

# Essays on (Mal)Adaptation to Climate Change and Environmental Problems

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*“In other words, there is a need to populate the environmental state – to understand better the relationship between state structures, policies, and governance styles on the one hand, and the people that are subjected to these regulatory efforts, who are interpreting, reproducing, and changing the rules and institutions of the environmental state, but who are also engaging politically (through elections, collective action, etc.) to defend or shift these frames.” Duit, Feindt, Meadowcroft, 2015, p. 16.*

## **Introduction**

Climate change policy is driven by fear of uncertainty, big impact and unpredictable dynamics (Tol, 2016; Hulme, 2008). The effects of decreasing average annual and seasonal rainfall, increasing likelihood of sudden heatwaves, droughts, storms and floods are already visible today and known to have disruptive qualities (IPCC, 2012). Climate change effects come with a high degree of uncertainty (Pacheco, Vasconcelos, Santos, 2014; Hagerman, Dowlatabadi, Chan, Satterfield, 2010; Vincent, 2007). While we can already see certain effects today, the future implications rely on probabilistic, large-scale models of an interconnected climate-human-ecological system that can only give a rough idea of what to expect in the future. This implies a need for flexibility in human reactions to climate change. As Carl Folke puts it: “uncertainty and surprise is part of the game and you need to be prepared for it and learn to live with it” (2006, p. 255). All this contributes to the fact that research on climate change, environmental problems and reactions to those is often pragmatic, solution-oriented and mostly highly context-dependent.

Climate-related risks result from interactions of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems (IPCC, 2012). In addressing these risks, research endeavours focus on strategies and action frameworks to resilient/sustainable/adaptive transitions and implementation programs (Thompkins, Adger, Boyd, Nicolson-Cole, Westherhead, Arnell, 2010; Moser & Ekstrom, 2010; Hallegatte, 2009; Pahl-Wostl, 2007), descriptions and discussions of best-practice examples (Bulkeley, 2006, Holzinger Jörgens, Knill, 2008; Moser, 2005; Weidner, 2002), and transdisciplinary apprehensions of concepts, models and scenarios relevant for understanding environmental and climate

development (Cash & Moser, 2000; Grothmann & Patt, 2005; Folke, Carpenter, Walker, Scheffer, Chapin, Rockström, 2010). Social and natural sciences interact, innovative, and address current (environmental) challenges against the background of coupled human-environmental systems (e.g. Turner, Kasperson, Matson, et al. 2003; Ostrom, 1990).

Political science writing is not at the forefront of interdisciplinary work on climate change and environmental problems, and social scientific research in general “remains limited in many cases, to the detriment of effective policy responses” (Davidson, 2016, p.433). One contribution of this thesis is thus clarify what political science brings to the table when it comes to interdisciplinary work on climate and the environment.

A combination of political science and natural science can result in meaningful interactions across disciplines that encompass ecological realities and societal practice. In the process of this, interdisciplinary research changes and challenges existing theoretical assumptions and conceptual standards in the sub-disciplines. Many authors point out that (re)defining standards in the context of interdisciplinary work could potentially provide for better policy designs and procedural outcomes (e.g. Seijger, Van Tatenhove, Dewulf, Otter, 2014; Aligica & Tarko, 2012; Newig & Fritsch, 2009; Folke, 2006; Folke, Hahn, Olsson, Norberg, 2005; Adger, Fairbrass, Brown, et al., 2003b). Research on social-ecological systems’ dynamics coincides with new regulatory arrangements that have been said to contribute to better environmental quality, improved decision-making effectiveness, as well as increased acceptance and understanding of problems (Brower, 2016; Newig, 2007; Newig & Fritsch, 2009). However, very early on, researchers have criticized the use of misleading, imprecise terminology and fuzzy concepts that are borrowed from other disciplines, such as ecology (Morecroft, Crick, Duffield, Macgregor, 2012; Duit, Galaz, Eckerberg, Ebbesson, 2010; Brand & Jax, 2007)<sup>1</sup>.

Interdisciplinary work is not only problematised in political science. One prominent discussion in ecology on “where is the politics in ecology” has criticized the “semantic muddle of ‘ecology’, ‘environment’, ‘nature’ and social struggle” (Walker, 2005, p. 79), and points out that a lot of political ecology writing is in fact perceived as a “politics

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<sup>1</sup> The authors criticize the use of resilience, adaptation, vulnerability or sustainability.



without ecology” (Walker, 2005, p.75)<sup>2</sup>. Apparently, there is a need for clear-cut analysis in an interdisciplinary context that provides a) useful, translatable empirics on environmental and social realities and developments, b) theoretically grounded discussions and application of interdisciplinary concepts, and c) an evaluation of the effects on the sub-disciplines’ concepts and theories in order to engage with new conceptual developments in a meaningful way.

This thesis contributes to both empirics and concepts that shed light on the question why and how individuals and societies adapt to climate change and deal with environmental problems. Both qualitative and quantitative methods are applied to explain the variance in addressing adaptation to climate change and environmental degradation at individual and aggregate level. This thesis works with concepts and theoretic insights from ecology (Paper 1, Paper 4), psychology and behavioural economics (Paper 2), geography (Paper 5) and relates those to political science (all Papers). In terms of empirics, the dissertation encompasses a computer-based linguistic analysis of policy documents to get at individuals’ perception of policies (Paper 1), experimental data on individual intentions to adapt to climate change (Paper 2), a comparative case study on consequences of participatory environmental governance in the context of irrigation policies (Paper 4) as well as insights into the outcome of collaborative freshwater planning in New Zealand that have been developed in a meta-analysis of all freshwater planning instances in the country (Paper 5). Discussed in all papers are the theoretical, conceptual and practical implications of environmental governance, policy and planning in the context of climate change challenges and environmental degradation. This is especially relevant in light of the discussions on how concepts and theories can be translated across disciplines.

Environmental and climate policy practice is described as fragmented and complex, with structures that are multi-level, polycentric, flexible and collaborative to govern specific problems (Brower, 2016; Newig, Schulz, Jager, 2016, Jager et al., 2016; Newig

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<sup>2</sup> While Walker considers this to be an exaggeration, he states that this discussion is an important trajectory for the future development of the field (2005, p.78). Interestingly, Walker finds that political ecology today is largely about “power, struggle and representation, while the connections of these struggles to the biophysical environment remain unexamined” (2005, p.78), which calls for a re-examination of the differences and similarities between ‘environmental politics’, ‘politicized environment’ and ‘political ecology’ (2005, p.78-79).

& Fritsch 2009). Rules of the game change and are subject for debate, which is valued for the associated flexibility that allows addressing specific challenges in any given context (Keohane & Victor, 2010; Duit, Galaz, Eckerberg, Ebbesson, 2010; Smit & Pilifosova, 2003). This entails rethinking and reconceptualisation of the distribution and representation of interests, problem definitions, power relations and institutional arrangements (Brower, 2016; Bulkeley, 2005; Köhler, 2008; Norman et. al., 201). Environmental politics today is broadly coordinated by soft-law, informal forums, and epistemic communities, in arrangements that span across scales and levels (Hooghe & Marks, 2003). Instead of an overarching climate policy there is a complex system of regimes (Keohane & Victor, 2010).

The setting of new governance arrangements is a compromise that comes with the loss of democratic principles (Brower, 2016; Slaughter, 2002; Brunkhorst, 2009), a depoliticization of governance (Offe, 2009) without actually reaching the envisioned environmental benefits (Brower, 2016; Jager et al., 2016; Kochskämper, Challies, Newig, Jager, 2016). The dispersed emerging legal, regulatory order that results, and its immense transformative impact on existing structures, is legitimised by a) the rationale that environmental resource boundaries do not adhere to political-administrative boundaries (e.g. Newig & Fritsch, 2009; Kochskämper et al., 2016; Jager et al., 2016), b) the nature of problems is said too complex, too ‘wicked’, to be dealt with in traditional ways (e.g. Börzel, 1998), c) participatory governance’ implicit (but hardly ever tested) input legitimacy, as well as increased output efficiency and higher acceptance rates (Kochskämper et al., 2016; Newig & Koontz, 2014; Newig, 2007), d) the charm of flexible structures that seem to allow for place-based, contextualised actions within a common frame which is seen as a necessary complement of successful adaptation (Cannon & Müller-Mahn, 2010; Folke, 2006; Folke et al., 2005), e) track-record of governments’ inability to stop environmental degradation (Steward, 1977), f) the allure of best-practice that can be translated across contexts and fields of expertise and a more innovative approach to problem solving (*co-management, learning-by-doing* – e.g. Lundmark & Jonsson, 2014; Pahl-Wostl, 2006, 2007; Folke et al., 2005).

In these contexts, political science writing is often merely an ex-post legitimisation of the processes of governing resource management. This raises the question if political

science theories and concepts are either a) outdated, b) inappropriately used in interdisciplinary work, or c) need to be revitalised and refocused to engage with effectively. If not developed rigorously, this could come as a challenge to the coherence of the research field as it adds to a fragmentation of approaches and theories as well as a highly normative approach to the analysis of environmental and climate change policies.

Much of the above-named challenges can be linked to a broader discussion on the relevance of the nation state in general, and the relevance of the national scale in environmental governance in particular. What nation states can and cannot do in a globalised, interconnected world is an old discussion; Publications on governing and governance *beyond, without* or *above* the state have proliferated in the context of globalisation (Held, 2009; Genschel, Zangl, 2008; Rosenau, 1992). Features of the nation state are challenged by globalisation, enabling “a multiplication of non-formalized or only partly formalized political dynamics and actors” (Sassen, 2009, p. 233). In that context, researchers ever so often raise the question of the optimal level of decision-making (e.g. Mayntz, 2008; Adger, Huq, Brown, et al., 2003a; Zürn, 1998; Rosenau, 1992). In order to foster agreement and somehow “bridge the gap between decisionmakers [sic!] and those affected by decisions” (Agder et al., 2003a, p. 1101), interaction of governmental actors, citizens, non-governmental Organisations (NGOs), and multilateral agencies has increased, creating new structures of involvement and decision making in the process.

In general, interaction of policy makers and stakeholders to govern environmental issues happens across levels, scales, and sectors, establishing inter-organisational arrangements that introduce a polycentric system structure (Ostrom & Ostrom, 1965). This leads to environmental and climate policies governed by a “regulatory patchwork of different instruments, principles and strategies” (Knill, 2001, p. 119). This can come with a loss of power at national levels, which brings about new power structures and politics at subnational, international, transnational and supranational levels (Sassen, 2009).

New power structures are apparent in the context of decision-making on freshwater, where governance levels are rescaled to meet regional and local needs (Kochskämper et al., 2016; Jager et al., 2016). This is for example the case in European agriculture,

freshwater Governance, in New Zealand water management, in US water planning and many other contexts (Colvin, Witt, Lacey, 2015; Engle, Johns, Lemos, & Nelson, 2011; Moss & Newig, 2010). In the context of the European Union's environmental policy-making, the debate around competences and participatory structures has taken up speed after EU explicitly focused on involvement of the public (European Commission, 2001). Two reasons for rescaling governance processes, for new politics and power structures are named: For one, this is a way to address the Union's legitimacy problems, furthermore, participation is said to increase output effectiveness. (Newig, 2011; Thiel, 2012). Broadening participation and deepening interaction among stakeholders is further justified along the lines of three rationales (Carmona, Varela-Ortega, Bromley, 2013, p. 401): (1) based on a democratic rationale, it is said that "the public should be involved in decisions that affect them"; (2) based on a substantive rationale, it is assumed that "citizens can provide scientists with their specialised knowledge, for better understanding of facts and values"; and, finally, (3) based on a pragmatic rationale, participation is justified by the conviction that "an involved and educated public is more likely to support implementation of resulting policies".

Following this notion, changes in environmental decision-making in accordance with and reaction to climate change and environmental problems are determined by the chances of and incentives for different stakeholders to become involved politically. Carmona's democratic rationale can however be challenged with regard to the stakeholders that actually get to participate, leading to the question of participation of 'the affected public' is actually democratic in the sense that it allows for equal access to decisions, transparent processes, representation of different groups, and clear accountability and legitimacy structures (e.g. Brower, 2016; Thiel, 2012). These challenges feature in Paper 1, 3, 4, and 5. Coming to the substantive rationale, knowledge has been mobilised as an argument either for or against participation. Again, the claim that specialised knowledge automatically justifies new power structures and governance processes can be problematized with regard to democratic and legitimate access to decision-making. This is especially relevant for Paper 5, which describes collaborative governance in New Zealand. Higher acceptance rates, the pragmatic rationale for broad participation in environmental decision-making contexts, are often a motivation for policy making that regulated common pool resources – these come with

high free-riding potential, low compliance and motivation to act on resource protection instead of exploitation (Ostrom & Ostrom, 1965). The outcome of participatory governance is described and evaluated in paper 3 and 4, once in a regional implementation of the EU water policy and once in regard to a comparison of participatory water policies in OECD countries.

Contextual factors affect and shape environmental decisions (Bulkeley, 2006), which makes it difficult to translate local practices into broader political agendas, rules and norms. Furthermore, climate change effects differ across regions, seasons and farm specialisation (Iglesias, Garrote, Quiroga, et al., 2008). The concepts of resilience and adaptation have gained some currency in this context to enable a conceptual shift away from farm-level support policies towards a more systemic approach that puts the resilience of farm systems at the centre (De Goede, Gremmen, Blom-Zandstra, 2013; Berkes & Ross, 2012; Duit, Galaz, Eckerberg, Ebbesson, 2010; Folke et al., 2010; Adger et al., 2009; Anderies, Walker, Kinzig, 2006; Walker, Holling, Carpenter, Kinzig, 2004). Paper 1 entitled ***Research into Adaptation features in EU Agricultural Policy and Planning*** describes regulatory features of the EU's Common Agricultural Policy, both in terms of the actual adaptation measures as well as the institutional structures that may promote long-term adaptation. To evaluate systematic incentives towards structures supporting long-term adaptation in the agricultural sector, this paper elaborates on links between adaptation, vulnerability and resilience on the one hand and governance structures on the other hand. Adding a practice dimension to the policy content and conceptual discussion, the paper ends with an analysis of regional CAP implementation to shed light on farming communities' perspective on adaptation structures.

The potential of policy incentives to trigger behaviour change is analysed in Paper 2 ***You Reap What You Sow? (Dis-)Incentives for Adaptation to Climate Change***. It offers a discussion on causal explanations for German farmers' adaptation intentions. The paper tests the effects of incentives on participants' change intentions in a survey experiment. A socio-cognitive model is used to get at the underlying psychological factors that shape an individual's decision to adapt. Contrary to the assumption of profit maximising individuals, economic incentives trigger less overall change intentions.

Economic rewards act on risk perception, but are less likely to trigger coping perception, while other treatments do so. As coping perception is one of two socio-cognitive reactions to climate change (Grothmann & Patt, 2005), it seems that current incentive structures fail to act on half the factors leading to adaptation intentions. These effects dependent on subgroups, farm structures, and climate experience. This suggests that a) subsidies alone are not enough to promote adaptation, and b) there is no ‘one-size-fits-all’-incentive for behaviour change, but a set of linked options to trigger change intentions.

Paper 3 *Doing Everything You Can, but Not (yet) Getting it Right: Challenges to Brussels’ Great Expectations for Water Quality*<sup>3</sup> addresses the effectiveness of re-scaling governance in the context of the Water Framework Directive (WFD) and its implementation in Schleswig-Holstein, Germany. The paper has been published in *Case Studies in the Environment*. It presents an analysis of the governance architecture for water in the European Union. The main research question asks why the innovative governance architecture of the WFD can not reach its environmental goals. This specifically addresses the implicit assumption that is often out forward that innovative environmental governance can solve all sorts of problems and address both societal regulatory as well as environmental concerns. Findings in this context include the time-need to arrive at consensus decisions, the processes or implementing new institutional structures of water governance and management (Europeanization of German water laws), the fact that several environmental policies cancel each other out; the lag-time of water quality standards (waters do not improve as fast); the fact that participation standards are not defined in the WFD; And, finally, actors rely on voluntary measures – and those are not implemented as thoroughly as would have been necessary to see an improvement both in social structures and environmental quality. Scale is a quite obviously not only a pragmatic, but also a political decision (Mostert, 2017; Mostert, 2015; Juerges & Newig, 2015) that is often controversial (Thiel, 2015; Juerges, Newig 2015). Rescaling leads to shifts in the existing power relations as it may prompt a redistribution of interests, problem definitions, power relations and institutional

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<sup>3</sup> Pessman JL, Wildavsky A. 1984. *Implementation. How Great Expectations in Washington are Dashed in Oakland; Or, Why It’s Amazing that Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals on a Foundation of Ruined Hopes*, 3rd ed. Univeristy of California Press.

arrangements and can open up or obstruct options for climate change related policies. Furthermore, it prompts factual and normative uncertainties (Newig, Pahl-Wostl, Sigel, 2005).

Paper 4 *What we learned about Governance in Multifunctional Irrigation Systems? Balancing Stakeholder Engagement in Hydrosocial Territories* puts the challenges that come with participatory water governance into a broader perspective. The paper has been accepted for publication by the *International Journal of Water Resources Development* and is revised and published with that journal (in a format that differs from the paper that is part of this thesis). The aim of this paper is to conduct in-depth and evidence-based analysis of the main policies, trends, drivers, barriers, tools, profiles, motivations, perceptions, concepts, scales and approaches able to influence in the engagement of stakeholders in multifunctional irrigation systems. Irrigation systems, as examples of complex social-ecological systems, deal with both the uncertainty of ecosystem dynamics and the interdependencies resulting from Anthropocene complexity. Debates over irrigation management and governance have increasingly been framed in relation to social, economic, environmental and cultural impact, stimulating policy framework changes in European common policies like the Common Agricultural Policy and the Water Framework Directive. That is, the water-agriculture nexus is context-dependent, socially constructed and technically uncertain, and it should be analysed as a hydrosocial cycle, which likewise takes into account the inseparability of social and physical aspects of water systems. The state-of-the-art review provides the necessary knowledge for promoting outcome-oriented, fit-for target, anticipatory and adaptive social-learning processes, and policy changes in those multifunctional irrigation systems with current or potential conflicts over water use. Accordingly, the intended goal of this paper is to assess the impact of stakeholder engagement in irrigation-related decision making and policy implementation, and to provide guidance to policy makers on how to set up the appropriate conditions for successful negotiation between irrigators and civil society. With this, it addresses the lack of evidence-based assessment on how effective stakeholder engagement processes have been in reaching intended objectives of water governance. The paper is joint work with Sandra Ricart Casadevall, Antonio Rico, Anna Ribas, David Pavón, and Nick Kirk. I have been

responsible for the analysis of EU and US contexts or irrigation practices and their policy context.

The paper entitled *Collaboration the Kiwi Way: A national meta-analysis of collaborative freshwater governance in New Zealand* is joint work with Ann Brower, Lea Desault and Nick Kirk. Final interpretation of the data is joint work of all authors. I have been responsible for data analysis with MaxQDA, and writing of the methods, results and discussion sections of the manuscript. The effects of collaboration in New Zealand are evaluated in a meta-analysis on the 22 instances in which water regulation has been shaped by public participation. We examined structures of representation, patterns of power distribution, forms of dissent, and models of consensus. We found that *Collaboration the Kiwi Way* is more neoliberal participation than a power-sharing collaboration. In other words, it is more deliberation than collaboration, as the power firmly resides with the central or regional government.

To sum up, analysed here are individual level adaptation to climate change, regional adaptation and regional governance arrangements to tackle resource degradation; country-level solutions to overcome resource problems; cross-scales and cross-continent comparisons of governance modes to regulate environmental and climate issues. The interdisciplinary concepts with which this thesis operates are vitalised for an informed discussion of the reasons why and contexts in which new governance modes are implemented. All papers contribute to an understanding of the nexus within which environmental and climate change governance is positioned today. In this way, this thesis reacts to the

“(…) need to populate the environmental state – to understand better the relationship between state structures, policies, and governance styles on the one hand, and the people that are subjected to these regulatory efforts, who are interpreting, reproducing, and changing the rules and institutions of the environmental state, but who are also engaging politically (…) to defend or shift these frames.” (Duit, Feindt, Meadowcroft, 2015, p. 16).

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## **Paper 1**

### **Research into Adaptation features in EU Agricultural Policy and Planning**

A certain amount of climate change is inevitable, leaving agriculture vulnerable to diverse climate change impacts. In light thereof, adaptation to climate change has become an important coping strategy. The concepts of resilience and adaptation have gained some currency in this context to enable a conceptual shift away from farm-level support policies towards a more systemic approach that puts the resilience of farm systems at the centre. The question is however, whether and how public policy – here the Common Agricultural Policy (CAP) of the European Union – helps the farming communities to adapt. This article describes (dis)incentives for climate change adaptation in the CAP. It then links these policy features to appropriate governance arrangements that support adaptation and resilience. Adding a practice dimension to the policy content and conceptual discussion, the paper ends with an analysis of regional CAP implementation to shed light on farming communities' perspective on adaptation structures.

*Keywords:* Common Agricultural Policy; Adaptation to Climate Change; Resilience; Vulnerability

#### **1. Introduction**

Climate change effects differ across regions, seasons and farm specialisation (Iglesias, Garrote, Quiroga, Moneo, 2008). While some regions might actually benefit from climate change, most regions do not flourish under decreasing average annual and seasonal rainfall, increasing likelihood of sudden heatwaves, droughts, storms and floods (IPCC, 2012). Changing climates are not a new phenomenon. Farmers are used to changing weather conditions and most naturally, farming includes reactions to those. However, farmers' reactions are often too limited to meet the climate change challenges ahead, most of which go beyond natural shifts in daily weather and climate. As research on US farmers shows (Arbuckle, Morton, Hobbs, 2015; Burke & Emerick, 2016), farmers *react* to changing conditions, but show only a limited amount of *proactive*

*activities* to deal with climate change. This leads to drops in agricultural productivity, prices and farmers' income (Burke & Emerick, 2016; Olesen & Bindi, 2002). Adaptation can reduce the damages caused by climate change (McCarthy, Canziani, Leary, Dokken, & White, 2001; Berrang-Ford, Ford, Paterson, 2011).

Climate change effects come with a high degree of uncertainty (Pacheco, Vasconcelos, Santos, 2014; Hagerman, Dowlatabadi, Chan, Satterfield, 2010; Vincent, 2007) and interpreting extreme weather events as a long-term trend is not a simple task. At what point do people adapt to climate change? Real or perceived climate change threats are the most frequently stated motivation for agricultural adaptation (Thomkins, Adger, Boyd et al., 2010). Koerth et al. (2013) find that personal experience is the main explanatory factor for risk perception and subsequently for adaptation behavior. Osberghaus, Finkel and Pohl (2010) confirm that a higher perceived personal risk will lead to a higher motivation to adapt. Nieves et al. (2015) point out that climate experience and impacts are the main source of regionally specific adaptation. In an application of Liebig's Law of the Minimum they find that a farming system's most limiting resource will be the main focus of farmers' adaptation efforts (2015: p.14).

All of these publications point at experience of climate as a threat to production, infrastructure, livelihood or all three of those. However, reactions might not be proactive and/or come with a long-term perspective, since the perception of what counts as a risk or threat differs and may result in adaptive reactions only after a large proportion of farm holdings are seriously damaged. Based on Arbuckle et al.'s findings (2015), it can be assumed that most farmers do not interpret weather events as consequences of climate change, but instead interpret them as single events that they react to at that point in time, in a specific region, context and sector. Hence, the necessity to make any efforts for long-term adaptation is not self-evident, unless farmers experience climatic variability as a reoccurring, limiting factor to agricultural production and planning.

This article specifies CAP content and its adaptive elements, both in terms of the actual adaptation measures as well as the institutional structures that may promote long-term adaptation. Effective institutions and decision-making structures can set strong incentives for adaptation to current and future climate change that consider longer time

frames (Yohe & Tol, 2002; Thomkins et al., 2010). Impacts of climate change and adaptation largely depend on farm characteristics (e.g. intensity, size, land use), and a larger diversity in farm types reduces impacts of climate variability at regional level (Reidsma, Ewert, Oude Lansink, Leemans, 2010). While this diversity shows benefits on an aggregate level, certain farm types may still be vulnerable, which is why Reidsma et al. (2010: p.101) suggest developing adaptation strategies at farm system or policy level. The CAP has been criticized for slipping back to more productivity and producer-oriented priorities during the 2013 CAP reform (e.g. Daugbjerg & Swinbank, 2015; Swinnen, 2015; Daugbjerg & Feindt, 2017). While rural development planning is said to be positive for adaptive structures as it decentralizes policy-making and promotes environmental objectives (Lowe, Buller, Ward, 2002: p.4), the CAP is fairly top-down driven, focused on creating bigger farm holdings that are more efficient than smaller farms, less environmental friendly, and less vulnerable to change, because larger farm holdings benefit from economies of scale (Berry, Rounsevell, Harrison, Audsley, 2006). Furthermore, rural development programs with their very specific administrative baggage are extensively scrutinized by the European Commission and hence national policy-makers design measures and seek to minimize the risk of administrative mistakes (Swinnen, 2015). This suggests that the policy may not match the conceptual assumptions put forward in the literature on resilience and vice versa.

To evaluate systematic incentives towards structures supporting long-term adaptation in the agricultural sector, this paper elaborates on links between adaptation, vulnerability and resilience on the one hand and governance structures on the other hand. Adaptive governance has been said to promote agricultural adaptation (Adger, Dessai, Goulden, et al., 2009). Adaptive governance is a concept for thinking about more flexible decision-making processes within a common institutional frame (Folke, Carpenter, Walker, Scheffer, et al., 2010). Basically, it emphasizes flexible institutional reactions within contexts of change and uncertainty instead of an organisational focus on complete systems' control (Folke Hahn, Olsson, Norberg, 2005). How do these normative assumptions that have been put forward with regard to adaptation potential relate to policy regulation and implementation practice?

To give an overview of the status quo of public policy contribution to agricultural adaptation to climate change in the EU, the following section presents (dis-)incentives under the CAP. This is followed by an overview of concepts on adaptation, vulnerability and resilience to present the desired goals that come with an implementation of those concepts, their common assumptions and selected difference with regard to policy evaluation. Subsequently, governance and institutional structures are discussed that have been put forward as beneficial conditions for adaptation and resilience. The paper closes with an exploration of the relevance of these concepts for agricultural practice in an attempt to come to an understanding of the way in which public policy promotes further long-term adaptation structures that help vulnerable businesses to deal with climate variability and extreme events.

## **2. (Dis-)Incentives for Agricultural Adaptation in the CAP**

Climate change encompasses temporal or spatial shifts in precipitation, yield levels, and changes in the growing period along with probabilistic extreme events such as long drought periods or heat waves that may demand a precautionary, systematic readjustment in order to avoid losses, such as insurance or infrastructural adjustments. Europe's climate is very heterogeneous; the impact of climate change on agricultural holdings depends on regional exposure, farm and sector characteristic sensitivity and the adaptation of the exposed region, sector, system. While climate change mostly has a negative impact on the northern European countries, its impact is often positive in the south (Berry et al., 2006; Reidsma et al., 2010). Agricultural adaptation potential and capacity dependent on regional socio-economic conditions, sector and farm specific conditions (Reidsma et al., 2010). Subsequently, not just the impact, but also the capacity to change in farm practices to avoid production losses differ across Member States. Adaptation can thus be differentiated according to forms (managerial, technical and financial), scales (local, regional and global) and actors (farmers, industries and governments) and four main categories: (1) farm production practices, (2) farm financial management, (3) technological developments and (4) government programs and insurance (Reidsma et al., 2010: p.92). This paper focuses on financial incentives, first with regard to the whole EU and its policy program, then with a regional implementation example to shed light on farmers' perceptions.

## 2.1 CAP Components

The Common Agricultural Policy (CAP) encompassed two pillars: one designed to help farmers to be competitive (pillar I), another with a focus on environmental issues and development in rural areas (pillar II). Additionally, the last reform period (2014-2020) introduced green payments in pillar I. Direct payments can be redirected through optional schemes: Younger farmers can receive additional first pillar payments, the first hectares can receive redistributive payments, small farms can enter a simplified support scheme and Member States can grant coupled support for vulnerable sectors (DG Agriculture and Rural Development, 2013).

CAP components that are relevant in the context of adaptation to climate change are (a) the cross-compliance scheme under pillar I of the CAP and (b) the agri-environmental measures<sup>4</sup> under pillar II of the CAP. The cross-compliance scheme includes statutory management requirements (SMR) that farmers need to integrate into their work. These specify certain standards concerning public health, animal and plant health, deriving from the provisions of existing EU legislation on these subjects. By complying, a farmer shall keep his land in good agricultural and environmental condition (GAEC). A reduction in or cancellation of the direct payments is the result of non-compliance, which acts as a strong financial incentive to act according to CAP guidelines. Agri-environmental measures focus on rural development and planning and generally serve broader environmental objectives (pillar II, CAP). Agri-environmental payments are available to farmers who commit to management schemes for a minimum 5-year period. In accordance with Community guidelines, Member States have to produce a national strategy plan for the period from January 2007 to December 2013, and submit them to the European Commission prior to presenting their rural development plans. The implementation of Member State's national strategies is carried out through rural development plans.

## 2.2 The CAP Governance Structure

The EU's climate change policies highlight the need to foster coalitions between all those concerned, introducing changes to decision-making procedures and routines of interactions (Seijger, Van Tatenhove, Dewulf, Otter, 2014). Much in line with this, the

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<sup>4</sup> Called *agri-environmental-climate measures* with the 2014-2020 CAP reform.

CAP has increasingly opened up with regard to innovative changes to its institutional as well as its ideational set-up (Lynggaard, 2006). Funding has been expanded to non-production targeted measures in the course of the Agenda 2000 reform. This includes a set of principles that take account of decentralisation and partnership. These allow for a responsive policy implementation process which is beneficial for addressing regionally specific agricultural climate change adaptation (Lowe, Buller, Ward, 2002; Reidsma et al., 2010; Tompkins et al., 2010).

The communication and coordination of the CAP is a top-down process, while rural development planning promotes decentralized policy-making (Lowe, Buller, Ward, 2002: p. 4). The implementation of Member State's national strategies is carried out through Rural Development Plans (Parliament UK, 2008). Part of this is the LEADER approach, which builds on seven principles: networking, cooperation, innovation, integrated multi-sectoral actions, local public private partnerships and Local Action Groups (LAG), a bottom-up elaboration and implementation of strategies as well as area-based local development strategies. Local Action Groups are comprised of local public, private and civil society representatives, who work together on strategies and delivery of those to address local priorities in a Local Development Strategy. LAGs are an example of flexible structures that allow for organizational learning and offer different ways to respond to and shape change (Folke et al., 2005).

Structures like the LAGs enhance the probability of finding regionalized solutions to climate change effects. Such an institutional design is conducive to the accommodation of diverse interests, to policy innovations, and democratic legitimation (Héritier, 1999). However, different scales of decision-making lead to incongruence between aspirations, aims, priorities and interests (Adger et al., 2009).

### **2.3 CAP adapts**

Several agricultural practices as well as farming technologies promote adaptation to climate change. For example agroforestry is mentioned as having a positive effect on soil and water erosion as well as the overall water management and crop output stability (McCarthy, Lipper, Branca, 2011: p.5). Another example for an agricultural measure that can be beneficial in terms of adaptation is reduced or zero tillage, which can increase water retention and improve soil structure and aeration (McCarthy, Lipper,

Branca, 2011). Incentives for climate change adaptation actions are often implicit in the CAP's environmental objectives. The newly implemented 'green direct payment' in pillar I of the 2014-2020 CAP reform presents a more pronounced interest in measures targeting climate change impacts on agriculture. It accounts for 30% of the national direct payment envelope and rewards farmers for respecting three obligatory agricultural practices, namely (1) Maintenance of permanent grassland; (2) Ecological focus areas; (3) Crop diversification. Additionally, at least 30% of the budget of each Rural Development Programme must be reserved for voluntary measures that are beneficial for the environment and climate change. Table 1 gives an overview of measures subsidized under the CAP<sup>5</sup>. Many of the measures displayed were categorized as environmental friendly farming measures in the CAP's pillar II, and as part of those, agri-environmental payments have been available to farmers who committed to those management schemes for a minimum 5-year period.

**Table 1 Overview on CAP Adaptation Aspects**

Activity	Content	Adaptation Aspect	(Cross-) Policy requirements
<b>Green-Cover/ winter Crops</b>	Arable land which would be bare is given temporary cover, e.g. rye, buckwheat, cowpea, or vetch	Erosion control, flood prevention, additional carbon to soils, reducing N2O emission, prevention of N, pesticide and P runoff	Minimum quantity required under Nitrates Directive (SMR 4); minimum soil cover and land management reflecting site specific conditions are compulsory GAECs for soil erosion; voluntary measures in 16 Member States
<b>Crop rotation/ Diversification</b>	Planned and ordered sequence of cultivated species of different botanical families	Better pest and weed control, allocation of more carbon below ground	Previously compulsory but in 2011 optional GAEC on soil organic matter; present in 9 Member States (2011)
<b>Permanent grassland</b>	Reversion of cropland to another land cover	Accumulation of soil carbon, flood preventions, erosion prevention	Compulsory GAEC on minimum maintenance; obligation to maintain the ratio of permanent pasture at Member State/regional level under Article 6(2) of

<sup>5</sup> Differences between reform periods not specified. Source: SWD 139 final, 2013.

			Regulation (EC) No 73/2009; present in 23 Member States (2011)
<b>Set aside</b>	land left fallow (not in production) for environmental purposes	Accumulation of soil carbon; reducing N2O emission, flood preventions, erosion prevention	Retain terraces (optional GAEC on soil erosion); establishment of buffer strips along water courses (compulsory GAEC as from 2012) is not yet implemented in most MS
<b>Improved irrigation and sustainable water use</b>	Support of improved irrigation technology; maintain drainage; re-use of drainage water; controlled drainage	Promote productivity throughout dry periods; suppress N2O emissions by improved aeration.	Agri-environmental payments; GAEC standards indirectly benefiting water; Blueprint to safeguard Europe's waters (2012); Roadmap to Resource Efficient Europe (2011); Water Framework Directive (2000) aims to reach good status of all waters by 2015; communication on water scarcity and droughts (2009)
<b>Afforestation/ Agro-forestry</b>	Planting of trees in agricultural zones	Stock carbon in the above ground parts and roots, decreased erosion.	Part of the CAP since 1992 (Council Regulation 2080/92); EU forestry strategy 1998; 2000 integrated into the support for Rural Development by Council Regulation 1257/1999

While CAP clearly offers pathways for agricultural adaptation to climate change, policy recommendations on adaptive capacity and climate effects are vague and do not specify climate change effects. This is mainly due to the uncertain character of adaptation and its diverse impacts across Europe's plains. Taking a step back from the CAP features, the next section approaches adaptive action from a theoretical perspective and describes which structural developments adaptation entails.



### **3. Interdisciplinary Concepts: Common Assumptions and Selected Differences**

#### **3.1 Vulnerability, Adaptation and Resilience – Where do we want to go?**

Adaptation to climate change is broadly defined as a conscious reaction to actual or expected changes in one's environment to avoid damages or exploit opportunities (McCarthy, Canziani, Leary, Dokken, & White, 2001; Berrang-Ford, Ford, Paterson, 2011). The ability to do that is summarized in the term 'adaptive capacity'. Adaptive capacity can be held by individuals and aggregate bodies alike. The capacity to adapt is effectively the ability to identify vulnerability (either before or after an external shock) and act to reduce this vulnerability (again, either actively or reactively) (Yohe & Tol 2002: p. 39). Vulnerability has been conceptualised in various contexts and research areas as "a multidimensional concept that refers to a system's defenselessness or susceptibility to damage or disruption" (De Goede, Gremmen, Blom-Zandstra, 2013: p.2). Being vulnerable as a farm means being unable to protect crops, livestock, infrastructure, and people from harm by exterior effects, like surprising extreme weather events, climate variability and overall climatic changes. The lack of resilience to address such conditions of defenselessness is understood to be an aspect of vulnerability (De Goede, Gremmen, Blom-Zandstra, 2013: p.4), and the more resilience a farm becomes, the less vulnerable it is. Thus, in the process of becoming more resilient, the condition of vulnerability can be improved by becoming more adaptive, i.e. by increasing adaptive capacity.

Thus, the general assumption is that adaptability is the capacity of actors in a system to influence resilience positively and thereby reduce their vulnerability (Walker, Holling, Carpenter, Kinzig, 2004). Although it would be satisfying to have a concrete set of adaptation traits, there is no such thing as a 'one size fits all'-capacity to adapt, as the determinants of adaptive capacity vary 'from system to system, sector to sector and region to region' (Yohe & Tol, 2002: p.25). Instead, adaptive capacity is best reflected by a broad 'coping range', which is location-specific, group-specific, and time-specific (Smit & Pilifosova, 2003). This suggests that in order to allow for a location-, group, and time-specific coping range, governance arrangements need to provide leeway for tailored reactions. Institutions are both a steady influence and a reflexive structure

shaped by individual and structural developments. Institutions mirror actions, but they also constitute the structures that influence an actor's behavior (Sjöstedt, 2015). Policies that leave room for incremental changes, for non-rational turns and modulation, for interconnected and redundant structures are said to foster resilience (Cannon & Müller-Mahn, 2010).

Resilience, a concept that was first put forward in ecology (Holling, 1973), has gained prominence across research domains and practice fields to express the ability to cope with challenges (Berkes & Ross, 2012). This is also the case for EU agricultural regulations, as one of the Common Agricultural Policy's objectives is to increase resilience in agriculture (SWD (2013) 139 final). It is thus directly relevant to both this analysis and any further development of EU agricultural policy content as a leitmotif and common goal beyond and within the farm gate. Giving *one* definition of resilience is difficult because interpretations vary across disciplines. It is, as Michael D. Morecroft et al. (2012: p.547) put it, a "slippery concept", but one that resonates with policy makers and researchers alike, increasingly producing a sort of commitment to 'become more resilient'.

While its theoretical implications and usefulness are challenged within the social sciences, resilience is broadly valued as a framework for studying the management of socio-ecological system dynamics (Anderies, Walker, Kinzig, 2006; Duit, Galaz, Eckerberg, Ebbesson, 2010; Walker et al., 2004). There are two overarching understandings of resilience in ecology research: (a) the amount of disturbance that an ecosystem can withstand without changing self-organised processes and structures; and (b) the return time to a (new) stable state following a perturbation (Morecroft, Crick, Duffield, Macgregor, 2012: p.547). Not too much of this can actually be translated into social sciences. For one, we cannot define an equilibrium state of a society. Furthermore, there are merely appropriations for the maximum possible change a social system can undergo, and its ease of changing. Thresholds and cross-scale interactions can be computed, but again, those do not provide the definition that we can find in research on ecological systems' dynamics.

The literature that seeks to combine social and ecological systems' thinking describe 'resilience' as "the capacity of a system to absorb disturbance and reorganize while

undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004). Four main aspects of resilience are named in this context: (1) *Latitude*, the system’s maximum possible change; (2) *Resistance*, the ease or difficulty of changing; (3) *Precariousness*, the closeness of the system to a limit or threshold; and (4) *Panarchy*, the cross-scale interactions, where different states of the system’s development influence each other and where cross-scale dynamics from above and below can be noticed. These four aspects are viewed as part of an ‘adaptive cycle’ (Walker, Gunderson, Kinzig, et al., 2006: p.13; Brand & Jax, 2007: p. 23; Berkes & Ross, 2012: p.6), often with regard to a system’s ability to return to an equilibrium state, which is called ‘engineering resilience’ (Brand & Jax, 2007, p. 23; De Goede, Gremmen, Blom-Zandstra, 2013: p. 3). Other definitions of the social-ecological systems’ literature branch omit the assumption of an equilibrium state and focus on the dynamics of change instead, as well as the amount of disturbance a system can absorb before assuming a (potentially new) stable state (Brand & Jax, 2007).

In the social science domain, Resilience can be described along the lines of four defining characteristics (according to Walker, Abel, O’Connell, and Grigg, 2016, p. 5):

- 1) The amount of change the system can undergo and still retain the same functions and structure – in other words, its ability to remain within the same stability domain, or ‘regime’;
- 2) The degree to which the system is capable of self-organization;
- 3) The ability to build and increase the capacity for learning and adaptation;
- 4) The capacity to transform part or all of the system into a different kind of system when the existing one is in an irreversibly undesirable state, or on a trajectory towards such a state.

When compared with the initial resilience concept, this version no longer includes the idea of *Panarchy* and couples the aspects *Precariousness* and *Resistance*. Additional components include the capacity to self-organize and a new focus on learning and adaptation. In summary, resilience can mean something different depending on the research field. The goal is to still retain essential system functions, and while

assumptions of how individuals and aggregate bodies get there differ, the concepts common assumption is the capacity to overcome stress and vulnerability by means of adaptation. The next subsection introduces adaptive governance as a social science framing of structures that promote adaptive reactions.

### **3.2 Adaptive Governance Characteristics and their Implementation**

Adaptive governance has been introduced as an overarching concept for achieving a higher degree of adaptation and, in general, the ability to deal with shocks (Adger et al., 2009). As a concept with more flexible decision-making arrangements (Folke et al., 2010), adaptive governance can be regionally and locally specific (Iglesias, Garrote, Quiroga, & Moneo, 2008). Adaptive governance arrangements work within contexts of change and uncertainty, instead of an organizational focus on systems' control (Folke et al., 2005). Ideally, adaptive governance allows for an interaction across multiple scales (Folke et al., 2005: p.442). It is often advocated to combine top-down and bottom-up approaches for decision-making at all levels (Pahl-Wostl, 2006; Andersson & Ostrom, 2008; Urwin & Jordan, 2008). Nested, polycentric structures are considered favorable in such decision-making contexts, as they potentially facilitate mechanisms of self-correction in the interaction of different actors (Andersson & Ostrom, 2008; Aligica & Tarko, 2012). In polycentric governance arrangements, policy scales intersect, stakeholders from higher policy levels are present at others and governance modes are participatory and interactive (Aligica & Tarko, 2012; Ostrom & Ostrom, 2014).

Typically, polycentricity describes multiple decision-making centers with regard to one single system of rules, whereby spontaneous arrangements result in different implementation specifics (Aligica & Tarko, 2012). Hoogh and Marks describe this type of multi-level governance as type II governance, that is task-specific has intersecting memberships, no limits to the number of jurisdictional levels and a flexible design (2003: p.236); Type I governance on the other hand addresses general purpose jurisdictions at a limited number of levels, has non-intersecting memberships and a systemwide architecture (Hoogh & Marks, 2003: p.236). The result of such participatory policy interactions across and between different levels are *communities of practice* that codify learning processes in “shared practices, tools, concepts, symbols, or material artefacts embedded in a context of meaning” (Pahl-Wostl, 2006: p.12). Such

flexible interaction mechanisms can introduce location-specific, group-specific and time-specific coping pathways and structures within a potentially vulnerable environment (Folke, 2006; Smit & Pilifosova, 2003). Claudia Pahl-Wostl conceptualizes this as a feature of an overall paradigm-shift towards increased adaptive capacity in resource management, which she describes as learning to manage by managing to learn (Pahl-Wostl, 2007: p.49).

Capacity concerns the ability of stakeholders to participate and act in processes and subsequent implementation. Adaptive co-management builds on this ‘learning by doing’-attitude, whereby several actors are involved in an iterative examination of and active involvement with input, output, institutional context and normative implications of specific governance contexts (Pahl-Wostl, 2007; Folke et al., 2005). Implicitly, adaptive co-management assumes a high capacity to evolve and adapt with and within systems and systematic changes. In order to adapt, individuals have to understand a changing surrounding and be capable to perform effective reactions to it; they need to show a high capacity to adapt and react to changes within their specific contexts, times and places. As a precondition to such a high capacity to adapt, farmers need to: (1) Understand the ecosystem dynamics that shall be addressed; (2) Develop management practices with regard to that system and interpret results of changes to it; (3) Build capacity in order to deal with uncertainty and surprises in current and future constellations, as well as (4) Include understanding of social processes, leadership, agents, networks, institutions and organizations that span the frame for future development, which is potentially innovative and flexible (Folke, 2006). In this context, adaptive co-management can be seen as an exchange between the more abstract governance system and the individual reaction within and to that system’s context variables.

#### **4. Exploring Adaptive Structures in Context: From Theory to Practice**

This subsection illustrates structures that regulate CAP implementation in the East Midlands. In 2008, an Adaptation Sub-Committee of the Committee on Climate Change was established to advise the government. This committee produced a national risk assessment and vested power in the Government to require public bodies to produce

adaptation plans (European Union Committee of the House of Lords, 2010: p.6). The Department for Environment, Food and Rural Affairs (Defra) coordinated a cross-Government *Adapting to Climate Change Programme*. Under the Defra's framing, agricultural adaptation is jointly managed by Defra, Natural England, the Environmental Agency and the Forestry Commission. National Rural Networks were a new form of intervention in the 2007-2013 CAP, funded by the EAFRD (Marquard, 2011). They are regarded as technical assistance and expected to improve governance and the effectiveness of Rural Development Programmes (RDPs) (Marquard, 2011). Rural Networks and Local Action Groups, institutionalized under pillar II, are an example of decentralized engagement and capacity building in a network. National governmental agencies like Natural England, The Forestry Commission, and the Environmental Agency that jointly manage CAP implementation under the Department for Environment Food & Rural Affairs' framing, are engaged in networking structures, seeking to promote knowledge exchange and providing for leadership in participatory settings (European Union Committee of the House of Lords, 2010). At national level, the RDPE network has been established to assist with the spread of good practice and networking beyond the region, as required by Rural Development Regulation (RDPE, 2009: p.5).

The 2007-2013 Rural Development Programme for England (RDPE) included a horizontal network of farmers, regional and national authorities (RDPE, 2010). The Regional Implementation Programme (RIP) was discussed in different meeting constellations in the context of the East Midlands Rural Affairs Forum, engaging a broad range of actors that had to arrive at a consensus on measures to be implemented in the region (RDPE, 2010).

The East Midlands Rural Affairs Forum (EMRAF) was launched in 2002 and is part of the 2000 initiative to link Ministers and rural areas to 'rural proof all domestic policies', which followed the publication of a Rural White Paper that underscored such a need (Atterton 2008). As a network of 86 organizations from the public, private and voluntary sector, the EMRAF is a forum for sharing information, disseminated in several formats: an Independent Chair, who meets the Minister for rural affairs, an Operations Group oversees and coordinates the Forum's activities, while delivery of

objectives is facilitated by the Regional Director of Rural Community Action East Midlands (EMRAF, 2010), whose activities are separated into four subgroups (Quality Services Accessible to All, A Thriving Rural Economy, Sustainable & Inclusive Communities Incorporating Housing and A High Quality Environment).

#### **4.1 East Midlands Climate Effects, Information and Knowledge**

Farmers in the East Midlands have to deal with coastal and river flooding as well as increased precipitation both today and in the future (RDPE, 2010). According to *UK Climate Projections*' 2009 data for the East Midlands, the region may see a 14% increase in winter mean precipitation by 2050, accompanied by an increase in more intense rainfall events (UK Climate Projections, 2014). Targeted information on agriculture and climate change in the East Midlands from 2007-2013 is – to a large extent – provided online (cf. [www.climate-em.org.uk](http://www.climate-em.org.uk)). For example, the Project 'East Midlands Adaptation Resource' addresses questions on why adaptation is important, aiming to prepare online users to develop abilities to adapt. The site lists climate impacts and highlight different response options. The project also shows links to both local authority adaptation plans and the National Adaptation Programme (Defra, 2013). The question here is however, how many farmers actively seek out such information channels. A more straightforward way to receive feedback on farming measures and performance are monitoring reports. Performance is monitored at regional level by the Programme Management Group (PMG) and at the national level by a Delivery Liaison Group for each delivery partner, such as Natural England, Forestry Commission, and Regional Development Agencies (RDPE, 2010: p.29). The PMG provides delivery partners with the opportunity to discuss progress and performance, share information and ideas (RDPE, 2010, p.40). This increases the visibility of activities and their effectiveness relative to delivery goals. EMRAF monitors and communicates the delivery of the Rural Framework through its annual reports (EMRAF, 2010: p.29). The governance and development of RDPE is overseen by a RDPE Monitoring Committee at the national level, additionally, data on mid-term and ex-post evaluation of the programme is given with the Common Monitoring and Evaluation Framework (RDPE, 2009a). Relevant measures on rural development planning are communicated and experiences shared in various monitoring and evaluation instances. 'Efficacy' is discussed as a product of personal development through learning in political

participation processes as well as a by-product of satisfaction from ‘making a contribution and influencing change’ (EMRAF, 2010: p.28).

Access to information is one of the first steps in the process of capacity building with regard to adaptation. Communication that stresses the negative implications of climate change, and the important role that individuals play in this context, has a positive effect on behavioral change intentions (Kachi, Bernauer, Gampfer, 2015; Bain, Hornsey, Bongiorno, Jeffries, 2012). In this context, information elicitation refers to the process of providing occasions and incentives for stakeholders to provide and receive information. Examples of elicitation methods are interviews, questionnaires or agenda points with lead questions (Newig, Adzersen, Challies, Fritsch, Jager, 2013). Another information channel is the Farm Advisory Service (FAS). It is set up to provide farmers with information on climate change risks and adaptation (Cf. Art: 20(a) v, EAFRD Council Regulation (EC) No 1290/2005; Council Regulation (EC) 1782/2003, Art. 13). According to the Central Science Laboratory’s Agricultural Development and Advisory Service (ADAS), farmers could adapt more effectively if a well-targeted support through Farm Advisory Services was provided (ADAS, 2009). This suggests that farmers missed their chance to get information on climate change effects and adaptation.

## **4.2 CAP Implementation and Perception of Regional-level Implementation (2007-2013)**

Quantitative text analysis is a promising method to systematically extract political information from texts (Klüver, 2015). Most analytical methods of text as data assume that ideology dominates the language that political actors use in their documents, which is relative frequency of words can be used to inquire about positions that actors hold (Klüver, 2015: p.457). This explorative case study is supported by a computer-based text analysis. This includes N-grams searches, collocate analysis as well as classic key word in context search and concordance analysis. N-grams, a scan of the corpus for ‘N’ length clusters and thus common expressions in a corpus, approximate the probability of a word given all the previous words, and can be ordered by the probability of the first word in a cluster or frequency, start or end of the word (Jurafsky & Martin, 2016). For



N-grams, the following sections list rank, frequency and relative probability of words' occurrence in our corpus to point to common expressions. I also look at collocates of search terms, ordered by the value of T, which takes into account mainly (in some cases only) the absolute frequency of joint occurrence of node and collocate (Stubbs, 1995: p.1)<sup>6</sup>. 'Mutual Information' (MI) of collocates measures the "relative frequency with which words occur in collocation and independently" (Stubbs, 1995: p.9). MI is thus a measure for information shared by collocate and node. The corpus encompasses a total of 77 publications, dating from 28<sup>th</sup> October 2009 to 07.April 2011, including protocols, development planning drafts, presentations and policy briefs on the East Midland's Regional Implementation Programme of the Common Agricultural Policy's pillar II (RDPE, 2010), published with the East Midlands Rural Affairs Forum's documents at ruralaffairs.org.uk.

Starting with a very general evaluation of adaptation and its perception amongst stakeholders, rank 1-15 in the MI analysis of collocates (in that order) for the search term 'adaptation' are 'underpins', '\*pment', 'humankind', 'everything', 'against\*', 'mitigation', 'implementing', 'adopting', 'mitigate', 'addressing', 'actively', 'practices', 'collectively', 'related', and 'resilience'. The association between collocate and nodes is process-oriented, describing adaptation as a development against climate change with the aim of becoming resilient, and, interestingly, a reference to humankind and collective goals. The T-score results for the search term 'adaptation' underscores this. Adaptation seems to be an abstract reference point rather than something that can be associated with specific and concrete response mechanisms.

Decisions on agricultural planning in the East Midlands were taken in cooperation between national and regional actors as well as networks and groups, for example Local Action Groups and Rural Farming Networks in the East Midlands. The East Midlands Regional Implementation Programme (RIP) draft states that there is 'a strong level of stakeholder engagement and agreement' (RDPE, 2009: p.5). Furthermore, the programme draft notes that 'There is a strong desire in the region to achieve as much

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<sup>6</sup> The main factor in the value of T is simply the absolute frequency of joint occurrences. The T-value picks out cases where there are many joint occurrences, and therefore provides confidence that the association between n and c is genuine. The statistic  $f(n,c)$  undergoes the minor arithmetic transformation to its square root (Stubbs, 1995, p. 11).

synergy as possible both across the axes of the RDPE and between the RDPE and other relevant activities and funding streams at regional and sub-regional level' (RDPE, 2009: p.32). In this 'desire', the RDPE network is a 'valuable communication route at national level and beyond' (RDPE, 2009: p.32). The RDPE is 'targeted at specific rural needs and opportunities' (RDPE, 2010: p.3) and exploits pathways to link those transnationally and nationally (RDPE, 2010: p.39). When looking at linguistic structures that communicate those objectives, 'responsibility' occurs frequently in the context of the term 'east midlands' (Rank 2, Freq. 668, Prob. 0.958), 'the region' (Rank 12, Freq. 192, Prob. 0.037), 'em rip' (Rank 13, Freq. 170, Prob. 0.590), 'leader approach' (Rank 18, Freq. 134, Prob. 0.470). This underscores the relevance of regional decision-making bodies, while terms pointing to national agencies 'natural england' (Rank 14, Freq. 165, Prob. 0.623), 'uk rdpe' (Rank 32, Freq. 111, Prob. 0.252), 'forestry commission' (Rank 39, Freq. 95, Prob. 0.319) are less prominent. The terms 'the european' (Rank 80, Freq. 59, Prob. 0.011) and 'the uk' (Rank 83, Freq. 59, Prob. 0.0119) as well as 'agri environment' (Rank 85, Freq. 56, Prob. 0.8629) further underscore the importance that regional responsibility has in the development of CAP pillar II objectives.

The positive impact of networks on adaptation has been pointed out in a number of studies concerning reactions to climate change (e.g. Bulkeley, 2005; Folke, 2006; Pahl-Wostl, 2006). Participation in networks strengthens the position of non-state actors in decision-making processes (Juhola & Westerhoff, 2011). As a complement to formal institutions, networks can contribute to effective governance and help solve 'wicked problems' (Börzel, 1998). Decisions can be achieved in cooperative arrangements which foster commitment, knowledge diffusion and trust (Bogason & Musso, 2006). An N-grams search on 'networks' shows a process and effect orientation, as the word most frequently occurs with verbs such as 'able' (Rank 2 & 3, Freq. 26, Prob. 1.00), 'abolish' (Rank 4, Freq. 1, Prob. 1.00), 'accelerate' (Rank 5 & 6, Freq. 2, Prob. 1.00), 'acceptable' as well as 'accepted' and 'accepting'. Furthermore, 'networks' is mentioned in association with different inflections of 'adapt' (Rank 36-40), underpinning our assumption of transformation via network participation and exchange. For the search term 'network', 'rdpe' is the most relevant collocate (Freq. 104, T 10.09). Other important collocates are 'national' (Freq. 36, T 5.93), 'em' (Freq. 29, T 5.30),

‘uk’ (Freq. 21, T 4.43), and ‘rural’ (Freq. 20, T 4.16). Interestingly, network is thus first associated with a specific regional body, followed by a reference to the ‘national’, ‘regional’ as well as ‘uk’ level, until finally mentioning the ‘rural’ dimension in publications on rural development. This demonstrates a high level of concern for links to other decision-making arenas, and a focus on lower scales.

Anything that can open up opportunities for learning, for example an exchange on regional and local best-practice examples of adaptation, can possibly lead to a transformation of habits (Folke et al., 2010; Dobson, 2009). The search term ‘cooperation’ occurs 23 times in the corpus, mostly in context of cooperation across policy context and programmes (RDPE, 2009: p.38) funding (RDPE, 2010: p.38) and the LEADER programme (Frost, 2009: p.3). Rural proofing is strengthened by Local Area Agreements (EMRAF, 2010, p.13). Increased engagement and participation in community and democratic processes is part of the EMRAF subgroup ‘A High Quality Agreement’ which has been evaluated with the findings that engagement had led to services that were more responsive to the needs of users (89 percent), more informed decisions (86 percent); more accessible services (81 percent), higher quality services (79 percent), more ‘joined up’ services (76 percent), better value for Council Tax payers (59 percent) (EMRAF, 2010, p.28). The term ‘best practice’ is mentioned 25 times in the corpus, mostly in context of networking, partnerships and knowledge exchange to increase the efficiency of measures. Best practice examples from regional participation in the East Midlands are mainstreamed in the European Regional Development Fund (ERDF) Competitiveness Programme (RDPE, 2010: p.35). The EMRAF specifically calls for the dissemination of written case studies to ‘illustrate the value of the environment in planning and the development of sustainable communities’ in the context of their subgroup ‘A High Quality Environment’ (EMRAF, 2010: p.23).

## **5. Final Comments**

Farmers’ adaptive capacity is assumed to depend on the flexibility of cropping system and the willingness of society to intervene through policy (Berry et al., 2009). Most modelling efforts that seek to project climate change impacts and adaptation effects assume a ‘business as usual approach’, which is sometimes “more harshly referred to as

the ‘dumb farmers’ approach” (Crane, Roncoli, Hoogenboom, 2011: p.179). In these models, farmers as proactive, innovative actors are mostly absent (ibid.); such modelling assumptions would however be valuable as complements to the theoretical literature on adaptive governance, as this presents some empirics that shed light on the validity of the normative assumptions that come with the concept. Surveys show contradictory results on farmers’ adaptation. While some find that farmers do not adapt to climate change (Arbuckle et al., 2015; Burke & Emerick, 2016), others find that farmers are currently adapting to climate change, while the “policies supporting higher resilience of farming sector to climate change are either missing or in preparation” (Olesen, Trnka, Kersebaum et al., 2011: p.108). Other researchers have shown that adaptive management strategies often fail to be successfully implemented and bring about the envisaged changes, because existing governance structures hinder their execution (Walker, Holling, Carpenter, Kinzig, 2004). The current status quo of adaptation to climate change in the agricultural sector is thus a question that is open to a broad debate, both in qualitative as well as quantitative research projects.

Most qualitative work posits that structurally empowering dynamic decision-making fosters reactive adaptation, as has been discussed here (Adger et al., 2009; Folke et al., 2010; Folke et al., 2005). Considering the uncertainty that comes with projections of future climate change and climate variability, structures that stimulate dynamic learning are considered as the most appealing approach to promoting adaptation in the agricultural sector without knowing the exact effects of those changes (Crane, Roncoli, Hoogenboom, 2011). This can be linked back to adaptive governance, co-management and resilience concepts that all start from flexible, dynamic structures (Walker et al., 2016; Walker et al., 2004; Folke et al., 2005; Folke 2006; Folke et al., 2010).

Following the notion of adaptive governance, changes in agricultural decision-making and farm management in accordance with and reaction to climate change are determined by the chances of and incentives for different agricultural stakeholders to become involved politically and/or interpret the regulation according to their needs. A major drawback could be that without an obligation to become involved in agricultural decision-making on adaptation, this only works for those farmers who are interested in this issue to begin with. The analysis of CAP structures shows that there are a number of measures that can have an adaptation effect on crop-systems. Furthermore, some

flexible regulatory structures have been implemented over the past reform periods. This gradual layering of reforms proved durable and resilient (Daugbjerg & Swinbank, 2015). The analysis of regional implementation and documents on the East Midlands shows features that speak in favour of an agricultural community that participates, cooperates, innovates and is willing to learn to adapt. The extent of this adaptation as well as its long-term effects is however not covered here and need further, empirically grounded investigation.

In their decision to adapt to climate change, farmers face a ‘stability-flexibility dilemma’ (Duit et al., 2010: p.366): They ought to aim at a flexibility to meet an uncertain future, which might temporarily cost them part of their profit and takes time away from farming activities. At the same time, they still need to make a living. Objective limits to adaptation action – such as a lack of financial resources, information, time, entitlements or social and institutional support (Grothmann & Patt, 2005) – put pressure on farmers’ reactions to climate change (Adger et al., 2009). This might lead to asymmetric involvement of farmers into decision making, favouring those with a high objective adaptation capacity to be represented in collaborative governance efforts, while others cannot contribute or are not included (Brower, 2016). This in turn hardly ever benefits the environment (Brower, 2016), and certainly won’t help to increase farmers’ adaptive capacity or agricultural adaptation and resilience. Although networks are important for collaborative and participatory governance, they potentially exclude disorganized groups of people, leading to disempowerment instead of democratization (Brower, 2016). Subsequently, a strong focus on network participation can strengthen the work within and across networks, but might prevent others from access and contribution to participatory decision-making processes. This might concern smaller farm-holders and result in an underrepresentation of the concerns those hold.

The new Green Payment is certainly a means to shift cropping practices and raise awareness for environmental-agricultural-climate measures. The focus of these payments as part of direct payment schemes is on bigger, efficient and less environmental friendly holdings. That might contribute to a concentration on intensive farming, which is not exactly the most flexible way to farm. Gerry Alons (2017: p.15) finds that while environmental actors have enhanced access to the policy-making process, their impact on these processes did not significantly increase, which “explains

why dissatisfying effectiveness of environmental measures has not instigated more far-reaching policy adaptations”.

This study presented policy structures that can contribute to adaptive agricultural planning. It also shed some light on the way qualitative literature on agricultural adaptation approaches the complex issue of adapting to climate change and climate variability. The question how public policy can help a vulnerable sector to adapt can cautiously be answered with: by increasing farmers’ ability to learn and changes to participate in agricultural management and planning, and by finding synergies between farm-level support via direct payment and incentives that also benefit environmental friendly production. Concerning the concepts discussed here, it seems that adaptive governance structures can be but one condition in the multifactorial decision to adapt and become resilient, but they are certainly a valuable stepping stone on the path to resilient agricultural systems.

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## Paper 2

### **You Reap What You Sow? (Dis-)Incentives for Adaptation to Climate Change**

Climate-friendly behaviour change is commonly incentivized financially. For example, the latest European Union's Common Agricultural Policy reform period subsidizes a climate friendly production by adding Greening Measures to its Direct Payment scheme. However, financial incentives do not seem to promote behaviour change in farmers. This study uses a survey experiment to test framing effects on German farmers' adaptation intentions. Contrary to the assumption of profit maximizing individuals, economic incentives trigger less overall change intentions. Economic rewards act on risk perception, but are less likely to trigger coping perception, while other treatments do so. As coping perception is one of two socio-cognitive reactions to climate change, it seems that current incentive structures fail to act on half the factors leading to adaptation intentions. These effects dependent on subgroups, farm structures, and climate experience. This suggests that a) subsidies alone are not enough to promote adaptation, and b) there is no 'one-size-fits-all'-incentive for behaviour change, but a set of linked options to trigger change intentions.

*Keywords: Climate Change Adaptation, Framing, Socio-Cognitive Model, Survey Experiment, Protection Motivation Theory*

#### **1. Introduction**

Climate change is an inevitable reality, resulting in substantially altered conditions (Burke & Emerick 2016). As a means to cope, adaptation, defined as a conscious reaction to actual or expected changes, gains importance (Adger, Dessai, Goulden et al. 2009; Berrang-Ford, Ford, Paterson 2011; Grothmann & Patt 2005). Agricultural production and planning is dependent on weather conditions. Negative impacts of climate change on agricultural productivity, prices and farmers' income are noticeable, and said to increase in the near future (Burke & Emerick 2016; Olesen & Bindi 2002). While a rational actor model would lead us to think that this comes as an incentive to adapt in order to avoid losses, most farmers' adaptation is limited, as has been shown in recent evaluations of U.S. farmers, along with the projected and current substantial

losses and decreased productivity in the sector (Arbuckle, Morton, Hobbs 2015; Burke & Emerick 2016). Successful adaptation is as much a product of individual willingness to adapt as it is the result of a choice architecture that encourages adaptive behavior (Sunstein & Reisch 2014). Effective policy interventions align privately profitable actions with socially desirable outcomes (Thompkins, Adger, Boyd et al. 2010; Yohe & Tol 2002). The latest reform to the European Union's Common Agricultural Policy (CAP) incentivizes adaptation via the green payment (EC 2014), and is thus a step into a more pronounced incentive structure for climate adaptation in the agricultural sector. As many other policies, it encourages changes in farming routines with subsidies. But does this resonate with cognitive structures that lead to implementation of the proposed policy measures?

This study applies Protection Motivation Theory (PMT) to a survey experiment to better understand a) how individuals decide to adapt and b) which incentives promote behavior change intentions. It contributes to an empirical understanding of the measurable and alterable psychological conditions of individual-level behavior change and provides causal explanations for their relevance.

A number of studies encourage the employment PMT to understand why people change their behavior with regard to climate change issues (Grothmann and Patt 2005; Stewart 2009; Osberghaus, Finkel, Pohl 2010; Cismaru, Cismaru, Ono et al. 2011; Koerth, Vafeidis, Hinkel et al. 2013). Rogers (1983) argued in his first publication on PMT that individuals show two defining socio-cognitive reactions when faced with an exterior risk, namely risk perception and coping perception. Grothmann and Patt (2005) add to PMT by further compartmentalizing and diversifying the two main socio-cognitive processes in a social setting. Incentives are included in Grothmann and Patt's model application (2005) as enablers, which neither specifies how incentives act on human perception nor accounts for heterogeneous effects that incentives may have. This insight, however is crucial to our understanding of the effect of regulation on behavior change intentions.

To find out which incentives and framing have an effect on farmers intention to adapt, four framings of adaptation are introduced: (1) Economic instruments, pointing to rewards and punishments; (2) Social norms and community-building, underscoring a



broader social acceptance of climate friendly behavior; (3) Information on the severity of a climate change event and implications for future generations, also mentioning the farmers' role in shaping future effects of climate change; and (4) Technological investments and economic benefits from innovation, implicitly saying that technology combats climate change challenges. Economic incentives (1) are modelled as a control group, which builds on the fact that most (environmental) policies work with a punishment and reward system to promote behavior change (Dobson 2009).

The paper is organized as follows. Section 2 gives an introduction to agricultural adaptation to climate change in the European Union. Section 3 presents the frames tested here and the theories they build on, all of which specify reasons why individuals change their behavior. Protection Motivation theory and the Model of Private Proactive Adaptation (Grothmann & Patt 2005) as well as the methodological approach to framing experimentation is described in section 4. An overview of the data and the effect that frames have on risk and coping perception are presented in section 5, and discussed in section 6.

## **2. Relevance of Financial Incentives for EU Adaptation**

The European Union's Common Agricultural Policy (CAP) operates under one of the Unions largest budgets. Most of that accounts for direct payments. The German distribution of CAP expenditure in 2014 amounts to about 87% of the overall payments (EU Commission 2016). It makes sense to think of direct payments as a relatively stable source of income, as about 28% of the EU average agricultural factor income in 2011-2015 are attributed to direct payments. Considering the sum of agricultural subsidies, 32% of the average EU agricultural income goes back to public support (EU Commission 2017).

CAP subsidies are tied to conditions, specified in cross-compliance standards for direct payments and to climate-agri-environmental activities within the rural development measures (pillar II of the CAP). The newly implemented 'green direct payments' of the 2014-2020 CAP reform account for 30% of direct aid to farmers. Another 30% of rural development payments must account for environmental/climate measures. Before 2014,

adaptation to climate change was implicit in cross-compliance standards and climate-agri-environmental measures. The Greening measure makes the connection between production and climate change more visible. Greening measures are: 1) Maintenance of permanent grassland at the farm level, 2) crop diversification, ecological focus areas of 7% of arable area.

First implementation of Greening measures in 2015 has come with significant variation across Member States (Hart, Baldock, Buckwell 2016), with farming organizations focusing more on ‚simplification‘ instead of environmental benefits (ibid). Farmers’ attitudes toward the policy are however a crucial factor for their overall effect. Since the policy does not differentiate between climate protection/mitigation and climate adaptation, Member states have more leeway in their interpretation of the policy – and also more responsibility for implementation (Röder, Osterburg, Kätsch 2013). Westhoek et al. (2012) come to the conclusion that individual farmers have a large degree of freedom in implementing the requirement of the ecological focus areas. They find several loopholes for the actual implementation, “such as renting marginal land nearby or even further away, which could render the whole measure almost ineffective” (Westhoek, van Zeijts, Witmer et al. 2012:3). Furthermore, most farmers already grow more than three crops (ibid.), which makes CAP specifications on crop-diversification almost redundant. The report on Greening also considers the added value of permanent grassland to be limited (Westhoek et al. 2012:4).

### **3. Don’t Go Changing? Incentives for Adaptive Behavior**

Values motivate pro-environmental orientation and behavior (Corner, Markowitz, Pidgeon 2014; Engqvist Jonsson & Nilsson 2014). Subsequently, regulatory incentives that are designed to promote adaptation intention need to act on beliefs, values and preferences that farmers hold. It is assumed that the subjective factors leading to an individual intention to adapt are shaped by individual risk perception and capabilities to act on climate change, as explained in section 2. To inquire how adaptation intention and action can be motivated and which conditioning factors present a challenge to farmers’ adaptation intentions, four frames are tested here, drawing on four motivations

for behavior change that have been tested elsewhere. These are financial matters, societal acceptance, risk information, and access to technology<sup>7</sup>.

The effect of financial incentives on farmers' adaptation risk perception and coping perception is analyzed here as a baseline scenario (Frame 1). The reason for this is that the Common Agricultural Policy, the main policy shaping German farmers' production, relies on subsidies to incentivize behavioral changes. Rewards and penalties are thus their status quo. Financial incentives or penalties encourage people to behave environmentally or climate friendly, as they try to avoid losses (Stern 2006; Dobson 2009; Steg & Vlek 2009). Such incentives are based on a rational-actor-model. Two observations make financial incentives less appealing. For one, financial penalties become less efficient as people usually try to work around them (Dobson 2009). Furthermore, financial rewards reduce the intrinsic motivation to act as individuals expect rewards for their behavior (Ariely 2009), decreasing the probability of voluntary behavior change.

Frame 2 is designed to capture an individual's need to be seen as moral in the sense that she contributes to the sustainable development of society. Societal norms are important for a broader acceptance of climate adaptation (Sunstein & Reisch 2014). This is because humans are deeply concerned with being seen as interpersonally warm, competent and moral (Bain, Hornsey, Bongiorno, Jeffries 2012). Some people select green options that imply their idealized self-conceptions in accordance with what they want to signal to others (so-called *expressive considerations*, Sunstein & Reisch 2014). In a study on climate friendly behavior in climate change deniers, Bain et al. (2012, p. 3) find that a framing of climate change actions "in terms of producing greater interpersonal warmth or societal development was [...] effective in promoting environmental citizenship [...], and this was particularly the case for deniers".

Frame 3 is basically a risk communication frame, pointing to the negative effects of climate change in terms of production losses, and subsequent effects on future generations and the growing population. This builds on findings concerning the norm-activation-model (NAM; Schwartz 1977) as well as the value-belief-norm theory of

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<sup>7</sup> This survey was distributed in German. Please find the original wording of the scenarios in the Appendix.

environmentalism (VBN theory; Stern 2000), which both have successfully explained behavioral change intentions in other research designs (Steg & Vlek 2009). Portraying climate change as a risk to societal development enhance the probability of adaptive action as people care about a society with strong societal development and minimal dysfunction (Bain et al. 2012, p. 1). Supporting this, Kachi et al (2015) found that individuals who worry about the risks of climate change are more supportive of climate policies. Risk communication alone does not necessarily result in adaptive action. However, framing risks in a way that implies the (social) effects of (in)action, specifically how adaptation promotes scientific and economic progress, increases the likelihood of change (Bain et al., 2012, p. 3). In an experiment of communicating climate risks, Bolsen et al. (2014) find that an emphasis on both „individual responsibility *and* collective environmental benefits can stimulate collective action“ (Bolsen et al. 2014, p. 24).

Frame 4 portrays the benefits of technological innovation. Technology plays a crucial part in a society's ability to adapt (e.g. Boeckmann & Zeeb 2014; Adger 2009; Patt 2015). In the farming sector, technological advancement has always played a role, for example in the form of new machinery that allows for larger production output. Innovative technology implies behavioral change, as users of such technologies need to understand, buy and use them (Steg & Vlek 2009). A high amount of trust in technology ought to find societal support and acceptance, which is why including the human dimension improves the fit of the human-technology-environment (Pahl-Wostl 2002; Pahl-Wostl 2006). The implications for PMT might however be that farmers become inactive as they wait for a technological fix.

## **4. Model & Method**

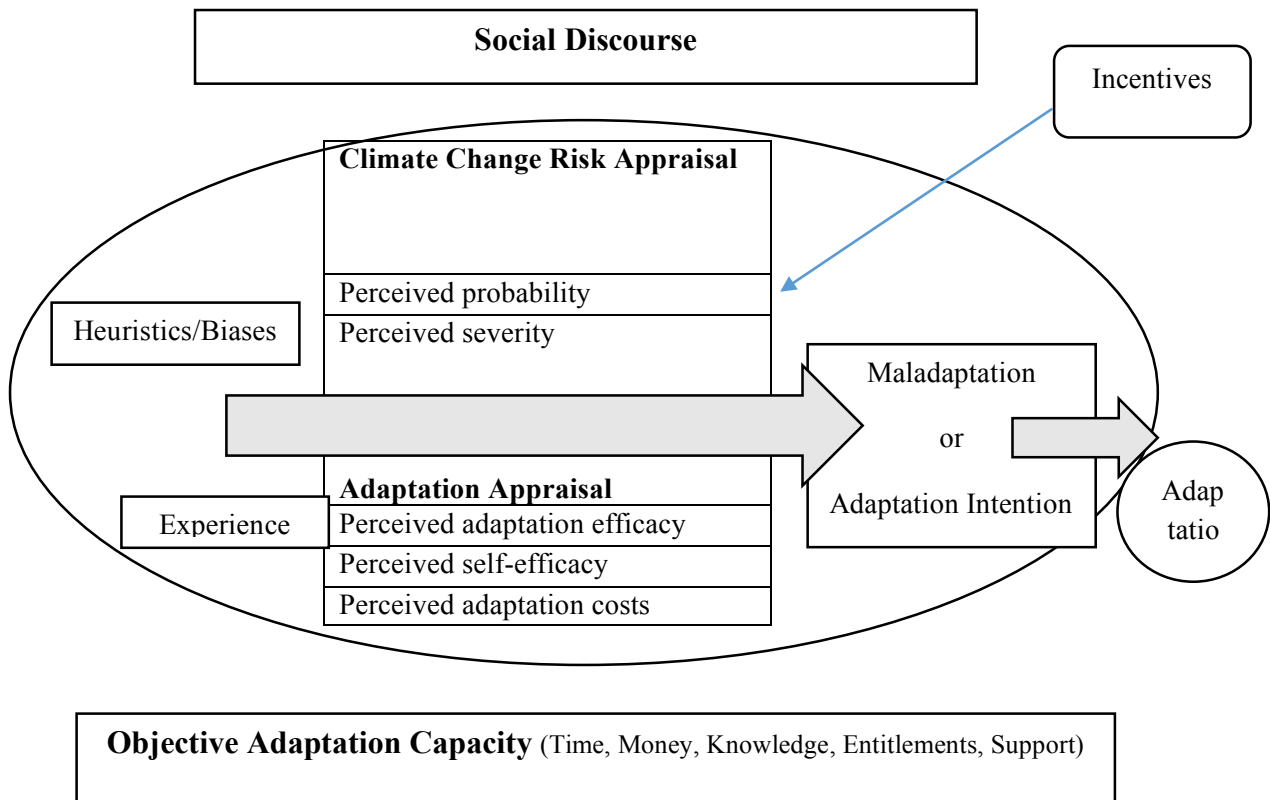
### **4.1 The Socio-Cognitive Logic of Adaptation Intentions**

Psychological factors have considerable influence on adaptation behavior (e.g. Burke & Emerick 2016; Arbuckle 2015; Grothmann & Patt 2005). PMT gives insight into factors that explain risk and coping behavior, and is therefore helpful for the development of communication instruments that are targeted at reactions to exterior shocks and changes in our environment (Koerth et al. 2013; Floyd et al. 2000). Focusing on the role of

perception for adaptation intentions, Grothmann and Patt (2005) build on PMT to develop a process model of private proactive adaptation to climate change (MPPACC). The authors assume that an individual shows two cognitive reactions when faced with a potential threat: risk perception and perceived adaptive capacity (Grothmann & Patt 2005, p. 202). According to the model, individuals are more likely to engage in adaptive action if they (a) perceive themselves to be capable of performing a relevant action and (b) think that this specific activity has an effect (Grothmann & Patt 2005; Yohe & Tol 2002).

A positive evaluation of self-efficacy and risk perception alone does not necessarily translate to adaptation (Berrang-Ford, Ford, Paterson 2011). Grothmann and Patt account for this by adding three external factors to their model, all of which act on an individual's socio-cognitive perception of risks and/or coping capacities: (1) Social discourse, (2) Adaptation incentives, and (3) Objective adaptive capacity, such as money, power, knowledge, entitlements, as well as social and institutional support (Grothmann & Patt 2005, p. 204). The latter is supposed to enable or impede the step from adaptation intention to adaptation action. Adaptation action is thus realized relative to the strength with which exterior factors impact on an individual's evaluation of adaptation intentions; they act as mediators to our own cognitive response to real world threats. But *how* do those three act on one's risk and coping appraisal? This research makes these links more specific by placing the MPPACC's assumptions in an experimental setting to test the relevance that incentives have on an individual's adaptation intention (cf. Figure 1).

Figure 1: PMT Adaptation Action Model and the Relevance of Incentives



Simplified and changed depiction of MPPACC, building on Grothmann & Patt (2005: 204). Highlight is on the role of incentives rather than the mere reaction to exterior risks. Arrows depict the cognitive process of decision-making. Everything within the larger circle is part of individual cognition.

## 4.2 Framing Experiments

Framing is considered „an unavoidable reality of the [science] communication process” (Bolsen et al. 2014, p. 2; Nisbet & Scheufele 2009, p. 1771) as mental pictures, e.g. frames, shape the way we see the world (Lakoff 2001). One can go so far and say that all information is (intentionally or unintentionally) framed by the context within which it is presented (Lakoff 2004). It can thus be assumed that (policy) incentives can be thought of as different – and competing – frames. A prototypical definition of framing effects points to a communication that „changes a person’s attitude toward an object (e.g., policy) by increasing the weight given to a subset of relevant considerations“ (Bolsen et al. 2014, p. 2).

Framing is criticized as being an ambiguous format for inquiries on public opinion (Iyengar 2010). Firstly, because individuals are hardly ever exposed to only one frame as is commonly assumed in framing literature (Bolsen et al. 2014). Secondly, because framing often cannot be distinguished from priming or persuasion (Iyengar 2010).

Finally, because the underlying considerations differ, not only in perspectives but also with regard to „multiple and hidden confounding variables“ (Bolsen et al. 2014, p. 3; Iyengar 2010: 188). These potential deficiencies can be avoided and addressed:

*Ad 1)* In the framing literature, the search for a ‘right’ baseline has often resulted in a comparison of alternative communication rather than comparing treatment and no-treatment groups (Morton & Williams 2010, p. 310). This is also applied in this research. Respondents do not enter surveys as blank slates (Sniderman 2011, p. 109), meaning that survey experiments could also be framed as the endeavor to understand pre-treatment, as in the previous conditioning individuals experience (Sniderman 2011, p. 110). It can be assumed that farmers are familiar with different lines of reasoning. Presenting one treatment to each participant of the survey does not assume that this person has never read anything else or similar before. The intention is rather to single out effects that some framings hold as compared to others, taking similar preconditions into account and testing for the factors that lead to certain reactions to the different frames. To weigh the effect of adaptation intentions, different incentive structures are compared to an economic incentive rational. It makes sense to compare alternative frames rather than treatment-no-treatment relation, as it is rarely the case that farmers are not exposed to any framing, or, put differently, to any policy guideline that promotes certain measures.

*Ad 2 & 3)* A prime motivation for research on framing is to find out which communication strategy has the strongest effect on a certain group of individuals. Framing experiments emphasize certain communication characteristics, which cause individuals to place a different weight on her considerations when exposed to a certain frame. That might be considered as persuasion. Intentionally, the frames in this study involve “(...) directional force in the form of a relevant reason to do what people are already predisposed to“, which makes it a “facilitative design” (Sniderman 2011, p. 108). Survey experiments allow for making inferences about attitudes and behavior from survey data (Gaines, Kuklinski, Quirk 2006) and help to compare frames and assesses their distinctive and *causal* impact on treatment groups. The element of causality implicit in the research design accounts for confounding variables.

## 5. Survey Data

The survey was distributed online, and 20 paper versions were sent to farmers in Schleswig-Holstein. 102 farmers participated in the online survey, of which 82 fully completed the survey, whose data could be used for analysis. Three farmers responded to the paper version, which means that this analysis is based on a convenience sample of 85 individuals. The recruitment strategy was based on a broad dissemination of the survey between October 2014 to October 2015 via farmers' networks as well as one of the biggest insurance company's mailing list. A cover letter, which was attached to the survey in the online as well as the paper version, informed about the intention behind the survey.

Farmers were first asked about some general demographics, their general interest in climate change and CAP measures with relevance for adaptation effects, their individual risk perception and trust levels towards different sources and actors. Included in demographics were factors that allowed for a more concrete idea of the living and working context within which adaptation would have to be realized. This includes ownership of the farm, size of arable land, responsibility and communication structures on the farm, financial, technical and informational preparation for extreme weather events and climate variability, as well as implementation of the farming measures that are part of the European Union's Common Agricultural Policy (CAP). Specifically, CAP measures were prompted that have a positive effect on agricultural adaptation to climate change (Lotze-Campen & Schellnhuber 2009).

Table 1: CAP Measures and Implementation Rate

<b>CAP measures</b>	<b>Implemented</b>	<b>Subsidised</b>	<b>Not Implemented</b>	<b>Response Count</b>
<b>Crop Rotation</b>	36	24	25	85
<b>Grasland</b>	29	27	29	85
<b>Crop Diversification</b>	27	22	36	85
<b>CC Insurance</b>	4	4	77	85



<b>Seed Insurance</b>	8	4	73	85
<b>Improved Irrigation</b>	12	6	67	85
<b>Move Cropland</b>	8	6	71	85
<b>Frost Protection</b>	7	3	75	85
<b>Pesticides +</b>	23	7	55	85

The majority of survey respondents are male (79%) with a median age of 43 years. Most respondents are owners of the farm (60%, as opposed to tenants). The average number of employees on each farm is 6.9. The survey respondents work between 39-40+ hours per week (83%). Most of the people who participated live in northern Germany, in Schleswig-Holstein (52 %), the second biggest group are from southern Germany, Baden-Wurtemberg (16%), and Rhineland Palatinate (7%). Most of the participants engage in conventional agriculture (74%) as opposed to 20% organic and 6% biodynamic agriculture. The size of the farming area ranges between 60 and 200ha. An overview of all survey items, their mean, and standard deviation, minimum and maximum values is given in the appendix.

Respondents were randomly assigned to one out of four survey versions (differing only with regard to the frame). The treatment is introduced as a separate survey section in the form of a short scenario, which is between 5-8 sentences long. Participants are evenly distributed across treatment groups (Frame 1: 22; Frame 2: 20; Frame 3: 21; Frame 4: 22), and do not differ significantly with regard to observable characteristics, indicating that the randomization was effective (cf. robustness checks).

Survey respondents' adaptation intention is tested in a set of statements that had to be evaluated after reading the framing treatment, with participants' approval ratings ranging from "fully agree" (5) to "do not agree" (1). Those statements were chosen in

accordance with Grothmann and Patt's research design (2005) as well as Koerth et al.'s PMT items (2013, p. 901). Table 2 gives an overview on the dependent variables<sup>8</sup>.

The relative adaptation intention was tested in a linear regression model, analyzing the variance of approval to statements between treatment groups, thus their relative risk and coping appraisal after having reading through (i.e. being treated with) the frames. Control variables, such as the experience of an extreme weather event, experience of different weather trends in the past years (covering rain, drought, heat, storm, snow, hail, and flood), risk perception, and farming type (conventional, organic or bio-dynamic), were added across all OLS analyses.

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<sup>8</sup> Simple mean effects of all 16 dependent variables can be found in the Appendix.

Table 2: Overview of Dependent Variables

<b>DV Number</b>	<b>DV Name</b>	<b>Statement</b>
1	OV_thinkCC	It is important to think about climate change effects and impact.
2	OV_CCnoRisk	Adaptation to climate change is not important, as climate change risks are not increasing.
3	OV_CCnoAdapt	There is no reason to adapt to climate change.
4	OV_CCrisk	Climate change is a serious risk to humankind.
5	CC_longtermEffect	Climate change has long-term negative effects on agriculture.
6	OV_CCnow	Climate change happens right now.
7	OV_CCimplPersonal	My life is affected by climatic changes and variability.
8	OV_CCBadFuture	The impact of climate change on agriculture will get worse.
9	OV_AdaptSingle	Individual people can do something to adapt to climate change.
10	CC_AdaptFarming	I am capable of meeting climate change challenges.
11	OV_PrevRisk	Preventive measures reduce climate change costs.
12	OV_AdaptPersSafe	Adaptation to climate change increases my personal safety.
13	Ov_AdaptnoEffect	Adaptation to climate change has no effect on my farming.
14	OV-AdaptCost	It is less costly to <b>adapt</b> than to pay for damages.
15	OV_AdaptTimeNeed	Adaptation to climate change takes too much time.
16	OV_Spending	I would rather spend money on something other than climate change adaptation.

As has been mentioned before, previous experience of extreme weather events has an influence on behavioral change intentions (Nieles et al. 2015). To account for the importance of experience as a potential moderator of socio-cognitive reactions to climate change, an interaction effect is modelled. Cell means are accepted as a straightforward way of representing an interaction effect (cf. Martinez 2015); values and standard errors are obtained from the model coefficients (cf. figures on interaction effects in the appendix).

## **6. Results**

The results of this experiment are assessed from two perspectives: First, the relevance of incentives per se is tested to inquire if incentives change the direction of adaptation intentions as predicted by the Model of Private Proactive Adaptation Action. Second, the effect of the four frames are compared and analyzed to examine which line of reasoning corresponds best with farmers.

Respondents' reactions to two statements are discussed here. Farmers' reactions to the statement "Climate change is a serious risk to me" account for risk perception. Their reactions to the statement "My farming is adapted to climate change" reflect on respondents' self-efficacy.

The treatment groups respond differently to the statement "Climate change is a serious risk to me", however the results are statistically insignificant (cf. Table 3, Model 1). With added controls (region, farming type and individual risk prevalence) the overall explanatory power of the model is considerably improved (cf. Table 3, Model 2). Organic farming turns out to be negative and highly significant ( $p < .05$ ), probably explained by the already relatively risk approved farming type. Experience of an extreme event turns out to be positive and highly significant ( $p < .01$ ). Experience acts as a moderator on one's ability to assess climate risks and the respond to climate change impacts (Nieles et al., 2015; Koerth et al., 2013). When modelling an interaction effect between frames and previous experience of an extreme weather event, organic farming remains negative and significant (cf. Table 3, Model 3). The interaction reveals that participants respond comparatively negative to the statement "Climate change is a

serious risk to me” if they read frame 4 and have not experienced an extreme event (cf. Figure 2). This suggests that a technology framing of adaptation to climate change reduces risk appraisal.

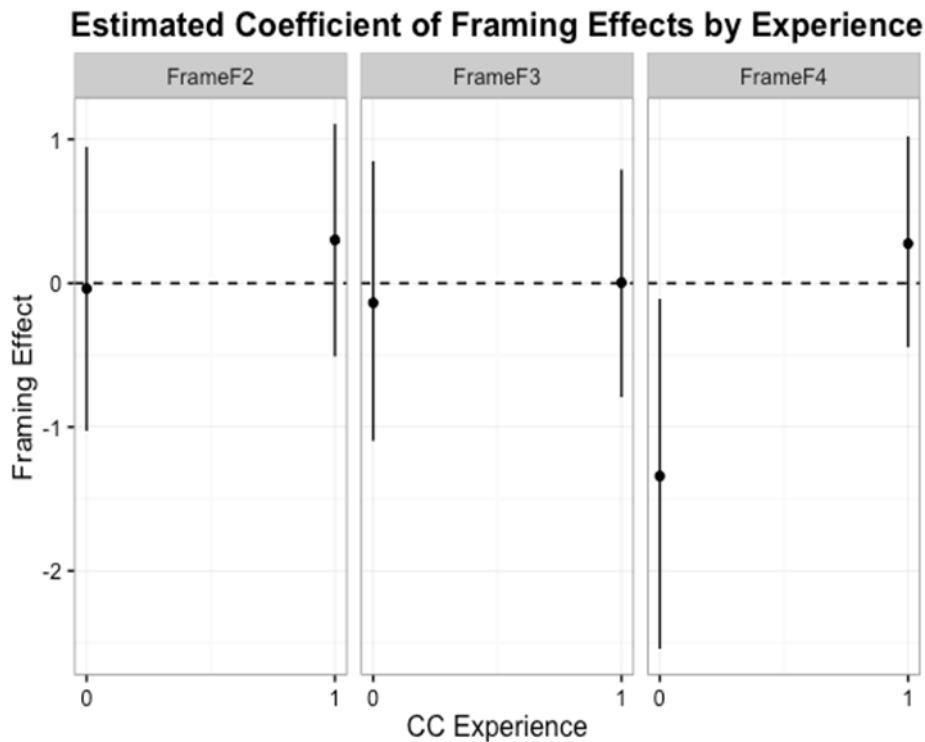
Table 3: OLS Results Variable CCrisk: “Climate change is a serious risk to me“

	Simple Effect	Effect Controls	Interaction Effect
	Model 1	Model 2	Model 3
<b>Frame 2</b>	0.283	0.153	-0.047
	(0.362)	(0.319)	(0.493)
<b>Frame 3</b>	-0.017	-0.060	-0.141
	(0.362)	(0.314)	(0.490)
<b>Frame 4</b>	0.018	-0.120	-1.323**
	(0.367)	(0.320)	(0.610)
<b>CC Experience</b>		1.225***	0.784*
		(0.252)	(0.454)
<b>Conventional Agriculture</b>		-0.662	-0.666
		(0.488)	(0.480)
<b>Organic Farming</b>		-1.202**	-1.124**
		(0.546)	(0.539)
<b>Risk_indiv</b>		-0.169	-0.125
		(0.140)	(0.139)
<b>Frame 2 x CC Experience</b>			0.356
			(0.632)
<b>Frame 3 x CC Experience</b>			0.144
			(0.629)
<b>Frame 4 x CC Experience</b>			1.603**
			(0.716)
<b>Constant</b>	3.667***	4.124***	4.260***
	(0.253)	(0.740)	(0.753)
<b>N</b>	80	80	80
<b>R-squared</b>	0.012	0.306	0.360
<b>Adj. R-squared</b>	-0.027	0.239	0.267

<b>Residual Std. Error</b>	1.160 (df = 76)	0.999 (df = 72)	0.980 (df = 69)
<b>F Statistic</b>	0.301 (df = 3; 76)	4.542*** (df = 7; 72)	3.877*** (df = 10; 69)

\*\*\* p < .01; \*\* p < .05; \* p < .1

Figure 2: Marginal Effects CC Risk “Climate change is a serious risk to me”



The treatment groups respond differently to the statement “My farming is adapted to climate change“. Frames 3 and 4 are positive and significant ( $p < .05$ ), relative to the baseline group (cf. Table 4, Model 1). These treatment groups thus consider their agricultural practice more adapted than the baseline group does. With added controls, this effect is reduced and only treatment group 4 is marginally significant ( $p < .1$ ) compared to baseline. Control variables added here are once again individual experience of an extreme weather event, risk perception, and farming type. Following this, Model 3 shows the interaction effect between frames and experience of an extreme weather event. This improves the model specification and changes the framing effects. As can be seen in figure 4, experience of an extreme weather event is of relevance to farmers’ self-assessment concerning their adaptation levels on the farm. On the condition that they

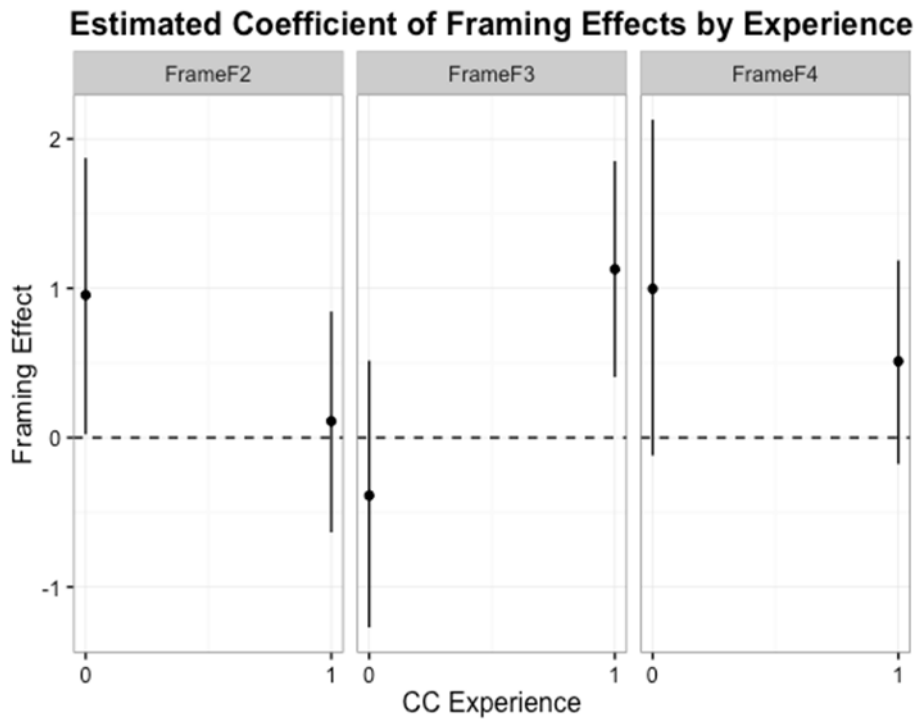
have experienced an extreme weather event, treatment group 3 (community building frame) considers their farming more adaptive than the baseline group. One potential explanation may be that after having been through an extreme event, and having been able to cope with it, individuals are more likely to assess their self-efficacy positively.

Table 4: OLS Results Variable AdaptFarming: “My farming is adapted to climate change“

	Simple Effect	Effect Controls	Interaction Effect
	Model 1	Model 2	Model 3
<b>Frame 2</b>	0.495	0.465	0.948**
	(0.317)	(0.319)	(0.457)
<b>Frame 3</b>	0.545*	0.522	-0.392
	(0.317)	(0.315)	(0.455)
<b>Frame 4</b>	0.674**	0.597*	1.012*
	(0.321)	(0.320)	(0.566)
<b>CC Experience</b>		0.227	0.140
		(0.252)	(0.422)
<b>Conventional</b>		-0.780	-0.823*
		(0.489)	(0.445)
<b>Organic</b>		-0.458	-0.592
		(0.546)	(0.500)
<b>Risk_indiv</b>		-0.152	-0.139
		(0.140)	(0.129)
<b>Frame 2 x CC Experience</b>			-0.827
			(0.587)
<b>Frame 3 x CC Experience</b>			1.520**
			(0.583)
<b>Frame 4 x CC Experience</b>			-0.493
			(0.664)

<b>Constant</b>	2.905***	3.881***	3.954***
	(0.221)	(0.741)	(0.699)
<b>N</b>	80	80	80
<b>R-squared</b>	0.064	0.139	0.317
<b>Adj. R-squared</b>	0.027	0.056	0.218
<b>Residual Std. Error</b>	1.014 (df = 76)	0.999 (df = 72)	0.909 (df = 69)
<b>F Statistic</b>	1.736 (df = 3; 76)	1.667 (df = 7; 72)	3.204*** (df = 10; 69)
*** p < .01; ** p < .05; * p < .1			

Figure 4: Marginal Effects AdaptFarming “My farming is adapted to climate change”



Having been faced with a frame that underscores the importance of agricultural performance under the impact of climatic changes, further intensifies this effect. Previous experience of an extreme event indeed has an effect on the treatment group’s



assessment of the degree to which climate change is considered a risk and how they assess their ability to cope with climate change. Furthermore, the framing effect differed relative to the type of farming: Those who engage in biodynamic and organic agriculture show higher degree of agreement towards the statement. The heterogeneity in the data is a result of the differences across sub-groups, and can be explained with the varying degree of adaptive capacity of farming types. As the interaction of means shows, different farming types result in different effects.

The analysis of exogenous factors that could systematically mediate subjects' responses has brought no results that would challenge the effect of the frames on the dependent variables (cf. Table 6). Treatment groups did not differ significantly in their composition, which excludes any such mediation effect and allows for confidence concerning experimental effects (McDermott 2011), as the experiment is internally valid. The external validity of survey experiments is subject of debate (Mc Dermott 2011; Mullinix, Leber, Druckman et al. 2015). One threat to external validity is restricted subject participation (McDermott 2011, p. 36). In order to insure variation, different networks and groups, representing diverging takes on agricultural production and values concerning resource-governance have been approached over a period of roughly eight months. However, the data discussed here and the results from the survey experiment are based on a relatively small convenience sample. As Kevin Mullinix et al. (2015) show, convenience samples, such as the sample in this project, indeed produce considerably similar results as population based, nationally representative samples. They conclude that convenience samples can play a fruitful role as research agendas progress (Mullinix et al. 2015, p. 111). This research can be seen as a starting point for more in-depth considerations of framing effects on adaptation intentions.

	<b>Frame</b>
Prev_Extreme_Weather	0.169 (0.291)
Risk_indiv	-0.024 (0.153)
Farming_Typeconventional agriculture	0.127 (0.587)
Farming_Typeorganic farming	0.321 (0.622)
Gender	-0.179 (0.374)
Age	0.018* (0.009)
Info_CC	0.155 (0.168)
Network_Active	0.167 (0.171)
Constant	-33.909* (18.362)
N	84
R-squared	0.114
Adj. R-squared	0.020
Residual Std. Error	1.135 (df = 75)
F Statistic	1.208 (df = 8; 75)

\*\*\*p < .01; \*\*p < .05; \*p < .1

Table 6: F-Statistic

## 7. Discussion

Climate change comes with a high degree of uncertainty. It has been argued that in order to respond and react to the uncertainty of future climate development, and the immediate as well as long-term climate change effects, flexibility is key (e.g. Adger et al. 2009; Folke, Carpenter, Walker et al. 2010; Folke, Hahn, Olsson, Norberg 2005). In other words, farmers need to be able to react to climate change effects as well as climate variability, extreme events and variance of mean temperatures. As agriculture is highly regulated, a part of that flexibility is subsumed in varying rates of agricultural subsidies that shape the farmers' decisions. Psychological factors have a considerable influence on adaptation behavior (e.g. Burke & Emerick 2016; Arbuckle et al. 2015; Grothmann & Patt 2005). Economic incentives, such as rewards or punishments, are one incentive for behavioral change; they build on a framing of gains and losses with

regard to a certain reaction to climate change. These might however not resonate with farmers, as U.S. research on climate adaptation shows (Arbuckle et al. 2015; Burke & Emerick 2016).

The EU's Common Agricultural Policy offers 'green payments' to farmers that are, in part at least, targeted at adaptation as well as a more environmental friendly production. Since farmers have a lot of leeway in implementing this, environmental targets might not be met. On the other hand, with climate change effects and development being as uncertain and diverse in effects (differing from region to region), a more restrictive design of subsidies can produce lock-in effects where farmers cannot react to the different climate effects. Already, farmers feel that the policy is too restrictive and not simple enough (Westhoek et al. 2012). Research on farmers' preferences and thoughts on climate change shows that they do recognize changing weather trends, but do not necessarily label them as climate change, identify them as part of a long-term trend, let alone adapt to them accordingly (Burke & Emerick 2016; Olesen & Bindi 2002). Today's farm regulations might thus a) not have the desired climate change adaptation effect as impacts differ, b) reduce farmers' flexibility to react, c) not correspond with their outlook on farming, specifically farm management and planning.

According to PMT, risk and coping appraisal are both relevant for an individual's intention to adapt and change (Grothmann & Patt 2005). Policies that seek to strengthen individuals' self-efficacy can most likely succeed if they emphasize on both individual responsibility *and* collective environmental benefits. Drawing on the outcomes of this research, it can be said that financial incentive structures act on risk appraisal but have only a limited positive effect on coping appraisal. This corresponds with other research projects' findings (e.g. Bolsen et al. 2014, p. 24; Koerth et al. 2013). Another finding is that incentives do not automatically act as enablers that trigger an adaptive response. The direction and power of incentives on socio-cognitive processes in farmers is highly dependent on farming type. Given certain conditioning factors, such as previous experience of an extreme weather event, farmers react to framing treatments differently. This modulates their socio-cognitive prevalence to form adaptation intentions. This in turn could be interpreted as a form of social discourse or rather social setting. The more involved farmers are in organic or biodynamic farming, the more pronounced their

reaction to adaptation incentives. Communication of technological innovation results in reduced risk appraisal. Trust in a technological fix might thus lower adaptive reactions.

This research does not suggest withdrawal from agricultural subsidies altogether. Instead it should be read as an insight into the relevance of framing and lead to an evaluation of incentive structures for designing a complement to existing policy incentives.

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## **Appendix**

The survey was distributed in German. The original wording of the frames is as follows:

1: Neben der Sicherung des landwirtschaftlichen Einkommens ist es das Ziel der neuesten Agrarreform, eine Anpassung an den Klimawandel zu ermöglichen. Es macht Sinn, wenn die Europäische Union mit Subventionen auf Veränderungen des Klimas reagiert. Denn wenn ich meine Produktionsweise verändern soll, dann muss ich dafür auch eine entsprechende Bezahlung erhalten.

2: Aus Umfragen geht hervor, dass es für immer mehr Menschen in Deutschland wichtig ist, klimafreundlich zu leben. Dafür verändern wir alle schrittweise unser Verhalten und arbeiten gemeinsam einer nachhaltigeren Lebensart entgegen. Das ist insbesondere deshalb wichtig, weil wir die Folgen des Klimawandels verringern können, wenn alle an einem Strang ziehen. Ich fühle mich in einer Gesellschaft wohl, in der alle gemeinsam für die gute Sache Veränderungen erwirken. So kann Klimawandel weniger Schaden anrichten.

3: Zukünftige Generationen sind mit den Folgen des Klimawandels konfrontiert. Schon heute ist die landwirtschaftliche Produktion durch Klimaveränderung beeinflusst. Die Forschung zeigt, dass der Klimawandel die Landwirtschaft so stark verändert, dass Erträge sinken. Für die wachsende Weltbevölkerung muss zudem immer mehr Nahrung produziert werden. Wenn wir heute etwas verändern, sichern wir die zukünftige Versorgung mit Nahrungsmitteln. Darüber hinaus gewährleistet eine Anpassung an den Klimawandel den stabilen Erwerb von Landwirten.

4: Alles ändert sich. Ich weiß, dass ständig neue Maschinen entwickelt werden, die mir das Leben einfacher und angenehmer machen können. Wenn ich heute anfangen, in technologische Innovation zu investieren, ist das ein Vorteil für meinen Anbau. Bestimmt kann man auf diesem Wege bessere Erträge erwirtschaften und gleichzeitig auf das Klima achten.

Table 6: Overview, All Variables

<b>Statistic</b>	<b>N</b>	<b>Mean</b>	<b>St. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Age</b>	85	2,054.482	751.479	1,916	8,900
<b>Gender</b>	84	0.155	0.364	0	1
<b>No_onfarm</b>	83	6.916	23.293	1	200
<b>No_People_Sale</b>	84	3.488	15.112	1	140
<b>No_People_Farming</b>	82	1.707	0.923	1	5
<b>No_People_Innovation</b>	82	2.341	2.267	0	20
<b>Work_Time</b>	83	3.819	0.735	1	5
<b>Owner</b>	85	0.576	0.822	0	2
<b>Region</b>	85	4.294	3.891	1	14
<b>Average_No_Crops</b>	83	5.675	8.261	0	60
<b>Use_of_Farmadvice</b>	85	2.624	1.058	1	5
<b>Info_CC</b>	85	3.576	0.792	2	5
<b>Network_Active</b>	85	2.259	0.888	1	4
<b>Imp_PolReg</b>	85	3.129	1.193	1	5
<b>Imp_Ecopactise</b>	85	4.082	0.954	1	5
<b>Imp_Weatherinfo</b>	85	4.518	0.781	1	5
<b>Imp_Subsidies_Sustainability</b>	85	3.506	1.231	1	5
<b>Imp_Invest_CCinfrastruc</b>	85	3.624	1.012	1	5
<b>Imp_Tech_Innovate</b>	85	3.718	0.934	1	5

<b>Imp_Info_CC</b>	85	3.600	0.966	1	5
<b>Crop_Rotation</b>	85	0.965	0.763	0	2
<b>Grassland</b>	85	1.000	0.802	0	2
<b>Crop_Diversity</b>	85	0.812	0.809	0	2
<b>Insurance_CC</b>	85	0.129	0.431	0	2
<b>Insurance_Seeds</b>	85	0.176	0.492	0	2
<b>Improve_Irrigation</b>	85	0.271	0.585	0	2
<b>Move_Cropland</b>	85	0.224	0.564	0	2
<b>Frost_Protection</b>	85	0.118	0.391	0	2
<b>Int_Pesticide</b>	85	0.412	0.623	0	2
<b>Risk_indiv</b>	85	2.694	0.873	1	5
<b>Trust_Church</b>	85	2.435	1.139	1	5
<b>Trust_Fedgov</b>	85	2.447	0.970	1	5
<b>Tust_LocalPolitics</b>	84	2.750	1.028	1	5
<b>Trust_EU</b>	84	2.250	0.930	1	5
<b>Trust_Police</b>	85	3.341	0.958	1	5
<b>Trust_Friends</b>	84	4.238	0.801	1	5
<b>Trust_Strangers</b>	85	2.529	0.971	1	5
<b>Trust_Neighbors</b>	85	3.412	0.930	1	5
<b>Trust_Colleagues</b>	84	3.512	1.000	1	5
<b>Trust_Media</b>	84	2.226	0.961	1	5
<b>Prev_Extreme_Weather</b>	85	0.647	0.481	0	1

<b>Prep_Tech</b>	84	2.738	1.077	1	5
<b>Prep_Financial</b>	85	2.729	1.117	1	5
<b>Occ_Flood</b>	84	0.345	0.478	0	1
<b>Occ_Drought</b>	85	0.671	0.473	0	1
<b>Occ_Snow</b>	84	0.119	0.326	0	1
<b>Occ_Hail</b>	83	0.217	0.415	0	1
<b>Occ_Storm</b>	85	0.600	0.493	0	1
<b>Occ_Rain</b>	85	0.753	0.434	0	1
<b>Occ_Heat</b>	85	0.588	0.495	0	1
<b>OV_thinkCC</b>	80	4.475	0.811	2	5
<b>OV_CCnoRisk</b>	80	2.050	1.135	1	5
<b>OV_CCnoAdapt</b>	80	2.438	1.146	1	5
<b>OV_CCrisk</b>	80	3.737	1.145	1	5
<b>CC_longtermEffect</b>	80	4.050	1.018	1	5
<b>OV_CCnow</b>	80	4.150	1.032	1	5
<b>OV_CCimplPersonal</b>	80	3.913	1.021	1	5
<b>OV_CCBadFuture</b>	80	4.075	0.911	2	5
<b>OV_AdaptSingle</b>	80	3.413	1.299	1	5
<b>CC_AdaptFarming</b>	80	3.325	1.028	1	5
<b>OV_PrevRisk</b>	80	3.875	0.933	2	5
<b>OV_AdaptPersSafe</b>	80	3.450	1.005	1	5
<b>OV_AdaptnoEffect</b>	80	3.013	1.153	1	5

<b>OV_AdaptCosts</b>	80	3.925	0.991	1	5
<b>OV_AdaptTimeNeed</b>	80	2.450	1.135	1	5
<b>OV_Spending</b>	80	2.638	1.183	1	5
<b>Frame_num</b>	85	2.506	1.140	1	4

Figure 3 Interaction Means CC Risk (*Climate change is a serious risk to me*)

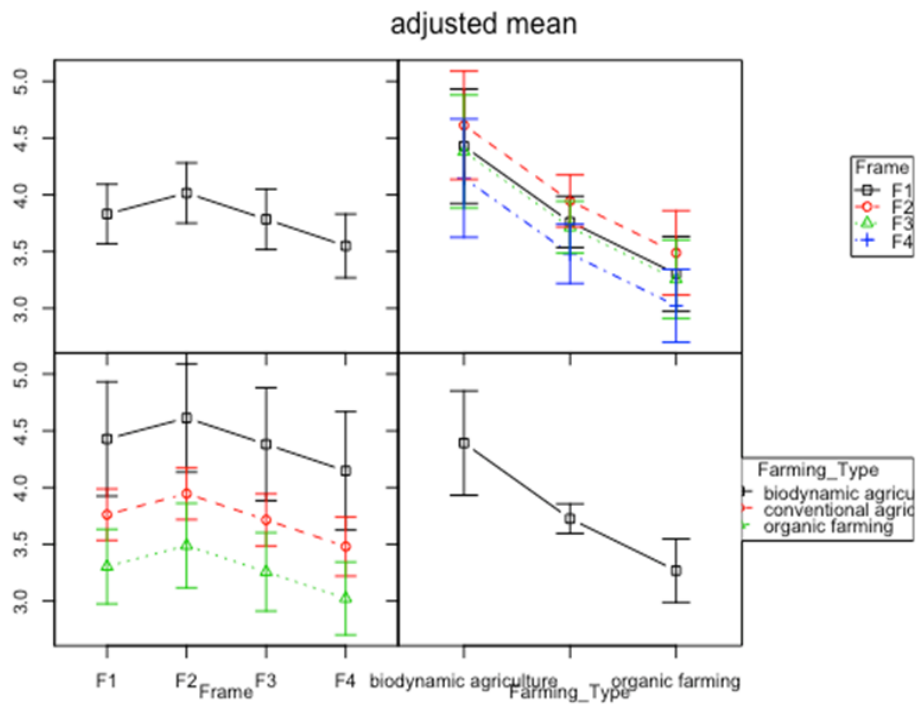
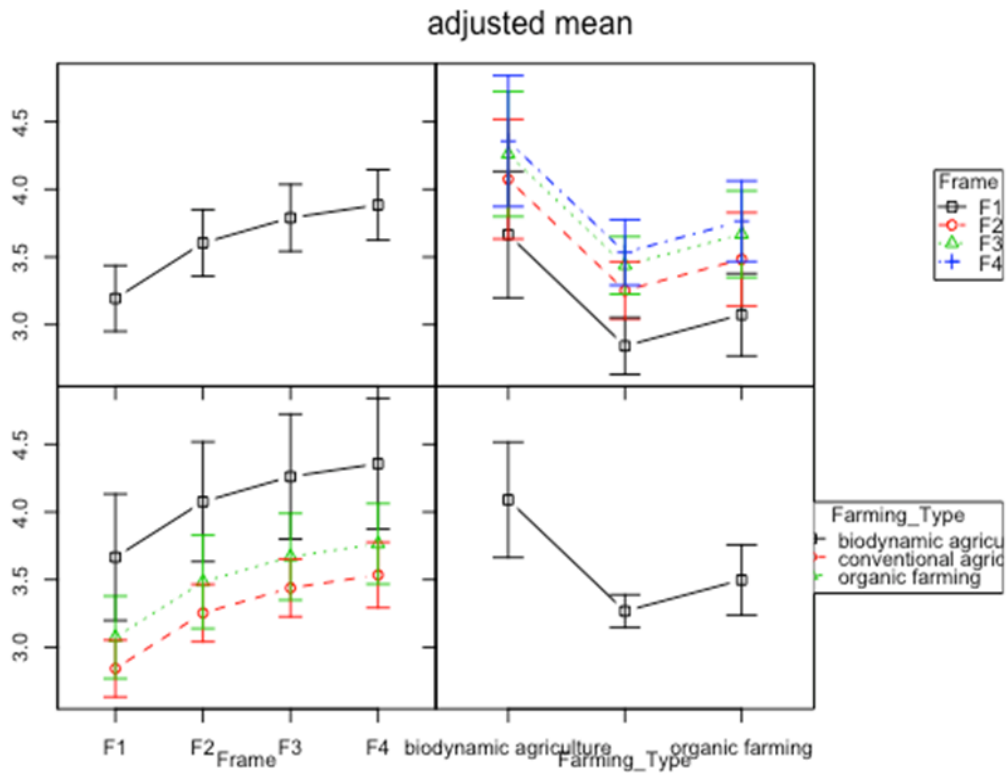


Figure 5: Interaction Means AdaptFarming (My farming is adapted to climate change)



## **Paper 3**

### **Doing Everything You Can, but Not (yet) Getting it Right: Challenges to Brussels' Great Expectations for Water Quality<sup>9</sup>**

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**ABSTRACT** To arrive at a good status of all European water bodies is the main objective of the European Union (EU) Water Framework Directive (WFD). Since its adoption in 2000, the policy has fundamentally changed the institutional, procedural and organizational structures of Member States' water management, leading to an Europeanization of national legislation and decision-making structures. The case of WFD implementation in Schleswig-Holstein is an example of the policy's highly innovative governance architecture that unfortunately is not (yet) able to take that one last hurdle: to improve water quality and establish a *good water status* across EU Member States by 2015 or 2027.

**KEYWORDS** Participation, Multi-level Governance, Water Framework Directive, Rescaling, Europeanisation

Learning Outcomes

This case study contributes to an understanding of (a) multi-level governance, (b) Europeanization as a consequence of institutional and policy misfit as well as (c) participatory decision-making across political-administrative levels and ecological scales.

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<sup>9</sup> Reference [1].

CLASSROOM TESTED? No

## **Introduction**

Water management in the European Union's (EU's) Water Framework Directive (WFD) is both a poster child for environmental governance and also a case of not (yet) reaching the envisioned water quality standards – thus a case of 'not getting it right'. Adopted in 2000, the policy initiated immense rescaling of decision-making arenas by (a) introducing the river basin as a new administrative level to match ecological scales (Article 3) and (b) demanding broad, public participation in decisions on water management (Article 14, 1). 'Competent river-basin authorities' designate the relevant water bodies quality and initiate participatory river-basin management planning, which results in river-basin management plans (RBMP) and programs of measures (PoMs). There are two complementary motivations behind this approach. First, it is considered more efficient and effective to address environmental problems at the level where they are happening [2]. Managing water pollution at the river basin is therefore preferred to arrangements that are solely based on political-administrative boundaries. Second, broadening participation might strengthen the EU's democratic legitimacy, while making it more accessible to citizens in their everyday lives [2,3,4,5]. Furthermore, it has been assumed that participation can increase the effectiveness of environmental governance as well as the environmental quality of decisions [6,7].

While the WFD governance setup is thus an innovative and state-of-the-art application of environmental governance standards, the quality of its outcomes is debatable. The WFD aims at 'good status' for all EU-waters (Article 2, 20). Surface water status is 'good', if water bodies meet chemical, biological and hydromorphological parameters (categorizing high, good, moderate, poor and bad status); groundwater quality is either 'good' or 'poor' based on chemical and quantitative criteria [8]. With this the WFD follows a holistic environmental approach [6], as it considers several interrelated parameters to assess water quality. German provincial water governance in Schleswig-Holstein (SH) – Germany's northern-most federal state – has followed EU guidelines on WFD implementation and institutionalized new, innovative governance structures for water management. Implementation in the region can be called ambitious in comparison [6,7]. SH did promote broad participation early



on and insitutuionalized all relevant new governance structures. Yet, it did not improve its water quality. The following case study illustrates the promises and pitfalls of the EU's environmental governance in the context of WFD implementation in Schleswig-Holstein, Germany.

## **Case Examination: Governance Across Scales for Good Water Status**

### **How Does the EU Operate?**

The EU and its 28 Member States interact in a vertically and horizontally differentiated *Multi-level Governance* (MLG). EU MLG allows for diversification and integration within a common frame [9] to balance the tension between common objectives and territorial differences [10]. The *Principle of Subsidiarity* underscores shared allocation of responsibilities *for policy and law-making between the European national and sub-national levels*. Power and decision-making authorities are divided vertically among the Commission, Council, Parliament and Court; and horizontally among local, national and transnational levels [11]. EU directives – such as the WFD – present vague guidelines on implementation, following a dynamic of self-commitment rather than a set of strict principles, so that regional differences can be accounted for [12]. What's good about this flexibility is that it allows for location, context and time-specific implementation against a common background [13]. Such flexible decision-making and policy implementation, however, often leads to normative and factual uncertainty [14]. On a normative dimension, flexible governance arrangements raise questions of legitimate inclusion, representation and delegation in decision-making process as well as the power relations associated with access to participation [13]. Factual uncertainty is tied to a lack of knowledge on the issues that need to be discussed and a lack of information on potential effects of a policy. These concerns put a damper on the high, flying hopes associated with participatory in a multi-level environmental decision-making context.

To get the WFD implementation process started and overcome factual uncertainties, the EU invited a number of actors to produce a *Common Implementation Strategy* (CIS) in 2001 [8]. The network of water practitioners was organized in working groups to create a set of documents with non-binding recommendations, intended to harmonize policy implementation across member states [5,8]. The idea was

to set everyone on defined tracks without letting go too much of the flexibility for knowledge creation in regional contexts. The WFD therefore considers and acknowledges Member States' varying concerns about country and region-specific implementation costs as well as differing interpretation of ambiguous terms (disproportionate costs)<sup>10</sup> and subsequent exceptions [8]. The CIS documents are an example of the way in which EU policies balance supranational common objectives and diverging national and regional realities. Voluntary measures and guidelines – such as the CIS documents – are the glue between the different decision-making levels. However, due to their non-binding character, the guidance put forward in CIS documents need not be implemented, let alone known by implementation bodies [7]. In other words, Member States are left with considerable leeway [6]. The following section describes national level approaches to the WFD implementation.

### **WFD: From the Supranational to the National Level**

Approximately 80% of environmental and agricultural policies that are implemented in Germany come from the European level [15]. This fact alone suggests a large degree of interdependence. The process of restructuring national decision-making structures to address the misfit between the supranational and lower institutional levels is called *Europeanization* [15,16]. 'The lower the compatibility between European and domestic processes, policies, and institutions, the higher the adaptational pressure' [15, p. 5]. In case of the WFD, the pressure to change was high.

The WFD implementation has been described as '[...] an experiment for governments, involved stakeholders and citizens across the European Union' [13, p. 1011]. In Germany, it resulted in several formal changes in water management structures and has produced 16 different implementation strategies, one for each federal state [13]. Before the WFD implementation, water management used to be highly formalized. As most German water policies were not governed in a participatory way, the restructuring of legislation and authorities in WFD decision-making context took time and resources that eventually shifted the focus from political to natural scales but retained some institutional stability. The German planning system is traditionally

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<sup>10</sup> Disproportionate costs or expenses are a reason for exemptions, as are technical feasibility and natural conditions. An exemption allows extended deadlines for WFD implementation [8].

sectoral and hierarchically organized [17]. Cross-sectoral cooperation or public consultation were not part of the decision-making process on water governance before implementing the WFD, neither was the river-basin as a political sphere [18]. Germany adapted its legislative structures for water governance by implementing federal reforms in 2006, a new Water Law (*Wasserhaushaltsgesetz*) in 2010, state law on water (*Landeswassergesetz*) as well as *Landesverordnungen*, which allowed the Länder to apply region-specific regulations. The following section gives an example of WFD structures and outcome in Schleswig-Holstein, a German federal state.

### **WFD Implementation in Schleswig-Holstein**

While Schleswig-Holstein put an organizational structure in place that could realize a collaborative implementation of the WFD, it could not improve its water quality in the process. Already in 2002, after an inventory at state level, it became clear that 95–98% of the water bodies in Schleswig-Holstein would not reach a ‘good status’, mainly due to bank reinforcement and straightening as well as high nutrient concentrations [19]. Connectivity and diffuse nutrient intake are the main factors that lead to SH’s bad water quality [6,20]. They were already addressed in water SH-specific regulations prior to the WFD [21]. SH changed water legislation according to WFD standards in August 2003, which coincided with an early start of implementation and planning to meet WFD deadlines [6]. Governance structures of implementation and different effects of WFD implementation in the region are explained as follows.

Administration and regulation of water governance in Schleswig-Holstein – the northern-most state in Germany – has not changed too much with the WFD [20], as the Ministry of Energy, Agriculture, the Environment and Rural Areas (MELUR) retained much of its powers in water management processes, which is quite common in WFD implementation [7]. However, with the implementation of the river-basin as the main decision-making arena, some degree of administrative rescaling was inevitable. The restructuring process provides for policy integration, with the designated areas for WFD implementation fitting the criteria of the Natural Habitat (92/43/EWG) and the Wild Birds Directives (79/409/EWG), as well as the Floods Directive and the Marine Strategy Framework Directive, which makes compliance to policy-measures as well as monitoring of policy implementation easier.

Table 1. MLG setting of WFD implementation

European Union framework	Supranational level	Policy-formulation and agenda-setting
GERMANY Transpose legislation, adapt structurally to meet EU benchmarks and indicators	National level	Provide legislative setting and take responsibility for overall outcome
SCHLESWIG-HOLSTEIN (SH) MELUR (competent authority, responsible for implementation in SH, process organizer) LANU (technological and scientific know-how) Planning Group (WFD implementation)	Federal level	Management of implementation processes, normative and strategic guidance, propose concrete management plans
River-Basin Advisory Board	River-basin	Coordination between different stakeholder groups with a vested interest in the policy outcome
34 Working Groups	Region within the river-basin	Discuss and implement measures

Source: Own depiction (Bruns 2010, p. 152ff).

SH comprises 10 WFD planning units, two of which traverse other German *Länder* (Hamburg and Mecklenburg-Vorpommern), three river-basin districts (Elbe, Schlei/Trave, Eider) and 34 working groups for distinct regions within the districts that are responsible for implementing the WFD [6,20]. While the MELUR together with the State Agency for Nature and Environment (*Landesamt für Natur und Umwelt*, LANU) assumed the role of process organizers, the main participatory processes – river-basin management planning and implementation of measures – are conducted at sub-basin level [20]. Table 1 gives an overview of the tasks and responsibilities of the relevant stakeholders in SH.

In general, centralization of planning and a limited uptake of knowledge in WFD implementation have been more frequent than expected [7], which is not the case in SH [6,20]. SH is thus a case of comparatively ambitious WFD implementation. Most stakeholders were appointed to participate (e.g. the Water Boards, who chaired working groups) [6,17]. The Water and Ground Associations (Water Boards, *Wasser- und Bodenverbände*) – an organization of mostly agricultural stakeholders, the MELUR and the *Staatlichen Umweltämter* (StUA) were the responsible authorities for the implementation process at the river-basin scale. These took decision-making powers away from the cities and municipalities, who then decided to block the processes by boycotting participation for the first round of meetings [20].

Initial satisfaction rates amongst participants was rather low in face of the tasks' complexity, which is largely a result of new roles assumed in the process, knowledge gaps, as well as a rather complicated, new regional implementation structure [20]. This improved significantly over time [6]. Local processes seem to be dominated by economic actors with a vested interest in water management across Germany [13]. In the case of SH, agricultural actors most prominently impacted decisions on water management and WFD implementation [20]. Their participation was considered relevant to increase acceptance amongst land-owners, which is important since implementation to a large degree relied on voluntary actions [6].

In the end, the RBMPs and PoMs in SH largely targeted river connectivity issues, which improved in the process of implementation [6]. Dealing with diffuse pollution and the high level of nutrient intake, mainly due to agricultural production, has proven to be more complicated. The measures mostly did not address diffuse pollution, which was no priority amongst the stakeholders [6]. The voluntary character of actions further decreased activities [6]. Another factor that has been named as a barrier to implementation of the WFD measures is the German Renewable Energy Source Act that led to increased investment in land to produce maize [6]. While maize has a higher nitrate-N load than grassland, indirect N<sub>2</sub>O emissions due to nitrate leaching can be considered as almost negligible [22]. Maize is used for biogas production, which shows similar nitrate-leaching potential as animal slurry [23]. This comes as a trade-off: while biogas further promotes renewables, it may exacerbate the problem of high nutrient

surpluses – especially in SH – with its high animal density [23]. Furthermore, SH has made use of exemptions under Article 4 WFD. These factors contribute to an explanation of why SH's water quality has not improved significantly although WFD structures have been implemented. Additionally, it might well be that changes in water parameters do not yet show because of lag times. It might also be worthwhile to consider if the governance structure is able to contribute to environmental quality, despite its innovative design.

Although the environmental objectives have not (yet) been reached in SH, participants in the working groups show a high degree of acceptance of the proposed measures [6]. This is not the case in most other implementation processes, where institutional adaptation has been limited or participation has not allowed for participants to actually influence decision-making [7]. Thus, while the innovative setup might not have guaranteed an improved water quality in the region, procedural, intermediary outcomes (learning, acceptance) of WFD implementation in SH should not be disregarded.

### **Final Comments**

The innovative WFD governance architecture has led to an institutionalization of hydrological scales, and promoted participation across scales and decision-making levels [13]. However, the European Commission and some stakeholders are rather dissatisfied with the implementation of the WFD, specifically with the use of exemptions as a mechanism to undermine environmental goals [8]. Understandably so, as WFD has encountered a fair number of obstacles [6,7,8]. The objective to arrive at 'good water' status across EU Member States has also not (yet) been met. However, some of the social or intermediary policy goals were met: the WFD did encourage a broadening of participation, confidence amongst stakeholders was built up in the process of implementation, and communication and understanding of environmental problems improved and collective learning processes were initiated [6,17].

The implementation of the WFD and its outcomes are interesting for water management in the EU specifically, and EU environmental governance in general. Integrated river-basin management under the WFD is an attempt to reduce the

complexity of human-nature interaction by harmonizing natural and administrative scales [6,7,8,13]. This is an example of a paradigm shift in EU environmental governance that increasingly draws on participatory planning and polycentric governance structures [2,7]. At its very core, this shift is about levelling the playing field and finding common solutions to environmental problems: government as partners in dialogue, the social interacting with the environmental, deliberative and collaborative plans instead to top-down programs. If anything, WFD implementation shows that the reality of the EU's environmental governance is a balancing act. Multilevel governance structures and a common EU objective with flexibility of implementation along the line allow for considerable discretion. This leads to different environmental outputs and outcomes across EU Member States as well as regions within Member States. Different environmental policies might not always complement each other, such as the WFD and the Renewable Energies Act. Participation comes with its benefits, but also with challenges as it opens-up new questions of representation and legitimacy, as can be seen with the participation of cities in SH. In the end, an innovative governance structure might solve neither environmental nor democratic challenges, but create new facets of what we have been dealing with all along.

### **Case Study Questions**

1. Are there more arguments for or against local and participatory implementation of environmental policies?
2. How and why are intermediate results (such as learning, acceptance etc.) of participation in the WFD implementation process important?
3. Considering environmental outcomes, what are the benefits of polycentric governance mechanisms that leave considerable discretion to many decision points and what are the benefits of top-down steering?

### **AUTHOR CONTRIBUTIONS**

The primary author is responsible for the conception of the work, the analysis and interpretation, and the drafting of the article.

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## COMPETING INTERESTS

The author has no competing interests to declare.

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## **Paper 4**

### **What we learned about Governance in Multifunctional Irrigation Systems? Balancing Stakeholder Engagement in Hydrosocial Territories**

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The aim of this paper is to conduct an indepth evidencebased analysis of stakeholder engagement in decisionmaking processes affecting multifunctional irrigation systems. The selection of case studies has allowed us to examine different types of tools that promote stakeholder engagement and good governance. Results show how stakeholder engagement in irrigation systems shape hydrosocial territories in different contexts and ways: 1) by reducing tension between stakeholders, 2) by redirecting regional planning and strategy, 3) as a reaction to water crises, 4) by decentralising water responsibilities, and 5) by integrating values and beliefs from different stakeholders.

Keywords: water governance; irrigation systems; multifunctionality; stakeholder engagement; hydrosocial territories

#### **Introduction**

In recent years the focus of stakeholder theory and good governance has shifted from a stakeholder participation approach towards network based, relational, and process oriented engagement approaches (Midin, Joseph, & Mohamed, 2017; Kuzdas, Wiek, Warner, Vignola, & Morataya, 2015; Tullberg, 2013). Governance, through its embrace of pluralism and integration of a range of values and interests, aims to produce instrumental and intrinsic goods such as best practice outcomes, public acceptance, civil engagement, democratic expression, and dynamic interaction (Lockwood, Davidson, Curtis, Stratford, & Griffith, 2010). Governance represents a shift from a government driven, hierarchical and command andcontrol model towards a model that encompasses a network paradigm where stakeholders share in the management, rights, and

responsibility for natural resources (De Boer, Vinkede Kruijf, & Özerol, 2013; Ogada, Krhoda, van der Veen, Marani, & van Oel, 2017).

A cursory glance at the literature on natural resources and water governance reveals that stakeholder engagement has long been considered an integral part of sound management (Akhmouch & Clavreul, 2016; Billgren & Holmén, 2008; Brisbois & de Løe, 2016; Clement, 2010; Podolak, Lowe, Wolny, Nickel, & Kelsey, 2017). Water governance acknowledges that the public sector is not the only actor capable of resolving societal problems linked to water (Driessen, Dieperink, van Laerhoven, Runhaar, & Vermeulen, 2012; Ricart, 2016). As such, public participation in water governance is typically motivated by normative concerns (people have a right to influence matters that affect them), substantive concerns (bringing diverse perspectives and knowledge together results in better policies) or instrumental concerns (the public accepts water policy because they were actively involved in shaping it) (Krueger et al., 2016).

In this context, constructing and implementing successful dialogues encourages both governmental and nongovernmental stakeholders ‘to engage more often in the difficult, but productive, task of listening to and learning from each another’ (Ferguson, Chan, Santelmann, & Tilt, 2017; Kaur & Lodhia, 2014). Successful engagement depends on understanding who to engage with (key stakeholders), for what reason (scope, purpose, challenge), from what perspective (culture, values), and with what methods (techniques and tools) (Kua, 2016; Sivapalan, Savenije, & Blöschl, 2012). The definition of water governance provided by the United Nations Development Programme (UNDP) Water Governance Facility (2013) also suggests that water governance should address, among other things: (1) the equity and efficiency of water resource allocation and distribution, (2) catchmentbased administration, (3) the need for integrated water management approaches, and (5) the need to balance water use between socioeconomic activities and ecosystems (Engle, Johns, Lemos, & Nelson, 2011). The UNDP also requests clarification of the roles of government, civil society, and the private sector, and their responsibilities regarding ownership, management, and administration of water resources and services (Araral & Wang, 2013; Bernauer & Gampfer, 2013). Stakeholder engagement is one of the main characteristics of the shift from governmental to non-governmental ownership, management, and administration of water resources and

services. Stakeholder engagement implies a combination of collaboration – which involves cooperation to achieve goals of efficiency, equity, and sustainability in water resources – and comprehension – which is made up of forces, systems, and mechanisms consisting of elements that exist inside and outside of social identity and work together to achieve particular outcomes in different scales (Colvin, Witt, & Lacey, 2015; Moss & Newig, 2010).

Proponents of stakeholder engagement argue that participation reduces the rigid influence of the technocratic state by devolving decisionmaking power to users directly invested in, and knowledgeable of, the management of natural resources (Lacroix & Megdal, 2016; Lukasiewicz & Dare, 2016). Including a broader set of stakeholders provides decisionmakers with different kinds of knowledge which may be vital for a full assessment of a resource governance problem and for finding innovative solutions to it (Montgomery, Xu, Bjornlund, & Edwards, 2016; Tortajada, 2010). This shift from a technocratic “topdown” approach to a more social “bottomup” approach is growing in popularity as water managers acknowledge that water problems are complex, requiring integrated solutions and a legitimate planning process (Guerrero, Bodin, McAllister, & Wilson, 2015; PahlWostl, 2009). Given this, we ask if the complexity of water use conflict is duly addressed by contemporary approaches to water governance.

A closer look at the literature reveals that despite extensive research, there is a lack of evidencebased assessment on how effective stakeholder engagement processes have been in reaching the intended objectives of water governance (Caniglia, Frank, Kerner, & Mix, 2016; Childs, York, White, Schoon, & Bodner, 2013; Grigg, 2011; Hasselman, 2017; Hommes, Boelens, & Maat, 2016; Ison, Collins, & Wallis, 2015; Kim, Keane, & Bernard, 2015; Kirchhoff & Dilling, 2016). For example, governance struggles to engage stakeholders who have expertise on water issues based on their professional and personal interests, while public engagement efforts are often only used to vet new policies or to gain social license to operate (Bos, Brown, & Farrelly, 2013). Accordingly, empirical analyses suggest that without significant changes in the supporting institutions, governance arrangements, and policy frameworks, the standard tools and models of water regulation will not be effective (Muro & Jeffrey, 2012; PahlWostl, 2015; Taylor & Sonnenfled, 2017).

As a field of research on power relations in human water or social nature systems, the term hydrosocial cycle has been employed by geographers for about a decade to refer to the inseparable social and physical dimensions of water, and as a socationatural process through which water and society make and remake each other over space and time from cultural meanings and values (Linton & Budds, 2014; Swyngedouw, 2009; Wesselink, Kooy, & Warner, 2017). In this context, a variety of infrastructures, policies, cultural values of water and governance interact and, according to this, stakeholder engagement in decisionmaking processes has gained acceptance as a mechanism for better understanding of the complexity of the hydrosocial cycle; the human influence and the compatibility and/or (potential) conflicts of multiple water uses and objectives; and for discovering existing patterns of interaction between opposing water demands (Boelens, 2014; Lafreniere, Deshpande, Bjornlund, & Hunter, 2014; Pomeroy & Douvere, 2008).

The water energy food nexus is context dependent, socially constructed and technically uncertain, and we argue it should be analysed as a hydro social cycle, which considers the inseparability of social and physical aspects of water systems (Meehan, 2013). As socationatural configurations, hydro social territories reflect the value laden and ideological dimensions of community based water management, including shared commitments to ensuring water access and protecting local water systems and access regimes from potential threats (Hommes & Boelens, 2017; Romano, 2016). This concept conceives water flows and management as physical, social, political and symbolic matters, entwining these domains in particular configurations, actively constructing and producing territoriality in technopolitical and socioecological interactions (Boelens, Hoogesteger, Swyngedouw, Vos, & Wester, 2016). In this context, debates over governance in multifunctional irrigation systems have increasingly been framed in relation to social, economic, environmental and cultural impact, stimulating policy framework changes (Fish, Ioris, & Watson, 2010; Groth & Curtis, 2017; MeinzenDick, 2007).

This paper conducts an in depth evidence based analysis of the main trends, frameworks, and tools used to ensure the engagement of key stakeholders in the management of multifunctional irrigation systems. In practice, this means scaling up

successful stories (identified as selected case studies), learning from failures and barriers, and exchanging new knowledge from examples at multiple geographic scales. We report on ten local experiences from Europe, Canada, South America, China, New Zealand and India, asking whether, and if so, how stakeholder engagement has been able to improve the management of irrigation systems. In particular, we trace how processes, tools and frameworks promote participation during water use conflicts, how they fostered deliberation and acceptance and how to analyse the benefit of considering stakeholders' engagement in the management of multifunctional irrigation systems.

### **Stakeholder engagement from institutional framework perspective: Between those who play a role and those who are affected**

In a paradigm shift from government to governance, agreements at supranational level have reinforced the role of participation and stakeholder engagement in water management (Jager et al., 2016; Luyet, Schlaepfer, Parlange, & Buttler, 2012; Newig, Schulz, & Jager, 2016; Page & Kaika, 2003). For example, the definition of governance principles by the Organisation for Economic Cooperation and Development (OECD), or the Global Water Governance strategy proposed by the Pacific Institute, illustrates how fragmented policymaking and implementation across the agricultural and water sectors continues to be a systemic feature of natural resource management and, consequently, a major obstacle for the governing of multifunctional water systems, like irrigation (Akhmouch & Nunes, 2016). In both contexts, the mix of regulatory strategies and a high degree of participation is intended to foster coalitions of diverse actors that commit to common objectives, while preserving the flexibility to react to their national, regional and local contexts (Folke, Hahn, Olsson, & Norberg, 2005).

In Europe, White Papers are the starting point for a debate on governance between the public, stakeholders, the European Parliament and the Council. These documents contain proposals for natural resources management in the European Union (EU). Although White Papers are documents with a mere declaratory value, their publication is meaningful (Brower, 2016). White papers demonstrate that a particular issue is now part of the European political agenda and their publication marks the start of the policy making process in which the various EU institutions and the member states will be

involved (Dreyfus & Patt, 2012). The White Paper on EU Governance underscores the relevance of participation in decisionmaking processes by promoting participation throughout the policy chain from conception to implementation (European Commission, 2001).

The European Water Framework Directive (WFD, Directive 2000/60/EU) is an example of active stakeholder engagement at European level (Andersson, Petersson, & Jarsjö, 2012). Public and stakeholder participation in water management is a central component of the WFD, particularly when considering the benefits: such as better use of knowledge and experiences from different stakeholders; increasing public involvement in more transparent decisionmaking processes; and reduced litigation, delays, and inefficiencies in implementation (RuízVillaverde & GarcíaRubio, 2017). Public and stakeholder participation has been described as “[...] an experiment for governments, involved stakeholders and citizens across the European Union” (Newig, Schulz & Jager, 2016, p. 1011). The design of participatory decisionmaking structures, rules of exemptions, as well as cost calculations are member state specific. Art. 14 (1) requires not only the active involvement of all interested parties to be encouraged in the production, review, and revision of River Basin Management Plans, but also in the whole process of implementing the WFD (Albrecht, 2016). Moreover, the WFD requires a threestep consultation procedure (information supply, consultation, and active involvement) with stakeholder groups on draft plans in which public and private stakeholders actively engage in planning processes (Koontz & Newig, 2014). There is no specific framework at a European level, which integrates the WFD with the Common Agricultural Policy (CAP). As a result, there are no provisions for stakeholder participation within the waterenergyfood nexus (Arle, Mohaupt, & Kirst, 2016; Flávio, Ferreira, Formigo, & Svendsen, 2017).

While the EU has a comprehensive programme for the governance of water and agriculture that formulates common objectives (however from independent policies), the situation of water governance in the United States of America (U.S.) is different. There is not one cohesive national U.S. policy for water, but rather a fragmented policy structure at federal, state and local levels. States have primary authority over water



quantity, but these distinctions tend to be blurred where there are federal water projects and links between water quantity and water quality (Innes, Booher, & Di Vittorio, 2010). Over 30 federal agencies, boards, and commissions in the U.S. are involved in water-related programs and stakeholders' responsibilities (Clarvis & Engle, 2015). Collaborative watershed planning gained popularity from the 1970s onwards in order to resolve the stalemate in environmental governance (Koontz & Newig, 2014). For example, the United States Rural Clean Water Program, created in 1980 and administered by the United States Department of Agriculture, recognized the necessity to reduce agricultural nonpoint source of water pollution by encouraging the participation of farmers (Dupont, 2010). In fact, the Clean Water Act (2006) encourages and provides for public participation in the development and revision of effluent treatment to maintain water quality standards (Centner, 2010). Although there is no linear collaboration between water and agricultural policies, there are two programs focused on water governance and irrigation development: the Conservation Reserve Program and the Environmental Quality Incentives Program. Both programs are voluntary and administered by the Farm Service Agency (FSA). The longterm goal of the first program is to reestablish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat, while the aim of the second program is to implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and nonindustrial private forestland (Reimer & Prokopy, 2014).

Public participation mechanisms in Australia and New Zealand's water governance are often developed ad hoc for specific contexts (Lennox, Proctor, & Russell, 2011). In recent years, important questions have been asked in both countries about the relevance of community engagement as an instrument of natural resources management policy, and about the efficacy of approaches by government to encourage stakeholders' engagement (Memon, Painter, & Weber, 2010). Despite this argument, both nations have limited statutory requirements for public participation in irrigation and water management when compared with the European context. In Australia, freshwater policy is the responsibility of individual State governments rather than the Federal government (Section 100, Constitution of the Commonwealth) (Tonts, Plummer, & Argent, 2014).

Within states, catchment management authorities offer the opportunity for community representatives to collaborate with government staff in freshwater decision making processes (Head, 2014). Farmers are able to participate in irrigation allocation through buying and trading water entitlements in certain areas, such as the Murray Darling Basin (Grafton & Horne, 2014; Wheeler, Loch, Zuo, & Bjornlund, 2014). And the Federal government have attempted to restore indigenous rights and influence over freshwater management through intergovernmental agreements such as the National Water Initiative 2004 (Weir, 2013). Authorities in Australia must engage stakeholders and the public when developing regional natural resource management plans (Curtis et al., 2014). In New Zealand this level of public participation is also required. Regional Councils ask New Zealand citizens for their opinion on draft regional plans that set rules for freshwater use. If a citizen objects to their Regional Council issuing a permit for freshwater use, they can challenge this decision at the Environment Court if they are not involved in a participatory process for a regional plan. In fact, there are no statutory requirements for public participation in New Zealand's freshwater management beyond those included in the National Policy Statement on Freshwater (2014) and the Local Government Act (2002), which promote partnership between communities and local government, increasing the relevance of collaboration in freshwater planning. Despite a lack of statutory stimulus, freshwater collaborations which include governmental and nongovernmental actors at a variety of scales have flourished in the last five years (CraddockHenry, Greenhalgh, Brown, & Sinner, 2017; Sinner, Brown, & Newton, 2016). Prominent examples include the Land and Water Forum and the Canterbury Water Management Strategy (Eppel, 2015; Kirk, Brower, & Duncan, 2017). These collaborations have been so successful that New Zealand's resource management legislation was amended in 2017 to include collaborative planning processes as an alternative mechanism for preparing or changing rules in policy statements and plans (Ministry of the Environment, 2017).

Water governance issues vary in the developing nations of East Asia. In China for example, water sewage, quality, and supply issues are governed by distinct administrative units resulting in fragmented and disjointed policy (Liu & Yang, 2012; Yi, 2016). Public participation in urban water governance, for example the public

hearings process in Beijing regarding the Yuanmingyuan Water Retaining Project, has been promoted, but these processes are not common in managing irrigation systems (Enserink & Koppenjan, 2007). Recently, in order to reverse topdown water management, it has been very popular for governments to transfer greater responsibility to user groups for irrigation system management and performance to improve irrigation efficiency, and an implicit debate has been focused on how public authorities can encourage farmers' participation (Li, 2006; Wang et al., 2017). China's topdown style of water governance contrasts with its neighbour India, in which "governance processes could be considered relatively open and governance structures relatively inclusive" (Lautze, de Silva, Giordano, & Sanford, 2011, p. 5). Prokopy's (2005) empirical research of Indian rural water supply highlights the linkage between community involvement in decision making and household satisfaction with water access. Bangladesh has incorporated 'good governance' practices into national legislation for water use, such as the 2013 National Water Act. However, despite best intentions, challenges such as climate variability, population pressure, unplanned urbanisation, and widespread poverty create vast challenges to public participation in water governance in Bangladesh (Benson, Gain, & Rouillard, 2015, p. 765).

### **Learning from successful stories**

In parallel to the institutional framework perspective and praxis of water governance, there is an increasing emphasis on deliberative or discursive processes as a means of building cooperation between stakeholders. However, it is rare to define standards for participation because participatory approaches to water governance can, and do, take many forms in order to adapt to the specific context of stakeholder demands. The following sections provide different examples of plans, tools, and mechanisms in order to explore the heterogeneity of stakeholders' engagement in water governance. With this, we contribute a comparative examination of participation in freshwater planning and management as well as a bird's eye perspective on common characteristics of participation in that context.

#### **Catalan River Basin District Management Plan (Catalonia, Spain)**

The Water Catalan Agency (WCA), created in 1998, is the public authority responsible

for planning and managing the complete water cycle in Catalonia. Since its creation, the WCA performs its functions with a comprehensive view of aquatic ecosystems, taking into account their balance based on the principles of effectiveness, efficiency and cost savings. Participatory processes are established according to 16 distinct geographical water areas and they should contribute to the development of the proposals included in the Management Plan for the Basin District of Catalonia (200915 and 20162021). The participatory processes were very complex. It was a pioneering experience at both Catalan and Spanish scales (Ricart & Pavón, 2014). As a first step, the WCA created Singular Water Participation Unit in 2005 in order to lead, run and coordinate the participation as an integral part of water management within the organization. The WCA was supported in the design, methodology and results achieved in at least eight other cases related to the WFD in France, United Kingdom, Poland and Spain. The four main objectives of the Plan were: 1) to promote participation in the management of the water cycle, 2) to set up a model of participatory debate in order to open new forms of relationship between WCA and the water stakeholders, 3) to encourage and facilitate the level of knowledge and trust between the different stakeholders in each basin and, finally, 4) to increase the efficiency in public management of water and to reduce the level of conflict regarding water's use. The processes adopted reflected the three levels of participation suggested by the WFD: information, consultation and active participation. With regard to active participation, the essential task was to stimulate the deliberation between stakeholders with different visions and perceptions of the territory. Therefore, stakeholders are able to express a diverse range of views rather than modifying their opinion in the goal of reaching a consensus. In fact, one of the main issues addressed regarding the future of water management in the oncoming revision of the Plan (20162021) is to ensure the involvement of social and economic stakeholders by creating basin councils that should become spaces for participation close to the local scale and the particularities of each territory.

### **The Water Consortium of Marina Baja (Alicante, Spain)**

An example of a mixed water management agency in the Spanish Mediterranean is the Water Consortium of Marina Baja (CAMB), which is able to integrate the management of surface, groundwater and unconventional water resources (Gil & Rico, 2015). Its

constitution, written in 1977, was designed to manage the scarcity of water that affects an eminently agricultural district (about three thousand hectares cultivated, mostly, by avocado and loquat), but with an exponential growth of urban and tourist water demand (with the city of Benidorm converted into the tourist capital of the region). The aim of the CAMB is to guarantee the integrated management of water resources and the maintenance of the associated water infrastructures (reservoirs, aquifers and wastewater) in order to assist the agricultural and urbantourist water supplies through the exchange of conventional (surface and underground water) and nonconventional water (treated water) (Gil, 2010). In drought situations, rainwater is used for urban and tourist water supply, while treated water is used for irrigation. This model of water exchange is a relevant mechanism for adapting to water scarcity periods by the promotion of different agreements of collaboration subscribed for more than three decades between irrigators and suppliers (Rico, Olcina, & Baños, 2014). A favourable condition for establishing these agreements is the regular and direct dialogue between end users and their representatives, focused on technical objectives and based on a real knowledge of the needs demanded for each water use, and leaving the political issues in a second place (even though politicians have been generally in favour of this culture of promoting covenants between competing water uses). In this context, different issues promoted the harmonization of agreements between opposing water users and stakeholders from agricultural and urbantourist sector. Firstly, the awareness of water availability and the most appropriate technology to enable its affordable use. Secondly, the leadership focused on water users and their coordination with the local administration. Finally, the predisposition of stakeholders such as irrigators and suppliers to enter into dialogue with each other.

### **Canal contract of CrauSud Alpilles (Bouches du Rhône, France)**

In France, the “contrats de milieu” are environmental agreements (generally applied at river but also a lake or canal irrigation) between water users (irrigators, nonconsumptive water demands) and local authorities (council, municipalities) which aim for comprehensive, integrated and sustainable management of a water body in alignment with the WFD (Ricart & Clarimont, 2013). As a voluntary and concerted action program with technical and contractual financial commitment, these types of contract

started in the early 1980s and were promoted by the French Water Agencies with the aim of organizing and managing waterways using participative methods to reach ecological goals.

In order to achieve multifunctional management of some irrigation canals, “canal contracts”, that is, an approach led by the managers of an irrigation canal, in consultation with stakeholders from nonconsumptive water uses present in the territory, are put in place to promote a sustainable and shared management plan for the water body (Ghiotti & RivièreHonegger, 2012). In fact, the canal contract is above all a tool for planning actions and investments necessary to adapt to changing needs, water usages and environmental issues identified by stakeholders. Contracts have proved to be an effective instrument for obtaining commitments from farmers to change their farming practices to reduce the negative impacts of water use, while other stakeholders recognize the role played by irrigated agricultural in maintaining local landscapes and ecosystem services. An example is the Contrat de canal CrauSud Alpilles, signed in 2014 by 73 partners (irrigators, municipalities, environmental associations, cultural and touristic agents, water agencies, etc.). The main objective of the canal contract was to improve governance in multifunctional irrigation systems, and in order to achieve this goal, the contract includes the consultation of stakeholders about their concerns and the potential solutions to address them. Irrigators expressed consensus on three points: 1) the multiple water uses associated with the canal justify the engagement of all stakeholders in the decisionmaking processes; 2) gravity irrigation is the historical reason for existing the canals, and its maintenance is an addedvalue for society; and 3) the status of the Property Owners Association appears to be the most suitable for ensuring stakeholders’ engagement as a guarantee of the sustainability of the canals and the economic, social and ecosystem services provided.

### **Muzza Bassa Lodigiana reclamation body (Lombardy, Italy)**

The Muzza canal is both the largest irrigation canal in the Padana Plain in terms of capacity (the canal serves water to 5.000 users across its 40 km long) and the first artificial canal built in northern Italy (Galelli, Gandolfi, SonciniSessa, & Agostani, 2010). During the winter, the canal is used for agricultural purposes, industrial purposes, fish-farming and environmental flows (Masseroni et al., 2016). This

illustrates the multifunctional nature of the Muzza system, adapting to changing socio-economic demands as shifts occur between historical water uses (drainage and irrigation) to new water demands (hydroelectric use, ecological functions, sport fishing, biking and hiking, or recreation and educational activities). In addition, the growing social interest regarding water use efficiency (due to a series of significant droughts that occurred in the recent years) and participation in decision making processes (based on the emergence and consolidation of environmental associations) have increased the focus on the Muzza system as a multifunctional irrigation system. In fact, information exchange and experience sharing are mutual throughout the network of involved key stakeholders; most stakeholders consider the reclamation body to be a reliable source of information (good quality of information and good predisposition to establish an agreement between consumptive and nonconsumptive water uses).

The constitution of a water alliance (Patto per l'Acqua) in the Lombardy region started in 2007 after a period of persistent drought. The water alliance encouraged the integrated management of multiple water uses and promoted understanding between competing water interests as an example of good governance. A total of 64 key stakeholders participated and signed the water alliance, among which included public administrators at the regional and local level, water users' association, regulating and reclamation authorities, public parks, farm unions, navigation associations and environmental platforms, energy companies, and universities. In fact, one of the benefits of this water alliance was the application of a creative methodology based on the "de-structuring" of a problematic issue in order to abandon stereotypes, prejudices or false beliefs to establish new points of view. To achieve this, a new practice for encouraging participation and engagement of stakeholders was devised. Entitled "the dialogue between masks", the new process required each stakeholder to wear a Greek theatre mask in order to debate without assuming any stakeholder stereotype. This process resulted in the establishment of certain rules: freedom of expression and legitimacy of all opinions, validation of all contributions regardless of the role represented, obligation to listen and put oneself in the other's place, and make an effort for transforming confronted demands into proposals elaborated from heterogeneous interests.

### **Alliance for Agriculture in the Odra River Basin District (Germany, Poland and the Czech Republic)**

To approach the complex task of managing the Odra River the basin was divided into six areas. Only 6.5 % of the Odra River basin (which covers 122,512 km<sup>2</sup>) is situated in Germany, and this area is mostly used by agriculture (Meyer & Thiel, 2012). MecklenburgVorpommern, where the different agencies already actively engaged in collaboration, founded the ‘Alliance Environment and Agriculture’ to specifically tackle diffuse nutrient pollution from agricultural production. Members of this subjectspecific cooperation include public agencies, an agricultural consultancy, the federal state institute for agriculture and fisheries, and farmer and nature conservation associations, who participate in newly founded working groups. According to this, farmers are now more present in decisions on water and attend regular meetings that coordinate water and agricultural policy (Bruns & Gee, 2009). This has led to a more informal collaboration and institutional exchange between the agricultural and the water sector, even though some conflicts between the sectors prevails, specifically on who should bear the burden of nutrient pollution (Kochskämper, Challies, Newig & Jager, 2016). Similarly, collaboration in Brandenburg is organised in the working group ‘Agriculture’, where representatives from the State Agency for the Environment (Landesumweltamt) and the State Department for Consumer Protection, Agriculture and Land reorganization in Brandenburg (Landesamt für Verbraucherschutz, Landwirtschaft und Flurneuordnung Brandenburg) cooperate. Collaboration between those agencies is relatively new in Brandenburg, which might be a reason why agreement on targets and ways to reduce nutrient inputs have not been achieved. Including these actors, who are already well organized and represent vested water interests, in such prominent positions as responsible authorities for the implementation process at the river basin scale makes sense with regard to their network, influence and the challenges to environmental problems (Van Ast & Boot, 2003). Both alliances in Mecklenburg Vorpommern and Brandenburg, as well as the participation of agricultural stakeholders in working groups and panels are important for an integrated implementation of the WFD and the Common Agricultural Policy (CAP) (Donati, Menozzi, & Fioravanzi, 2015). Both have changed the influence of NGOs who can now participate in decision making processes. However, NGOs still don’t participate on an equal footing with other actors or users.



### **Rural Water Quality Program (Ontario, Canada)**

Several locally based rural water quality programs have been developed by watershed - based conservation authorities across Ontario. One notable example is the Rural Water Quality Program (RWQP), which will celebrate its 20th anniversary in 2018. The RWQP is promoted by the Grand River Conservation Authority, one of Ontario's largest and best resourced authorities, has jurisdiction over the Grand River watershed, which covers parts of 34 municipalities and the entire Region (Grand River Conservation Authority, 2013). The program has the objective of improving and protecting groundwater and surface water quality from farmers' engagement. Most of the selected best management practices include stream fencing, tree planting, manure storage, and well decommissioning. The formation of the RWQP benefited from a number of preexisting partnerships involving the provincial and local agricultural community, where farmers helped create and continue to oversee the program from the integration of local and scientific input, along with the beliefs and values of the stakeholder groups. Local committees, with representation from agricultural organizations, provincial water agencies, and other interest groups prioritize best management practices applications and determine which actions would be supported, in which areas, the rate of support and the maximum size of grant for an individual applicant. One of the added values of the program is the creation of the Stakeholder Agency (named the Steering Committee), as a working environment that facilitated collaboration between agricultural leaders, farm community and water authorities (Simpson & de L oe, 2014). With the support of the program, farmers can achieve their own environmental goals and help ensure there is enough clean water for farmers, their neighbours and all the residents of the Grand River watershed. In addition to influencing the decision to participate, cost sharing incentives are likely to have an impact upon the degree of participation.

### **National Water Resources Forum and Inter-Institutional Forum for Irrigation, (Ecuador)**

The 2008 Constitution of Ecuador is seen by many as one of the most progressive constitutions worldwide in terms of water governance (Harris & Roa-Garcia, 2013). This legislative tool promotes water governance through the recognition of water user

organization's autonomy, the acknowledgment of water as a national heritage for public use, as well as encouraging end-user participation in water decisions (Hoogesteger, 2016). The National Water Resources Forum, created in the early 1990s, is one of the policy advocacy platforms that played an important role in the definition of many of the water related articles of this Constitution. The Forum brings together multiethnic groups, grassroots organizations, individuals, NGOs, state institutions and academics from the whole country. The Forum has ensured that civil society platforms and NGOs played an important role in the creation of water user associations (WUAs) and their broader networks and alliances in Ecuadorian water governance (Hoogesteger, 2013). The Forum has become an important channel through which water users' influence multiscale governance structures and national water legislation affecting their water access and rights, and with this, their autonomy over local water territories (Castro, 2008). NGOs have been involved in the coproduction of community managed irrigation systems in the Ecuadorian Highlands since at least the 1970s. This is an example of promoting upscale water users' representation and participation at regional, provincial and national levels (Hoogesteger, Boelens, & Baud, 2016). However, since the 1990s, some of these same NGOs have been engaged in setting up and strengthening WUAs in state-managed irrigation systems. The idea comes from growing international and national recognition that irrigation systems should be managed by WUAs, even the large state-built and state-managed irrigation systems (Andolina, 2012; Hoogesteger, 2014). In fact, a specific example of this promotion of civil society in the management of irrigation is the configuration of the Inter-Institutional Irrigation Forum, a broad water-user organization and NGO-based civilsociety alliance for water user empowerment and democracy in Ecuador's irrigation sector.

### **Smallscale Irrigation and Water Conservancy Key Counties Construction (China)**

Given the public good nature of water and the role that the state will play in managing water, the real debate over the future severity of China's water problem comes down to a question of how well policymakers can respond to the various water-related issues confronting them (Cai, 2008). As the nation's largest consumer of water, China's government identified the nation's rising water scarcity as key problem. Reasons for scarcity include the poor performance of irrigation systems and increasing water

scarcity, both of which threaten the longterm development of the agricultural economy (Wang, Xu, Huang, & Roselle, 2006). This century has witnessed two major changes in China's irrigation policy (Nian, 2001). First, in 2003, China's government instituted decentralized irrigation management throughout the country (Zhou, 2013). This initiated the creation of WUAs and transferred management power to them from the government (or from the village organization). In fact, China's government has been investing large amounts of capital to construct small scale gravity-fed irrigation systems. Among these investment projects, the exemplar is the small scale Irrigation and Water Conservancy Key Counties Construction (referred as Key Counties Construction), which was built in 2009. The Key Counties Construction has unusual characteristics compared with other government funded agricultural projects (Chai, 2014). For example, a prerequisite for selecting a project area in a county is that farmer WUAs must already exist there. The aim was to incentivize counties to form well organized systems of decentralized management, with WUAs assuming small scale facility operation and maintenance, promoting farmers' engagement in decision making processes and connecting with water supply agencies (Huang, Rozelle, Msangi, Wang, & Huang, 2008).

The second major development in China's irrigation policy was the promotion of "formal monitors", that is, a leader able to enforce rules or collect information about potential issues from irrigators (Chai & Schoon, 2016). Recently, the World Bank has worked with China to implement another example of stakeholder' engagement, the Water Conservation Project II (20122016) in Hebei, Shanxi and Ningxia, the three most water scarce provinces in the Northern region. The project aimed to improve agriculture water management and increase agriculture water productivity by involving irrigators in decision making processes. For example, in 2016, a village WUA held a special drawing of lots in Youzhai Village in Guantao County to manage irrigation water and determine the order of irrigation access for households in the village. The obtained results show how farmers who have reduced water consumption receive awards, while those who use more than their allotted water have to pay a higher price (Wang et al., 2006).

### **The Canterbury Water Management Strategy, CWMS (Canterbury, New Zealand)**

The Canterbury Water Management Strategy (CWMS) is a non-statutory planning document that redefines the priorities, principles, and targets for freshwater management in the Canterbury region of New Zealand's South Island. Existing statutory processes resulted in litigation and antagonism between farmers who desired greater irrigation development and environmentalists who sought a reduction in irrigation due to its effects on local ecosystems (Russell & Frame, 2011). The CWMS asked these two stakeholders as well as indigenous Māori, local government, and hydro-electricity companies to develop a plan which all could agree too (Jenkins & Henley, 2014). The main challenge was reaching a consensus on future directions for Canterbury's water governance. The CWMS steering group created four broad future options for Canterbury's water governance: business as usual, environmental protection before infrastructure development, integrated infrastructure development and environmental protection side by side, or development first and protection second (Canterbury Mayoral Forum, 2009). After public deliberation, the CWMS chose to promote economic development and environmental protection side by side.

A review of the Strategy concluded that collaboration "is perceived by all informants as a major step forward in terms of resolving current water conflicts and from a longer-term perspective as an exercise in social learning" (Lomax, Memon, & Painter, 2010, p. 22). Since the CWMS' publication, the rules for freshwater are clearer in Canterbury through statutory regional planning documents, and litigation is no longer the default response of farmers and environmentalists to Regional Council decisions (Eppel, 2015). The CWMS illustrates that collaboration is a political tool that can help people find solutions while respectfully disagreeing, and that this is far superior to expensive litigation in the courts.

### **Madhya Pradesh Participatory Irrigation Management Act (Central India)**

In India, various policy reforms were carried out over the past decade in the water sector. The most recent is the National Water Act (2013), promoted in order to make provisions for development, management, abstraction, distribution, use, protection and conservation of national resources in an integrated approach. According to the Act, stakeholder participation should be established in a form that elicits direct input from

people at all levels of engagement (Narayanamoorthy, 2017). In order to ensure that all stakeholders actively and fruitfully participate in water resources management decision making at all stages, government developed the Guidelines for People's Participation in Water Development Projects, which promotes involvement of the public and the specific water users. In addition, the government also promotes the Guidelines for Formation of Water User Groups. Both guidelines become more important in those regions with significant irrigation infrastructure, for example, in the state of Madhya Pradesh (MeinzenDick, Raju, & Gulati, 2002). In order to resurrect the irrigation sector, institutional reforms were initiated by the government, first through creating irrigation local governments and then by defining farmers' management committees. Both attempts yielded little success, and meetings and discussions were held with progressive farmers about the need and importance of promoting participatory irrigation management with government advice. Surprisingly, there was no involvement of civil society organizations in these initial stages of policy discourse. In order to redirect the situation, The Madhya Pradesh Participatory Irrigation Management Act was enacted in 1999 and brought into force for the entire state by passing the rules for Act implementation in the same year. Since then, the dual purpose of the Act was to improve system condition and to involve end users in irrigation management

*Table 1 here. Examples of mechanisms for addressing governance in multifunctional water systems where irrigation is a key factor of development (Appendix)*

## **Discussion**

Stakeholder engagement can be achieved in a variety of ways and what works in one context might not work in another (Megdal, Eden, & Shamir, 2017). As the case studies illustrated, nations implement stakeholder engagement at different scales using different methods and frameworks (Franzén, Hammer, & Balfors, 2015; Van Lieshout, Dewulf, Aarts, & Termeer, 2014). One of the recognised benefits of stakeholder participation is the inclusion of local knowledge (Graversgaard, Jacobsen, Kjeldsen, & Dalgaard, 2017). An associated benefit is the integration of contesting viewpoints, which limits power asymmetries and overcomes the preconceived idea of winners and losers in managing irrigation systems (Zeitoun & Allan, 2008; Bellamy, Head, & Ross, 2017). In

fact, in last decade the term new governance has emerged to describe the popularity of collaborative approaches among government and nongovernment stakeholders from the private sector and civil society (Howlett & Rayner, 2006; PahlWostl, Holtz, Kastens, & Knieper, 2010).

This paper asked if these new governance approaches were applicable to multifunctional irrigation systems. In all the case studies analysed public administration, private services, rural communities, and civil society were engaged with new governance approaches. To recap, stakeholders were engaged: 1) to limit tensions and ensure stable water supply during scarcity periods, for example, the Water Consortium of Marina Baja (Spain), the Canal Contract (France), and the Alliance for Agriculture (Central Europe); 2) in response to water crises, for example, the Water Alliance (Italy) and the Inter-Institutional Forum for Irrigation (Ecuador); 3) to create water strategies and plans in situations of stakeholder conflict, for example, the Catalan River Basin District Management Plan (Spain), the Canterbury Water Management Strategy (New Zealand) and the Participatory Irrigation Management Act (Central India); 4) to decentralize water responsibilities, for example, Key Irrigation Counties Construction (China); 5) to integrate the values and beliefs of stakeholders, for example, Stakeholders Agency (Canada).

Over the last two decades, integrative, collaborative, and adaptive governance frameworks and more flexible which encourage engaged roles for society have been the cornerstone of dialogues on water governance (Eberhard, Margerum, Vella, Mayere, & Taylor, 2017). Following this trend, one of the major irrigation reforms carried out in the past decades is to include farmers in the management of irrigation systems, which is referred to variously as “irrigation management transfer” or “participatory irrigation management” (Choi, Yoon, & Kim, 2016). Under this arrangement, an attempt is made to decentralize irrigation management functions, which includes the active involvement of end users through the formation of local-level institutions (Zema, Nicotra, Tamburino, & Zimbone, 2015). Proponents argue that involving end users in the operation and maintenance of the multifunctional system can improve irrigation efficiency (and also urban water efficiency), generate a sense of ownership among

farmers towards the canal system, and enhance recovery of water charges (Bassi & Kumar, 2011; Biswas & Tortajada, 2010). However, this engagement should not ignore the uncertainties and challenges of multifunctional irrigation systems (Knieper & Pahl-Wostl, 2016). For example, is multifunctionality a characteristic or an objective to be accomplished by irrigation systems? The first interpretation considers multifunctionality as a characteristic of an economic activity, like agriculture, with positive or negative outputs to be valued in existing markets. The second interpretation of multifunctionality is in terms of different roles assigned to agriculture, that is, agriculture as an activity entrusted with fulfilling certain functions in society. Consequently, multifunctionality is not merely a characteristic of the production process, it also takes on a value in itself. For example, the public value the landscaping functions of irrigation systems as seen in the Water Consortium of Marina Baja case study.

The idea of multifunctionality is closely linked to how an irrigation system is perceived as an hydrosocial territory (Seeman, 2016). According to Perramond (2013), when analysing irrigation systems through the lens of hydrosocial territories, they appear as spatially bound sociomaterial constructs in which water is managed by interrelated physical elements (e.g. water sources and flows, and hydraulic infrastructure to divert, conduct and distribute water), normative elements (rules, rights and obligations regarding access to water), organizational elements (tasks for sustaining the system; capacities and knowledge of the art of irrigation) and agroproductive elements (soil, crops, technology, capital, labour force). Although these elements are considered in the participative tools presented in this paper, specific attention has been focused on how the promotion of good or new governance is or is not part of the water management tasks (Thomas, 2014). Most of the case studies analysed include water governance principles like openness, participation, accountability, and cooperation while factors like the effectiveness of the decisionmaking processes or the coherence between normative, organisational and technical frameworks are undervalued (for example, the lack of coordination between the WFD and the CAP policies or the incipient promotion of waterenergyfood nexus). In addition, only a few of our case studies considered the barriers and challenges limiting the promotion of governance, or how these risks can be addressed in order to proceed with irrigation governance. These questions are important

because the multifunctionality of irrigation systems requires understanding of scenarios where water scarcity, increasing water demands, conflict between water uses, and environmental requirements have to be integrated.

## **Conclusion**

Water governance and stakeholder engagement are receiving research attention for their role in formulating and implementing solutions to the world's critical water challenges. Recently, the United Nations, the World Bank, the Global Environmental Facility, the OECD, and the European Commission have joined forces to improve water governance globally. These efforts are rarely examined with competing water uses in mind, and they are even less frequently analysed in the context of multifunctional irrigation systems. In fact, there is a broad consensus in literature and in practice that engagement of stakeholders is a key ingredient for successful ecosystem-based management in general, and hydro-social territories and irrigation systems in particular. Stakeholder empowerment encourages 'ownership' of the decisions, strengthens trust among all partners and can reduce conflict. However, stakeholder participation requires an investment of time and resources, and the ability to recognize and address different points of view. In the case of multifunctional irrigation systems, the social 'endorsement' and stakeholder engagement are complementary, as an example of how stakeholder perceptions are included as influencing values in water decision making processes. However, one of the main risks of participation is when the recommendations of collaborators and stakeholders remain nonbinding on local governments and public administration. That is, the plurality of water cultures is an intrinsic feature of democracy and handpicked collaborators who are asked to reach consensus decisions limit the scope of debate.

Though some researchers suggest that there has been a shift from traditional, hierarchical forms of governance to more networked arrangements involving the private sector and civil society, others argue that this is more complex in practice. As disclosed in the case studies, irrigation management is not merely a technical field that can be addressed through infrastructure provision and scientific expertise, but a political one that involves human values, behaviour and organization. The findings suggest that the promotion and definition of figures specifically created for increasing governance in



multifunctional irrigation systems delivers some advantages. One benefit is the adaptability of each mechanism to the specificities of irrigation systems and also the ability to adapt to climate change future scenarios on water, food and energy. However, these benefits are conditioned by the promotion of ‘social learning’ as a way to demonstrate that a change in understanding of irrigation systems occurs and this change goes beyond rural community and interacts with the characteristics of each hydro-social territory. From its practical side, relevant authorities can use the results obtained in this research as a first step towards customizing their interventions at local and regional, scales, as it will give them prior knowledge, in a comparative form, about the value of applying specific mechanisms of governance to multifunctional irrigation systems

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## Appendix

Table 1. Examples of mechanisms for addressing governance in multifunctional water systems where irrigation is a key factor of development

<b>FIGURE</b>	<b>Applie s some princi ple of the White paper</b>	<b>Includes OECD governanc e principles</b>	<b>Diver sity of stake holde rs involv</b>	<b>Exists comm on issues addre ssed by</b>	<b>Pro mote s an agre emen t betw</b>	<b>Identifi es risks for governan ce implem entatio</b>	<b>Identifi es barrier s for governan ce implem</b>	<b>Includ es innov ative techni ques of</b>	<b>Provid es added value to the gover nance</b>
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	on governance		ed	stake holders	een parts	n	entation	governance	proces s
<b>Catalan River Basin District Management Plan (Spain)</b>	Openness Participation Effectiveness	Effectiveness (Principles 1-3) Trust and engagement (Principles 9-12)	X	X	X			Singular Water Participation Unit	Experience from EU countries in order to provide new forms of relationship between stakeholders and increase the level of trust between parts.
<b>Water Consortium of Marina Baja (Spain)</b>	Participation Accountability Effectiveness Coherence	Effectiveness (Principles 1 and 4) Efficiency (Principles 5,8) Trust and engagement (Principles 10,11)	X	X	X	X		Permanent and reviewable covenants between stakeholders	The covenant promotion as a traditional and cultural way to manage water resources
<b>Canal contract</b>	Openness	Effectiveness	X	X	X	X	X	Conducting a	Effective

<b>of Crau-Sud Alpilles (France)</b>	Participation Accountability Effectiveness Coherence	(Principles 1-4) Efficiency(Principles 6-8) Trust and engagement (Principles 10,12)						diagnosis of the concerns of each stakeholder in order to identify potential synergies	instrument in obtaining commitments from farmers
<b>Muzza Bassa Lodigiana reclamation body + Water alliance (Italy)</b>	Openness Participation Accountability Effectiveness	Effectiveness (Principles 14) Efficiency (Principles 7,8) Trust and Engagement (Principles 1012) <b>For Peer Review Only</b>	X	X	X	X	X	Water alliance: the dialogue between masks as a method for de-structuring stakeholder stereotypes	Information exchange and experience sharing
<b>Alliance for Agriculture in the Odra River Basin District (Germany, Poland and the Czech Republic)</b>	Openness Participation Accountability Effectiveness Coherence	Effectiveness (Principles 1,2,3) Efficiency (Principles 5,7,8) Trust and Engagement (Principles 9,10,11)		X	X		X	New networks of (cross-sectoral) cooperation	Regular interaction between potentially opposing views and with stakeh

									olders that have an impact on water quality
<b>Rural Water Quality Program + Stakeholders Agency (Canada)</b>	Participation Accountability Effectiveness	Effectiveness (Principles 1,2) Efficiency (Principle 8) Trust and Engagement (Principles 9-12)	X	X	X	X		Stakeholder Agency (steering committee)	Pre-existing partnerships involving farmers for integrating local and scientific input along with the beliefs and values of the stakeholders groups
<b>National Water Resources Forum + Inter-Institutional Forum for Irrigation(Ecuador)</b>	Openness Participation Effectiveness Coherence	Effectiveness (Principles 1-3) Trust and Engagement (Principles 9-12)	X	X	X		X	Forums for improving water governance	Promoting up-scale water users' representation
<b>Smallscale Irrigation and Water</b>	Participation Accountability	Effectiveness (Principles 2-4) Trust		X				Key Counties Constr	Decentralized management.

<b>Conservation Key Counties Construction(China)</b>	Effectiveness	and Engagement (Principles 10,11)						action: formal monitors	Farmers who reduce water consumption receive awards
<b>Canterbury Water Management Strategy (New Zealand)</b>	Participation Accountability	Effectiveness (Principles 1,2,3) Trust and Engagement (Principles 10,11)	X	X	X		X	Sustainability appraisal of future governance options	Growth in social learning and understanding from working and negotiating with stakeholders from opposing points of views
<b>Madhya Pradesh Participatory Irrigation Management Act (Central India)</b>	Openness Participation Accountability	Effectiveness (Principles 2,4) Efficiency (Principles 6-8) Trust and Engagement (Principles 10-12)		X	X		X	Guidelines for participation	Irrigation local governments as mechanism for discussing

## **Paper 5**

### **Collaboration the Kiwi Way: A national meta-analysis of collaborative freshwater governance in New Zealand**

Ann Brower, Franca Buelow, Lea Delsaut, Nick Kirk

Collaborative environmental governance is a prominent model for managing natural resource protection and extraction. It has critics and proponents, in both theoretical and practical terms. We have done a meta-analysis of the collaborative endeavors to govern freshwater in New Zealand to examine structures of representation, patterns of power distribution, forms of dissent, and models of consensus. We have found that Collaboration the Kiwi Way is more deliberation or consultation than collaboration, as the decision-making power resides firmly with the central or regional government. There are a variety of forms of representation, which raises interesting questions about equity and democracy. There is no consensus on consensus; some collaborative endeavours require it, others aspire to it, still others don't care. Finally, there is a variety of ways in which collaborative participants object to decisions taken - at the most extreme, a founder of a collaborative endeavor challenged its outcomes in the Environment Court.

#### **1. Introduction**

Collaborative environmental governance is becoming more prominent as a way to navigate difficult and entrenched resource conflicts (Ansell and Gash 2008, Cullen, McGee, Gunton, Day 2010, Benson, Jordan, Cook, Smith 2013, Chaffin, Gosnell, Cosens 2014, Hurlbert and Gupta 2015, Brower 2016, Cradock-Henry, Greenhalgh, Brown, Sinner 2017). Proponents of collaboration posit that, in creating better social relationships (Mandarano 2009, Floress, Stalker Prokopy, Broussard Allred 2011, Allen, Fenemor, Kilvington et al. 2011), it creates better and more socially sustainable outcomes (National Research Council 2008, Innes and Booher 2010, Lubell and Lippert 2011, Rinkus, Dobson, Gore, Dreelin 2015). Critics say that such endeavours risk being “less than democratic, less than fair, and less than good for the environment” (Brower 2016).

Collaborative endeavors often bring together those most affected by resource distribution and depletion issues. They often aim for consensus around how to distribute access to resources (Conley and Mooto 2003, Sabatier, Focht, Lubell et al. 2005, Innes and Booher 2010). Collaborative governance has been described as “a process in which sufficient trust in other stakeholders and commitment to the process has to generate ongoing pursuit of win-win policies” (O’Brien 2012, p.8).

Collaborative governance has been theorized (Ostrom 2005), formalized (Emerson and Nabatchi 2017), and frameworked (most recently Craddock-Henry et al. 2017); many normative lessons about contributors to success and failure have been gleaned from numerous case studies (Ansell and Gash 2008). Several review articles on New Zealand’s experience with collaboration have been produced. Ali Memon and Ed Weber (2008) produced a report which examined the obstacles to a successful collaborative approach to Canterbury’s freshwater management. Elizabeth Eppel (2013) provided a preliminary framework to guide collaborative governance in New Zealand by producing nineteen propositions from an international literature review. Rosemary O’Leary (2014) investigated the conditions necessary for the adoption of collaboration across New Zealand’s public sector. Ann Brower (2016) similarly compares the New Zealand experience in practice with an international literature review, and argues that “there is room for nascent optimism if the structure contains an effective mix of checks and balances between national and local interests. However, ... collaborative governance will favour development over the environment, and insiders over outsiders” (Brower, 2016, p. 396).

In other words, case studies have contributed an empirical base to a normative literature of what governance should be, and to what characteristics it aspires. Occasional meta-analyses test the theories, frameworks, and normative suggestions against what is and is not happening on the ground around the world (e.g. Ansell and Gash 2008). Broad review articles are rare. Substantively, the majority of scholarly research on New Zealand’s collaborative freshwater governance has focused on who participates, and who ought to participate, in the collaborative process. Methodologically, most focus on one to five case studies.

In this article, we conduct a national meta-analysis of all collaborative freshwater governance endeavors in New Zealand to discern the state-of-play in freshwater collaboration as of 2017, while testing the theoretical and normative propositions of what collaboration should be. In other words, we use the New Zealand freshwater governance panoply to explore the normative “shoulds”, the empirical “ares”, and the theoretical “wills”.

## **2. The Kiwi Context**

Over the last two decades, the governance of many of New Zealand’s freshwater resources has shifted towards a decision mode of ‘collaborative governance’ (Ansell and Gash, 2008) following the legislative impetus of the passing of the Local Government Act (LGA) in 2002 (Jenkins 2011a-c). The LGA promoted a partnership between communities and local governments, especially in the creation of long-term plans. Jenkins (2011a, p.54) argues the LGA “represents a shift from representative democracy towards participative democracy”.

Ostrom’s (1990) scholarship about shared ownership of, shared power over, and shared responsibility for a resource inspired Bryan Jenkins, the Chief Executive of the Canterbury Regional Council to make Canterbury an early-adopter (Jenkins 2011a, p.56). Jenkins promoted collaborative governance as a way to resolve tensions over Canterbury’s freshwater management. Canterbury’s experiments with collaborative governance in freshwater decision-making have now been adopted in at least six of New Zealand’s sixteen regional or unitary authorities (Sinner, Brown, Newton 2016).

The need for greater community involvement in freshwater decision-making had been perceived by scholars in the early 2000s (Memon and Selsky 2004, Marquardt and Russell 2007). Maurice Marquardt and Shona Russell examined two local water storages and sharing schemes in Canterbury – the Opuha Community Water Storage Dam and the Ashburton Water User Group – and concluded that the schemes had economic and social benefits but were detrimental to the environment. Significantly, the authors noted that these environmental problems:



“...were not regarded as... [a] failure, but rather as opportunities to learn and develop new solutions. Community involvement, albeit supported and facilitated to varying degrees by the regional Council, led to the discussion of options to reach a consensus locally, rather than having solutions imposed from a distant bureaucratic body”. (Marquardt and Russell 2007, p. 443)

This desire for catchment-scale consensus-based decision-making over freshwater policy became an important feature of the New Zealand model of freshwater collaborative governance. The earliest examples of collaborative governance in practice occurred in Canterbury during the 2000s. Canterbury’s Living Streams Programme (LSP), which started in the year 2000 but was formalised in 2003, involved land owners, NGOs, and community members coming together to reach “consensus on a short plan of action” (Holley and Gunningham 2011, p.320). In the LSP, the community identified at risk streams and then a collaborative group was formed to collate knowledge and take practical actions to improve the health of the waterways.

Another collaborative established in Canterbury was the third stage of the Canterbury Strategic Water Study (CSWS) (Whitehouse, Pearce, McFadden 2008). This collaboration involved the establishment of a steering committee to debate the merits and drawbacks of irrigation expansion in Canterbury. The steering committee included farming representatives, environmental NGO representatives, local Māori, hydro-electricity representatives, district Council representatives, an economist, and academics.

The success of these collaborations encouraged the Canterbury Mayoral Forum and the Canterbury Regional Council to experiment with collaborative planning for land and freshwater management in the region. The result was the non-statutory Canterbury Water Management Strategy (CWMS) (Canterbury Mayoral Forum 2009). The CWMS was the first region-wide collaborative freshwater endeavour in New Zealand, and as such, its publication remains an important moment in the development of a New Zealand model of freshwater collaboration (Eppel 2013, 2015). The CWMS is one of the cases reviewed in this analysis.

The CWMS has received scholarly attention since its creation in 2009 (Kirk 2015). Lomax et al. (2010) produced a preliminary evaluation of the CWMS a year after its publication. The authors concluded that the development of “the Strategy is perceived by all informants as a major step forward in terms of resolving current water conflicts and from a longer-term perspective as an exercise in social learning” (Lomax, Memon, Painter 2010, p. 22). The authors noted that the success of the collaboration was due to “a deliberate tactic on the part of the two or three leaders who oversaw the formulation of the Strategy” to specifically pick participants who were willing to collaborate, and to pick participants on the basis of their expertise and diversity of perspective rather than as representatives of a particular interest group (Lomax et al. 2010, p. 23). Elizabeth Eppel (2015) is complimentary of the Strategy and the process, but notes that collaboration alone will not resolve declining freshwater quality in the Canterbury region.

Following Canterbury’s footsteps, the national Land and Water Forum (LAWF) brings together stakeholders to discuss New Zealand’s freshwater policy. The Forum began meeting in 2009, producing a series of reports into New Zealand’s freshwater policy and management which make direct recommendations to central government. LAWF’s second report (2012) argued that collaborative processes are faster, more efficient, and more equitable than alternative decision-making frameworks. The success of the CWMS and the promotion of collaboration by the LAWF resulted in central government promoting collaboration for freshwater management across New Zealand. In 2013 the Ministry for the Environment suggested reforming the Resource Management Act to include optional collaborative planning processes (Ministry for the Environment 2013, p.10).

The participation of Māori stakeholders has been an important topic for examination. In 2016 the Ministry for the Environment released a consultation document in which they expressed their desire to strengthen Māori interests and rights in freshwater management (Ministry for the Environment 2016). This is occurring simultaneous to the Māori Council claim to freshwater rights through the Waitangi Tribunal (Forbes 2016).

Jacinta Ruru (2011) argues that Treaty of Waitangi settlements, such as those being sought by the Māori Council, provide opportunities for Māori to co-manage freshwater in a direct partnership with the Crown. Ruru cites the example of the Waikato-Tainui Raupatu Claims (Waikato River 2010) Settlement Act, which helped established the Waikato River Authority, a collaborative group consisting of iwi members, an environmental trust, and five members appointed by the Ministry for the Environment (Ruru 2011, p.122). Memon and Kirk (2012) used the Ngai Tahu Treaty of Waitangi settlement, and the management of Te Waihora/Lake Ellesmere, to illustrate the factors that enable and constrain Māori access to natural resources such as freshwater. Harmswoth et al. (2015) argue that “effective collaboration is achieved by using the correct (tikanga) decision-making processes, through a greater understanding and appreciation of Māori values that can be supported by a variety of kaupapa Māori-based assessment tools” (Harmsworth, Awatere, Robb 2015, p. 1). These authors distinguish between a variety of models of engagement the Crown uses to engage with Māori over freshwater management, distinguishing between co-governance arrangements, co-planning arrangements, and co-management arrangements. The most in-depth examination of Māori engagement with freshwater management in New Zealand is Robb et al. (2015). This article introduces the different collaborative frameworks noted above, the challenges unique to Māori within these processes, and the tools for effective collaboration. The work of Sinner and Harmsworth (2015) and Schiele (2015) complements this research.

Stakeholder participation, perception, and representation on collaborations, beyond a focus on Māori, has also been a topic of scholarly research. Lennox, Proctor and Russell (2011) examine stakeholder participation in two Canterbury case studies, and conclude that participation was beneficial and increasingly necessary to resolve tensions around freshwater management. However, there are barriers to the success of stakeholder participation. As such, Lennox et al. (2011, p. 1390) recommend providing adequate time for stakeholder preparation in collaborative schemes, ensuring confidentiality in stakeholder input, as well as substantiating the issues such that there will be meaningful and practical outcomes from the process. Fenemor et al. (2011, p.17) interviewed a variety of stakeholders across New Zealand and discovered that these stakeholders

wanted recognition of a wide variety of values in New Zealand's freshwater decision-making: such as landscape, spiritual, and amenity values. The authors concluded that "the levels of satisfaction with planning processes and plan outcomes appear to correlate with the level of influence of the various stakeholder groups" (Fenemor, Neilan, Allen, Russell 2011, p. 18).

New Zealand's collaborative experiment has developed without much legislative intervention. As a result, New Zealand's freshwater collaborations often mix statutory-planning methods with more informal collaborative processes. In an amendment of Schedule 1 of the Resource Management Act 1991, Councils were able to "adopt a collaborative planning process as an alternative planning track when undertaking a review or change, or preparing a new plan or policy statement, including a combined regional and district document" (Ministry for the Environment 2017a). Previously, the RMA had only one statutory process for preparing or changing policy statements or plans. Berkett and Sinner (2013) argue that Regional Councils should take four specific roles in a collaborative process: Councils ought to lead the process, Councils ought to facilitate the process, Councils ought to provide expert analysis and advice to any collaborative stakeholder groups, and as a stakeholder itself Councils have a responsibility to represent the local community. The Ministry for the Environment has recently published a guide on collaborative planning processes under the 1991 Resource Management Act (Ministry for the Environment 2017b). Landcare Research, one of the six Crown Research Institutes, published several guidance documents for government, Regional Council, and industry to better understand, design and evaluate collaborative planning processes (e.g. Cradock-Henry 2013; Cradock-Henry, Berkett, Kilvington 2013; Berkett, Challenger, Sinner, Tadaki 2013).

Based on the literature, collaboration the kiwi way appears to feature 3 characteristics:

1 – Freshwater collaborations should be bounded by bio-physical boundaries, such as those provided by a local river or lake catchment.

2 – Freshwater collaborations should reach consensus over policy and planning decisions. This will reduce the likelihood of stakeholders appealing decisions to the Environment Court or through planning hearings.

3 – Freshwater collaborators ought to be selected on the basis that they are: a) not representing specific interests, b) bring a unique set of values to the collaboration, and c) can collaborate and compromise in order to reach a consensus.

### **3. Methods and Data**

Our research builds on the substantive findings and questions highlighted by previous studies. But ours stands out methodologically as it is a national meta-analysis. Thus, it combines the best of both the review and the small-n case study approaches. It uses the full population (N) of cases to examine and test the findings of the empirical case studies (e.g. Nissen 2014, Craddock-Henry et al. 2017) and the propositions put forth by the reviews (e.g. Brower 2016, Memon and Weber 2008) published to date. With this, our analysis allows to compile an overview of dominant themes and prominent exceptions of Collaboration the Kiwi way in the governance of freshwater resources across NZ.

We compiled a corpus of 22 cases<sup>11</sup>, selecting scientific publications and grey literature such as reports and newspaper articles. The data were analysed by Qualitative Data Analysis (QDA) software MaxQDA. Such forms of analysis have a thirty-year history (Saillard 2011). MaxQDA allows researchers to merge qualitative and quantitative analyses. A Code-Matrix Browser (appendix) and a Code-Relations Browser visualize the distribution of codes over all texts and the intersections of codes respectively. We conducted a comparative Computer Assisted Qualitative Data Analysis (CAQDAS) analysis around a set of questions that are discussed in the literature on collaborative (freshwater) governance in New Zealand and elsewhere (cf. table 1). Following a Grounded Theory Methodology (GTM) (Charmaz 2006), these questions informed our variable-based analytical scheme around a total of 12 variables to allow for a structured, systematic integration of case studies into a coherent analysis in a case

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<sup>11</sup> Table 1 in Appendix 1 lists the cases examined.

survey method (Yin and Heald 1975, Larsson 1993, Newig and Fritsch 2009). While this method allows us to arrive at insights beyond the scope of the publications that are being analysed, it is also challenged by the heterogeneity of cases.

Our analytical scheme specifically targets process characteristics of freshwater governance as well as the contextual factors shaping decisions taken. Dimensions of a policy cycle considered here are input (who is part of the process and why are they involved), throughput (quality of participation, setting and scale for the collaborative interaction), output (what is the result of the interaction, decisions taken), outcome (what does this entail for society and resource quality) (Newig 2011). What this analysis cannot cover however is the impact of these processes as well as the environmental outcome of collaborative governance. We analyse both scientific publications as well as grey literature on the collaborative governance cases in New Zealand, but are unable to perform long-term analysis of the overall effects at this point.

Table 1 Coding Questions and Associated Literature

Category for coding/associated Questions	Relevance/associated Lit
<b>Who/What is represented by participants in the collaborative process (REPRESENTATION)</b>	Are participants elected, voted in, appointed. What can we say about the mechanism of ‘getting in’? Flexible governance arrangements raise questions of legitimate inclusion, representation and delegation in decision-making process as well as the power relations associated with access to participation (Newig, Schulz, Jager 2016). Brower 2016, Sinner et al. 2014, Nissen 2014, Lomax et al. 2010).
<b>What sort of decision-mode was chosen (consensus/unanimity/majority/minority/authoritative) (DECISION-MODE)</b>	Testing the focus on consensus and its relevance for a decision (Thomas 2014, Marquardt & Russell 2007, Holley & Gunningham 2011).
<b>Was the process mediated/facilitated (MEDIATION)</b>	Clear objective setting, skilled

	<p>facilitation and a careful selection and combination of participatory tools and other methods are recommended by several authors (Lynam et al. 2007, Reed 2008).</p>
<p><b>Considering Power issues, did Council accept local/catchment proposals &amp; did the collaborative efforts include any legislative directory force (in terms of implementation of proposed actions) (POWER ISSUES)</b></p>	<p>The authors Cooke &amp; Kothari (2001, p. 14f.) outline the “tyrannical potential” of participation processes due to unequal power-relations between facilitators and participants. A reflexion on relations, processes and consequences can be a starting point for a conscious handling with participation processes; See also: Berkett &amp; Sinner 2013.</p>
<p><b>Which problems/limiting factors affect collaborative processes (LIMITS OF COLLABORATION)</b></p>	<p>Normative and factual uncertainty; disagreements, not legitimate, undemocratic (Newig, Pahl-Wostl, Sigel 2005, Brower 2016, Newig &amp; Fritsch 2009).</p>
<p><b>Who defined the problem and how was it framed (PROBLEM DEFINITION)</b></p>	<p>Reasoning behind the process design is often tied to failing processes (Ansell &amp; Gash 2008, Cullen et al. 2010, Chaffin et al. 2014, Hurlbert &amp; Gupta 2015, Brower 2016, Craddock-Henry et al. 2017).</p>
<p><b>At what scale does collaboration take place (catchment/sub-catchment, local, regional, national) (SCALE)</b></p>	<p>Governing the environment involves both political processes of scaling and rescaling the objects and agents of governance, as well as attempts to create new, networked, arenas of governance (Duncan 2013, Fenemor et al. 2011, Newig, Schulz, Jager 2016, MfE 2013, Bulkeley 2005). Folke et al. (2010) state that a transformational change at a smaller scale enables resilience at larger scales; Newig &amp; Fritsch (2009)</p>

	assume quite generally that the choice of governance scale and level as well as the nature of participation (or its absence) in governance decisions affects environmental outcomes.
<b>Who defines success of the process/why (SUCCESS)</b>	Collaboration as a way to overcome conflicting views on resources and to reach “win-win policies” (O’Brien 2012, p.8, Ansell & Gash 2008, Cullen et al. 2010, Chaffin et al. 2014, Benson et al. 2013, Hurlbert & Gupta 2015, Brower 2016, Craddock-Henry et al. 2017).
<b>What are the social/ecological/economic reasons for collaboration? Is there a common narrative/motivation that we can identify within and across cases? (REASONS FOR COLLABORATION – COMMON NARRATIVE)</b>	General inquiry to get at the framing of collaborative freshwater governance. Testing the normative “wills” of Kiwi Collaboration.
<b>What is the outcome (social/ecological) of the process(es)? (OUTCOME – if any)</b>	It is assumed that participation reaches ‘better’ outcomes and higher acceptance rates (National Research Council 2008, Innes & Booher 2010, Lubell and Lippert 2011, Rinkus et al. 2015).
<b>What is the impact that the process has (legislative/ecological/social)? (IMPACT)</b>	Berkett et al. (2013) underscore the relevance of associated values; Stakeholder participation guarantees a long-term implementation (Reed 2008, p. 2426).
<b>Maori involvement in decision-making/collaboration? (Degree of indigenous co-governance)</b>	Diverse problems and opportunities have been discussed by Memon & Kirk 2012, Robb et al. 2015, Schiele 2015, Sinner & Harmsworth 2015.

MAXQDA allows researchers to set variables for each document and/or coded parts of each document. Individual colours are used to represent the 12 codes applied here and to differentiate between themes (cf. figure X *Overview of coding scheme*). The



respective quotes are used to emphasize or support characteristics of collaborative freshwater governance in New Zealand as perceived by participants.

In this study, the team of four researchers came together to discuss the codes after the initial phase of individual, open coding to increase inter-coder reliability. The dominant themes and prominent exceptions to our examination questions are presented in the following section.

#### **4. Results**

The management and allocation of freshwater resources have been the “subject of court cases, criticism and contestation, spanning concerns about land-use development and intensification, scientific modes and understanding of the region’s groundwater system, and lack of opportunities for public participation in decision-making” (Russell and Frame 2011, p. 7). Our analysis looks at 22 cases of freshwater governance to shed some light on the working of these processes in New Zealand. The following subsections describe the general trends and some prominent features of the collaborative instances. As this study aims at a structured, systematic integration of case studies into a coherent analysis, we do not present the individual case characteristics. Following general remarks that we found in the meta-analysis, we present the general trends and single cases that stand out with quotes from the corpus. Table 2 displays more detailed information on the individual cases; a spreadsheet of all coded segments can be found in the appendix.

##### ***DECISION-MODE***

Normatively, consensus is the preferred decision mode for all cases of collaboration analysed here. Empirically, only Lake Brunner and the TANK group did not manage to reach consensus and had instead agreed on an 80% majority vote if no consensus is reached. For Healthy rivers, disagreements led to the use of a casting vote, where the chair (who responded directly to Regional Council) made the final decision on the plan. This was accompanied by the comment that the Council was legislatively obliged to address water quality in the rivers due to the National Policy Statement for Freshwater and Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy for the Waikato and

Waipa rivers) (Healthy Rivers\HR.15.09.16.Waikato Regional Council agrees to Healthy Rivers W 5 – 5)<sup>12</sup>.

Theoretically, consensus agreements in a collaborative governance setting are perceived as a means to increasing effectiveness (cf. Motueka\MfE ICM Final Report 2010\_06\_28 Report 82: 1081 - 82: 1919; Land and Water Forum). This is because they spur capacity building ‘amongst each other’ in a coordinated approach to decision-making (Motueka\MfE ICM Final Report 2010\_06\_28 Report 96: 3508 - 96: 3744). Furthermore, increased efficiency with which information is processed and disseminated, smooth financing agreements with “more creative approaches to this and/or for the additional costs of development”, and “a non-adversarial approach to science-provision will increase the efficiency with which an agreed base of scientific, Mātauranga Māori and technical information is developed” (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 58: 1190 - 58: 1763).

The preconditions for reaching consensus are described in the context of feedback mechanisms, when those “who are most affected by the changes have been at the table developing the policy and providing input and feedback from their communities and sectors” (Waikato\5184 - HRWO Infosheet The Process 1: 947 - 1: 1464; Takaka\2016-11-21SummaryofTakakaFLAGProcessAndInterimDecisions 23: 1450 - 23: 1588). Newspapers reported on disagreements, official reports downplayed these disagreements and instead emphasised successful consensus-based decision making<sup>13</sup>. Problematized is the relationship with iwi, since they have “not always been fruitfully engaged, neither at national nor regional or local levels” (e.g. in the context of the Land and Water Forum, Living Streams; Canterbury Water Management Strategy, Land and Water Forum\land\_and\_water\_forum\_report 9: 2236 - 9: 2458).

Formal standards for participation and access to participation differ between cases. In the case of Healthy Rivers, the Council and each of the River iwi must discuss and recommend to Council the process to be adopted for the preparation, review, change or variation and the general form and content of the plan. The legislation requires that joint

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<sup>12</sup> All citation names for text references associated with the corpus of freshwater case document are MaxQDA associated references. For full quotes and document names, please consult the Code Matrix provided as supplementary material in the electronic version of this thesis.

<sup>13</sup> Cf. Quotes in the Code Matrix in the Folder Supplementary Material.

recommendations are made by each River iwi and Council. These are: 1) to commence the process to prepare, review, amend and/or vary a RMA planning document; and 2) to notify the draft RMA planning document. Waikato Regional Council retains final sign off authority to the plan change, providing that such decision making is consistent with the Vision and Strategy (Healthy Rivers\HR.CSG Terms of Reference 20: 1949 - 20: 2676). Many other processes merely mention that plans are discussed with all parties. Procedural comments that are comparable across cases are lacking or at least not openly communicated.

Most of the work prior to a consensus agreement builds on the preparation, review, change or variation and the general form and content of the plan to Council. Put differently, the collaborative output has the character of a recommendation on which participants with 'vested interest' in water management can agree.

Planning and consenting processes are perceived as cumbersome and adversarial by some "with contested science, high costs, lengthy processes, litigation, delays and frustration" (cf. Land and Water Forum\land\_and\_water\_forum\_report 30: 868 - 30: 1571). In general, commentary on the collaborative efforts and the decisions taken are positive when they concern community projects and more critical when it comes to the impact of community and stakeholder input.

### ***POWER ISSUES***

Responsibilities amongst actors do not seem to be clear, and allocation of power is often challenged by participants. Documents on Takaka are especially critical: "Central government abrogating its responsibility to ensure the control of an essential resource is being carried out by democratically elected members of local authorities is a genuine issue. Allowing local government to bend the rules and give private groups control of water on a case by case basis is a genuine issue" (Takaka\15.11.15.NZCPRHands off our water 44 – 45). The new governance mode and re-scaling of governance levels are seen as neither transparent nor democratic. Documents on Motueka state that "decision-making and management involves the responsible agencies in their separate and combined interactions with iwi and communities, and may mean sharing or blurring legislative and jurisdictional

boundaries” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 171: 3211 - 171: 3424).

Interestingly, some newspaper correspondents interpret the collaborative, participatory setting as a chance to repeal the Sections 33 and 36 provisions of the RMA, which are allowing iwi to become resource consenting authorities (Takaka\15.11.15.NZCPRHands off our water 54 – 54). Some argue that “no future government can be coerced into the racial control of public resources”, implicitly voicing concern over democratic access to decision-making, where “half of the members are unelected iwi representatives with voting rights” (Takaka\15.11.15.NZCPRHands off our water 18 – 18). They continue “Allowing local government to bend the rules and give private groups control of water on a case by case basis is a genuine issue” (Takaka\15.11.15.NZCPRHands off our water 44 – 45). Quite the opposite perspective is voiced in context of Motueka documents, “where iwi/hapu have limited capacity available to them, they are disadvantaged as active and knowledgeable participants” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 173: 219 - 173: 918). More insight on the perception of participation of iwi is presented in another subsection.

Participation by rule of most affected sectors and actors seems to open up discussions on legitimate access to policy decisions on resources. Power shifts are discussed in the context of who has a say in the collaborative discussions on freshwater. The Land and Water Forum presents the process of legitimizing authority in context of collaborative governance a “template for enabling and managing the transfer of authorisations between or within zones” (Land and Water Forum\Rec by rec analysis - April 2016 14: 6553 - 14: 6786). A ‘sustained government mandate’ is what the stakeholders arrive at in the case of Motueka (Motueka\MfE ICM Final Report 2010\_06\_28 Report 131: 3597 - 132: 106). Similarly, and arguing along these lines, the Land and Water Forum is cautious of the new governance mode and calls for measures ‘to avoid the risk that it will need to be revisited later, with disruptive consequence’ (Land and Water Forum\land\_and\_water\_forum\_report 13: 2764 - 14: 178). The vocabulary for such new governance modes does not seem to be clear, as are the implications of new constellations and processes.

Motueka documents describe empowerment of participants to hold governmental actors accountable for actions, since there was “a response to the strong community and stakeholder buy-in the programme received, it was held accountable for its actions by catchment stakeholders, iwi and community member (Motueka\Harrison\_mapplsc 97: 1498 - 97: 1677). This seems to happen “in response to an apparent lack of interest by the two Regional Councils responsible for it” (see Section 8.5.Motueka\MfE ICM Final Report 2010\_06\_28 Report 173: 1296 - 173: 1464).

Iwi empowerment is a prominent issue in the context of Te Arawa, when they “reiterated that they owned the lakes and that they had never given up that ownership” (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 31: 461 - 31: 578). In that case, an agreement on ownership was formalised in the Native Land Amendment and Native Land Claims Adjustment Act 1922. The 1922 Act declared the lakebeds to be the property of the Crown (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 32: 2297 - 32: 2466). Collaborative governance modes are potentially a way of counteracting “the lack of a clear path for iwi to engage in national and regional planning and decision-making processes” (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 17: 1148 - 17: 1324). However, since participation mostly happens upon nomination, exclusion of stakeholders might still occur.

In sum, Regional Council has the final say in all processes and is always the main authority (Forum\SecondReportoftheLandandWaterForum-April2012.pdf 78: 4900 - 78: 507). This means that, final decision is taken by governmental actors “following consultation with stakeholders and the community”, and that Regional Councils “retain the ability to determine to use current statutory processes” (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 51: 59 - 51: 243). Furthermore, Regional Council makes additions to complete the “proposed” plan, notifies the plan, calls for submissions (and further submissions) and appoints an independent hearing panel (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 78: 3752 - 78: 3976). Power of Council is demonstrated in Healthy Rivers, where disagreements led to the use

of a casting vote, accompanied by the comment that the Council was legislatively obliged to address water quality in the rivers due to the National Policy Statement for Freshwater and Te Ture Whaimana o Te Awa o Waikato (Vision and Strategy for the Waikato and Waipa rivers) (Healthy Rivers\HR.15.09.16.Waikato Regional Council agrees to Healthy Rivers W 5 – 5). The Bay of Plenty Regional Council (Council) has been granted a royalty-free, non-exclusive, non-transferable and revocable licence to amend the standing orders (Amended Standing Orders) so that they are suitable for the Council’s context and needs (Rotorua Te Arawa Lakes Strategy Group\2017-03-03-rotorua-te-arawa-lakes-strategy-group-meeting-agenda 37: 1669 - 37: 2118).

Actual power shifts are thus miniscule or non-existent in the collaborative governance cases.

### ***REPRESENTATION***

Participants to the collaborative freshwater governance processes are nominated by their stakeholder groups and communities, and then invited and appointed by members of the Council.

The size of groups as well as their organization and way of negotiating differs from region to region. There are more the 60 members in the Land and Water Forum, drawn from the primary sector (including farming, horticulture, and forestry) from industry (including power generators) from the services sector (including tourism) and from civil society (including Green NGOs) (Land and Water Forum\Third Report of the Land and Water Forum 5: 2397 - 5: 3033). Others met in community groups and completed projects, often of a non-regulatory character, which “are a critical part of the Freshwater Plan – they recognise that we can’t achieve our objectives and outcomes for fresh water through regulation alone” (FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 1: 2290 - 1: 2677). The roles within these meetings, groups, projects vary. Put positively, the Land and Water Forum states that “(W)ithout Treaty Partners any outcome would have lacked legitimacy. We were assisted by active observers from central and local government, who participated fully in all of our conversations, but were not obliged to form part of the consensus” (Land and Water Forum\Third Report of the Land and Water Forum 5: 2397 - 5: 3033).

There is, as has been mentioned in the other subsections, a general lack of a clear path for iwi to participate that “evokes legacies marked by their exclusion from decision making” (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 17: 1148 - 17: 1324). In the Healthy Rivers process the Council and River iwi have agreed to work together rather than the Council having to work separately with each of the River iwi” (Healthy Rivers\HR.2154945 Stakeholder Engagement Strategy March 28 2013 11: 243 - 11: 663), establishing a single Joint Working Party (JWP) to progress the plan change, comprising staff representatives from all five River iwi and the Council. This approach is “consistent with the requirements and intent of the legislation” (Healthy Rivers\HR.2154945 Stakeholder Engagement Strategy March 28 2013 11: 243 - 11: 663).

All in all, the logic of representation is less than transparent and comparable across cases. The stakeholders that are nomination because of vested interests in water do represent specific interests, and the activities following their individual logic of behaviour can of course lead to very different outcomes in terms of water protection and extraction. With Regional Council having the final say in the decisions on freshwater, the output of collaborative processes can be called consultative in character. In this context, appointing people within community groups has an interesting ring to it.

### ***MEDIATION/facilitation***

Comments on facilitation are sparse. It seems that facilitators are often present, and seen as a way to “engage effectively (...) on the agency’s or agencies’ behalf”, which is especially important when participants identify a “failure of agencies to provide good facilitators or to give them enough time and resourcing” as in the case of Motueka collaboration (Motueka\MfE ICM Final Report 2010\_06\_28 Report 19: 2489 - 19: 2667). Besides facilitators, chairpersons that are appointed to lead and organized discussions, negotiate between stakeholders and Council (Waikato\WRC 2014 - CSG Terms of Reference 8: 297 - 8: 575).

### ***SCALE***

According to the Ministry for the Environment, a Water Management Area can be a water body, multiple water body or part of a water body that is an appropriate spatial

scale for setting objectives and limits, and “an appropriate scale is one that enables us to provide for them adequately” (FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 3: 1326 - 3: 1791). In the interest of “a shift in philosophy from an individual rights basis for using water resources to a collective interests approach” (Canterbury Water Management Strategy\Eppel 2015 5: 1070 - 5: 2339) most collaborative processes have been downscaled from regional to catchment levels. It has been argued that catchment level provides for an identification of values within the catchment (e.g. FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 3: 1326 - 3: 1791).

The logic of working at catchment level is explained as “this is where water quality and quantity allocation limits, management targets and other methods will sit. Limits will apply to areas within each catchment and give effect to requirements for setting limits under the National Policy Statement for Freshwater Management” (FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 1: 1562 - 1: 1958). However, in some cases this reasoning for downscaling is rather unspecific in its definition of doing “what works well”, “using region-wide approaches where appropriate and localised solutions for specific issues” (Waiora.NRCWhat is Waiora Northland Water). Interestingly, targets and timetables to meet those are framed in reference to the way waterbodies are valued (Land and Water Forum\land\_and\_water\_forum\_report 18: 761 - 18: 1091), in order to “link and co-ordinate the policies, methods and rules in the regional plan with implementation on the ground” (ibid). This does not necessarily deviate too much from the status quo of freshwater management prior to collaboration. Considering that the Takaka River catchment “is currently being managed by default provisions for both water quality and water quantity that are not specific to this river and its tributaries” (TasmanCouncilFLAGFAQ) it might be misleading to assume that collaboration leads to the improved water quality. When the macroscale is being addressed and coastal waters are part of the governance planning, it “is critical to defining the issues which should be addressed, the public and private sector participants that should be involved and the goals, objectives and timeframes for developing, implementing, monitoring, reviewing and adapting an integrated catchment and coastal” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 23: 2167 - 23: 2536).



All in all, the reports recommend an integrated approach to setting national and then local objectives for water bodies, and to derive at catchment limits to takes and discharges from them.

### ***LIMITS OF COLLABORATION***

Power ultimately rests with Council and final realisation of resource management in policy output limits the impact and influence of the collaborative efforts. The lack of influence on the final outcome is criticised by collaborators who ask for the “governance’ back to those who are doing the “collaborating”, rather than selectively prune from the process only those parts that actually fit its agenda” (Waituna Lagoon\Act now to save Waituna 16 – 17). Publications on Motueka criticise a lack of enforcement mechanisms, narrow scope and lack of integration internally within the lead agency and externally with iwi and other sectoral or community interests (Motueka\MfE ICM Final Report 2010\_06\_28 Report 118: 1542 - 118: 1705).

While environmental bottom lines are defined, the lack of comparable water quality standards makes it hard to come to comparable decisions on water quality across NZ (Motueka\MfE ICM Final Report 2010\_06\_28 Report 168: 835 - 168: 1419). This leads stakeholders to say that “(E)ndless political and legal contests are giving poor outcomes, as always happens when property rights are ambiguously defined and/or unenforceable” (L&W.26.01.2016.ACTpartyFresh Water and RMA reform a plan or a b).

Fish & Game, one of New Zealand’s leading environmental and recreation advocates left the Land and Water Forum six years into the collaborative process when they felt that their positions were being ignored for the benefit of pre-defined interests and policy positions (cf. Brower 2016). Limits of collaboration occur thus whenever participants to a collaborative endeavour feel like they do not have enough of a say in the matter or when the values, ideas, and aims for water quality do not match. A clear limit is of course the way in which participants can contribute to Regional Councils’ decisions on freshwater policies.

### ***REASONS FOR COLLABORATION***

“New Zealanders have spent a great deal of time fighting one another about them, politically, at hearings and in Courts – and often with sub-optimal outcome” (Land and Water Forum\land\_and\_water\_forum\_report 6: 1425 - 6: 2074). Against this background, a common reason given for collaboration is to the hope for improved range of outcomes, reducing risks for applicants and reducing litigation and contention over infrastructure schemes (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 6: 228 - 6: 786; Land and Water Forum\land\_and\_water\_forum\_report 14: 1560 - 14: 2001). Better (environmental) outcomes are said to be achieved in collaboration/consultation (Waikato\WRC 2012 - Raukawa Joint Management Agreement 23: 1284 - 23: 1820). Reaching “solutions that have buy in and commitment from a range of sectors and groups” (Canterbury Water Management Strategy\Eppel 2015 5: 1070 - 5: 2339; Healthy Rivers\HR.28.02.14.WaikatoRegionInterim chair of Collaborative Stakeho 9 - 9), as “on-the-ground realities and views will be gathered, resulting in robust policy recommendations” as well as “new ideas and innovations” (Waikato\WRC 2013 - 2154945 Stakeholder Engagement Strategy March 28 201 28: 830 - 28: 1054) also, improved understanding, and is said to lead to more caution in water treatment (Lake Brunner\LakeB30.08.16.Nick Smith sets out the Government 124 – 124). Collaboration is further promoted as a means to the foundations for implementation are prepared prior to plan notification. GDC 2014 - Update-on-Waipaoa-Catchment-Plan FWAG

Following National Policy Statement requirements and national guidelines, participation is a must (interpretation differs across regions, since participation is not clearly defined) (Land and Water Forum\land\_and\_water\_forum\_report 6: 1425 - 6: 2074). Treaty settlement makes it necessary to include certain parties (Manawatu, Te Arawa, Healthy rivers...).

Non-regulatory projects are a critical part of collaborative freshwater planning and often accompany the processes, as “they recognise that we can’t achieve our objectives and outcomes for fresh water through regulation alone” (FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 1: 2290 - 1: 2677). They “provide non-regulatory methods or projects that involve a collaborative approach to managing our freshwater or improving water quality” (FWAG\GDC 2014 - Update-on-Waipaoa-Catchment-Plan 1: 2290 - 1: 2677). The sustainable dimension of such planning processes is underscored

as ‘future generations’ benefit from today’s activities in “the promotion of the sustainable management of the Rotorua Lakes for the use and enjoyment of present and future generations, while recognising and providing for the traditional relationship of Te Arawa with their ancestral lakes (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 24: 1206 - 24: 1530).

### ***Degree of indigenous co-governance MAORI***

The RMA Reform Bill – a deal between the National and Maori Parties – requires Councils to introduce Iwi Participation Agreements. These could serve as a pathway for iwi to become joint or full resource consulting authorities (Ministry for the Environment 2017a,b). Collaboration as empowerment “to support iwi/hapu in their growing role in collaborative management through the Treaty Settlement process” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 172: 2710 - 172: 3378). Access to resources is provided because of the Treaty of Waitangi, the settlement agreement and reports are written in regard to both the Vision and Strategy and the National Policy Statement on Freshwater Management in its deliberations (Healthy Rivers\HR.06.09.16.RuralNews 9 – 9). For Healthy Rivers, “legislation requires that joint recommendations are made by each River iwi and Council” (Healthy Rivers\HR.CSG Terms of Reference 20: 1949 - 20: 2676).

Iwi/hapu representation and agreement is especially challenging in the Rotorua Te Arawa Lakes Strategy development, primarily because of the longstanding grievances of Te Arawa in relation to Crown acts and omissions concerning the Te Arawa Lakes, expressed through petitions to Government and the Stout-Ngata Commission (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 28: 440 - 28: 1024); “The Crown acknowledges that it has failed to deal with those grievances in an appropriate way and that recognition of Te Arawa’s grievances is long overdue” (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 35: 150 - 35: 698).

Waiora documents criticise the lack of opportunities for hapu to “participate in the assessment decision process to decide if, and where fencing off of waterways should take place in their respective rohe of

kaitiakitanga guardianship” (Waiora\Report-033-Mangere-River-Survey-June-July-2013 3: 803 - 3: 1007). Documents on Motueka mention a need for more participation and “conversation amongst key parties” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 168: 835 - 168: 1419).

Officially, the mana and kaitiakitanga status of iwi over the nation’s land and natural resources have been recognized when Local Government NZ signed a memorandum of understanding with the Iwi Chairs Forum; this does however not define what that means in practice (L&W.26.01.2016.ACTpartyFresh Water and RMA reform a plan or a b). The realities of iwi/hapu representation and access to decision making opportunities differ. While the Land and Water Forum suggests that a “non-statutory National Land and Water Commission should be established on a co-governance basis with iwi” (Land and Water Forum\land\_and\_water\_forum\_report 21: 92 - 21: 205), it has also sidestepped the issue, saying that whatever iwi rights and interests in fresh water might be is to be resolved between iwi and the Crown.” (L&W.26.01.2016.ACTpartyFresh Water and RMA reform a plan or a b). Takaka’s Environment and Planning Committee will confirm the advisory group members from the nominations received and will also invite iwi representation (Takaka\AdvisoryGroupsTerms ofReferenceV3EPC19-12-13 2: 2066 - 2: 2224). Healthy Rivers established “a single Joint Working Party (JWP) has been established to progress the plan change, comprising staff representatives from all five River iwi and the Council” (Healthy Rivers\HR.2154945 Stakeholder Engagement Strategy March 28 2013 11: 243 - 11: 663).

### ***SUCCESS***

To some, success is “win-win opportunities to develop New Zealand’s freshwater resource and enhance all parties’ interests in freshwater” (Land and Water Forum\Third Report of the Land and Water Forum 90: 1477 - 90: 2380). Others seem to be satisfied with overall agreement, societal coordination and cooperation across stakeholder groups. Collaboration is tied to the hope that “(a)n active approach to the management of our fresh water resources will allow us to sustain and enhance our land and water over time, along with all the uses they sustain (including economic uses)” (Third Report of the Land and Water Forum). This is to “remain resilient in the face of future changes

or crises” (ibid.). The report on the Land and Water Forum is cautious about the future of collaborative freshwater governance and mentions that “if performance at the regional level does not improve this question should be revisited” (Land and Water Forum\land\_and\_water\_forum\_report 14: 2682 - 14: 3180).

### ***PROBLEM DEFINITION***

Degradation of New Zealand’s freshwater resources is the main motivation for the adoption of new governance modes. Te Arawa say that the negative effect on the mana and wairua of lakes need to be addressed (Rotorua Te Arawa Lakes Strategy Group\lakes-090528-rotorualakesstrategydeedofsettlement 33: 1997 - 33: 2120). Environmental bottom lines are defined with the National Policy Statement Freshwater Management (NPSFM). The NPSFM specifies two values as compulsory values which must be provided for: ecosystem health and secondary contact recreation and provides some bottom lines for a few attributes relevant to these values which the Council must provide for as a minimum (TasmanCouncilFLAGFAQ).

Collaborative decisions are presented as a way to understand these issues better “helping to crystallise the issues from a mixed stakeholder perspective, and offering carefully considered views about how to proceed, while recognising that final decisions rest with decision makers” (WRC 2014 - CSG Terms of Reference Waikato). Collaboration is discussed as a way of communicating issues broader and furthering an understanding of freshwater concerns, which is “one way to lessen the burden on decision makers with some well-thought out idea” (WRC 2014 - CSG Terms of Reference Waikato). It has been mentioned that support of ‘key people’ is not enough to guarantee long-term, effective planning (Motueka\MfE ICM Final Report 2010\_06\_28 Report 113: 357 - 113: 620). The Motueka process also raised criticism concerning “Enforcement mechanisms, narrow scope and lack of integration” (Motueka\MfE ICM Final Report 2010\_06\_28 Report 118: 1542 - 118: 1705).

### ***IMPACT and OUTCOME***

Concrete outcomes are not mentioned. Documents instead report stakeholder perceptions and hopes of potential effects of collaborative governance. In other words,

they fill the hole left by the lack of empirics on what the outcomes of collaboration are, with norms and theories of what collaboration could and should become.

Collaboration is part of a “plan change is designed to take the rivers on the first stage of an 80-year journey towards being safe for swimming and food gathering along their entire lengths” (Healthy Rivers\HR.06.09.16.RuralNews 9 – 9). The goals formulated for Manawatu combine this with the hope that the river could be “a source of regional pride and mana” as the catchment is returned to a better condition while “sustainable use of the land and water resources of the Manawatu Catchment continue to underpin the economic prosperity of the Region” (Manawatu\Community-Grants-2016-2017 2: 1485 - 2: 1908). Waikato documents show a more relaxed stance towards environmental quality: “It is important to note that this is a check of “basic completeness” rather than accuracy or adequacy. In other words, it is not for checking the quality of the assessment of the effects of the proposal on, for example, water quality, but rather merely to check that water quality has been addressed [...]”(Waikato\WRC 2012 - Raukawa Joint Management Agreement 24: 2065 - 24: 2392). Documents on this case focus more on the societal impact of collaboration, stating that the outcome of “this stakeholder engagement strategy will be that decision makers understand the issues from all sides and workable solutions are generated” (Waikato\WRC 2013 - 2154945 Stakeholder Engagement Strategy March 28 201 4: 2602 - 4: 2756).

Voluntary measures that accompany collaborative processes are seen as “far more effective in addressing environmental issues than blanket and blunt regulatory methods” by Federated Farmers (Waiora\Waiora.10.16FederatedFarmersFarmers praise Northland plan 26 – 27). This statement comes from a farming interest group, and is broadly shared in official reports (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 55: 1441 - 55: 1708; HR.28.02.14.WaikatoRegionInterim chair of Collaborative Stakeho). The perspective on collaboration as a means to effectively address environmental issues, coming from an agricultural viewpoint, is surprising as water extraction and degradation in most areas is mainly due to agricultural effluent.

Takaka’s ‘Save our Springs’ Campaign issued a statement saying that they “hope that TDC’s Takaka FLAG will rethink its reckless and potentially illegal proposal and instead focus on public interests”. Final decisions for TANK were considered

“outrageous” as Regional Council “overturned a decision made by the major community stakeholders”. Forest and Bird’s Kevin Hackwell comments on the Machenzie Agreement: “After three years the government has rejected the collaborative process’s integrated package of recommendation and has instead cherry picked just a single aspect of the agreement (...)”. Forest and Bird left the Land and Water Forum for similar reasons.

Involvement can work as a control mechanism as programmes are “held accountable for its actions by catchment stakeholders, iwi and community members” (Motueka); Participation allows inclusion of local and cultural values and knowledge (Motueka\Harrison\_mapplsc 108: 197 - 108: 864). The Land and Water Forum assumes that “(T)here may also be opportunities to use the trust and confidence generated by a collaborative plan-making process to amend limits or other plan provisions within parameters established at the time the plan was agreed” (Land and Water Forum\SecondReportoftheLandandWaterForum-April2012.pdf 61: 2094 - 61: 284).

Documents on Manawatu specify environmental improvements, indicating that “(E)arly monitoring results show improvement in levels of treatment at both sites” (Manawatu\Action-Plan-Progress-Report-April-2014 14: 3138 - 14: 3388). Most other cases do not mention that in the context of collaboration – however, they also state that it “will take time for work carried out in the Manawatū Catchment to be reflected in the datasets. This is due to the time it takes for water to leave the root zone, move through groundwater and emerge in the river channel” (Manawatu\MRLA 2015 - Science-and-Matauranga-Maori-Advisory-Panel-Stateme 3: 615 - 3: 860)

## **5. General Trends in the Corpus**

The NZ literature review hypothesised that collaboration the kiwi way appears to feature three characteristics:

1 – Freshwater collaborations ought to be bound by bio-physical boundaries, such as those provided by a local river or lake catchment.

2 – Freshwater collaborations should reach consensus over policy and planning decisions. This will reduce the likelihood of stakeholders appealing decisions to the Environment Court or through planning hearings.

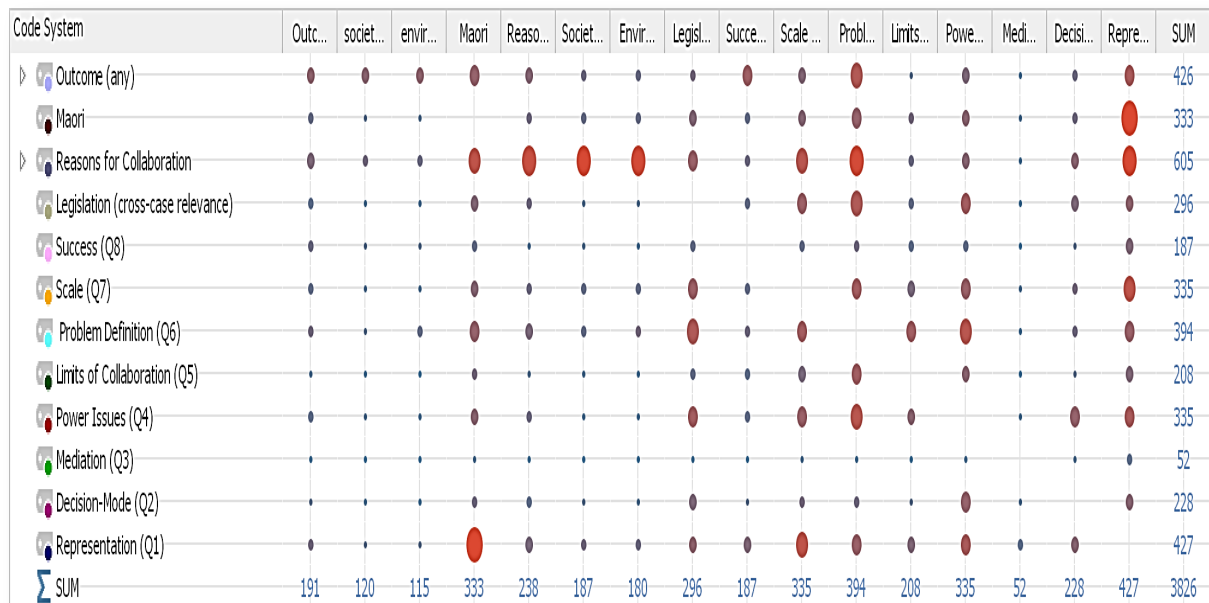
3 – Freshwater collaborators ought to be selected on the basis that they are: a) not representing specific interests, b) bring a unique set of values to the collaboration, and c) can collaborate and compromise in order to reach a consensus.

Our meta-analysis of the publications on 22 cases of freshwater governance in New Zealand affirms most these features. However, building on the empirics from the meta-analysis, representation of specific interest in freshwater collaboration is a fact. In some cases, actors could not compromise and collaborate in order to reach consensus; their unique set of values can also be questioned. While agricultural and governmental actors seem satisfied with the output of collaboration, environmental actors, the public and iwi stakeholders are the ones to voice concerns. This raises the question whether Collaboration the Kiwi Way is less about better freshwater quality and careful resource extraction, and instead more about pragmatic, agreeable policy making.

Our analytical scheme sheds light on perceptions, values and opinions that are voiced in the context of collaboration. As can be seen in the code relations-browser (*displayed below*) most co-occurrences of codes point to a high importance of Maori representation, environmental and societal motifs as well as problem definition as reasons for collaboration. This presentation of the codes also shows that a mentioning of decisions on scale mostly coincides with what we coded as ‘reasons for collaboration’ and ‘representation’. Since most processes happened at catchment and local levels, this underscores the relevance of rescaling to fit bio-physical boundaries. This chart also points at the low overall relevance of mediation, mentioning of ‘success’ in collaboration, and outcome variables. The higher co-occurrence of ‘power issues’ and ‘problem definition’ can be explained by the idea that power was mostly defined and reasoned with in regard to the character of the freshwater problems at hand. Regional Council has the legitimate power and the final responsibility to deal with resources problems, while emphasised normatively, collaboration is in place to guarantee that these decisions are a) actually accepted, b) implemented, and c) build on agreement among all collaborators.



Figure 1: Code-Relations Browser Collaboration the Kiwi Way



## 6. Discussion & Conclusion

The issue of stakeholder participation raises the question of who is represented in the New Zealand model of freshwater collaboration. Sylvia Nissen (2014, p. 33) provides a “gentle caution” to the adoption of collaboration across New Zealand, because its adoption in Canterbury has resulted in the implicit exclusion of certain voices from the debate. Sinner et al. (2014, p. i) also investigate representation and “how affected interests are involved in collaborative deliberations”. The community in Sinner *et al.*'s (2014) research perceived the collaborative process as creating unequal opportunities for participation between different groups, and as a result the collaboration was not as representative of the community as it proclaimed.

We find that collaboration the kiwi way is ‘collaboration in the shadow of hierarchy’ with the state underpinning community-based initiatives. Collaborators are selected in the basis of their ability to collaborate, reach consensus, rather than because of their quality as representative of a particular sector or entrenched interest group. Collaborators are specifically chosen in the New Zealand model of collaboration to provide a multitude of values to the decision-making process. Berkett et al. (2013)

examine the concept of values in regards to collaborative freshwater decision making and planning. These authors argue that collaborative governance offers a method of resolving difference of value due to context, because it provides a new context in which values can be “jointly constructed and prioritised, leading to agreed management objectives and strategies” (Berkett et al. 2013, iii). However, the authors note that one of the challenges of collaboration is ensuring that power imbalances between collaborators does not affect the outcomes of the process (ibid). Ronlyn Duncan (2013) examined how local knowledge and values were embraced within Canterbury’s zonal committee process. Duncan (2013, p. 221) argued that “[t]o be accepted as legitimate, the expression of local knowledge had to align with the mutually constituted sociocultural values of science and policy, which were framed by the objective to calculate politically palatable and economically viable quantified nutrient limits”. This is a serious concern, as it leads to the concern that collaboration might not include all voiced, especially not those that don’t accord with the dominant and received policy positions. If it really is the cases that actors have to temper themselves in order to be let into the process or stay part of it, collaboration in New Zealand has a serious selection bias.

Memon et al. (2012, p.27) argued that the process of hand-picking collaborators, and having the recommendations of the committees non-binding on local authorities, means that the “zone committee process is a lesser version of the deliberative collaboration practice model as commonly understood in the international literature”. Amanda Thomas (2014, p.12) shares Memon et al.’s (2012) concern, and argued that a plurality of values is an intrinsic feature of democracy, and that “political tools need to be designed in such a way that people are able to disagree respectfully, rather than trying to permanently resolve differences through consensus”. Other zonal committees examined by scholarly research include the Selwyn-Waihora district (Rennie, 2014, 2015, Sinner, Newton, Duncan 2015). Rennie (2015, p. 27) concurs with Memon et al. (2012) and Thomas’s (2014) criticisms when he writes that one of the lessons of the zonal committee is process was that these committees “are not truly community collaborative processes and the outcomes lack community legitimacy”.

Even with the new RMA amendment, collaboration is a choice, rather than a requirement. Although, the NPS states that some form of public participation is required in freshwater decision making, this requirement can be met through regularly RMA

planning processes that do not require collaboration. However, as we show, collaboration is perceived as a fix for environmental as well as societal problems of agreement on resource policies and framed as such in the communication on the cases.

Of course, when it comes to decision making, anything seems “better than the costly conflictual stalemate experienced” (O’Brien 2010, p. 8). New Zealand’s collaborative experiment has developed without much legislative intervention, and is only now issuing suggestions for standards of collaborative (Ministry for the Environment 2017b). As a result, New Zealand’s freshwater collaborations often mix statutory-planning methods with more informal collaborative processes. While collaboration suggests a level playing field, hierarchies are pretty much still in place. Hierarchy in combination with collaborative planning processes is likely to shed light on the needs of various stakeholders, the fact that stakeholders are nominated by their peers and appointed by government (given that they have a vested interest in water) does not guarantee equal access to decision-making, nor does it adhere to standards of democratic representation. As long as the ‘way in’, and the procedures of participation lack transparency and raise questions of legitimate access to collaboration, Brower (2016) is right in her analysis that this might be “less than democratic”.

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### **Erklärung zum selbständigen Verfassen der Arbeit:**

Ich erkläre hiermit, dass ich meine Doktorarbeit „Essays on (Mal)Adaptation to Climate Change and Environmental Problems“ selbstständig und ohne fremde Hilfe angefertigt habe und dass ich als Koautor maßgeblich zu den weiteren Fachartikeln beigetragen habe. Alle von anderen Autoren wörtlich übernommenen Stellen, wie auch die sich an die Gedanken anderer Autoren eng anlehnenden Ausführungen der aufgeführten Beiträge wurden besonders gekennzeichnet und die Quellen nach den mir angegebenen Richtlinien zitiert.

Datum Unterschrift

## **Supplementary Material**

### **AntConc Data Paper 1**

AntConc Results can be either saved to the clipboard, saved to a text file (.txt) or saved to a new window using keyboard commands, the appropriate option in the 'File Menu', or by clicking on the "Save Window" button in each tool, respectively.

Please find the documents that have been analysed as well as the results in .txt format in the folder named AntConc Results & Data on the CD with the electronic version of this dissertation.

### **R Codes Paper 2**

```
setwd("~/Documents")  
Data <- read.csv("Test.csv", header = TRUE, sep = ";", fill = TRUE)  
Data$Frame_num <- as.numeric(substr(Data$Frame, 2,2))
```

### **# Packages**

```

library(dplyr)
library(stargazer)
library(lme4)
library(arm)
library(prettyR)
library(interplot)
library(phia)
install.packages("ggplot2")
library(ggplot2)
install.packages("experiment")
library(experiment)
install.packages("multcomp")
library(multcomp)
install.packages("xtable")
library(xtable)

```

### **#Plots simple effects**

```

g<-ggplot(Data, aes(Frame, OV_CCrisk))+geom_point(color="firebrick")
g+geom_boxplot(fill="darkseagreen4") +
labs(x="Frame", y="CC is a risk to me")
g+geom_jitter(alpha=0.5, aes(color=Frame),position = position_jitter(width = .2)) +
labs(x="Frame", y="CC is a risk to me")
g1<-ggplot(Data, aes(Frame, CC_AdaptFarming))+geom_point(color="firebrick")
g1+geom_boxplot(fill="darkseagreen4") +
labs(x="Frame", y="My Farming is Adapted")
g1+geom_violin(alpha=0.5, color="gray")
g1+geom_jitter(alpha=0.5, aes(color=Frame),position = position_jitter(width = .2)) +
labs(x="Frame", y="My Farming is Adapted")
g2<-ggplot(Data, aes(Frame, OV_thinkCC))+geom_point(color="firebrick")
g2+geom_boxplot(fill="darkseagreen4") +
labs(x="Frame", y="It is important to think about CC")
g2+geom_violin(alpha=0.5, color="gray")
g2+geom_jitter(alpha=0.5, aes(color=Frame),position = position_jitter(width = .2)) +

```

```

labs(x="Frame", y="My Farming is Adapted")
g3<-ggplot(Data, aes(Frame, OV_CCnoRisk))+geom_point(color="firebrick")
g3+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="CC is no risk to me")
g4<-ggplot(Data, aes(Frame, OV_CCnoAdapt))+geom_point(color="firebrick")
g4+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="There is no reason to adapt")
g5<-ggplot(Data, aes(Frame, CC_longtermEffect))+geom_point(color="firebrick")
g5+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="CC has longterm effects on my farm")
g6<-ggplot(Data, aes(Frame, OV_CCnow))+geom_point(color="firebrick")
g6+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="CC happens right now")
g7<-ggplot(Data, aes(Frame, OV_CCimplPersonal))+geom_point(color="firebrick")
g7+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="CC has an impact on my surrounding")
g8<-ggplot(Data, aes(Frame, OV_CCBadFuture))+geom_point(color="firebrick")
g8+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="CC will increase")
g9<-ggplot(Data, aes(Frame, OV_AdaptSingle))+geom_point(color="firebrick")
g9+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="Individual Adaptation shows Effects")
g10<-ggplot(Data, aes(Frame, OV_PrevRisk))+geom_point(color="firebrick")
g10+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="Preventive Measures Reduce CC Impacts")
g11<-ggplot(Data, aes(Frame, OV_AdaptPersSafe))+geom_point(color="firebrick")
g11+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="Adaptation Increases my Personal Safety")
g12<-ggplot(Data, aes(Frame, OV_AdaptnoEffect))+geom_point(color="firebrick")
g12+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="Adaptation has no Effect")
g13<-ggplot(Data, aes(Frame, OV_AdaptCosts))+geom_point(color="firebrick")
g13+geom_boxplot(fill="darkseagreen4") +
  labs(x="Frame", y="Adaptation Costs less than CC Damage Control")

```

```

g14<-ggplot(Data, aes(Frame, OV_AdaptTimeNeed))+geom_point(color="firebrick")
g14+geom_boxplot(fill="darkseagreen4") +
labs(x="Frame", y="Adaptation is too time intensive")
g15<-ggplot(Data, aes(Frame, OV_Spending))+geom_point(color="firebrick")
g15+geom_boxplot(fill="darkseagreen4") +
labs(x="Frame", y="Prefer to Spend Money Differently")

```

### **#Descriptive Analysis**

```

str(Data)
summary(Data)
options(xtable.floating = FALSE)
options(xtable.timestamp = "")
data(Data)
xtable(Data[1:10, ])
xtable(Test1)
x.side <- xtable(Test1, caption = "A sideways table")
print(x.side, floating = TRUE, floating.environment = "sidewaystable")

```

```

Overview_Data <- c(Data$Age, Data$Gender, Data$No_onfarm,
Data$No_People_Sale, Data$No_People_Farming, Data$No_People_Innovation,
Data$Work_Time, Data$Owner, Data$Region_f, Data$Cropland_ha,
Data$Farming_Type, Data$Average_No_Crops, Data$Use_of_Farmadvice,
Data$Info_CC, Data$Source_info_CC, Data$Network, Data$Network_Active)
rm(Overview_Data)
table(Data$Owner)
table(Data$Frame)
freq(Data$No_People_Sale)
freq(Data$Work_Time)
freq(Data$Average_No_Crops)
freq(Data$Info_CC)
table(Data$Gender) # mehr Männer (71 zu 13)
table(Data$Age) # Median 43 Jahre alt
table(Data$Work_Time)

```

### **#Randomization Support, F-statistic**

```
Data$Frame_num <- as.numeric(substr(Data$Frame, 2,2))
f_test <- lm(Frame_num ~ Prev_Extreme_Weather + Risk_indiv + Farming_Type +
Gender + Age + Info_CC + Network_Active, data = Data)
summary(f_test)
```

### **#Frequencies CAP Measures and Subsidies**

```
freq(Data$Crop_Rotation)
freq(Data$Grassland)
freq(Data$Crop_Diversity)
freq(Data$Insurance_CC)
freq(Data$Insurance_Seeds)
freq(Data$Improve_Irrigation)
freq(Data$Move_Cropland)
freq(Data$Frost_Protection)
freq(Data$Int_Pesticide)
hist(Data$Crop_Rotation)
parm <- c(Data$Imp_Subsidies_Sustainability, Data$Info_CC, Data$Risk_indiv)
cftest(ML1,parm )
Region <- Data$Region
Exp <- Data$Prev_Extreme_Weather
Wetter <- lm(Prev_Extreme_Weather ~ Region_f, data = Data)
summary(Wetter)
plot(Region, Exp)
summary(aov(OV_CCrisk ~ Frame * Prev_Extreme_Weather * Risk_indiv *
Farming_Type, data = Data))
risk.mod<-lm(OV_CCrisk ~ Frame, data = Data)
anova(risk.mod)
summary(risk.mod)
plot(risk.mod)
adapt.mod <- lm(CC_AdaptFarming ~ Frame, data = Data)
anova(adapt.mod)
summary(adapt.mod)
plot(adapt.mod)
adapt1.mod <- lm(OV_CCnow ~ Frame, data = Data)
```



```

anova(adapt1.mod)
summary(adapt1.mod)
effects.mod <- lm(CC_longtermEffect ~ Frame, data = Data)
anova(effects.mod)
summary(effects.mod)

plot(CC_AdaptFarming~Frame_num,data=Data,xlab="CC_AdaptFarming",ylab="Frame_num")

```

```

#OLS "es ist wichtig, sich mit Klimawandel auseinander zu setzen" OV_thinkCC
thinkCC <- lm(OV_thinkCC ~ Frame*Prev_Extreme_Weather + Risk_indiv + Farming_Type, data = Data)
summary(thinkCC)
interactionMeans(thinkCC)
thinkCC_means <- interactionMeans(thinkCC)
plot(thinkCC_means)
interplot( m = thinkCC, var1 = "Prev_Extreme_Weather", var2 = "Frame") # fkt nicht

```

#### **# maximum likelihood estimation**

```

ML1 <- glm(OV_thinkCC ~ Frame + Risk_indiv + Prev_Extreme_Weather + Info_CC, data = Data)
display(ML1)
summary(ML1)
AIC(ML1)

```

#### **#Fit a varying intercept model**

```

ML2 <- glm(OV_thinkCC ~ Frame + Risk_indiv + Prev_Extreme_Weather + Info_CC + Imp_Subsidies_Sustainability, data = Data)
summary(ML2)
anova(ML1, ML2, test = "F")
CCBadFuture <- lm(OV_CCBadFuture ~ Frame*Risk_indiv, data = Data)
summary(CCBadFuture)
interplot(m = CCBadFuture, var1 = "Risk_indiv", var2 = "Frame" ) #interplotting for interaction between Frame and Risk indiv

```

### **# CAP implementation**

```
CAP <- lm(OV_CCrisk ~ Frame + Crop_Rotation + Grassland + Crop_Diversity +  
Insurance_CC + Insurance_Seeds + Improve_Irrigation  
+ Move_Cropland + Frost_Protection + Int_Pesticide, data = Data)  
summary(CAP)  
plot(CAP)
```

### **# signifikante Ergebnisse mit Frame 2 und bei Interaktionseffekt mit Frame 3 (\*0.05)**

#### **# variable "Mein Anbau ist an den Klimawandel angepasst"**

```
AdaptFarming <- lm(CC_AdaptFarming ~ Frame*Prev_Extreme_Weather +  
Farming_Type + Risk_indiv, data = Data)  
summary(AdaptFarming)  
AdaptFarming1 <- lm(CC_AdaptFarming ~ Frame*Prev_Extreme_Weather, data =  
Data)  
summary(AdaptFarming1)  
interplot(m = AdaptFarming1, var1 = "Prev_Extreme_Weather", var2 = "Frame") +  
xlab("Weather Experience") +  
ylab("Estimated Coefficient for Adaptation") +  
theme_bw() +  
ggtitle("Estimated Coefficient of Adaptation Assessment/Experience") +  
theme(plot.title = element_text(face="bold")) +  
geom_hline(yintercept = 0, linetype = "dashed")  
ggplot(AdaptFarming1, aes(x='CC_AdaptFarming', y='Frame'), data=Data) +  
geom_line() +  
stat_smooth(colour='blue', span=0.2)  
frame_wt <- lm(CC_AdaptFarming ~ Frame + I(Frame^2), data = Data)  
interplot(m = frame_wt, var1 = "Frame", var2 = "Frame")  
interplot(m = AdaptFarming1, var1 = "Frame", var2 = "Prev_Extreme_Weather")  
  
support <- lm(CC_AdaptFarming ~ Prev_Extreme_Weather, data = Data)  
plot(support)  
summary(support)  
interactionMeans(AdaptFarming)  
Adapted2 <- interactionMeans(AdaptFarming)
```

```

plot(Adapted2)
testFactors(Adapted2)
testFactors(AdaptFarming)
interactionMeans(AdaptFarming)
AdaptFarming_means <- interactionMeans(AdaptFarming)
plot(AdaptFarming_means)
interplot( m = AdaptFarming, var1 = "Frame", var2 = "Prev_Extreme_Weather")
+ xlab("CC Experience") + ylab("Framing Effect") + theme_bw() + ggtitle("Estimated
Coefficient of Framing Effects by Experience") + geom_hline(yintercept = 0, linetype =
"dashed") + theme(plot.title = element_text(face="bold"))
interplot( m= AdaptFarming, var1 = "Frame", var2 = "Prev_Extreme_Weather", hist =
TRUE) + geom_hline(yintercept = 0, linetype = "dashed")
testInteractions(AdaptFarming)
Adapted1 <- lm(CC_AdaptFarming ~ Frame, data = Data)
Adapted2 <- lm(CC_AdaptFarming ~ Frame + Prev_Extreme_Weather + Farming_Type
+ Risk_indiv, data = Data)
summary(Adapted1)
summary(Adapted2)

```

#### **# signifikante Ergebnisse und Interaktionseffekt mit Frame 4 (\*0.05)**

#### **# variable "Klimaveränderung ist ein ernstes Risiko für mich"**

```

risk1 <- lm(OV_CCrisk ~ Frame, data = Data)
risk2 <- lm(OV_CCrisk ~ Frame + Prev_Extreme_Weather + Farming_Type +
Risk_indiv, data = Data)
CCrisk <- lm(OV_CCrisk ~ Frame*Prev_Extreme_Weather + Farming_Type +
Risk_indiv, data = Data)
summary(risk1)
summary(risk2)
summary(CCrisk)
CCrisk_interact <- interactionMeans(CCrisk)
plot(CCrisk_interact)
CCrisk_interact
interplot( m = CCrisk, var1 = "Frame", var2 = "Prev_Extreme_Weather") + xlab("CC
Experience") + ylab("Framing Effect") + theme_bw() + ggtitle("Estimated Coefficient
of Framing Effects by Experience") + geom_hline(yintercept = 0, linetype = "dashed")
+ theme(plot.title = element_text(face="bold"))
testInteractions(CCrisk, fixed="Frame", across="Prev_Extreme_Weather")

```

```

ATEbounds(OV_CCrisk ~ Frame, data=Data) # package experiment
mod.fr <- lm(OV_CCrisk ~ Frame*Prev_Extreme_Weather, data=Data)
par(mfcol=c(1,2))
plot(mod.fr, 1:2) # Plot diagnostics for the model
Anova(mod.fr)
testInteractions(mod.fr, fixed="Prev_Extreme_Weather", across="Frame")

# significant results for interaction with Frame 2 (*0.05) und Frame 3 (**0.01)
# Variable "Präventive Maßnahmen reduzieren das Klimarisiko"
PrevRisk <- lm(OV_PrevRisk ~ Frame*Prev_Extreme_Weather + Risk_indiv +
Farming_Type, data = Data)
summary(PrevRisk)
Prevent1 <- lm(OV_PrevRisk ~ Frame, data=Data)
Prevent2 <- lm(OV_PrevRisk ~ Frame + Prev_Extreme_Weather + Farming_Type +
Risk_indiv, data = Data)
interactionMeans(PrevRisk, factors = "Frame")
PrevRisk_means <- interactionMeans(PrevRisk)
plot(PrevRisk_means, multiple = FALSE)
interplot( m = PrevRisk, var1 = "Prev_Extreme_Weather", var2 = "Frame")

#Interaction effects Weather experience and Frame
# and Variable "Klimawandel hat langfristige Folgen für meinen Anbau"
support1 <- lm(Prev_Extreme_Weather ~ Occ_Heat + Occ_Hail + Occ_Drought +
Occ_Storm + Occ_Snow + Occ_Rain + Occ_Flood, data = Data)
cor(Data[,c("Prev_Extreme_Weather", "Occ_Heat", "Occ_Hail", "Occ_Drought",
"Occ_Storm", "Occ_Snow", "Occ_Rain", "Occ_Flood")],use = "pairwise.complete")
plot(support1)
summary(support1)
Data$Region_f <- factor(Data$Region) # Region as factor Variable
CCLongterm_Heat <- lm(CC_longtermEffect ~ Frame*Occ_Heat, data = Data)
summary(CCLongterm_Heat)
CCLongterm_Hail <- lm(CC_longtermEffect ~ Frame*Occ_Hail + Region_f +
Prev_Extreme_Weather, data = Data)
summary(CCLongterm_Hail)
CCLongterm_Drought <- lm(CC_longtermEffect ~ Frame*Occ_Drought + Region_f +
Prev_Extreme_Weather, data = Data)

```

```

summary(CClongterm_Drought)
CClongterm_Storm <- lm(CC_longtermEffect ~ Frame*Occ_Storm + Region_f +
Prev_Extreme_Weather, data = Data)
summary(CClongterm_Storm)
CClongterm_Snow <- lm(CC_longtermEffect ~ Frame*Occ_Snow + Region_f +
Prev_Extreme_Weather, data = Data)
summary(CClongterm_Snow)
CClongterm_Rain <- lm(CC_longtermEffect ~ Frame*Occ_Rain + Region_f +
Prev_Extreme_Weather + Age + Owner, data = Data)
summary(CClongterm_Rain)
CClongterm_Flood <- lm(CC_longtermEffect ~ Frame*Occ_Flood + Region_f +
Prev_Extreme_Weather, data = Data)
summary(CClongterm_Flood)
interactionMeans(CClongterm_Flood)
CClongterm_EXP <- lm(CC_longtermEffect ~ Frame*Prev_Extreme_Weather +
Occ_Flood + Occ_Rain + Occ_Snow + Occ_Storm + Occ_Drought + Occ_Hail +
Occ_Hail + Region_f, data = Data)
summary (CClongterm_EXP)
interactionMeans(CClongterm_EXP)
CClongterm_means <- interactionMeans(CClongterm_EXP)
plot(CClongterm_means)
interplot( m = CClongterm_EXP, var1 = "Prev_Extreme_Weather", var2 = "Frame")

```

**# Variable "Die Auswirkungen von Klimaveränderungen auf die Landwirtschaft werden sich in Zukunft verschlimmern"**

```

CCBadFuture <- lm(OV_CCBadFuture ~ Frame*Prev_Extreme_Weather + Region_f +
Risk_indiv + Imp_Weatherinfo + Network_Active + Farming_Type, data = Data)
summary(CCBadFuture)
interactionMeans(CCBadFuture)
CCBadFuture_means <- interactionMeans(CCBadFuture)
plot(CCBadFuture_means)
interplot( m = CCBadFuture, var1 = "Prev_Extreme_Weather", var2 = "Frame")

```

**# Variable CCnoRisk "Klimaanpassung ist nicht wichtig, weil das Klimarisiko nicht zunimmt"**

```

CCnoRisk <- lm(OV_CCnoRisk ~ Frame*Prev_Extreme_Weather + Region_f +
Risk_indiv + Network_Active + Farming_Type + Info_CC, data = Data)

```

```

summary(CCnoRisk)
interactionMeans(CCnoRisk)
CCnoRisk_means <- interactionMeans(CCnoRisk)
plot(CCnoRisk_means)
interplot( m = CCnoRisk, var1 = "Prev_Extreme_Weather", var2 = "Frame")

```

**# Variable CCnoAdapt "Es gibt derzeit keinen Grund, Anpassung an das Klima vorzunehmen"**

```

CCnoAdapt <- lm(OV_CCnoAdapt ~ Frame*Prev_Extreme_Weather + Risk_indiv +
Farming_Type + Info_CC, data = Data)
CCnoAdapt1 <- lm(OV_CCnoAdapt ~ Frame)
CCnoAdapt2 <- lm(OV_CCnoAdapt ~ Frame+ Prev_Extreme_Weather + Risk_indiv +
Farming_Type + Info_CC, data = Data)
summary(CCnoAdapt)
summary(CCnoAdapt1)
summary(CCnoAdapt2)
interactionMeans(CCnoAdapt)
CCnoAdapt_means <- interactionMeans(CCnoAdapt)
plot(CCnoAdapt_means)
interplot( m = CCnoAdapt, var1 = "Prev_Extreme_Weather", var2 = "Frame")
support_risk_adapt <- lm(OV_CCnoRisk ~ OV_CCnoAdapt, data = Data)
plot(support_risk_adapt)

```

**# Variable CCnow "Klimawandel passiert jetzt"**

```

CCnow <- lm(OV_CCnow ~ Frame*Prev_Extreme_Weather + Risk_indiv +
Network_Active + Farming_Type + Info_CC, data = Data)
CCnow1 <- lm(OV_CCnow ~ Frame, data= Data)
CCnow2 <- lm(OV_CCnow ~ Frame + Prev_Extreme_Weather + Risk_indiv +
Network_Active + Farming_Type + Info_CC, data = Data)
summary(CCnow1)
summary(CCnow2)
summary(CCnow)
interactionMeans(CCnow)
CCnow_means <- interactionMeans(CCnow)
plot(CCnow_means)

```

```
interplot( m = CCnow, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable CCimplPersonal "Mein Lebensraum ist von Klimaveränderungen betroffen"**

```
CCimplPersonal <- lm(OV_CCimplPersonal ~ Frame*Prev_Extreme_Weather +  
Farming_Type + Info_CC, data = Data)
```

```
summary(CCimplPersonal)
```

```
interactionMeans(CCimplPersonal)
```

```
CCimplPersonal_means <- interactionMeans(CCimplPersonal)
```

```
plot(CCimplPersonal_means)
```

```
interplot( m = CCimplPersonal, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable Adapt Single "Einzelne Menschen können wirkungsvolle Anpassung leisten"**

```
Single1 <- lm(OV_AdaptSingle ~ Frame, data= Data)
```

```
Single2 <- lm(OV_AdaptSingle ~ Frame + Prev_Extreme_Weather+ Risk_indiv +  
Network_Active + Farming_Type + Info_CC, data = Data)
```

```
AdaptSingle <- lm(OV_AdaptSingle ~ Frame*Prev_Extreme_Weather + Risk_indiv +  
Network_Active + Farming_Type + Info_CC, data = Data)
```

```
summary(AdaptSingle)
```

```
summary(Single1)
```

```
summary(Single2)
```

```
interactionMeans(AdaptSingle)
```

```
AdaptSingle_means <- interactionMeans(AdaptSingle)
```

```
plot(AdaptSingle_means)
```

```
interplot( m = AdaptSingle, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable AdaptPersSafe "Klimaanpassung steigert meine persönliche Sicherheit"**

```
AdaptPersSafe <- lm(OV_AdaptPersSafe ~ Frame*Prev_Extreme_Weather +  
Risk_indiv + Farming_Type + Info_CC, data = Data)
```

```
summary(AdaptPersSafe)
```

```
PersSafe1 <- lm(OV_AdaptPersSafe ~ Frame, data=Data)
```

```
PersSafe2 <- lm(OV_AdaptPersSafe ~ Frame +Prev_Extreme_Weather + Risk_indiv +  
Farming_Type + Info_CC, data = Data)
```

```
summary(PersSafe1)
```

```
summary(PersSafe2)
interactionMeans(AdaptPersSafe)
AdaptPersSafe_means <- interactionMeans(AdaptPersSafe)
plot(AdaptPersSafe_means)
interplot( m = AdaptPersSafe, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable AdaptnoEffect "Klimaanpassungsmaßnahmen zeigen keinen Effekt auf meinen Anbau"**

```
AdaptnoEffect <- lm(OV_AdaptnoEffect ~ Frame*Prev_Extreme_Weather +
Risk_indiv + Farming_Type + Info_CC, data = Data)
summary(AdaptnoEffect)
noEffect1 <- lm(OV_AdaptnoEffect ~ Frame)
noEffect2 <- lm(OV_AdaptnoEffect ~ Frame + Prev_Extreme_Weather + Risk_indiv +
Farming_Type + Info_CC, data=Data )
interactionMeans(AdaptnoEffect)
AdaptnoEffect_means <- interactionMeans(AdaptnoEffect)
plot(AdaptnoEffect_means)
interplot( m = AdaptnoEffect, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable AdaptCosts "Es kostet weniger, sich landwirtschaftlich an den Klimawandel anzupassen als für mögl. Schäden zu zahlen"**

```
AdaptCosts <- lm(OV_AdaptCosts ~ Frame*Prev_Extreme_Weather + Risk_indiv +
Farming_Type + Info_CC, data = Data)
summary(AdaptCosts)
Costs1 <- lm(OV_AdaptCosts ~ Frame, data=Data)
Costs2 <- lm(OV_AdaptCosts ~ Frame + Prev_Extreme_Weather + Risk_indiv +
Farming_Type + Info_CC, data = Data)
summary(Costs1)
summary(Costs2)
interactionMeans(AdaptCosts)
AdaptCosts_means <- interactionMeans(AdaptCosts)
plot(AdaptCosts_means)
interplot( m = AdaptCosts, var1 = "Prev_Extreme_Weather", var2 = "Frame")
```

### **# Variable AdaptTimeNeed "Klimaanpassung kostet Zeit, die ich nicht habe"**



```

AdaptTimeNeed <- lm(OV_AdaptTimeNeed ~ Frame*Prev_Extreme_Weather +
Risk_indiv + Farming_Type + Info_CC, data = Data)
summary(AdaptTimeNeed)
TimeNeed1 <- lm(OV_AdaptTimeNeed ~ Frame, data=Data)
TimeNeed2 <- lm(OV_AdaptTimeNeed ~ Frame + Prev_Extreme_Weather +
Risk_indiv + Farming_Type + Info_CC, data = Data)
summary(TimeNeed1)
summary(TimeNeed2)
interactionMeans(AdaptTimeNeed)
AdaptTimeNeed_means <- interactionMeans(AdaptTimeNeed)
plot(AdaptTimeNeed_means)
interplot( m = AdaptTimeNeed, var1 = "Prev_Extreme_Weather", var2 = "Frame")

```

#### **#Variable Spending "Ich gebe mein Geld lieber für etw anderes aus, als für neue Anbaugeräte und Anbaumethoden"**

```

Spending <- lm(OV_Spending ~ Frame*Prev_Extreme_Weather + Region_f +
Risk_indiv + Network_Active + Farming_Type + Info_CC + Prep_Tech +
Prep_Financial, data = Data)
summary(Spending)
interactionMeans(Spending)
Spending_means <- interactionMeans(Spending)
plot(Spending_means)
interplot( m = Spending, var1 = "Prev_Extreme_Weather", var2 = "Frame")

```

#### **# Overview on mean, standard deviation etc. for each Output Variable and Treatment**

```

frame_test1 <- Data %>%
filter(!(Frame == "")) %>%
group_by(Frame) %>%
select(starts_with("OV_")) %>%
summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))

```

```

frame_ttest <- Data %>%
filter(!(Frame == "")) %>%
group_by(Frame) %>%
select(starts_with("OV_")) %>%

```

```
t.test(Frame)
```

```
adapt.df = Percs_risk
```

```
plant.df$group = factor(plant.df$group,
```

```
  labels = c("Control", "Treatment 1", "Treatment 2"))
```

#### **# Filter trust**

```
Trust <- Data %>%
```

```
  filter(!(Frame == "")) %>%
```

```
  group_by(Frame) %>%
```

```
  select(starts_with("Trust")) %>%
```

```
  summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))
```

```
write.csv(Trust, "Trust.csv")
```

#### **# Filter implementation of CAP policy measures**

```
Imp_Measures <- Data %>%
```

```
  filter(!(Frame == "")) %>%
```

```
  group_by(Frame) %>%
```

```
  select(starts_with("Imp")) %>%
```

```
  summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))
```

```
write.csv(Imp_Measures, "importance.csv")
```

#### **# Interaktionseffekte pro Output Variable und Text-Treatment (funktioniert noch nicht)**

```
library(broom)
```

```
library(tidyr)
```

```
Test4 <- Data %>%
```

```
  filter(!(Frame == "")) %>%
```

```
  group_by(Frame) %>%
```

```
  select((Frame, starts_with("OV")), (starts_with("CC"))) %>%
```

```
  summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))
```

```
gather(variable, value, -Frame) %>%
```

```
group_by(variable) %>%
```

```
summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))
```

```
do(tidy(lm(value ~ Frame, data = .)))
```

```
frame_test1 <- Data %>%
```

```
filter(!(Frame == "")) %>%
```

```
group_by(Frame) %>%
```

```
summarise_each(funs(mean(., na.rm = TRUE), sd(., na.rm = TRUE)))
```

```
plot(Test1)
```

```
write.csv(Test1, "overview.csv")
```

## # Graphics

### # all weather events with significant interaction effects

```
stargazer(CClongterm_Flood, CClongterm_Rain, CClongterm_Snow,  
CClongterm_Heat, CClongterm_Drought,
```

```
title = "Importance of CC Experience", style="ajps", align = TRUE,
```

```
dep.var.labels = ("Long Term Effect"), column.labels = c("Flood", "Rain",  
"Snow", "Heat", "Drought"))
```

### # comparison of a model with all weather exp as confounding v and as interaction in case of significance

```
stargazer(CClongterm_EXP, CClongterm_Rain, CClongterm_Drought, title = "CC  
Experience",
```

```
style = "ajps", align = TRUE, dep.var.labels = ("Long Term Effect"),
```

```
column.labels = c("All Events", "Rain", "Drought"))
```

## # Risk Perception

```
stargazer(list(risk1, risk2, CCrisk), style = "ajps", align = TRUE, dep.var.labels = ("CC  
risk"), column.labels = c("Simple Effect", "Effect \& Controls", "Interaction Effect"),  
type = "html", out = "./tab1.html")
```

```
stargazer(list(risk1, risk2, CCrisk), style = "ajps", align = TRUE, title = "Risk",  
dep.var.labels = ("CC risk"), column.labels = c("Simple Effect", "Effect \& Controls",  
"Interaction Effect"))
```

```

# Vgl. Risk-Perception & Self-Efficacy
stargazer( CCrisk, title = "Regression Results", style="ajps", align = TRUE,
dep.var.labels = ("CC risk"), column.labels = c("Risk Perception", "Self-Efficacy"))

# f test
stargazer(f_test, title = "Randomization (Support)", style="ajps", align = TRUE,
dep.var.labels = ("Frame"))
stargazer(f_test, title = "Randomization (Support)", style="ajps", align = TRUE,
dep.var.labels = ("Frame"), type = "html", out = "./tab6.html")

#trust table
stargazer(Imp_Measures, title = "Decriptive Statistics", style = "ajps", align = TRUE)

# Frames descry overview
stargazer(Trust, type = "text", title="Descriptive statistics", digits=1, out="table1.txt",
flip=TRUE)
stargazer(Data, type = "html", out = "./tab7.html")
stargazer(Test1, type = "html", out = "./tab5.html")

# AdaptFarming - efficacy
stargazer(list(Adapted1, Adapted2, AdaptFarming), style = "ajps", align = TRUE,
column.labels = c("Simple Effect", "Effect \& Controls", "Interaction Effect"), type =
"html", out = "./tab3.html")
stargazer(list(Adapted1, Adapted2, AdaptFarming), style = "ajps", align = TRUE,
column.labels = c("Simple Effect", "Effect \& Controls", "Interaction Effect"))

# "Präventive Maßnahmen reduzieren das Klimarisiko"
stargazer(list(Prevent1, Prevent2, PrevRisk), style = "ajps", align = TRUE,
dep.var.labels = ("Adaptation Risk Reduction"),column.labels = c("Simple Effect",
"Effect \& Controls", "Interaction Effect"), type = "html", out = "./tab4.html")

library(ggplot2)
ggplot(data = Test1, aes(variable, estimate, colours = blues9)) +
geom_pointrange(aes(ymin = estimate - qnorm(0,075)*std.error, ymax = estimate +
qnorm(0,075)*std.error), position = position_dodge(width = 0.75))

```

## **MaxQDA Data Paper 5**

Please find the Code System as well as the Quote Matrix in the Folder Supplementary Material with the electronic version of this thesis. The full corpus can be made available in case further analysis of the statements and coding are planned.