</b> Chair: <b>Klaus Fichter</b></p> <p><i>Adaptation to Climate Change in the German Railway System: The Interplay between Actors and Institutions</i></p> <p><b>Anna Pechan   Maja Rotter   Esther Hoffmann   Rebecca Stecker</b></p> <hr/> <p><i>Climate Technology Cooperation: Making adaptation Solutions Accessible within the UN Climate Technology Centre and Network</i></p> <p><b>Severin Beucker   Klaus Fichter   Jens Clausen</b></p>		<p><i>an Sundarbans</i> <b>Rajarshi Dasgupta   Rajib Shaw</b></p> <hr/> <p><i>Adaptive Capacity and Water Governance in North-western Germany and the Eastern Cape Province, South Africa</i> <b>Kevin Grecksch/ Maik Wings</b></p> <hr/> <p><i>An Approach towards Developing Framework for Assessing Impacts and their Vulnerabilities</i> <b>Parameswaran Radhakrishnan</b></p> <hr/> <p><i>Using Local Remote Sensing, Statistical and Survey Data to Identify Vulnerability Patterns and Sustainable Adaptation Options</i> <b>Claudia Bach   Tobias Blätgen   Jörn Birkmann</b></p>	<p><b>Torsten Grothmann   Manfred Born   Heiko Garrelts</b></p> <hr/> <p><i>The Role of National Water Legislation in the Adaptation of Climate Change: Could the EU Experience be a Model for the Rest of the World?</i> <b>Mohamed Faiz Abdul Raheem</b></p> <hr/> <p><i>Strategies and Indicators for Green Building as a Key Factor for Climate Change Adaptation in Cities</i> <b>Torsten Lipp   Tina Gäbler   Ryan Weber   Mitchell Reardon   Christian Fredricsson   Ines Vilhena da Cunha   Carla Silva   Stefan Dirlich</b></p> <hr/> <p><i>A Strategy for Bremen's Adaptation to Extreme Climate Change-Related Rainfall Events: The KLAS Project</i> <b>Holger Hoppe   Jan Benden   Michael Koch</b></p>	<p><b>Heiko Garrelts   Michael Flitner</b></p> <hr/> <p><i>Regional Governance and Management for Drought and Scarcity Adaptation in NW EUROPE - First Insights from the DROP Project</i> <b>Ulf Stein   Hans Bressers   Cheryl de Boer   Rodrigo Vidaurre   Isabelle La Jeunesse   Jenny Tröltzsch</b></p> <hr/> <p><i>Problems of Fit in the Multi-level Implementation of Climate Change Adaptation Policies in Copenhagen and Stockholm</i> <b>Bart Jan Davidse   Sonja Deppisch</b></p> <hr/> <p><i>Strengths and Weaknesses of Policy Frameworks for Climate Change Adaptation in Switzerland and Germany.</i> <b>Marco Pütz   Winfried Osthorst</b></p>
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**Date: Tuesday, 25/Feb/2014****9:00am****Poster: Poster presentation Town Hall - Lower Hall**

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Location: **Town Hall - Lower Hall****10:30am**

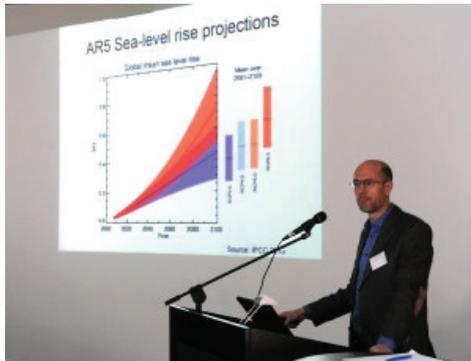
The poster session will be open on both days of the conference

*A Block Level Estimation of Water Scarcity in Rural Semi-arid India***Mrittika Basu | Satoshi Hoshino | Shizuka Hashimoto***Adaptation to Climate Change and land use Conflicts in northwest Germany***Stefan Wittig | Bastian Schuchardt***Building Resilience for the Education Sector in the Coastal Areas: A Case Study in Central Vietnam***Thi Thi My Tong | Rajib Shaw***Climate Adaption Options for Industrial Buildings***Andreas Herrmann | Corina Dorn***Climate Adaptation Strategies for the Agri-food Industry***Hedda Schattke | Karsten Hurrelmann | Marion Akamp***Climate Change Adaptation: Applying Science and Strategies at the Community Level***van Bers, Caroline M.; Hare, Matt P.; van der Keur, Peter***Climate Change and Livelihood Security in Indian Perspectives***Mahendra Singh Pal***Developing Guiding Visions and Goals for Adaptation: Potentials and Current Practice in Europe***Torsten Grothmann***Economic Impact of Climate Change on Crop Production in Lower Saxony***Margit Paustian***Flood Risk Governance in the Flemish Scheldt Estuary***Hannelore Mees | Ann Crabbé***Increasing Vulnerability to Climate Change: Challenges in Adaptation in India***Shadananan Nair Krishnapillai**

	<p><i>Learning from Extreme Weather Events: How Companies Make Sense of Climate Risks</i>  <b>Esther Hoffmann   Maja Rotter</b></p> <hr/> <p><i>Participation of Youth Councils in Local-level HFA Implementation in Makati and Infanta, Philippines</i>  <b>Glenn Fiel Fernandez   Rajib Shaw</b></p> <hr/> <p><i>Paths to a Resilient Future: Integration of Local Climate-related Disaster Resilience and Risk Communication</i>  <b>Farah Mulyasari   Rajib Shaw</b></p> <hr/> <p><i>Serious Gaming Improves Flood Disaster Communication</i>  <b>Nikeh Booister   Darja Tretjakova   Rense Bakker   Jose Kooi</b></p>		
<p><b>10:45am - 12:30pm</b></p>	<p><b>Analysis 2: Analysing Impacts and Assessing Vulnerabilities 2</b>                  Location: <b>House of Science Conference Room 2. Floor</b>                  Chair: <b>Stefan Gößling-Reisemann</b></p> <p><i>Climate Shocks and Patterns of Change of City-regions in Asia: Variations in Historical Resilience</i>  <b>Adriana Kocornik-Mina</b></p> <hr/> <p><i>Analyzing Impacts of Long and Short Term Disasters on Vulnerable Occupations.</i>  <b>Nitin Kumar Srivastava   Rajib Shaw</b></p> <hr/> <p><i>Climate Change and Adaptation Preparedness of Tribal Farmers in Jharkhand - India</i>  <b>Hari Shankar Gupta   Debajyoti Kundu</b></p> <hr/> <p><i>On Vulnerability and Violence: Analyzing the Geographical Distribution of Vulnerability to Climate Change-Related Violent Conflict Across Kenya and Uganda</i>  <b>Tobias Ide   Janpeter Schilling   Jürgen Scheffran   Grace Ngaruiya   Thomas Weinzierl</b></p>	<p><b>Designing 2: Designing and Testing Solutions for Regional Climate Adaptation and Resilience 2</b>                  Location: <b>House of Science Small Conference Room, 2. Floor</b>                  Chair: <b>Matthias Ruth</b></p> <p><i>Understanding the Concrete Boundary Qualities of Resilience</i>  <b>Christopher James Lawless</b></p> <hr/> <p><i>Effective Emergency Flood Control with Innovative Constructions</i>  <b>Bärbel Koppe   Armin Krebs   Karsten Daedler</b></p> <hr/> <p><i>Stakeholder-based Dynamic Modeling as a Tool for Regional Climate Adaptation in the Energy and Food Sector</i>  <b>Jakob Wachsmuth   Matthias Ruth   Onur Ozgun   Stefan Gößling-Reisemann   Nana Karlstetter   Rebecca Gasper   Andrew Blohm   Sönke Stührmann</b></p> <hr/> <p><i>An Assessment of Options for Supporting a Climate-resilient Electricity Infrastructure - the Case of the Netherlands</i>  <b>L. Andrew Bollinger   Gerard P.J. Dijkema</b></p>	<p><b>Implementation 2: Implementing Climate Adaptation and Paths to a Resilient Future 2</b>                  Location: <b>House of Science, Grand Conference Room 2.T1, 2. Floor</b>                  Chair: <b>Sean O'Donoghue</b></p> <p><i>Mainstreaming Climate Change Adaptation Through its Integration with Multilevel Natural Resource Governance System in High Mountain Ecosystems: A Case Illustration from Himalaya</i>  <b>Prakash Chandra Tiwari   Bhagwati Joshi</b></p> <hr/> <p><i>When the Future is Present: Experiences from a Trans-disciplinary Pilot Project about Coping with Small Scale Water Shortages, Water Conflict and Climate Change in Germany</i>  <b>Frank Sondershaus</b></p> <hr/> <p><i>Land Use and Climate Change: New Approaches to Integrate Climate Adaptation into Stakeholder Processes</i>  <b>Julia Oberdörffer   Nana Karlstetter   Reinhard Pflerl   Ulrich Scheele</b></p> <hr/> <p><i>Fostering Stakeholder's Reflexive Capacity to Cope with Long-term challenges</i>  <b>Manuel Gottschick   Cornelius Laaser</b></p>

## II. Keynotes

### *i. Jochen Hinkel*



**Title:** Vulnerability, Impacts and Adaptation: From Problem-Oriented to Solution-Oriented Approaches.

**Name:** Dr. Jochen Hinkel

**Organization:** Global Climate Forum (GCF)  
Berlin, Germany

In this paper I argue that the role of vulnerability and impact assessment approaches in climate change adaptation research needs to be redefined. These approaches were most useful in the “early days” of climate change research in order to identify and scope out the adaptation challenges we are facing. Now many of these challenges are known and, in many instances, vulnerability and impact assessments are either not necessary or need to change form in order to advance adaptation. Overemphasising the need for exact quantitative assessments on impacts may even delay adaptation. For helping climate change adaptation action on the ground the story behind the impact numbers is often more important than the numbers themselves. Many of these stories are already well known and, other than the numbers, robust in the sense that conducting more impact assessments is not likely to change the stories over the next decade or two. In many (but not all) instances, research aiming at advancing adaptation may therefore start off with the known problems instead of conducting impact and vulnerability assessments.

I illustrate this shift in focus needed for promoting climate adaptation action in the context of three impact domains: sea-level rise, food security and health. I find robust stories for all three domains. For sea-level rise, it is known that impacts will be significant, but also that adaptation is possible and affordable for most countries. For some of the poorer countries, however, adaptation costs are clearly not affordable and the problem that needs to be addressed is what kind of adaptation funding mechanism will allow the poorer countries to make the necessary investment in coastal adaptation. For food security, it is known that socio-economic development has a much greater effect on impacts than climate change, and two problems emerge: How can we assure the security of the global food and trade system? And how can we assure the development of the poor so that they can access the market? For health impacts, the effect of local socio-economic development is of even greater importance, and one major challenge to be addressed is the limited access of the

poor to clean water and sanitation. Across all of these three domains I conclude that climate change exacerbates existing problems of coastal flooding, food insecurity and disease. Climate change adaptation thus means addressing known challenges including poverty reduction, equitable development and the establishment and maintenance of global governance arrangements that ensure financial assistance as well as stability in trade and food prices.

## ***ii. Katrien Teermer***



**Title:** Designing and Testing Solutions for Regional Climate Adaptation and Resilience

**Name:** Prof. Dr. Katrien Teermer

**Organization:** Wageningen University, The Netherlands

Climate proofing the Netherlands is not only a technical issue but also a demanding matter of governance. Because of the high stakes and many uncertainties surrounding climate change, it has been called a “wicked problem par excellence”. Adaptation to climate change poses some specific, particularly demanding governance challenges like:

- controversies due to important uncertainties about the nature of climate risks and the effectiveness of mitigation and adaptation responses;
- long term perspective of climate change;
- multilevel and fragmented policy contexts at various levels and policy sectors (energy supply, forestry, water management, spatial planning, infrastructure and agriculture) are involved;
- diverse interests and logics are at play;
- complex science-policy relations due to the strategic use of knowledge, the misfit of demand for and supply of knowledge and difficulties in handling scientific uncertainties.

The specific complexities of adaptation call for new advanced governance knowledge. The Dutch governance of adaptation program (Knowledge for Climate; 2010-2014) aims to contribute to this knowledge. The focus was on developing and testing governance arrangements that can contribute to realizing adaptation options, and to increasing the adaptive capacity of society. These arrangements should be effective, legitimate and resilient. This speech will present and discuss the first results of this program.

Mainstream literature about climate adaption governance focusses on emphasizing the big long term challenges of climate change, the many controversies, the need for

participative approaches, the advantage of smart science-policy arrangement's and boundary workers, the importance of decision support tools to deal with the many uncertainties involved, the importance of mainstreaming, etc. The first insights from this program, however, show a more nuanced picture. Emphasising the enormous challenge of climate change problems can also result in leaning backwards, participation is not always effective, emphasizing controversies can result in deadlocks, science-policy arrangements can also result in less innovative approaches, drawing of clear boundaries between (for example) the public and the private is as important as boundary spanning, and in some cases cherry-picking can be more effective than integrating and mainstreaming everything.

### ***iii. Roger Street***



**Title:** Learning from Experience: Implementing Climate Adaptation

**Name:** Roger Street

**Organization:** UK Climate Impacts Program, Oxford University, United Kingdom

Critical to understanding and implementing climate adaptation is accepting that it is a learning process. In a complex system of systems with many agendas/perspectives and the existence of interdependencies, adaptation poses many challenges for which adopting a learning perspective can prove to be beneficial. Some of the key elements of this learning process relate to understanding what compromises adaptation and how what can be and is implemented changes with capacity, time and learning; who needs to be involved/engaged, and how and when; and how the learning process can be best supported.

This presentation will explore these aspects of the adaptation process based on lessons learned within the UK, but also drawing on lessons from other parts of the world. It will explore the challenges of implementing adaptation as a learning process, including what this means for assessment of adaptation options and for monitoring and evaluating implemented measures. It will also draw on experiences in other countries and regions to look at the challenges associated with supporting adaptation as a learning process.

#### *iv. Andrew Griffiths*



**Title:** Resilience and Slack: The Climate Changing Advantage of Nations, Industries and Firms

**Name:** Prof. Dr. Andrew Griffiths (Dr. Martina Linnenluecke)

**Organization:** University of Queensland Business School, The University of Queensland, Australia

It may seem unusual to begin a presentation on resilience and slack by talking about some of the fundamental political economy and management strategy literature and authors – but this paper proposes, that any discussion of resilience – needs to consider the future conditions of national competitive advantages in a climate changing world and how slack may be created as a useful response.

How are competitive industries created and sustained? How do we create the conditions of the competitive dynamics of individual companies? These are obviously large and complex topics. Competitive national industries and firms have been seen as the wealth generating lifeblood of nation states. Their creation, revitalization and decline are both an indicator of and impact on the economic health of nations. However a walk down the history of economics and political economy provides some insights and also some constraints in to how we deal with issues associated with climate change, resilience and extreme events. In the Wealth of Nations Adam Smith described what he saw as the ideal conditions by which nations could maximize their economic prosperity – this could be undertaken by enhancing free trade and reducing regulation, country's specializing in their 'natural competitive advantages'. It extended a long tradition of political economic discussion – which I won't elaborate upon here, but which culminated in a at least the most accessible framework for understanding dynamics of nations competitiveness– that of Porter in the Competitive Advantage of Nations – where he articulated the Porter Diamond of Competitiveness.

While it is not uncontroversial to suggest that Governments have focused on these issues – what is more controversial is the sources of that competitive advantage. According to the conventions of neoclassical economics, comparative advantages either from an abundance of resources, geographical location or cheap inputs such as labor enable countries to compete. In contrast – a competing perspective focuses on the importance of the firm level capabilities, strategies and resources as important components of competitive advantage. While the studies on this are diverse, its common focus is on organizational capabilities for attaining competitive outcomes. It is proposed that neither approach – economics and or firm level is sufficient. For instance Porter noted that clustering's of competitive firms are found in nationally

competitive industries. Porter developed a generic model for understanding the dynamics of national competitive advantage. The diamond consists of factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry. These conditions form a diamond of mutually interactive relationships which according to Porters study enhance national competitive advantage. Variants in national competitive advantage can therefore, for example be explained by reference to resource abundance and utilization or to weakness in industry structure. Lying awkwardly on the periphery of his model – are two factors – the role of government and chance...

But what about the impacts of a changing climate? How do we address issues to do with an industry structure – where natural comparative advantages are now diminished – because of extreme cycles of drought, and flood – for instance? Or the Relocation of Industries? Admittedly the models of Smith and Porter – were built on the foundations that stability and abundance in the natural environment were a given.

Other management scholars, argue that the dynamic nature of competitive advantage rests on distinct process that occur in firms – ie capabilities – specifically organizational capabilities enable distinctiveness between firms and account for competitive advantage and outcome. Researchers in this domain suggest that organizational adaptation to a changing environment has focused on how organizations can create core competencies and a competitive advantage based on efficient resource utilization. Attempts have been made to both conceptually and empirically link arguments for business action on climate change to this debate, suggesting that organizations can gain financial and thus competitive benefits from strategically reducing their resource throughputs and carbon footprints and complying with more stringent emission regulation. However, the focus on mitigation and corporate “greening” through creating efficiencies may have a downside that has so far been overlooked. Organizations that focus on mitigation and carbon efficiencies alone may not possess effective resources and capabilities to adapt to the effects of climate change, especially to greater climate variability (i.e., more frequent and/or severe weather extremes) and potential abrupt climate changes. Motivated by indicators that some already observable impact of climate change have begun to pose significant challenges to vulnerable industries, this paper examines whether “slack” resources such as engagement with social networks, resource co-management, income diversification or resources for learning and innovation enhance adaptation to climate change in the long term. Furthermore, we suggest that Climate Change Advantage of Nations relies on the long term understanding of the impact that localized events will have and assisting firms and industries to build the appropriate capabilities to deal with these events.

## CREATION OF DELIBERATE SLACK FOR CLIMATE ADAPTATION

Impacts from climate change already pose major challenges for organizations and

industrial systems, and vulnerabilities are expected to increase in the future, particularly in vulnerable sectors and locations. Findings by the Intergovernmental Panel on Climate Change (IPCC) sound a warning that climate change related vulnerabilities of organizations and industries, but also of settlement and society as a whole, are not just brought about by the gradual warming trend alone; instead, it is expected that vulnerabilities will mainly be related to greater climate variability (e.g., changes in the intensity and/or frequency of extreme weather). While companies in the reinsurance industry (e.g., Munich Re, Swiss Re) have begun to undertake research into changes in trends of extremes, most current debates on climate change and corporate response are mainly focused on mitigation of greenhouse gases – that is, longer-term adjustments that organizations can take in response to policy and legislative changes. The question of how organizations can cope with the physical impacts of global warming and especially greater climate variability has largely remained outside of these debates – and we see these as core to maintain competitive advantage in a climate changing world.

Organization researchers and managers have not yet systematically considered the organizational implications of a more volatile natural environment, such as changes to the intensity and/or frequency of storms, floods, and droughts. We argue that discussions on adaptation and resilience need to be broadened, and that new conceptual and practical approaches are needed to incorporate the effects of climate change and a greater occurrence of weather extremes into corporate strategy, decision-making and the longer term notions of competitive advantage.

Consequently, we suggest to view adaptation not as a process of optimizing organizational economic outcomes, but to consider adaptation of a dynamic process of continuous learning and adjustment to cope with greater uncertainty and unpredictable environmental change. While much of the current adaptation debates only apply to the comparatively narrow competitive and economic environment of the firm and emphasize equilibrium-seeking behavior and fitness to existing conditions we add another conceptualization of slack to the already existing constructs:

- Climate adaptation slack - which focuses on providing organizations with capabilities for taking on board shocks associated with impacts from climate and weather extremes of organizations and industrial activity.

Unlike studies that seek to both conceptually and empirically link arguments for business action on climate change to an efficiency debate, climate adaptation slack takes a long term position in relation to a firm, the natural environment and the sets of firm-specific capabilities that are developed to understand, interpret and adjust to changes in the firm's natural environment. A firm takes deliberate actions to develop slack resources and capabilities to cope with a range of potentially harmful external environmental impacts.

In light of expected climate change outcomes, we argue that current definitions of both corporate environmentalism and even of corporate sustainability (e.g., Hart & Milstein, 2003) need to be recast to include the perspective of adaptation and resilience of organizations to climate impacts, indeed of industries.

## SLACK AND CLIMATE ADAPTATION: A CONCEPTUAL FRAMEWORK

Returning to studies on slack and corporate greening, we argue that the desired outcome to build organizational slack for climate adaptation is a set of actions that will maintain or enhance organizational well-being under different types of environmental impacts, including (1) greater climate variability (i.e., more frequent and/or severe weather extremes), and (2) a larger potential for abrupt climate change. We argue that the ideal level of slack resources depends on whether or not the impacts of climate change have reached a threshold beyond which they become noticeable. In particular, where climate change is characterized by larger-scale and more abrupt types of changes, organizational capacity to adapt depends highly on which configuration the organization is in. However, the aim is not to try to maximize adaptation to a particular state, but to address a variety of different external environmental states in ways that they do not impose a significant cost and competitive dislocation on organizations.

We hypothesize here that organizations may only require low levels of climate adaptation slack if dealing with very predictable and stable natural environmental conditions. However, as environmental uncertainty increases, so may the level of climate adaptation slack required to deal with a vastly more unpredictable environment. As long as the level of climate change remains below a critical threshold, organizations with low level of slack will enjoy the competitive advantages outlined in much of the current management literature, while organizations with high levels of slack would face adverse competitive consequences for their operations. However, once a critical level of environmental change is reached, we suggest that this relationship changes and that organizations with high levels of climate adaptation slack are much better adjusted to cope with environmental changes.

## CONCLUSION

More recent research linking large-scale and human-induced changes in the ecological environment with societal collapse and failure has found it difficult to identify structures and systems for managing severe environmental dislocations (Diamond, 1992). We have proposed in this paper that the Climate change Advantage of nations will require the development of frameworks for securing the long term competitive advantage of industries by developing a through capacity to be able to understand fully the longer term impacts and by being able to extend these capabilities to a firm level. We suggested the ability to build slack resources may be one such approach.

Despite these observations, it has been noted before that there is ample evidence showing that the dynamic conservatism of organizations and their resistance to change can hinder adaptive responses to environmental jolts and even discontinuous events in technological fields, even if the consequences are disastrous for organizations (Tushman & Anderson, 1986; Schon, 1971; Gersick, 1991). This suggests that in such cases the ample supply of, or access to, slack resources may not be enough to overcome entrenched firm, industry or institutional practices and precedents.

Motivated by indicators that massive change events are occurring with increasing frequency (e.g., extreme climate variability), we revisited “slack” as the conceptual counterpart to “efficiency” and examined the potential contribution of slack to corporate sustainability in general, and to adaptive capability in particular. Understanding organizational resilience through the application of slack resources we argue is a fruitful avenue of research inquiry. Furthermore, by taking some of our existing strategy and organization theory concepts out of the narrow economic business domain and by reapplying them to issues around the ecological environment to firms, we can provide new insights for managers and organizations.



## III. Oral Presentations

### *i. Analysing Impacts and Assessing Vulnerabilities*



**Title:** Climate Change Risk Analysis as a Basis for Adaptation: Case Study of Aargau/CH

**Names:** Niels Holthausen<sup>1</sup> | Pamela Köllner-Heck<sup>2</sup> | Michael Bründl<sup>3</sup> | Peter Locher<sup>1</sup> | Marco Pütz<sup>4</sup> | Lilian Blaser<sup>1</sup> | Sabine Perch-Nielsen<sup>1</sup> | Martina Zoller<sup>2</sup> | Thomas Probst<sup>2</sup> | Roland Hohmann<sup>2</sup>

**Organizations:** 1: Ernst Basler + Partner, Switzerland; 2: Federal Office for the

Environment (FOEN), Switzerland; 3: WSL Institute for Snow and Avalanche Research SLF, Switzerland; 4: Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Switzerland

In Switzerland, an analysis of both risks and opportunities of climate change is to provide a transparent basis for adaptation decision making on the national scale. To account for the strong regional differences (e.g. high mountains vs. lowlands), the analysis will comprise a case study for each of six predefined regions. Here, the case study Aargau, representing the lowlands, is in the focus. The risk analysis focuses on climate change impacts on the policy areas health, agriculture, forestry, buildings and infrastructure, water management, tourism, energy consumption and supply, and biodiversity. Today's risks are compared with those projected into the future (2060). For that purpose, future risks and opportunities are calculated for two different climate change scenarios and one socioeconomic and demographic scenario.

Impacts on each policy area are compiled for every short term hazard or long term effect. In a semi-quantitative approach, most relevant impacts on the policy areas are quantified and monetized. The results show quantified impacts but also consider descriptions of non-quantifiable impacts in the final assessment. The assessment is based on a rigorous treatment of uncertainties through to the presentation of results. For the moderate climate scenario (+1.4°C from 2010-2060), the results show relevant stress for public health and biodiversity. The major opportunity is a decrease in costs (and emissions) due to reduced heating in winter time. The other policy areas show relatively moderate benefits and risks until 2060. The more serious climate scenario (+3.1°C) would lead to serious stress in public health with heat waves as those of 2003 becoming normal. As a consequence of longer vegetation periods, increasing stress due to hay fever is expected. Biodiversity would suffer from relevant changes in ecosystems. In this scenario, most benefits of the moderate

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scenario turn into risks and most policy areas will experience relevant impacts.

Climate change will change today's opportunities and risks. There will be winners (e.g. consumers due to lower heating costs) and losers (e.g. people stressed by heat waves or pollen). The results provide a valuable basis for the discussion of climate change adaptation priorities among responsible administration units and stakeholders. And they will provide an important input to the next version of the national adaptation strategy.

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**Title:** Implication of Local Knowledge in Framing Coastal Resilience Assessment Indicators: Case Study from Indian Sundarbans

**Name:** Rajarshi DasGupta | Rajib Shaw

**Organization:** Graduate School of Global Environmental Studies, Kyoto University, Japan

Every coastal area is unique in terms of its risk profile, social, economical and most importantly ecological settings. Further, as we march into a regime marked by climate uncertainties, significant variation is also expected in climate exposure along the world's coast line. Therefore, understanding of the local context remains extremely important in order to assess and enhance coastal community's resilience against climate change & climate induced natural disasters. The present study attempts to formulate a pragmatic coastal resilience assessment framework which is flexible to the need of the local context and takes into account all major socioeconomic & ecological interactions in coastal areas.

This dynamic framework consists of five major dimensions i.e. socioeconomic, physical, institutional, coastal zone management & Natural with 125 variables/indicators and essentially supplements some of the earlier resilience assessment frameworks. In the present study, it has been used to assess community resilience of 19 coastal administrative blocks in Indian Sundarbans (Delta region of lower Gangetic basin) which serves as a typical example of low-lying coastal area extremely prone to climate induced disasters and depleting mangrove ecosystem services coupled with dire poverty projects it to be among the future climate hot spots. In order to capture community resilience in Indian Sundarbans, the study essentially gathered local knowledge about social, economical, ecological and climatic settings and their dynamic interaction to modify the present assessment framework according to the local need. An institutional survey of administrative officials was conducted to get precise data for each coastal block. The study also collected secondary data from scientific literature to obtain a detailed understanding of the complex geo-climatic scenario of the delta. The overall resilience of the study area was found to be extremely unsatisfactory with composite score varying from 2.51 (lowest) to 3.6 (highest) in a five point assessment scale. Although, natural exposure was found to be the key contributor, distinct examples of socioeconomic & physical resilience were also observed to play an important role in overall community resilience. Further, gradual depleting ecosys-

tem services leads to significant risks of lowering community resilience against projected climate change threats. The study concludes with an urgent call for ecosystem based adaptation in order to improve community resilience in Indian Sundarbans.



**Title:** Adaptive Capacity and Water Governance and Spatial Planning in the Eastern Cape Province, South Africa

**Names:** Kevin Grecksch | Maik Wings

**Organization:** Carl von Ossietzky University Oldenburg, Germany

Successful adaptation to climate change requires flexible adaptation strategies which consider regional ecologic, economic and social circumstances. Coastal zones are considered to be significantly vulnerable to climate change impacts. This paper uses an existing framework, the Adaptive Capacity Wheel (ACW), complemented by two additional dimensions: adaptation motivation and adaptation belief to analyse the adaptive capacity of two case studies in South Africa.

The objectives were first to assess the adaptive capacity of water governance and spatial planning in the study regions, and second, to show how the ACW can be used as an approach and a communication tool with stakeholders to identify strengths and weaknesses. Based on this, a further objective was to discover what lessons and recommendations can be drawn that could help water experts, spatial planners and stakeholders in the future. The first case study is the water management within the Keiskamma River Catchment in the Eastern Cape Province, South Africa. South Africa, being a semi-arid country faces water resource constraints. The projected impacts of climate change in the study area are, for example, changes in rainfall with effects to the streamflow, salt water intrusion, decreasing water quality due to run-off, erosion and droughts. The results show a low adaptive capacity and that the addition of the psychological dimensions was valuable. However, it is important to look closely at each dimension assessed by the ACW. The key recommendations are: to ensure better coordination across and within governmental levels; to raise awareness, capacity and skills among decision makers and the public; and to reduce the lack of political will to overcome adaptation barriers. The second case study deals with spatial planning in the Nelson Mandela Bay Municipality. Relevant for commerce, habitation, mobility, recreation and nature itself, spatial planning faces significant challenges under changing climatic conditions. Infrastructure needs to be robust towards the increasing number of weather extremes such as heat waves, floods, droughts and soil erosion. Space might be required for city ventilation or flooding zones. Moreover, sea level rise might not be covered by traditional instruments. The key recommenda-

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tions are: to improve public participation; to ensure better coordination; to raise awareness; and to reduce the lack of political will to overcome adaptation barriers.

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**Title:** An Approach towards Developing Framework for Assessing Impacts and their Vulnerabilities

**Name:** Parameswaran Radhakrishnan

**Organization:** Indian Institute of Management, India

More than a billion people across 100 countries are directly or indirectly vulnerable to climate change. There has been a rise in extreme weather events in the recent past, thereby affecting more people. The concept of vulnerability expresses the multidimensionality of cause and effect relationships, combining with the inability to withstand environment forces. Vulnerability to climate change is a function of exposure to climate variability, sensitivity to climate shocks and adaptive capacity. Several vulnerability frameworks have been developed to strengthen the adaptive capacity. Vulnerability is determined by physical, environmental, social, economic, political and institutional factors. This paper focuses on developing vulnerability framework for a given region/area based on other existing frameworks. By integrating approaches from different paradigms, the proposed process offers a holistic approach for measuring vulnerability. Measuring vulnerability would facilitate towards the responses to combat the climate change challenges or at-most provide strategies for adaptation. A case study of Shimla City, India is included in the paper to validate its applicability.

In the current study both natural and anthropogenic events are considered. The city is vulnerable to natural hazards like earthquake, landslides, flash floods and many more. The increasing population also creates pressure on land demand. This indeed results in illegal construction along the steep slopes of the hills, thus disturbing the natural topography. Increasing land pressure would result in deforestation, thus would loosen the soil and may lead to landslides. Increased construction activities have also lead the lesser natural surface area, this reduces the permeability of the soil & therein reducing the water table levels. This indirectly hampers the hydrological cycles & minor changes in micro climate. The city is vulnerable to all these natural and human induced hazards in every sense. Only a proper institutional framework along with other social, physical, economic and political framework can mitigate the impact. These impacts should be dealt considering the present condition of the region. In the current study, assessing the impacts and their vulnerabilities are conducted for the Shimla city. It also proposes suitable strategies for mitigation the impact.

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**Title:** Using Local Remote Sensing, Statistical and Survey Data to Identify Vulnerability Patterns and Sustainable Adaptation Options

**Names:** Claudia Bach | Tobias Blätgen | Jörn Birkmann

**Organization:** United Nations University Institute for Environment and Human Security (UNU-EHS), Germany

Global and regional climate models have been an important tool in determining the potential results of climate change. However, measures that can be based on them are still limited due to model uncertainties but also to limitations in downscaling. With respect to estimations at the municipal level, estimations of different models vary.

A second methodology to derive information about changes in local climate is the use of historical climate data and their analysis for the identification of trends. Specifically with respect to extremes however, data might not be specific enough. An important tool that might help to circumvent these challenges are vulnerability assessments which have also been recognized as an important contributor to climate change adaptation by the IPCC. Exposure patterns related to certain hazards are already frequently used, e.g. for the development of flooding maps. The exposure assessment of municipalities to other hazards such as heat waves and extreme rainfall can also be conducted using remote sensing and statistical data in combination with calculations based on engineering services and measurements. The paper will thus introduce methodologies that have been developed for exposure assessments towards heat waves and heavy precipitation. At the same time, it will link exposure patterns to other vulnerability factors, i.e. susceptibility and coping capacity of the system of interest. For the example of the population, respective indicators and criteria based on literature reviews, expert interviews and household surveys are introduced. They can be differentiated in more generic factors (e.g. age and dependency) and hazard specific factors such as design standards of buildings.

Overall the introduced methodology allows for the identification of vulnerability hot spot in municipalities and allows for the development of effective measures without being dependent on climate models.

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**Title:** Climate Shocks and Patterns of Change of City-regions in Asia: Variations in Historical Resilience

**Name:** Dr. Adriana Kocornik-Mina

**Organization:** The London School of Economics and Political Science, United Kingdom

A body of work has examined the intersection of climate hazards and urban areas with a view towards preparing for an uncertain future under climate change. Key products include estimates of current and future exposure of urban areas to climate hazards and associated losses; and classifications of cities according to characteristics known to determine levels of future risk and resilience in the face of climate hazards, for example. The proposed research places an emphasis on past dynamics of city-regions. It is postulated under the assumption that the historical experience with climate shocks of today's city-regions (and by inference, their level of resilience), can be observed and analyzed using night-time light satellite data. The paper asks how patterns of change of city-regions in Asia have differed according to their historical experience with climate shocks /hazards.

The paper acknowledges that climate shocks are one of the many factors that drive patterns of change of city-regions, including agglomeration economies, innovation, policy, and culture. It recognizes there are differences in the impact of climate shocks by type, and within types according to their magnitude and duration. It also recognizes other major challenges associated with this type of analysis, including that climate hazards are internalized and reflected in a city-region's pattern of change at no set point in time, particularly in the context of fast-paced urbanization; and that the stimuli (climate shock) – response (change in city-regions) relation of interest is the product of the interaction of two complex systems.

Despite potential pitfalls, it is the notion of complexity that suggests a way forward through Perrow's (1999) work on interactive complexity and tight couplings. Perrow's sources of vulnerability (concentrations of populations, some of them high-density, concentration of economic and political power, concentration of energy) are one element of a conceptual framework that outlines the most likely patterns of change that a city-region can observe. Other elements in this conceptual framework, both static and dynamic, rely on stylized facts from the extensive work on path dependency, urban growth and disaster studies. Thus the conceptual framework provides a point of reference for contrasting results from the empirical analysis, as well as in the matching exercise to be conducted using classes or typologies of city-regions some of which have experienced climate hazards and some of which have not. Spatial-temporal methods are used to examine data for the period 1992 – 2010 for Asia.

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**Title:** Analysing Impacts of Long and Short Term Disasters on Vulnerable Occupations in Gujarat, India

**Names:** Nitin Kumar Srivastava | Rajib Shaw

**Organization:** Kyoto University, Japan

The paper elaborates on the underlying characteristics of 'vulnerable occupations' and introduces the new concept of occupational resilience, which is the ability of an occupation exposed to hazards, to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of providing livelihood to its erstwhile employees. Vulnerability is categorized as exposure, as social condition, and as spatial dimension of integration of potential exposures and societal resilience. High levels of vulnerability suggest low levels of resilience and vice versa.

It is widely accepted that the low income population is bound to be affected more than others.

People with different income levels have different resilient capacities against disaster. The authors define vulnerable occupations described by 9 parameters: loss of productive assets, displacement and migration, loss of employment, decline in productivity, reduced income, workforce participation, change in occupation, effect on social structure and recovery time.

The authors examine two case studies in the form of flood-affected Ahmedabad and salinity-inflicted Jamnagar districts of Gujarat state in India. Both the disasters vary in the effectual period, and therefore have different effects on the occupations of these areas. The findings are based on assessment through focused group discussions, and household surveys of both urban and rural populations.

The concept of occupational resilience is the key to achieve overall resilience of the community and requires that the strategies should consider the market demand, local skills and experience. The paper also provides a framework for the governments to strive for occupational resilience, with following objectives:

- Provide occupational opportunities with stable income through support to agrarian interventions; microfinance interventions and enterprise development,
- Provide training and placement programs: cash-for-work and food-for-work; and building-in-camp economies
- Rebuilding of assets for improved productivity and income
- Limit migration to nearby or distant places in search of employment

Following quantitative and qualitative analysis, the paper comes out with the following findings:

- The factors to analyze and assess the impacts of even small scale disasters on micro economy of an area
- The vulnerable populations in rural areas rely to urban areas as survival strategy in case of unemployment due to disasters in both the cases

The urban occupational resilience is greater than the rural resilience due to diversity of employment opportunities and better micro economic structure within the small communities.

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**Title:** Climate Change and Adaptation Preparedness of Tribal Farmers in Jharkhand, India

**Names:** Dr. Hari Shankar Gupta | Debajyoti Kundu

**Organization:** Jharkhand Tribal Development Society, India

Climate change is having its adverse affect on livelihood of almost all sectors, but the worst affected are those totally dependent on agriculture and forest for their livelihood. Tribal people in Jharkhand, an Indian state, are no differently placed. Most of the tribal in state are still subsisting on agriculture. Supplementing their need, these people depend on various timber and non timber forest produces. Change in the climatic condition has started affecting badly both agriculture and forest. Changing pattern of rainfall during the monsoon aggravates the problems in agriculture also. In the last decade erratic monsoon has caused famine like situation in tribal Jharkhand, many a times. Thus tribal can be termed as victims and not the creator of climate change; hence suitable adaptation to the climate change is only option for their survival. This study tries to understand how tribal are using their indigenous knowledge

and how they can be enabled to tackle this problem. How they can be supplemented by additional scientific adaptive methods, which can be scaled up and replicated in the other tribal dominated areas.

Major issues with tribal farmers:

- Erratic behavior of rainfall and temperature.
- Rampant use of high breed seeds requires high input in terms of water, fertilizer etc. Which if not fulfilled and with climate variability – result in poor yield.
- Abandoning the practice of using traditional indigenous seeds – forcing them high input mode.
- Various agencies working in the field of climate adaptation recommend various technologies; most of them are in isolation, hence not easily adapted by tribal farmers.

Methodology:

- Six villages have been randomly selected from two districts of Jharkhand, covering 435 farmers.
- Information regarding details of land type, topography, soil properties (both chemical and physical), area of plot, plot detail of individual farmers' land - collected by primary survey, for each farmer in 'Excel' sheet.
- Based on the above integrated information; suitable crop variety, crop combination and annual crop cycle would be prescribed to individual farmers.
- Institutes like "Birsa Agricultural University" and "Central Upland Rain fed Rice Research Centre" are helping in prescription.

Expected outcome:

- Prescription would be tested in field, analyzed and taken for adaptation, at large level.

Promotion of locally available climate resilient variety would result in optimum use of inputs like water, fertilizer etc. - using the natural moisture and nutrient - thus making agriculture less susceptible to climate vagaries.



**Title:** On Vulnerability and Violence: Analyzing the Geographical Distribution of Vulnerability to Climate Change-Related Violent Conflict Across Kenya and Uganda

**Names:** Tobias Ide<sup>1,3</sup> | Janpeter Schilling<sup>2</sup> | Jürgen Scheffran<sup>1</sup> | Grace Ngaruiya<sup>1,3</sup> | Thomas Weinzierl<sup>1</sup>

**Organizations:** 1: University of Hamburg, Germany | 2: International Alert, London, United Kingdom | 3: SICSS, Germany

Several recent studies debate the link between climatic changes and violent conflict for Sub-Saharan Africa and especially for eastern Africa. While there exists extensive literature on the question whether climate change increases the risk of violent conflict

onset, not much is known about where this climate-conflict-link is likely to become manifest. We address this shortcoming by analyzing the geographical distribution of the vulnerability to climate change-related violent conflict onset in Kenya and Uganda. More specifically, we focus on a reduced potential for agricultural production (RPAP) as the mediating factor between climatic changes and violent conflict. The study draws on most recent literature on (i) climate change and violence, (ii) climate impacts on agriculture, (iii) vulnerability to climate change and (iv) violent conflict onset in order to develop a combined index indicating the vulnerability to RPAP-related violent conflict onset. The index shows the region's most vulnerable to climate change-related violent conflict in Kenya and Uganda at a spatial resolution of half a degree (which is approximately 50 x 50 kilometers). Three case studies were conducted in order to contrast the risk index with the findings of recent qualitative research. While the case studies in general confirm the accuracy of the risk index, they also point to data needs and conceptual tasks for future research.

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## ***ii. Designing and Testing Solutions for Regional Climate Adaptation and Resilience***

**Title:** Lessons Learned in Adaptation: Application of the “Stadtbakasten”-Toolkit for Kiel

**Names:** Hinnerk Ries | Steffen Bender | Markus Groth | Jörg Cortekar

**Organization:** Climate Service Center, Germany

Supporting cities in increasing their resilience to the adverse impacts of climate change is highly context specific. It is not only the city specific vulnerability due to its location, structure, inhabitants and operational capability. Equally important is the consideration of the individual backgrounds of the stakeholders involved in the process of adaptation. As an interdisciplinary topic the approaches of the different stakeholders involved are very diverse and so are the specific preferences for adaptation. The range of different impacts, backgrounds and stakeholder preferences makes the implementation and transferability of adaptation measures a difficult issue.

With the example of Kiel, our pilot city for the application of the “Stadtbakasten”-toolkit, we learned that enhancement of inter-departmental communication is a prerequisite for the adaptation process. Another prerequisite is to build consensus about threats and preferences for adaptation measures between the stakeholders. The consensus is defined in the form of a general principle. Also the inventory of existing data is a valuable source for the generation of adaptation relevant knowledge. However, in order to respond flexibly to the cities' needs, the most important lesson learnt is to have a flexible consultation framework. With its modular concept the “Stadtbakasten”-toolkit tries to fulfill this aspect. The modules are designed in a way that they integrate in existing processes, thus offering efficiency benefits. This leads to broad acceptance in the administration.

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**Title:** Same, Same, but very Different: Discussing the Transferability of Adaptation Solutions Developed in 'nordwest2050'

**Names:** Torsten Grothmann<sup>1</sup> | Born, Manfred<sup>2</sup> | Heiko Garrelts<sup>3</sup>

**Organizations:** 1: Carl von Ossietzky University Oldenburg, Germany | 2: econtur, Bremen, Germany | 3: University Bremen, Germany

Research on capacities for and barriers to climate change adaptation shows that a multitude of intertwined factors is influencing the emergence, progress and success of adaptation processes: biogeophysical (e.g. exposure to sea-level rise), historical (e.g. weather extremes in the past), political (e.g. political will for adaptation), institutional (e.g. existence of science-policy interactions), cultural (e.g. norms and values for proactive risk management), educational (e.g. skills for stakeholder engagement), cognitive (e.g. risk awareness and knowledge), economic (e.g. costs of climate change impacts and adaptation costs), technological (e.g. access to technological adaptation options), infrastructural (e.g. existing energy infrastructure), and other factors. As the characteristics of these factors differ between regions a direct transfer of adaptation solutions from one region to another appears impossible. Instead, before adaptation solutions or 'good practices' are transferred and implemented similarities regarding the factors influencing adaptation processes should be analyzed, and where differences appear, adaptation solutions have to be tailored to the regional conditions. Nevertheless, scholars highlight generic guiding principles and lessons learnt for adaptation. For example, multi-level governance and cross-sectoral policy integration are considered as requirements for successful adaptation. Prutsch et al. (2010, 2014) identified a list of guiding principles for adaptation (e.g. "Identify and cooperate with relevant stakeholders"); from local to European decision making levels; from governmental organizations, NGOs, business and research organizations; and from 17 climate sensitive sectors such as civil protection, energy, forestry, health management, protection of biodiversity, tourism, water management. Hence, on a rather general level transferability and generalizability of adaptation solutions seem to exist.

Addressing this tension between region specific conditions and generic guiding principles for adaptation we discuss the transferability of adaptation solutions developed in the project 'nordwest2050'. Based on policy transfer literature we evaluate the transferability focusing on two regions we cooperate with: Maryland (USA) and Durban (South Africa). Furthermore, we compare the 'nordwest2050' adaptation solutions with solutions developed in adaptation processes in other coastal regions, e.g. Rotterdam region (Netherlands), Helsinki area (Finland) and Queensland (Australia).

**Title:** The Role of National Water Legislation in the Adaptation of Climate Change: Could the EU Experience be a Model for the Rest of the World?

**Name:** Mohamed Faiz Abdul Raheem

**Organization:** University of Canterbury, New Zealand

It is sufficiently established through a number of researches and projections that water resources are vulnerable to climate change. Climate change potentially brings a range of adverse impacts on the sustainability of water resources. The consequences of these impacts can seriously affect human life and ecosystems. The impacts of floods and droughts on the use of water and the management of water resources require appropriate responses. The prudent responses should aim at developing and implementing measures mitigating the adverse impacts; and strengthening the ability to adapt and be resilient to the eventualities of climate change.

While advancement of science and technology contribute to the development of measures, underdevelopment of policies and law in this area will considerably affect the implementation of these measures. Although policies at national level are being formulated, translating these policies into proper and binding legal provisions is rare to be seen, especially in the developing countries that are particularly vulnerable. Action is required to include clear legislative provisions to establish appropriate rights and obligations and institutional framework. Inaction could render the quality and quantity of available water at risk and lead to increased water related conflicts and disasters.

Although adaptation strategies are country specific and broadly depend on changing circumstances and societal needs specific to the country, the principles of law relating to climate change adaptation have universal application. The European Union has set precedence in this aspect that could provide a model for countries outside the Union. In my paper, I will discuss the salient features of relevant EU directives; and the implementation measures under these Directives at national level with a view to highlighting the likelihood of these features setting out a model for other nations. The salient features under discussion include the recognition of water as a unique resource; identification of water as, the basic need of human and the ecosystems, part of the environment and the resource for satisfying the economic, social and cultural aspirations of human; the framework legislative approach; catchment based multilevel governance; preventive mechanism; mandatory disclosure provisions and stakeholder participation.

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**Title:** Strategies and Indicators for Green Building as a Key Factor for Climate Change Adaptation in Cities

**Names:** Torsten Lipp<sup>1</sup>; Tina Gäbler<sup>1</sup>; Ryan Weber<sup>2</sup>; Mitchell Reardon<sup>2</sup>; Christian Fredricsson<sup>2</sup>; Ines Vilhena da Cunha<sup>3</sup>; Carla Silva<sup>3</sup>; Stefan Dirlich<sup>4</sup>

**Organizations:** 1: University of Potsdam, Germany; 2: Nordregio, Sweden; 3: Inteli, Portugal; 4: IÖR, Germany

Approximately one third of the global energy end use is taking place within buildings. In Europe, 40 % of the total energy consumption is estimated to be represented by the building sector (European Parliament 2010, p. 1). Furthermore, more than one third of global resource consumption, including 12 % of all fresh water use is caused by the construction sector. Thus reducing the energy consumption of the building sector is central to any attempt to diminish GHG emissions and to use resources more efficiently. In this context, the project “Regional Policies towards Green Buildings” ([www.RE-GREEN.eu](http://www.RE-GREEN.eu)) was set up. Its overarching objective is to promote innovative policy solutions for green buildings, green urban development and green public procurement. The participating cities and regions share knowledge and transfer experience to improve their regional policies towards green building. The RE-GREEN project provides a conceptual framework that respects the understanding of what green building means to each of the engaged actors. It therefore extends an urban planning-based recognition that once a building is constructed it is inseparable from its greater context of the existing built environment of a city region. It also aims to overcome the paradox of providing a concept that is concise and operational on one hand, but also mindful of the comprehensiveness of buildings and their connections with the built environment. In addition, an indicator system was developed to promote the implementation of sustainability concepts for green building rehabilitation. The indicator system aims to assess policies for a sustainable retrofitting and green urban development and thereby considers future requirements for energetic and environmental performance of buildings as codified in several EU regulations. Within this context, public authorities are considered as key players. One of them is the city administration of Dublin, Ireland, a coastal city. They provide strategies like the Dublin City Development Plan or the Climate Change Strategy for Dublin, which aim to adapt to and mitigate the effects of climate change. With the help of the conceptual framework and the indicator system, these strategies were analysed regarding their climate change effect. The Re-GREEN framework and indicator system as well as the results from the analysis can provide a great input for other cities and regions.

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**Title:** A Strategy for Bremen’s Adaptation to Extreme Climate Change-Related Rainfall Events: The KLAS Project

**Names:** Holger Hoppe<sup>1</sup> | Jan Benden<sup>2</sup> | Michael Koch<sup>3</sup>

**Organizations:** 1: Dr. Pecher AG, Germany | 2: RWTH Aachen, Germany | 3: Free Hanseatic City of Bremen: The Senator of Environment, Construction and Traffic, Germany

Hotter and drier summers, wetter winters and more stormy days - climate change has many different aspects in Bremen. These also include extreme rainfall events, which, according to various climatic projections, could affect Bremen more frequently in future. The extreme rainfall events of 2011 have already demonstrated the problems. That is why the KLAS project is setting out to develop a climate change-related adaptation strategy with regard to extreme rainfall events, for the purpose of getting Bremen to adapt to the risk of such rainfall events, thus making long-term preparations for the city's future.

KLAS has set out to develop strategies and courses of action that might help to mitigate the repercussions of extreme rainfall events and enable the city to manage the risk better. To that end, all the pertinent protagonists in Bremen have been brought to one table for the purpose of elaborating joint strategies; e.g. urban drainage, town-, transport- and landscape planning departments.

KLAS's goal is to investigate whether or not, and the extent to which, concrete measures in the sewer system and on the surface can be found that are capable of improving adaptation to the hazards of extreme rainfall events and that might help to reduce the impacts occurring in critical areas. The first step to be taken here is to identify areas that are sensitive to urban flooding. Maps are already developed to describe the situation for the whole city. In these areas, it is to be investigated what kind of combination of measures can be taken to mitigate the damage and obstructions associated with extreme rainfall events efficiently. Possible measures are centred, on the one hand, in the public sphere, but, on the other hand, property owners are also called upon to carry out measures to bring their properties into line with comprehensive property protection goals. Furthermore, the project aims, in the long term, to establish "water-sensitive urban design" as a part of urban development and planning activities in the context of a city wide climate adaption strategy. Consequently, every individual citizen is called upon to participate in a climate change-related adaptation strategy relating to extreme rainfall events. Both the city and its inhabitants must act hand in hand. An information strategy is developed.

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**Title:** Understanding the Concrete Boundary Qualities of Resilience

**Name:** Christopher James Lawless

**Organization:** Durham University, United Kingdom

It has been observed that the term 'resilience', as it relates to climate change and social-ecological systems, is often defined in malleable and sometimes ambiguous ways. It has been argued that this malleability gives 'resilience' the loose quality of a 'boundary object', namely a linguistic device which, while open to individual interpretation, provides a focus to unite groups and actors who may hold differing perceptions and interests. The increasingly widespread use of the term 'resilience' has however raised concerns that its descriptive value risks becoming diluted. This paper seeks to redress this issue by sketching a new way of framing climate change resilience as a boundary object. This framing places greater emphasis on the more concrete manifestations of boundary objects, rather than how they are conceived in abstract terms. I argue that more attention should be paid to the ways in which tangible material, technical and social elements (people, objects, environments, institutions

etc.), may combine, over potentially wide spatial and temporal domains, to realize local instances of climate resilience. Drawing upon Science and Technology Studies (STS) literature I introduce a framework which could be used to understand how the boundary qualities of resilience manifest themselves in empirical terms. The aim of this framework is to facilitate interpretations of climate resilience which are both critically aware and practicable, and which can accommodate various policy and economic interests. In doing so, this framework seeks to meet key criteria advocated by Brand & Jax (2007): that resilience should be framed in a way which permits its specification to particular objects, but which also recognises the useful versatility of the term.

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**Title:** Effective Emergency Flood Control with Innovative Constructions

**Names:** Bärbel Koppe<sup>1</sup> | Armin Krebs<sup>2</sup> | Karsten Daedler<sup>3</sup>

**Organization:** 1: University of Applied Sciences Bremen, Germany | Optimal - Tarpaulin and Environmental Technics GmbH, Germany | Karsten Daedler e.K. – Manufacturer of Tarpaulin and Fabrics, Germany

Natural hazards have become natural disasters since people have been settling in flood prone areas. During the last decades the need of protection has been increasing with rising population density and concentration of assets in low lying coastal and river areas. It is expected that climate change will lead to a further increase of floods in number as well as severity. Therefore, the demand for technical protection measures is growing, but these can never provide overall but only a limited protection against inundation. The degree of safety depends on a Cost-Benefit Analysis of the measure. Additionally, limited financial budgets lead to restrictions in technical flood protection.

A failure of a flood protection system must always be taken into account. In an emergency, appropriate interim protection systems must be at hand to support weak and overloaded structures in withstanding the flood event. Within the research project HWS-Mobile<sup>1</sup>, funded by the German Federal Ministry of Economics and Technology, different prototypes of water-filled tube constructions for the use in emergency flood control have been developed and tested in the field as well as in laboratories. After completion of the project HWS-Mobile three types of constructions were tested and certified by the German Technical Inspection Agency TÜV Nord for the use in emergency flood control in 2012. The innovative flood control systems offer the following advantages:

- low consumption of resources
- rapid deployment
- small number of personnel required
- deployable on different undergrounds without any destructive installations

The constructions can be used either for strengthening endangered dikes due to

long lasting high water levels as well as for the construction of emergency dams in low-lying areas where no permanent flood protection exists. The paper will describe the pros and cons of water-filled tube constructions for emergency flood control. It will conclude with impressions of the successful use of the systems during the major flood event in Germany in 2013.



**Title:** Stakeholder-based Dynamic Modeling as a Tool for Regional Climate Adaptation in the Energy and Food Sector

**Names:** Jakob Wachsmuth<sup>1</sup> | Matthias Ruth<sup>2</sup> | Onur Özgün<sup>2</sup> | Stefan Gößling-Reisemann<sup>1</sup> | Nana Karlstetter<sup>3</sup> | Rebecca Gasper<sup>4</sup> | Andrew Blohm<sup>4</sup> | Sönke Stührmann<sup>1</sup>

**Organizations:** 1: University of Bremen, Germany | 2: Northeastern University Boston, USA | 3: Carl von Ossietzky University Oldenburg, Germany | 4: University of Maryland, USA

Decision making about adaptation to climate change requires knowledge about potential technical, social, economic and ecological conditions in the future. The interplay of all these conditions and their uncertain evolution makes it difficult to prepare decisions today that produce desirable results in the future. Moreover, decision making has to take into account that individual measures may have an impact on the overall system - such as an entire economic sector or region. Promotion of biomass as an energy source, for instance, will trigger changes in crop mix and thus input requirements in the agricultural sector. Changes in outputs from agriculture, in turn, are likely accompanied by differences in energy demands for processing, cooling and shipments of food products. "Optimal" strategies thus usually do not exist in such complex situations. With sufficiently good understanding of the issues and interactions, however, it may be possible to find strategies that can be considered acceptable for a broad set of developments.

In the course of the research project 'nordwest2050' we have developed a model designed to capture the dynamic interrelationships between the energy (electricity + district heating) and food production sectors in the northwest metropolitan region of Germany. The model has three main purposes: (a) provision of a structured platform for data organization and dialog with stakeholders; (b) exploration of a wide range of what-if scenarios in preparation of investment and policy making; and (c) recursive (adaptive) planning where the results of past actions are assessed within an ever-changing socioeconomic, technological and environmental context to guide future action. Based on consultations of selected regional stakeholders from the energy and agriculture sector, as well as regional planning, we derived principles and constraints for regional strategies, e.g. to satisfy the monthly electricity demand solely with re-

gional wind, solar and CHP plants and to avoid increasing fodder imports. Given these principles and constraints we evaluated the effects of two competing strategies, an emission-oriented strategy and a cost-oriented strategy, for three different framing scenarios for the external conditions (e.g. climate change) and two possible developments of energy demand. Here cost refers to the costs of regional electricity generation when the regional demand is met monthly. Our results suggest that the influence of emission reduction policies that do not involve demand reductions will be limited. Furthermore, cost-oriented policies may not be resilient to shocks because of a low generation diversity.



**Title:** An assessment of options for supporting a climate-resilient electricity infrastructure – the case of the Netherlands

**Names:** L. Andrew Bollinger; Gerard P.J.Dijkema

**Organization:** Delft University of Technology, The Netherlands

Climate change may affect the electricity infrastructure in myriad ways. Of particular concern are anticipated changes in the frequency and severity of extreme weather events such as floods, windstorms, droughts and heat waves. Events such as these can induce the failure of infrastructure components and threaten the integrity of the infrastructure as a whole. This has been forcefully demonstrated by events such as the 2012 blackouts in India (620 million people without power) and Hurricane Sandy (8.5 million people without power).

A resilient electricity infrastructure may be defined as one which preserves continuity of service despite perturbations in its environment – if it fails, it does so gracefully, not catastrophically. As complex systems, however, electricity infrastructures may be prone to catastrophic failure, caused by disturbances propagating through the network. This begs the question of how and where we must support the climate-resilience of our electricity infrastructure? As a low-lying coastal country located at the mouth of several major rivers, the Netherlands may be particularly exposed to anticipated changes in the frequency and severity of floods and windstorms. This paper introduces results from a model for assessing the vulnerability the Dutch electricity infrastructure to such events and exploring options for supporting infrastructure resilience.

The starting point for the model is a comprehensive dataset that describes the current configuration of the Dutch electricity infrastructure - including generation, demand and transmission – as well as key environmental sensitivities of infrastructure components. The model uses the technique of structural vulnerability analysis to assess patterns of degradation in infrastructure performance following from the successive failure of components under extreme weather conditions. The performance of

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the infrastructure is captured using a resilience metric. The state of the network is gauged using a power flow analysis sub-model, and the consequences of the network's complexity are captured using a cascading failure algorithm. The Dutch electricity infrastructure is tested against the occurrence two types of extreme events – floods and windstorms. By observing patterns of degradation in infrastructure performance, we seek to discern the degree to which the infrastructure may be vulnerable to impending climatic changes. By assessing how various targeted changes in the infrastructure's use, composition and management affect these patterns of degradation, we aim to gain insight into the potential effectiveness of various options for supporting resilience. In a next step, we link this model with an agent-based sub-model which explores how future patterns of investment may affect the infrastructure's resilience.

### ***iii. Implementing Climate Adaptation and Paths to a Resilient Future***

**Title:** Extension of Regional Governance in the Emscher-Lippe Region (North Rhine-Westphalia) by the Roadmap 2020 "Regional Adaptation to Climate Change"

**Names:** Jürgen Schultze<sup>2</sup> | Jens U. Hasse<sup>1</sup> | Michael Kohlgrueber<sup>2</sup> | Nicole Rauscher<sup>2</sup>

**Organizations:** 1: FiW Research Institut for Water and Waste Management Aachen, Germany | 2: ZWE Technical University Dortmund, Germany

By developing the Roadmap 2020 from the perspective of applied research, the concept of Integrated Roadmapping has for the first time been transferred to a region and used for the development of a region-spanning climate adaptation strategy. It helped to translate strategic guidelines into specific - technical as well as people-related and organizational - measures. The roadmap process developed new potential for regional and local governance processes and successfully broadened the existing framework of master plans, regional plans and action programs.

With the aim to develop a network-based regional adaptation strategy for the Emscher-Lippe region, the roadmap process integrated multiple issues and dimensions. It connected various relevant actors beyond administrative, disciplinary, sector and knowledge limits and involved many of those affected as well as user groups in decision and implementation processes. At the same time, it summarized separated stocks of regional knowledge and abilities and linked them in a synergetic way. Not least, the process called and still calls for clarification and if necessary renegotiation of requirements and priorities of the region and its actors regarding regional development.

First, this contribution provides first-hand information about the roadmap process of the *dynaklim* network which covers government processes (formal planning, guidelines and legislation) as well as governance processes (e.g. voluntary integrated planning processes in municipal pilot projects) and cross-sector and cross-organizational cooperation requirements and solutions. In the last three years, the regional actors participating in the process developed region-spanning as well as thematic strategies, adaptation paths and measure profiles in the light of the coordinated goals and options for action. These sets of actions give information about specific measures, responsibilities, time periods as well as required resources and abilities for proactive implementation of the climate adaptation. In the second part, the advancement of the roadmap concept for applications in the field of regional development will be reflected in the light of current governance discussions and findings delivered by various KLIMZUG publications. Furthermore, region specific and systematic success factors and obstacles of implementation as well as a transfer of the method to other regions will be discussed. In conclusion, a set of recommendations for the initiation and execution of further "regional integrated roadmap processes" will be framed.



**Title:** Successfully Adapted with Regional Governance? The Case of 'nordwest2050'

**Names:** Dr. Heiko Garrelts | Prof. Dr. Michael Flitner

**Organization:** artec, University of Bremen, Germany

The governance principles of the German research initiative “KLIMZUG – Climate change in regions” consist of various instruments such as competition, promotion of best practices, funding based on certain conditions, and the steering of the program by regional management bodies (beyond geographical and administrative boundaries, wherever feasible). With regard to its regional addressees, the focus lies on participation, networks and cooperation. In so far, the KLIMZUG program matches perfectly with the theoretical concept of regional governance which has so far prominently been promoted in European rural policy, among other things.

With its mechanisms mentioned above, the concept is linked to several expectations. First, political processes in accordance with regional governance are supposed to pool the resources of a range of different actors and thus to improve not only the effectiveness but also the input legitimacy. Second, win-win-constellations among different actors shall enhance the emergence of new integration and innovation processes. Third, it is suggested that regional governance might help the state which is conceptualized as an overburdened and rather homogenous entity. The paper reflects the project 'nordwest2050' in the light of these optimistic expectations. We will show that participation has taken place in a selective manner. The involvement of many market-based actors stands in contrast to the modest representation of both legislative actors and of the organized and non-organized civil society (first expectation). Win-win constellations can be identified among members of the consortium and different market-based actors. However, such constellations were limited to the design and subsequent implementation of technically oriented innovations.

In contrast, when parts of the regional stakeholders asked for modifying both, decision making processes and land use patterns, severe conflicts between the project and status-quo oriented political actors arose (second expectation). Instead of unburdening “the” state, a majority of state actors rather acted as opponents of substantial climate adaptation processes. The explanation lies in “multi-level games” (A. Benz) state actors are involved in, with a range of linked cooperative and conflictual constellations (third expectation). Finally, we will reflect about the notion of success of projects such as 'nordwest2050'. Conflicts as the observed ones can of course be highly problematic for some members of the regional consortium. Nevertheless, we argue, that it is exactly these conflicts which can disclose important starting points for broader processes of societal transformation as they may be necessary for a meaningful climate change policy.

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**Title:** Regional Governance and Management for Drought and Scarcity Adaptation in North West Europe: First Insights from the DROP Project

**Names:** Ulf Stein<sup>1</sup> | Hans Bressers<sup>2</sup> | Cheryl de Boer<sup>2</sup> | Rodrigo Vidaurre<sup>1</sup> | Isabelle La Jeunesse<sup>3</sup> | Jenny Tröltzsch<sup>1</sup>

**Organizations:** 1: Ecologic Institute, Germany | 2: University of Twente, The Netherlands | 3: University Francois Rabelais, France

North West Europe (NWE) will increasingly face drought periods that harm *inter alia* agricultural production, natural ecosystems and fresh water supplies. In addition to adaption measures, an optimal water governance setting is crucial for effective drought adaptation in NWE. The DROP project aims to take early action to adapt to climate change and water scarcity, with a focus on adapting to drought. To this purpose, DROP promotes the use of governance models in the process of designing long-term drought adaptation strategies.

In the project, a governance assessment tool was developed as a model for analyzing governance systems regarding droughts and water scarcity. The bare-bones of the model is a matrix in which five governance dimensions are evaluated according to four qualitative governance criteria. This tool enables the development of the concept of “governance” as a modification and extension of the concept of “policy”. In general, the model can be used to systematically describe the contents of a governance regime in a certain area concerning a certain issue, like drought. In particular, the model draws attention to the governance conditions that can hinder water resources management policies and projects under complex and dynamic conditions.

This paper first presents insights of the operationalization process, which adapts a general governance tool for its specific application to drought adaptation in northern Europe. In a second step, results of applying this tool for analysis of governance systems in selected case study regions are presented. Interviews with an extensive set of stakeholders involved in the management of drought, dryness and water scarcity form the basis for this analysis of the governance setting. These regional assessments help identify barriers and hindrances in the governance context that practitioners will have to reckon with or circumvent in adapting to drought. Preliminary lessons will be drawn in the identification of a range of possible pathways for better governance of drought and water scarcity across North West Europe. Cross-region comparisons of the different case studies round up the analysis.

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**Title:** Problems of fit in the multi-level implementation of climate change adaptation policies in Copenhagen and Stockholm

**Names:** Bart Jan Davidse | Sonja Deppisch

**Organization:** HafenCity University Hamburg, Germany

This paper presents an analysis of ongoing implementation processes in the context of adapting to the effects of climate change in two urban regions along the Baltic Sea coast, Copenhagen and Stockholm. The analytical multi-level governance perspective used in this paper enables to uncover which enabling and constraining elements can be discovered in the multi-level implementation processes in both urban regions. In the analysis, urban regions are conceptualised as social ecological systems, in which problems of fit occur between the multi-level governance structures in the social system and the spatial and temporal challenges of climate change adaptation in the ecological system. It is argued that such problems of fit have to be minimised, in order to successfully implement climate change adaptation policies. The problems of fit in Copenhagen and Stockholm are discussed, based on the analysis of a series of semi-structured expert interviews with representatives from all governmental levels, involved in the implementation of climate change adaptation policies and/ or spatial planning, complemented by an analysis of relevant policy documents.

In the Danish policy context, climate change adaptation is formally considered to be a municipal responsibility. Every municipality is obliged to develop and implement a separate climate change adaptation strategy. Interviewees from local and regional government however state that the spatial and temporal challenges of climate change go beyond the municipal boundaries, water issues for instance often have a regional dimension. Informal efforts to develop regional strategies to deal with these challenges are hampered by the formal division of tasks and responsibilities. In the Swedish context, efforts are made to mainstream climate change adaptation into existing policies, for instance through a formal obligation to consider climate change in urban planning. Interviewees from Stockholm however state that the sectoral character of formal institutions forms a barrier to deal with the cross-sectoral and long-term characteristics of climate change.

The analysis in both urban regions uncovers these and other problems of fit in both approaches, showing that the governance structures do not match the characteristics and challenges of climate change adaptation. It is questionable if such constraining elements in governance structures can be fully eliminated. We argue that by continuously monitoring, addressing and reflecting on constraining elements, it is possible to optimise implementation processes, whereas the result is at best 'sub-optimal' and highly context dependent.



**Title:** Strengths and Weaknesses of Policy Frameworks for Climate Change Adaptation in Switzerland and Germany

**Names:** Marco Pütz<sup>1</sup> | Prof. Dr. Winfried Osthorst<sup>2</sup>

**Organizations:** 1: Swiss Federal Research Institute WSL, Switzerland | 2: University of Applied Sciences Bremen, Germany

Designing policy frameworks for climate change adaptation requires to deal with the following challenges. Existing policy frameworks for climate change adaptation include policies tackling climate change impacts indirectly, e.g. in the fields of spatial planning, tourism, or energy. Climate change adaptation policies are developed at the international or national level but impacts are effective at the local and regional level. Climate change impacts, vulnerabilities or adaptive capacities can vary tremendously between regions and municipalities. These challenges are usually referred to as problems of fit, denoting the mismatch between the geographical extent of an environmental issue (here: climate change adaptation) and the territorial scope of institutions affecting its governance. Problems of fit constitute a common feature of environmental governance and can comprise functional, temporal, and spatial dimensions. Dealing with problems of fit and transforming institutional arrangements involves policy integration, mainstreaming, and rescaling. However, at subnational level institutions are often shaped in favour of dominating economic activities, often based on particular forms of natural resource uses questioned by climate change. As a result, integrative approaches could question the political and economic power of lower political levels. This effect is expected to be particularly observable in federal multi-level governance systems such as Switzerland and Germany.

We assess the strengths and weaknesses of policy frameworks to develop and implement climate change adaptation strategies in Switzerland and Germany against a set of normative and analytical criteria. The first four criteria are normative evaluative criteria for judging the success of adaptations at different scales outlined by Adger et al. (2005): effectiveness, efficiency, equity and legitimacy. We expand this set by proposing two additional criteria addressing current adaptation practices in public administration and the policy environment: science-policy interaction, and institutional change. Considering science-policy interaction allows to take into account the ways policy making considers uncertainties and risks as well as distributional effects of adaptation between sectors or regions. Second, we also add institutional change in order to consider how institutional arrangements are transformed to deal with problems of fit as sketched out above. Applying these criteria allows for an assessment of the state of policy integration and mainstreaming, as well as policy capacities regarding climate change adaptation in Switzerland and Germany. We conclude with recommendations to improve existing policy frameworks for climate change adaptation.

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**Title:** Mainstreaming Climate Change Adaptation through its Integration with Multi-level Natural Resource Governance System in Himalaya

**Names:** Prakash Chandra Tiwari<sup>1</sup> | Bhagwati Joshi<sup>2</sup>

**Organizations:** 1: Kumaun University, India; 2: Government Post Graduate College, India

Increasing rainfall variability is resulting into decreased rainfall, hydrological disruptions, increased extreme weather events, water-resource depletion and decreased food production in Himalaya. Climate change adaptation plans have not been effective as being stand-alone and conflicting with ongoing resource management programs. Environmental and socio-economic benefits, feasibility, complementarities and conflicts of mainstreaming climate adaptation processes with natural resource governance mechanism were analyzed in Kumaon Himalaya. Results indicated ongoing climate change adaptation measures, such as water conservation, rural livelihood improvement and natural risk reduction programs are highly complementary to integrated watershed management, integrated rural development and disaster reduction programs under implementation in the region. A multi-stakeholder consensus based integrated climate adaptation and resource governance framework was evolved and implemented. Besides receiving community support and active participation, this lessened inter-sectoral conflicts, maximized mutual-benefits with other developmental processes and helped in reducing risks of crop failure (27%), increased groundwater recharge (15%), improved rural livelihood (17%) and food production (11%) that contributed towards building resilience against climate change.

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**Title:** When the Future is Present: Experiences from a Transdisciplinary Pilot Project about Coping with a Local Water Conflict and Climate Change in Germany

**Name:** Frank Sondershaus

**Organization:** Leibniz-Institute for Regional Development and Structural Planning (IRS), Germany

In recent years transdisciplinary research became an important part of science in Germany. Therefore there is a growing need to reflect and to evaluate the experiences within inter- and transdisciplinary projects on adaptation to climate change, regarding the potential and especially the limits of implementation orientated research. The characteristics of the pilot project are periodic water shortages culminating in a water conflict, between water users of two villages. Within the context of a local water conflict the social, spatial and institutional dimension are of high importance. On the background of the measure programme developed within the project it becomes clear that the water shortages cannot be solved within technical measures, but social measures (within the fields of cooperation/governance and participation, mediation, social learning) are necessary to cope with the conflict-situation. Contrasting necessary measures and prospect measures is leading to the

limits of transdisciplinary research and its reasons. With respect to the experiences of the last four years of inter-transdisciplinary research, three types of limits are sketched: management limits (e.g. water conflict as a zero sum game) (1), limits due to unpredictable events (e.g. windows of opportunities / impossibility) (2) and socio-spatial limits (e.g. administrative borders and its consequences, the social construction of vulnerabilities) (3). The conclusions focus on transdisciplinary research for adaptation to climate change, pointing out the scientific value of “bad practice”-examples and a need for a basic reflection of goals and structures within transdisciplinary research. Illustrated by personal experiences and examples the main thesis highlights that many catchments as well as transdisciplinary socio-ecological research are confronted with these limits.



**Title:** Land Use and Climate Change: New Approaches to Integrate Climate Adaptation into Stakeholder Processes

**Names:** Julia Oberdörffer<sup>1</sup> | Dr.Nana Karlstetter<sup>2</sup> | Reinhard Pfriem<sup>2</sup> | Ulrich Scheele<sup>1</sup>

**Organizations:** 1: ARSU GmbH, Germany | 2: Carl von Ossietzky University Oldenburg, Germany

This contribution describes research on land use under climate change conducted in the project ‘nordwest2050’ in Northwest Germany: With the aim to identify decision options for a climate resilient region an approach to integrate indicator based decision support with local and regional stakeholder processes has been developed.

Northwest Germany is characterized by fossil and renewable energy production, intensive agriculture and a unique natural landscape. Extensive studies in ‘nordwest2050’ have shown that most of these facilities are vulnerable to climate change. Particularly in the energy and food sector vulnerabilities are tightened by current conflicts on land use. These conflicts will most likely worsen under changing climatic conditions: Sustainable climate adapted transition in both sectors is dependent on land intensive measures. Expansion of renewable energies and energy efficiency as well as sufficient food production despite the maintenance of natural resources meet with current problems such as loss of arable land due to biogas production or excess manure aggravated by early summer droughts. Necessary ongoing and future transformation processes they are constrained by (i) scarcity of land and resources, (ii) path dependencies and conflicting interests of regional actors such as enterprises, administrative authorities etc., and (iii) uncertainties due to cross scale dynamics, e.g. overlapping institutional, spatial or time frames.

In the years 2009 to 2014 climate adapted land use strategies have been analyzed with a strong stakeholder involvement. As on one result an event-based procedure has been developed with the output of a regional document: the “Auricher Erklärung” is a joint statement on paths towards resilient land use, which has been signed by relevant stakeholders and can be basis for realization steps. Secondly a method for indicator based decision support has been elaborated, based on assessing land use decisions in terms of their environmental impact on specified ecosystem services. By visualizing geographic information for explicit areas and consequences of land use decisions, discussions on flexible, multifunctional and timely measures can be supported. Although regional actors know current problems well, it is difficult to forecast their development. In illustrating the environmental situation related to decision capacities, the approach is able to frame options under uncertain climate change impacts. Thus, this contribution outlines a way to reduce uncertainty and complexity in climate adaptation by interleaving knowledge and capacities of stakeholders with data-based regional information.

**Title:** Fostering Stakeholder’s Reflexive Capacity to Cope with Long-term Challenges

**Names:** Dr.-Ing. Manuel Gottschick<sup>1</sup> | Cornelius Laaser<sup>2</sup>

**Organizations:** 1: University of Hamburg, Germany | 2: Potsdam Institute for Climate Impact Research, Germany

The German research project “KLIMZUG-NORD” and the European FP7 research project “PSI-connect” conducted a workshop series “*For the children of our children*” in the city of Buxtehude, Germany (in 2011). Participants were relevant civil society organizations that have a mandate to stipulate change for the community as a whole (selection criteria: ‘no individuals’, but a ‘representative variety of organizations/institutions’; a ‘variety of issues, gender, and age’; ‘interest in discussing long-term sustainable development’).

In the series of four consecutive workshops participants were meant to estimate future challenges for their city up to 2060 (the next 50 years) that could arise from the nexus of demographic, economic, and climate change. Against this background they should commonly determine objectives for a future sustainable development of their city, learn about dynamic interrelations and interdependencies between sectors, and finally discuss means to achieve the agreed objectives for a sustainable development. The first workshop “Buxtehude makes for the future” intended to help participants to develop a common vision for the city of Buxtehude (participatory scenario development). The second workshop “See the forest for the trees” aimed at examining interrelations and interdependencies more precisely and clarify who could be affected by which effects of long-term changes (conceptual [System Dynamic] influence diagram, group model building). At the third workshop, participants started to discuss options for action to reach a sustainable future for their city. At the last workshop we continued to discuss the requirements needed to implement strategies successfully (Back-Casting). The presentation focus on stakeholder’s reflexive capacity

which is necessary to cope with uncertain or disputed knowledge and to build evidence based opinions for informed decisions. Furthermore, I will introduce the underlying theoretical approaches introduced (reflexive governance; social innovation). Subsequently, I will present some practical lessons learned relevant for multi-stakeholder adaptation networks.

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***iv. Resilience for Business: Climate adaptation challenges and strategies of sectors and companies***



**Title:** Advancing Private Sector Adaptation to Climate Change  
**Names:** Tina Schneider | Prof. Dr. Klaus Fichter  
**Organization:** Carl von Ossietzky University Oldenburg, Germany

In contrast to mitigation the emerging necessity of adapting to climate change is not yet considered by the vast majority of business organizations. The project 'northwest 2050' ([www.nordwest2050.de](http://www.nordwest2050.de)), that is funded by the German Federal Ministry of Education and Research, therefore has undertaken a panel survey (N=4.000) to analyze how business organizations cope with risks and opportunities caused by direct and indirect impacts of climate change.

Though the IPCC (2013) reveals that in industrialized countries several branches of economy are vulnerable to climate change and for some economic branches climate change implies opportunities, the IPCC does not respond to the micro level and the fact that business organizations hold a diverse exposure, a diverse vulnerability and a diverse adapting capacity. Thus, our aim is to broaden the view on resilience management in the private sector. Based upon our assumption, that exposure, vulnerability and adaptive capacity are endogenous variables that can be modified by decision makers, we present a theoretical framework and results from our panel study that we have conducted in summer 2010 and autumn 2012 in the study area called "Metropolitan Region Bremen-Oldenburg in northwestern Germany". We emphasize on two main issues:

1. How to operationalize the concept of resilience for empirical research in the private sector.
  2. Results from our survey with the focus on factors that impede and advance climate change adaptation in business organizations.
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**Title:** Serious Gaming Improves Flood Disaster Communication

**Names:** Nikéh Booister<sup>1</sup> | Rense Bakker<sup>1</sup> | José Kooi<sup>1</sup> | Darja Tretjakova<sup>2</sup>

**Organizations:** 1: FloodCom, The Netherlands | 2: Wageningen University, The Netherlands

In order to deal with the increased chance of flooding in the future, the Netherlands adopted the so-called multi-layer safety approach for water safety. The first layer, primary protection, is well represented in the Netherlands by strong dikes and dunes. The second layer, spatial planning and adaptation of buildings, is now being worked on as cities are preparing to cope with the coming changes through, among others, adaptive and green design. The third layer, crisis management has not received as much attention yet mainly because the last large flood happened in 1953 and the awareness of flood risk has gradually been subsiding since then. The third layer of the multi-layer safety approach focuses on disaster management, and includes evacuation plans, communication towards civilians and also communication between governmental bodies involved in disaster management. Governmental bodies in the Netherlands admitted that this communication is a problem, because large floods are rare in the Netherlands. The organizations involved in flood disaster management can only learn from smaller events, events from other countries or from non-water-related events.

To practice with large flood events and communication between governmental bodies, serious-gaming has been considered. The Flood Control game was designed to improve communication between organizations involved in flood disaster management in Rotterdam and surrounding areas. The players work together to save the city from flooding. This board game is based on reality: the tasks of the organizations, topography of the city, possible events during flooding are taken into account. Uncertainty is generated by dice and randomized events and players are kept under stress by constant time pressure. Players are forced to work together to solve problems on the game board, and are thus learning about each other's tasks. The game is played in a workshop setting, creating an opportunity for representatives of the involved organizations to sit together, discuss and interact on decision-making processes and high levels of uncertainty.

Players experience that they are more aware of the possible communication problems during flooding, and are more informed of the tasks and responsibilities of the other organizations.

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**Title:** Feasibility Study of Drought Index Insurance in Shandong Province, China

**Names:** Wen Chen | Roman Hohl | Lee Kong Tiong

**Organization:** Nanyang Technological University, Singapore

The objective of the research paper is aiming to analyze the drought impact on corn yield in Shandong province during 1980 to 2012. Given the shortfalls of indemnity-based agricultural insurance and weather risks occurred in China recent years, a feasibility analysis of drought index insurance for insurers and government policymakers is studied as well.

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Standard Precipitation Index (SPI) calculated after cleansing and detrending precipitation data at prefectural level is used to assess the impact of drought on corn yield fluctuation, showing that year of 1987 and 2002 has huge deviation of corn yield with negative SPI. In the drought index insurance model, growth period of corn in Shandong is divided into three phases based on corn phenology, which is Germination and Jointing (I), Flowering (II) and Harvest (III), cumulative rainfall of each phase shows obvious correlation with yield deviation. Two insurance contracts are developed with previous study: one is based on lifelong growth period, another one is based on three growth phases. Trigger and limit is set according to water requirement of corn in different growth stages and payout per tick is based on corn market price and production cost per mu in Shandong province in recent three years. The historical burnt analysis shows that insurance company would have huge loss in year of 1987 and 2002 for both two contact model.

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**Title:** Resilient Electricity Generating Infrastructures – Enhancing Climate Action Plans

**Name:** Dr. Jeannette Sieber

**Organization:** European Institute for Energy Research, Germany

Within the Energy Turnaround, Germany established ambitious goals regarding the development of renewable energy installations on a regional level. Effective instruments to guide such a development in terms of climate resilience are so-called Climate Action Plans (CAPs). Until now, within the concepts of Climate Action Plans, potential analyses are carried out to estimate “to-be-installed” wind turbines, PV modules or hydro power plants without taking into account risks for installations posed by extreme weather events (EWEs). Thus, this project develops a risk factor based on number and location of EWEs and renewable energy installations on a district level. Subsequently, this risk factor is implemented into Climate Action Plans. Accordingly, this work shows the combination of high risk and high potential areas to integrate adaptation and mitigation into one enhanced plan with a common catalogue of adaptation and mitigation options developed in a CAP. The input of EWE data as well as infrastructure data on a regional level allows for a transfer of the approach to other regions and needs worldwide. The approach is structured into various steps: the first step consists of a Geographical Information System (GIS)-based analysis of the spatial and the temporal distribution of EWEs and renewable energy installations in Germany. Therein, measured EWEs and installed renewable energy units are mapped on a zip-code level using three time slices between 1980 and 2009. The second step uses a literature review of possible adaptation measures and displays them on the most affected structures. Consequently, there will be a ranking of best practice solutions in the context of climate change. The last point is the transfer of these findings into a decision-support for districts in planning issues. Here, the options of localisation for renewable energies in an adapted manner help to improve the concept of local climate mitigation strategies. The above described risk factor is an assessment of past events in combination with in the past installed infrastructures. With the help of climate change projections concerning frequency and intensity of EWEs, the present approach could also be extended to a prospective assessment.

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**Title:** Adaptation to Climate Change in the German Railway System: The Interplay between Actors and Institutions

**Names:** Maja Rotter<sup>1</sup> | Esther Hoffmann<sup>2</sup> | Anna Pechan<sup>3</sup> | Rebecca Stecker<sup>3</sup>

**Organizations:** 1: German Society for International Cooperation (GIZ), Ghana | 2: Institute for Ecological Economy Research, Germany | 3: Carl von Ossietzky University Oldenburg, Germany

Railway infrastructure is a critical infrastructure, which is characterized by its importance for society as a whole and for a sustainable transport system; its failure may result in both, shortages of supply and dangers to public safety and security. Recent extreme weather events have moreover shown that railway infrastructure is vulnerable to weather events and climate change.

Based on the framework of the actor-centered institutionalism we conducted an exploratory case study on the German railway system. We aimed at identifying how the actors in the system (railway companies, ministry for transport, public authorities) are adapting to climate change and what influences action and decision-making towards a (climate) robust infrastructure. Following the guiding framework we analyzed action situations, institutional setting, actor constellations, and actor orientations. Our empiric approach includes document analysis, semi-structured in-depth interviews and sectoral workshops.

The main results of the analysis are: Although the German railway system was severely affected by extreme weather events during the last decade, the different actors have only tentatively started adaptation measures (e.g. improved vegetation management, integration of climate aspects in the environmental impact assessment for new railway constructions), but do not follow a strategic proactive approach to adaptation. Hampering factors can be found in the institutional setting, the actor constellation and the actor orientation: existing institutions in the railway sector do not define responsibilities for decision-making on climate change. On this topic an institutional void prevails. Moreover the different actors have contrasting perceptions how adaptation should proceed and who should be responsible. Interestingly, most actors ask for top-down decision-making while adaptation research often argues for bottom-up approaches for successful adaptation. On the other hand, we found that single actors, who have a high willingness to act, are able to use the unclear responsibilities to proactively integrate adaptation issues in existing institutions such as the environmental impact assessment. Our results hence show that existing institutions are not per se constraints to adaptation but may be changed by the actors in the system.

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**Title:** Climate Technology Cooperation: Making Adaptation Solutions Accessible within the UN Climate Technology Centre and Network

**Names:** Dr. Severin Beucker | Prof. Dr. Klaus Fichter | Dr. Jens Clausen

**Organization:** Borderstep Institut, Germany

Promoting and enhancing national and international cooperative action on the development and transfer of environmentally sound technologies to developing country Parties are critical to supporting action on mitigation and adaptation. In 2010 in Cancun, the United Nations as represented at the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) have established a Technology Mechanism. The Technology Mechanism is expected to

facilitate the implementation of enhanced action on technology development and transfer in order to support action on mitigation of greenhouse gas emissions and adaptation to climate change. It consists of the following two components: a Technology Executive Committee (TEC) and a Climate Technology Centre and Network (CTCN). The mission of the CTCN is to stimulate technology cooperation, to enhance the development and transfer of technologies and to assist developing country Parties at their request, according to their respective capabilities, national circumstances and priorities. National Designated Entities (NDEs) serve as contact points in the countries for the development and transfer of technologies. They act as focal points for interacting with the CTC regarding requests from developing country Parties about their technology needs.

Up to now no developed country (industrialized country) can provide a systematic overview of adaptation technologies, products and services provided by companies or organizations in their country. Against this background the NDE in Germany, the Division Climate Change and International Environmental Policy of the Federal Ministry of Economic and Technology, has commissioned a study to develop a suitable classification of relevant climate adoption technologies, products and services, collect information to enable access to German products and services for climate mitigation and adaptation and to make suggestions how this information on existing climate solutions and its suppliers can be made easily accessible for developing countries. The study is the first worldwide to deal with this aspect and is carried out by the Borderstep Institute for Innovation and Sustainability, Berlin, Germany.

The oral presentation will be presenting first results of this study. It will particularly focus on:

Demand side: Key insights from Technology Needs Assessments for climate adaptation from developing countries

Supply Side: Classification and climate adaptation technologies, products and services and its challenges to make it easily accessible

Cooperation mechanisms: How to provide easy access information on climate adaptation solutions from industrialized countries to developing countries.

## IV. Poster Presentations

### *Winner Best Poster Award*



**Title:** Serious Gaming Improves Flood Disaster Communication

**Names:** Nikeh Booister<sup>1</sup> | Darja Tretjakova<sup>2</sup> | Rense Bakker<sup>1</sup> | Jose Kooi<sup>1</sup>

**Organizations:** 1: FloodCom, The Netherlands | 2: Wageningen University, The Netherlands

In order to deal with the increased chance of flooding in the future, the Netherlands adopted the so-called multi-layer safety approach for water safety. The first layer, primary protection, is well represented in the Netherlands by strong dikes and dunes. The second layer, spatial planning and adaptation of buildings, is now being worked on as cities are preparing to cope with the coming changes through, among others, adaptive and green design. The third layer, crisis management has not received as much attention yet mainly because the last large flood happened in 1953 and the awareness of flood risk has gradually been subsiding since then. The third layer of the multi-layer safety approach focuses on disaster management, and includes evacuation plans, communication towards civilians and also communication between governmental bodies involved in disaster management. Governmental bodies in the Netherlands admitted that this communication is a problem, because large floods are rare in the Netherlands. The organizations involved in flood disaster management can only learn from smaller events, events from other countries or from non-water-

related events.

To practice with large flood events and communication between governmental bodies, serious-gaming has been considered. The Flood Control game was designed to improve communication between organizations involved in flood disaster management in Rotterdam and surrounding areas. The players work together to save the city from flooding.

This board game is based on reality: the tasks of the organizations, topography of the city, possible events during flooding are taken into account. Uncertainty is generated by dice and randomized events and players are kept under stress by constant time pressure. Players are forced to work together to solve problems on the game board, and are thus learning about each other's tasks. The game is played in a workshop setting, creating an opportunity for representatives of the involved organizations to sit together, discuss and interact on decision-making processes and high levels of uncertainty.

Players experience that they are more aware of the possible communication problems during flooding, and are more informed of the tasks and responsibilities of the other organizations.

### **Best Poster First Runner-Up**



**Title:** Building Resilience for the Education Sector in the Coastal Areas: A Case Study in Central Vietnam  
**Names:** Thi Thi My Tong | Rajib Shaw  
**Organization:** Kyoto University, Japan

Education has a vital role in disaster risk reduction as its services reach a large number of people, from the elementary age children to junior and senior secondary school students. The extensive effects of disaster risk reduction education has also been proved to be an effective method to prepare community for a long-term response to disaster, especially in the coastal areas, where people are facing reduced resources yet increased disaster risks associated with rapid urbanization and development. Strengthen educational resilience in the coastal areas is therefore a crucial task in the effort of reducing risk and sustaining people lives. In order to improve the level of educational resilience, it is important to have understanding on the existing level of school resilience. This study is an attempt to apply the School Disaster Resilience Index (SDRA) in assessing the capacity of primary schools located in the coastal areas in Central Viet Nam, one of the most vulnerable areas to the severe impacts of climatic disasters such as floods and typhoons. The SDRA is a measurement developed based on the Hyogo Framework for Action and the Climate Disaster Resilience Index, which includes five dimensions: Physical conditions, Human resources, Institutional issues, External relationships,

and Natural conditions. Findings from the study provide an important insight on the factors that have strong influence on enhancing the overall educational resilience for the coastal areas. Being less developed compare to urban schools in the coastal areas of Da Nang City, rural schools located in the coastal areas of Hue Province show the lower capacity in the Physical conditions and Human resources, while higher capacity in the Institutional issues and External relationships. As a result, despite the lower score in Natural conditions, or the more damages by disasters, the difference between overall resilience of urban and rural schools in the coastal areas of Hue Province and Da Nang City is insignificant. The variations in the levels of resilience as found between the coastal regions in Hue Province and Da Nang City suggest that decision-makers need to understand the cumulative effects of different socio-economic conditions, especially the relationship between school and community in planning for disaster risk reduction education and enhancing the educational resilience to disasters.

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### ***Best Poster Second Runner-Up***

**Title:** Participation of Youth Councils in Local-level HFA Implementation in Makati and Infanta, Philippines

**Names:** Glenn Fiel Fernandez | Rajib Shaw

**Organization:** Kyoto University, Japan

In the Philippines, the Climate Change Act of 2009 and the Disaster Risk Reduction and Management Act of 2010 share a common goal of promoting disaster resilience and safer communities. Both affirm the Philippines' priorities related to the Hyogo Framework for Action (HFA) and recognize the importance of involving stakeholders. HFA promotes participatory DRR and states that communities and local governments should be empowered to manage and reduce disaster risk by having access to the necessary information, resources, and authority. One group of stakeholders, the youth, is recognized to have great promise in addressing concerns like DRR because of their energy and number. The government is encouraging youth participation in DRR activities, such as in organizing quick response groups in identified disaster-prone areas, as well as in the inclusion of DRR as part of the Sangguniang Kabataan (youth council) projects. To investigate the extent of participation of Filipino youth in DRR, questionnaire surveys and interviews were conducted among youth council and barangay (village) council officials in 36 barangays of Infanta Municipality, Quezon Province and 33 barangays of Makati City, Metro Manila. Respondents were asked to rate their involvement in and prioritization of the village-level implementation of 20 relevant Hyogo Framework for Action (HFA) tasks and to share details about their past, present, and future DRR activities. The study finds that although youth councils place high importance ( $2.53 \pm 0.08$  on a scale of 1=low to 3=high) to 19 of 20 the local HFA tasks, very few youth councils have a clear understanding of what is expected of them. Only five out of 69 youth councils surveyed were able to plan for or conduct their own DRR activities. This means that very little has been done to actually involve the youth in DRR in their community, especially in the coastal municipality of Infanta, where the youth councils did not allocate budget for DRR activities. Documentation and reporting of details of DRR activities, such as the number of participants, cost of the activities, resources used, etc., have not been

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widely disseminated. This present study tries to contribute in adding to the scarce empirical research on the practice of increasing the visibility and significance of the roles of young people in DRR. Research that sheds light on the extent to which young people are engaged in DRR and the factors that facilitate or inhibit their involvement is currently sparse not only in the Philippines but in other countries as well.

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**Title:** A Block Level Estimation of Water Scarcity in Rural Semi-arid India

**Names:** Mrittika Basu | Satoshi Hoshino | Shizuka Hashimoto

**Organization:** Kyoto University, Japan

India is facing a serious problem of water availability due to its population growth and economic development. In most parts, surface water resources, which are often seasonal and limited, are now fully exploited. Highly variable rainfall and frequent droughts, often influenced by monsoons and climate change, mean that surface water sources are unreliable and vary considerably from season to season and year to year. This fluctuation led to the use of ground water as a primary source of water in many rural areas. As a result many rural households receive less than the 40 liters per capita of safe water per day recommended by the World Health Organization (WHO), a situation that leads to significant social, economic and health related problems. The main objective of this study is to develop a vulnerability assessment tool to assess water scarcity at village level. This study was carried out in five rural community development blocks in the district of Purulia, West Bengal, India. A block is a local administrative unit in India that is responsible for a number of villages under it. The district is primarily a rural district where poverty and deprivation appear to prevail in the lives of the people of both urban and rural areas. The study area is characterized by undulating topography with rugged and hilly terrains with the soil not very supportive for agricultural productivity. The rivers are mostly non perennial and are nearly or entirely dry during the summer. Agriculture, being the primary livelihood of the local people, is severely affected by the scarcity of water, resulting in the deterioration of the living conditions of the villagers. A questionnaire survey was conducted with the Block officers and data were collected on the socio demographic, livelihood, education, health, Land use/cover and agriculture and most importantly, water supply, access and use. The paper discusses the construction of the indicators, weighing methodology, field sites and statistical validation of the results. Remote sensing and GIS was used to spatially demonstrate the results. The results obtained showed the different scale of vulnerability of the blocks to water scarcity and also the linkage between the water unavailability and poverty of the local communities. The vulnerability assessment is expected to provide a detailed insight on the water situation of the rural area which will significantly contribute to the development of a village level water management plan.

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**Title:** Adaptation to Climate Change and Land Use Conflicts in North-west Germany

**Names:** Stefan Wittig | Bastian Schuchardt

**Organization:** BioConsult Schuchardt & Scholle GbR, Germany

The low lying marshes on the German North Sea coast are highly sensitive to the impacts of climate change. The impacts results from a more rapidly rising sea level, increasing temperatures and changes in precipitation. Precautionary research on the complex social interactions and trade-offs are necessary.

For this reason the project 'nordwest2050' investigate the vulnerability of the natural and socio-economic system of the metropolitan region Bremen-Oldenburg. The results from a differentiated set of disciplinary tools will be presented in summary form with focus on land use conflicts.

The results show that the regional climate change will lead to a broad spectrum of impacts, both on the natural and the social system. For example, limitations concerning dike security will occur and water management has to reckon with increasing expenditure for water management measures. Positive impacts can be partly expected for agricultural yield and for tourism. Changes are likely for the aquatic and terrestrial ecosystems and biodiversity. Overall, the impacts of the climate scenario examined can be assessed as weak to moderate.

The accelerated sea level rise is identified as a key parameter of climate change for the region. Because of a higher probability of failure in the coastal defense line, there is need for action for the coastal protection system. Due to the historically developed land use structures, the adaptability of the region is generally high. However, the necessary adaptation measures, particularly with regard to coastal protection, will change the conditional framework for present-day land use and aggravate existing land use conflicts. Above all regional planning has to develop appropriate concepts at an early stage.

The results make it clear that though there is adequate time to plan and implement adaptation measures, it is necessary to:

- intensify the already initiated social debate on how to deal with the consequences of climate change on a long-term basis,
  - increase awareness of more rapidly changing natural boundary conditions among the actors involved and the public,
  - examine as of now all spatially relevant planning for their consequences for adaptability,
  - establish integrated risk management for the future challenges posed by climate change and changing land use demands,
  - preserve and/or boost the adaptability of the regional systems,
  - further develop the instruments for socially shaping the future, including modern forms of participation.
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**Title:** Climate Adaption Options for Industrial Buildings**Names:** Andreas Herrmann | Corina Dorn**Organization:** TU Bergakademie Freiberg, Germany

The climate change has a relevant impact on industrial buildings concerning energy demand and protective function. Reasons for this are the increasing temperatures and solar radiation as well as a large number of extreme weather events. Hot periods in the summer time will increase as well as heavy rainfall, storms and floodings.

Middle- and high-temperature processes, which are typical in the industrial field (e.g. steel and plastic production), are less affected. In contrary, the heating as well as the cooling energy demand of the industrial buildings itself are affected due to the fact that the indoor temperatures of buildings are similar to the ambient temperatures. Therefore, small changes of the climate parameters will have a significant impact. On the one hand, model calculations, which have been performed for industrial buildings with an indoor air temperature of 19°C, resulted in a decrease of the heating energy demand of 15% until the year 2050 and of 30% until the year 2100. On the other hand, the cooling energy demand will increase in the medium-term by 50 to 70% and in the long-term by 200%. A constructional adaption of the industrial buildings to the expected extreme weather events is essential. Recommendable are a higher tightness of the buildings and wind and hail resistance as well as the usage of moisture-resistant or moisture-repellent building materials. In summary, figure 1 shows the essential climatic influences on industrial buildings as well as the most important adaption strategies.

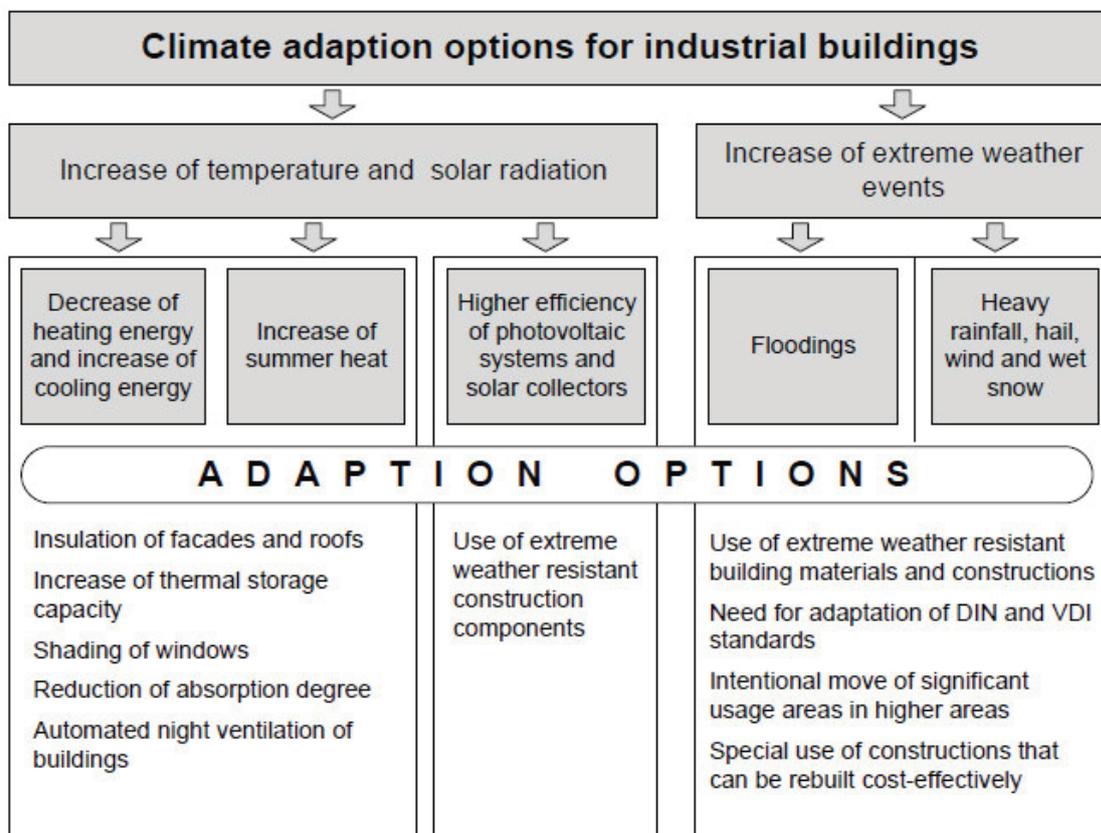


Figure 1: Climate adaption options for industrial buildings (authors own graph)



**Title:** Climate Adaptation Strategies for the Agri-food Industry

**Names:** Dr. Hedda Schattke | Dr. Karsten Hurrelmann | Dr. Marion Akamp

**Organization:** Carl von Ossietzky University Oldenburg, Germany

The Metropolitan Region Bremen-Oldenburg is located in the center of the agri-food sector in Lower Saxony. This sector is very diverse, with regionally different focuses. One intersectoral characteristic is the dense spatial connection between the agricultural system and its coherent supply chains, supported and promoted by a tight network of many different actors. This region is the empirical focus of the research project 'nordwest2050', which goal is to develop and to test climate adaptation strategies in different industries. The key questions for the regional agri-food sector are: How will climate change impact the supply chain processes of the agri-food sector in the future? And: How can these changes be addressed by flexible and innovative solutions?

In this contribution we present significant climate adaptation strategies for the regional agri-food sector. Furthermore, we analyze the sector with respect to its vulnerability and ability to innovate. First of all, a vulnerability analysis referencing the supply chain focuses on the natural adaptive capacity, adaptation options, adaptation knowledge, and the willingness to adapt. Therefore, regional actors of the agri-food sector were involved in the adaptation processes from the outset of the project. Following a joint approach with the researchers they developed innovation projects for meeting the respective expected climate changes specific to their own needs. In the course of the five-year term of the project, the actors have implemented and tested these innovation projects in cooperation with the researchers.

The innovation projects that will be presented on the poster include both company-related and supply chain/network related adaptation activities. According to our findings different levels of corporate adaptation exist: 1) technological process innovations, 2) product innovations, and 3) organizational innovations. The first field covers innovations for optimizing existing processes under the altered conditions of climate change. For example, the maintenance of an uninterrupted cooling chain for food and a constant, sufficiently cool temperature in the stables are key factors. By contrast, the second innovation field involves innovations targeting more profound structural transformations. For example, new marketing strategies for climate robust varieties and breeds were investigated in order to introduce humidity or heat-resistant species into production. Finally, the organizational innovations refer to changes of

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cooperation and communication between actors such as addressing the topic “climate change” in the management of supply chains. The willingness to adapt is closely related to awareness of and responsibility for future challenges in the agri-food sector and should always be discussed in the context of sustainability.

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**Title:** Climate Change Adaptation: Applying Science and Strategies at the Community Level

**Names:** Caroline M.van Bers<sup>1</sup> | Matt P.Hare<sup>1</sup> | Peter van der Keur<sup>2</sup>

**Organizations:** 1: seeconsult GmbH, Germany | 2: Geological Survey of Denmark and Greenland, Denmark

We have sufficient knowledge to make significant strides in climate change adaptation (CCA) and disaster risk reduction (DRR). This core message of the IPCC special report on extreme events (IPCC, 2012) is reflected in the recently completed FP7 project, CATALYST (Capacity Development for Hazard Risk Reduction and Adaptation) with its contribution to the strengthening of this capacity in regions exposed to climatic and tectonic hazards. CATALYST has assessed and analysed the existing, albeit rapidly-expanding, knowledge base. With a network of more than 130 researchers, decision-makers, members of NGOs, and SME's, together forming a Think Tank, it has strengthened the science-policy interface, promoted the integration of CCA and DRR into existing policies, plans and programs, and added value to the existing knowledge base. The results have also been published in various reports including regionally-specific best practice papers on four continents, as well as a globally-relevant best practice notebook that together with other products, have also identified gaps in research, networks, and capacity. All are available on the project website: [www.catalyst-project.eu](http://www.catalyst-project.eu).

In order to take advantage of the momentum gained in, and the existing network of the CATALYST Project, the partners together with a number of think tank members, have initiated follow-up activities to bring the knowledge gained in the project to the local level. Capacity development needs at this level are seemingly infinite. Furthermore, such efforts need to tailor the available knowledge to local languages, culture and governance structures. In the so-called CATALYST-Local Community of Practice, efforts are being made to pool resources in order to develop this capacity in selected regions and localities known to project members and stakeholders based in these countries.

This paper will describe the results of a training program that integrates science and local knowledge to increase capacity for adaptation to climate change in an increasingly drought-prone region of central Mexico dependent on agriculture. In December 2013, 25 postgraduates and 25 scientists will work together with a local community, Las Palomas, in the Sierra Gorda range to apply the theory to the practice of adaptation in a case study setting. It is intended to enrich the research activities of the participants and increase their practical knowledge of the possibilities

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for and the limits to the implementation adaptation at the community level. Projects will be related to real community needs, involve community members, and support the development of integrated applied research skills and teamwork in an intercultural setting. It is intended that in subsequent years, follow-up training programmes will bring new researchers to the community, for a sharing of new knowledge and insights, thus expanding on the work initiated this year.

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**Title:** Climate change and Livelihood Security in Indian Perspectives

**Name:** Mahendra Singh Pal

**Organization:** G B Pant University of Agriculture & Technology, India

The atmospheric temperature is expected to increase by 1.4 to 5.80C over the period from 1990 to 2100 mainly due to increase in greenhouse gases. The extremes of rainfall, drought, floods, cold waves, cyclones etc. are also expected in years to come mainly due to climate change. The main drivers of agricultural responses to climate change are biophysical effects and socio-economic factors. Crop production is affected biophysically by meteorological variables including rising temperature, changing precipitation regimes and increased CO<sub>2</sub> levels.

The IPCC (2007) projected that temperature increase by the end of this century is expected to be in the range 1.8 to 4.0°C. For the Indian region (South Asia), the IPCC (2007) projected 0.5 to 1.2°C rise in temperature by 2020, 0.88 to 3.16°C by 2050 and 1.56 to 5.44°C by 2080, depending on the future development scenario, so overall, the temperature rise is likely to be much higher during the winter (Rabi) rather than in the rainy season (Kharif). It is projected that by the end of the 21st century, rainfall over India will increase by 10-12% and the mean annual temperature by 3-5°C. The warming is more pronounced over land areas with a maximum increase over northern India. These environmental changes are likely to increase the pressure on Indian agriculture, in addition to the on-going stresses of yield stagnation, land-use, competition for land, water and other resources and globalization. It is also estimated that by 2020, food grain requirement would be almost 30-50% more than the current demand. This will have to be produced from the same or even the shrinking land resource due to increasing competition for land and other resources by the non-agricultural sector.

According to the recent IPCC assessment, the area-averaged annual mean warming in South Asia by 2020 is projected to be between 1.0 and 1.4°C, between 2.23 and 2.87°C for 2050 and may rise by 3-4°C towards the end the 21st century, therefore the agricultural production in the region could fall by 30% by 2050 if no action is taken to combat the effects of increasing temperatures and hydrologic disruption. Other projections indicated reduction would be more to the tune of 40 to 50% of the current level. It is clear by different projections that the yield level of most of crops including rice and wheat will go down under climate change. Agrawal and Mall (202) reported that rice and wheat yield would be decreased up to 15 to 17% at increase of

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20C temperature, while Sahi (2012) found 1 t/ha reduction at increase of 20C temperature. Parry et al. (1994) projected 18% reduction in corn yield. Jayanti Natrajan (2012), Hon'ble Environmental Minister, GOI informed to UN on climate change that the yield of wheat, chickpea, pigeon pea, tomato, tomato and soybean would increase nearly 14% under controlled environment. Long et al. (2006) also found 8 to 15% increase in yield of C3 plants, while there was no significant yield increase in C4 plants. Overall it has been expected that the crop productivity of kharif crops will decrease by 20-35% while the productivity of winter crops will increase by 5-15% and finally the total food grain production and livelihood security are at great risk due to climate change in Indian sub-continent in future.

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**Title:** Developing Guiding Visions and Goals for Adaptation: Potentials and Current Practice in Europe

**Name:** Torsten Grothmann

**Organization:** Carl von Ossietzky University Oldenburg, Germany

Research has shown that positive guiding visions for cities and municipalities are particularly effective in mobilizing social actors and the co-ordination of dispersed agency, also in terms of climate change action (including mitigation and adaptation). To analyze the role of adaptation visions and goals in adaptation practice beyond local processes regional adaptation processes in Europe (e.g. in flood plains) were examined. Second, the role of adaptation visions and goals at national levels were investigated, focusing on three European countries (UK, Denmark and Switzerland) that were identified as most advanced regarding the definition of adaptation goals. Third, recent comprehensive guidelines for planning, implementation and evaluation of adaptation (PROVIA 2012, UKCIP 2011, UNDP 2010 and WRI 2011) were examined.

Generally, all three analyses revealed that the formulation of adaptation visions and goals as descriptions of desired future states is given a rather low relevance in current adaptation practice at local levels. Instead a vulnerability reduction paradigm is favored: After analyses of possible climate change impacts and vulnerabilities (often triggered by the experience of impacts from extreme weather events in the past) adaptation measures for reducing the impacts and vulnerabilities are deliberated – without undergoing an explicit vision or goal formulation process that could clarify, which desired future states should be reached with the adaptation measures. In those cases where adaptation goals are formulated they do not fulfill the SMART-criteria (specific, measurable, adequate, relevant, time-phased) of good goal formulations.

This neglect of formulation of adaptation visions and goals entails the danger that present non-sustainable goal preferences (e.g. ski tourism in low-lying areas) remain unquestioned and adaptation measures solely aim at securing a non-sustainable status quo and business as usual. Even more, the focus of adaptation processes on

reducing vulnerabilities to a non-sustainable status quo can become a barrier to transformations to a resilient future and necessary triple-loop learning (reconsideration of underlying values and beliefs, world views, and goals).

Hence, methods should be elaborated that allow the development of shared adaptation visions and goals that also allow triple-loop learning also at regional and national levels. The “future workshop method” (Zukunftswerkstatt) could provide a starting point for this endeavor. But, as experiences from the project ‘nordwest2050’ show, the development of shared guiding visions is very difficult at regional levels. It has to be assumed that this is even more difficult at national levels.

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**Title:** Economic Impact of Climate Change on Crop Production in Lower Saxony

**Name:** Margit Paustian

**Organization:** Department for Agricultural Economics and Rural Development, Georg-August-University Göttingen, Germany

Climate change has an important influence on agriculture and especially on crop production. Temperature, rainfall and CO<sub>2</sub>-concentration have a direct influence on yields. Climate also influences pests. For that climate change has a direct influence through weather conditions and an indirect influence through pests. It is expected that the pest situation will change in future caused by climate change. In this study we analyze the economic impact of changing pests on crop production in five regions in Lower Saxony. To evaluate the economic impact of climate change on crop production we use the farm model Farm Boss®. Variation of crop losses due to pests as a consequence of climate change is expected in the future. Farmers can react with adaption strategies in crop protection and preventive measures. The gross margin was used to compare the economic impact of yield losses and adaption strategies. Five regions with different foci in crop production were considered in this study: the marsh in the coastal area with wheat and rapeseed production, moorland and sandy soils with corn production in the northwestern part of lower saxony, the region around Uelzen with wheat, sugar beet and potato production under irrigation, the high productivity region Hildesheimer Boerde and the Leinebergland region in the south of Lower Saxony. For each region a representative farm was defined to show the effects of the changing crop protection, pest situation and adaptive measures on farm management. In the analysis of adaption strategies to climate change and a changing pest situation it was differed between effects on yield influenced by climate and pests, adaption strategies in chemical crop protection and adaption strategies in preventive measures like soil cultivation and choices of well adapted seeds. The deviation of product prices and costs of pesticides, seeds and fertilizers also influence the gross margin. Constitutive to risk analyses of changes in pests due to climate change, the effects on the gross margin of wheat, oilseed rape, corn and sugar beet in the five regions were analyzed. The results show that for all crops the fluctuations of market prices have more influence on gross margins than yield deviations due to pests. In comparison to possible adaption strategies the results show that it is more profitable to use more tillage than application of more pesticides.

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**Title:** Flood Risk Governance in the Flemish Scheldt Estuary

**Names:** Hannelore Mees | Ann Crabbé

**Organizations:** Antwerp University, Belgium

As a transition zone between salt and fresh water, the Scheldt estuary hosts a unique nature potential. But it also confronts policy makers with considerable challenges: the river delta is densely populated, intensively navigated and has important logistic and industrial activities at its embankments. In addition, it has an international character, as the estuary covers both Belgian and Dutch territory.

The Scheldt basin has a long history of flooding, and by the year 2000, policy-makers in Flanders came to the conclusion that, due to climate change projections and the increase of solid surfaces, the basin would no longer be flood risk proof in the future. In 2005, the original flood risk management plan of 1977 has been updated. Our paper will give an overview of the evolution of Flood Risk Governance in the Flemish Scheldt estuary. It will focus on policy initiatives taken at Flemish level and their local implementation. The study will be evaluating the rules, actors, resources and discourses of the arrangement in place, thereby making use of the Policy Arrangement Approach.

Research questions:

- How is the current FRGA in the Flemish Scheldt basin composed in terms of actors, resources, rules and dis-courses?
- How are the regional and local FRGAs interrelated?
- Which role is played by private actors within the FRGA?

We expect to see a top-down approach starting from the Flemish level but with an intense cooperation with local authorities on design development and implementation. Civil society and citizen interests are represented by traditional stakeholder participation structures. Private actors play a limited role in decision-making, financing and implementation.

Methodology

Our analysis will base itself on document analysis and semi-structured interviews with key actors. The case study is part of the EU-FP7 STAR-FLOOD project.

Contribution to CLARR. The research fits into the 3th theme addressed at the CLARR conference, by seeking an answer to the question on how to organise implementation to get the broadest possible support of regional governance systems, private sector and the public.

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**Title:** Increasing Vulnerability to Climate Change: Challenges in Adaptation in India

**Name:** Shadananan Nair Krishnapillai

**Organization:** Nansen Environmental Research Centre (India), India

Millions with low adaptive capacity living in climate sensitive regions and an economy closely linked to natural resources base make India highly vulnerable to the impacts of climate change. Extremes in climate are serious challenges to the securities in food, water and energy. Their impacts on agriculture and forestry are reflected in all facets of life. Increasing severity of heat and cold waves results in high mortality rates. Vectors and pests extend their geographical expanse. Water availability falls sharply, leading to conflicts. Retreat of the Himalayan glaciers leads to hydrological extremes in north India. Changes in the frequency and intensity of cyclones, and changing sea level are of serious concern in the coastal zones. Associated with the changes in coastal circulation and sea temperature fish population is diminishing. Social issues such as migration and competition and conflict over resources allocation are worsening. Setbacks in agriculture promote urban migration and even the spread of extremism. But, India's preparedness for the effects of climate change is poor. India was too late to develop a climate policy. Several initiatives have been taken in sectors such as water, agriculture, energy and transport, but the progress is slow. Though the country is heading towards a water crisis and famine, measures taken in these sectors are inadequate. Major constraints to strengthening adaptation include alterations of the physical environment that limit adaptation possibilities and the low adaptive capacity of millions of poor. There are several hurdles to adopt and implement the policies, such as competing development objectives, resource constraints, weak administrative mechanism, corruption, social issues and vested political interests. Vulnerable groups are often neglected. Projects lack transparency and accountability. India urgently needs an appropriate climate change policy and adaptation strategy and a mechanism for their effective implementation. Increased public participation in policy development and implementation, proper awareness for the vulnerable group on key issues and increased awareness among public and students are vital. This paper is a comprehensive assessment of the impact of climate change on different sectors, the effectiveness of the current adaptation strategies and policies and the efficiency of the institutional mechanism to face such challenges. Current policies, strategies and management practices have been critically reviewed. Guidelines for the development of an appropriate climate change policy and adaptation strategy have been provided.

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**Title:** Learning from extreme weather events: how companies make sense of climate risks

**Names:** Esther Hoffmann<sup>1</sup> | Maja Rotter<sup>2</sup>

**Organizations:** 1: Institute for Ecological Economy Research (IÖW), Germany | 2: German Society for International Cooperation (GIZ), Germany

Climate change adds a new dimension to the dynamics, risks and uncertainties in corporate environments. A precondition for dealing with climate change is that companies recognize and make sense of climate change related risks. Based on a conceptual background in sensemaking and learning from rare events we conducted case studies in two German companies (Energy and Railway). The case studies show that both companies have already suffered from extreme weather events. However, they do not yet perceive these as a sign of broader climate change. Both companies are currently convinced that they are well prepared to deal with climate change impacts and they perceive climate change as a manageable risk that can mainly be treated by technical measures. They rely on established behavior and ignore that climate change may lead to discontinuities and massive change, which cannot be dealt with by current strategies.

A low threshold of concern has been described as an important barrier to adaptation and our results illustrate how and why companies fail to develop a sufficient threshold of concern. Different sensemaking patterns such as “extreme events are nothing new”, “infrastructure is robust enough”, “we cannot invest based on uncertain data on climate change”, or “interruptions must be accepted by society” may hamper companies from problem recognition and awareness. We identify typical patterns that constrain learning from rare events such as cautious action, wishful thinking or searching for more data. Moreover we show that companies shift responsibilities to other actors (standardization organizations, regulating authorities) and use missing action from others as a reason for their own inaction. In stressing the responsibility of others, the companies treat climate change impacts as an external problem that cannot be influenced by internal action.

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**Title:** Paths to a Resilient Future: Integration of Local Climate-related Disaster Resilience and Risk Communication

**Names:** Farah Mulyasari | Rajib Shaw

**Organization:** Kyoto University, Japan

Indonesia is the world’s largest archipelago with more than 17,000 islands. With 240 million inhabitants, Indonesia is the fourth most populous country. Data derived from the international database (CRED-EMDAT) shows that in the last 100 years the number of events, affected people and total cost are increasing. These events were predominantly geological and climate-related disasters. While geological disasters were the deadliest, yet climate-related disasters such as high frequency and low consequence floods occurred more frequently and affected more people. Recent

publications on climate change risk indices such as the World Risk Index from Buendnis Entwicklung Hilft and UNU-EHS or the Global Climate Risk Index from Germanwatch show that Indonesia is at the top end of the most vulnerable country to climate change and natural hazards. This condition will exacerbate Indonesian urban areas. The 2004 Indian Ocean Tsunami is the turning point for Indonesia in rearranging its institutional framework on disaster risk reduction and climate change adaptation, focusing on institutionalizing local initiatives. Therefore the study addresses the linkage of climate disaster resilience and risk communication approaches at the local level. The adoption of Climate Disaster Resilience Index (CDRI) at the micro-city level (sub-district level) of Bandung City, Indonesia, demonstrates an approach to disclose the resilience of physical, social, economic, institutional, and natural dimensions of different areas within the city. The focus on resilience aims to foster actions enhancing the capacity of the city to future climate-related disasters through adequate planning decisions. Enabling this, communication envisages as the last mile of this comprehensive climate-related disaster resilience assessment on how the risk and resilience information collected at and conveyed to the public. Community-Based Society Organizations of Bandung has the potential in conveying that information to wider communities, which would trigger them to take actions. A set of indicators in Social Institutional and Economic Resilience Activities (SIERA) approach is developed to characterize the delivering process of risk information by community organizations through their activities at sub-districts and wards. Results indicate that communities' organization activities in Bandung implement a certain degree of risk communication, which is embedded in their activities by involving the local government, agencies, private sector and media in the process. As the output, the study offers a model of comprehensive risk communication approach, in integrating climate-related disaster assessment and risk communication processes driven by local novel initiatives in city.

