

Publizierbarer Endbericht

gilt für Studien aus der Programmlinie Forschung

A) Projektdaten

Allgemeines zum Projekt	
Kurztitel:	Flood-Adapt
Langtitel:	Flood protection policies and climate change adaptation in Austria, Germany and Switzerland
Zitiervorschlag:	Steurer, R.; Löschner, L.; Nordbeck, R.; Pelaez-Jara, M.; Pregernig, M. (2019): Flood protection policies and climate change adaptation in Austria, Germany and Switzerland. Final report of the ACRP Flood-Adapt project.
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B) Projektübersicht

1 Kurzfassung

Flood-Adapt war ein disziplinäres politikwissenschaftliches Projekt in dem mittels vergleichenden Länderstudien analysiert wurde, wie stark die Hochwasserschutz-Politik in Österreich, Deutschland und der Schweiz nicht nur auf Hochwasserereignisse in der Vergangenheit aufbaut, sondern auch auf mögliche zukünftige Entwicklungen Bedacht nimmt. Zu Beginn des Projekts stand der Zusammenhang von Hochwasserschutz-Politik einerseits und Anpassung an den Klimawandel im Mittelpunkt. Schon bei der Erarbeitung des analytischen Rahmens für das Projekt wurde klar, dass Klimawandel nur eine von mehreren zukünftigen Entwicklungen ist, die für ein möglichst effektives Hochwassermanagement relevant sind. Ebenso relevante Entwicklungen sind sozio-ökonomische Aspekte wie z.B. Ausweitung von Siedlungsräumen in von Hochwasser gefährdete Räume und dadurch sich verknappende Retentionsräume. Aus diesem Grund haben wir die Zukunfts-Orientierung von Hochwasserschutz im Allgemeinen in den Fokus des Projekts gerückt.

Wir haben die Länder Österreich, Deutschland und Schweiz ausgewählt, weil diese Länder zum einen viele Ähnlichkeiten gemeinsam haben (alle drei Länder sind föderale Staaten, deren Topografie und Hochwasserrisiko sind zumindest teilweise vergleichbar), zum anderen aber unterschiedliche Ansätze im Hochwasserschutz verfolgen. Die Analyse und der Vergleich der drei Länder haben zu einem besseren Verständnis verschiedener integrativer Ansätze des Hochwassermanagements geführt. Zentrale Ergebnisse können folgendermaßen zusammengefasst werden:

Die Fallstudie zu Österreich zeigt, dass Entscheidungen zum Hochwasserrisikomanagement in erster Linie auf historischen Daten und Status-Quo-Risikobewertungen basieren. Zukünftige Änderungen des Hochwasserrisikos und die damit verbundenen Wissensunsicherheiten werden anerkannt, aber nur selten berücksichtigt. Jüngste Entwicklungen deuten jedoch darauf hin, dass das Hochwasserrisikomanagement zukunftsorientierter geworden ist, da Expositions- und Vulnerabilitätsminderungsmaßnahmen mittlerweile fester Bestandteil der österreichischen Hochwasserpolitik sind.

Die deutsche Fallstudie hat sich auf die süddeutschen Bundesländer Baden-Württemberg und Bayern konzentriert und dabei den Klimawandelfaktor (CCF) als Vorsorgeinstrument für den technischen Hochwasserschutz in den Blick genommen, der Anfang der 2000er Jahre eingeführt wurde. Es wird der Schluss gezogen, dass die Innovationskraft dieses Instruments nachgelassen hat, nachdem kurz darauf ein allgemeiner Paradigmenwechsel weg vom technischen Hochwasserschutz hin zu einem umfassenderen Hochwasserrisikomanagement eingesetzt hat.

Die Schweizer Fallstudie untersucht ausgewählte Entwicklungen hin zu einem integrierten Hochwasserrisikomanagement aus Sicht der politischen Koordinierung. Die Arbeit zeigt, dass das Hochwasserrisikomanagement in der Schweiz seit mehreren Jahren durch ein starkes sektorales Zusammenspiel von Wasserbau und

Raumplanung geprägt ist. Durch die Förderung hochwasserangepasster Flächennutzungen verringert die koordinierte Hochwasserpolitik der Schweiz die Anfälligkeit für ungewisse zukünftige Änderungen des Hochwasserrisikos und stärkt die Kapazitäten des Landes zur Schadensminderung bei extremen Hochwasserereignissen.

Ein Vergleich der Rolle von Wissenschaft in der Hochwasserpolitik der drei Länder verdeutlicht, wie die Hochwasserrisiko-Governance mögliche Auswirkungen des Klimawandels berücksichtigt. Die Ergebnisse zeigen, dass der Klimawandel in den drei ausgewählten Alpenregionen keinen einheitlichen, jedoch einen zunehmend starken Einfluss auf das Hochwasserrisiko hat. Klimaanpassung ist in allen drei Untersuchungsgebieten mehr oder weniger explizit zu einem wichtigen Thema der Hochwasserpolitik geworden. Diese Entwicklung wurde stark durch evidenzbasierte Argumente gestützt.

Ein Vergleich der österreichischen und schweizerischen Fallstudien konzentrierte sich darauf, wie sich die Hochwasserpolitik in beiden Ländern von einem sicherheitsorientierten Ansatz des Hochwasserschutzes zu einem stärker integrierten Ansatz des Hochwasserrisikomanagements entwickelt hat. Auf der Grundlage von Dokumentenanalysen und semistrukturierten Experteninterviews charakterisieren wir diesen Paradigmenwechsel, entsprechende institutionelle Arrangements und akteursbezogene Interessen in der Hochwasserpolitik beider Länder. Darauf aufbauend diskutieren wir vertikale und horizontale Koordinationsmuster sowie den Aufbau eines grenzüberschreitenden Hochwasserregimes zwischen beiden Ländern.

In einem Vergleich der föderalistisch organisierten Klimawandel-Anpassungs- und -Vermeidungspolitik in Österreich wird schließlich die Ambivalenz von föderalistischen Systemen in der Klimapolitik deutlich: Während das föderalistische politische System in Österreich die Ökologisierung der Baupolitik deutlich behinderte, sind dessen Auswirkungen auf den Hochwasserschutz deutlich neutraler.

Insgesamt liefert das Projekt Flood-Adapt vertiefte Einblicke dazu, wie sich die Hochwasserschutzpolitik in drei Nachbarländern vom technischen Hochwasserschutz zu einem stärkeren integrierten, vorausschauenden Ansatz des Wassermanagements entwickelt hat, in dem auch die Auswirkungen des Klimawandels zunehmend Berücksichtigung finden. Neben den in den letzten Jahren erzielten Fortschritten dieses Paradigmenwechsels zeigen die Projektergebnisse auch die Grenzen und zukünftigen Herausforderungen des integrierten Wassermanagements auf.

2 Executive Summary

Flood-Adapt was a disciplinary political science project in which flood protection policies in Austria, Germany and Switzerland have been analysed and compared. The project explored how flood protection policies in the three countries build not only on flooding events in the past but also take possible future developments into account. At the beginning of the project, the focus was on the relationship between flood protection policies and adaptation to climate change. When we developed the analytical framework for the project, it became clear that climate change is only one future development among others that decides about how effective flood risk management will be in the future. Other relevant developments are socio-economic aspects, such as the expansion of settlement areas in areas at risk of flooding, and the associated shortage of retention space. Thus, we were interested in how far flood protection developed further from a backward-looking, reacting policy-field to a future-oriented policy-field that aims to anticipate future developments that are relevant for flood protection, among them climate change. We have selected the countries Austria, Germany and Switzerland because these countries share many similarities (their political systems, topographies and flood risks are at least partially comparable), and because they nevertheless pursue different approaches in flood protection. Key results of the Flood-Adapt project can be summarized as follows.

The case study on Austria shows that flood risk management decisions are primarily based on historical data and status quo risk assessments. Future changes in flood risk and the related knowledge uncertainties are acknowledged, but they are rarely considered. However, recent developments indicate that flood risk management has become more future-oriented because exposure and vulnerability reduction measures are now a regular feature of Austrian flood policy.

The case study on Germany has focused on the two southern federal states (*Länder*) of Baden-Württemberg and Bavaria. Topic-wise, it looked at the Climate Change Factor (CCF) as precautionary instrument for technical flood protection introduced in the two states in the early 2000s. It concludes that the innovativeness of this instrument faded once the overarching sectoral paradigm had shifted from technical flood protection to more comprehensive flood risk management.

The Swiss case study examines Switzerland's shift towards integrated flood risk management from a policy coordination perspective. The paper shows that flood risk management in Switzerland displays a high degree of sectoral interplay between hydraulic engineering and spatial planning. By fostering flood-adapted land uses Switzerland's coordinated flood policies reduce the vulnerability to uncertain future changes in flood risk and strengthen the country's capacities to mitigate damage in extreme floods events.

A comparison of the science-policy interfaces in the three countries sheds light on how flood risk governance regimes embrace the possible impacts of climate change. Findings show that there is a mixed, though increasing influence of climate

change on flood risk governance in the three selected Alpine regions. Climate adaptation has become an important issue of flood policy in all three study areas and this shift has been strongly supported by evidence-based arguments.

A comparison of the Austrian and Swiss case studies focused on how flood policies in the two countries have shifted from a security-oriented approach of flood defence towards a more integrated approach of flood risk management. On the basis of document analysis and semi-structured expert interviews, we characterise the underlying ideas, institutional arrangements and actor-related interests in the two countries' flood policies, and then discusses the extent of the vertical and horizontal sectoral relations and the empirical evidence for the establishment of boundary-spanning flood policy regimes.

Finally, the comparison of federally organised adaptation and mitigation policies in Austria revealed the ambiguity of federalism in climate policy making: While the federal political system in Austria clearly hindered the greening of building policies, its impact on flood protection is not that negative.

Overall, the Flood-Adapt project provides insights into how flood protection policies in three neighbouring countries have developed from technical flood protection to more integrated, forward-looking approaches of water management that also take climate change impacts into account. Apart from progress made in the last few years the project findings also highlight limitations and future challenges of integrated water management.

3 Hintergrund und Zielsetzung

Despite uncertainties about the exact impacts of climate change, many experts (including the IPCC) emphasise that “climate change contribute[s] to an increase in the likelihood and adverse impacts of flood events” (European Union 2007, L 288/27) and that flood risk management should address climate change adaptation proactively. Flood-Adapt has analysed to what degree flood protection policies in the three neighbouring countries Austria, Germany and Switzerland address possible future developments, ranging from increasing socio-economic pressures to climate change impacts. By doing so, we paid particular attention to the role science plays in this field of policy-making.

We analysed flood protection policies in Austria, Germany and Switzerland for the following three deliberations:

- 1) First, they all have federal political systems in place in which flood protection is not only a policy field that cuts horizontally across different ministries but also vertically across the competencies of federal, regional and local levels of government.

- 2) Second, Austria, Germany and Switzerland are neighbouring countries sharing Alpine spaces with similar topographies, facing similar climate change impacts and struggling with the same scientific uncertainties.
- 3) Third, despite political and topographic similarities we can observe clear variances with regard to our dependent variable: the degree to which climate change adaptation is integrated in flood protection policies in the three countries. While flood protection policy makers in Germany have embraced adaptation as a new challenge early on, their Austrian peers are still cautious (if not adverse) in this respect. Swiss authorities seem to be somewhere between the German and the Austrian positions.

All three deliberations proofed to be relevant during the case study phase and we detected remarkable similarities as well as differences between the three countries. They have been highlighted in two comparative papers (see below), and an additional one on mitigation and adaptation policies within Austria.

The project consisted of four WPs, three of which were concerned with research and the fourth with management and dissemination issues. The three research WPs and the activities performed hereunder can be summarised as follows:

WP1: Here we developed an analytical framework that guided all subsequent research steps. The framework was developed based on the relevant literature, and it opened the focus of the Flood-Adapt project from possible climate change impacts to all kinds of possible future developments relevant for flood protection policies (including socio-economic developments). For further details, see the analytical framework attached to this report.

WP2: In this WP we conducted the three case studies on Austria, Germany and Switzerland. The three case studies are the empirical core of the entire project. It proofed to be more demanding than expected because the differences we encountered in the three countries required us to adjust the analytical focus of each country study in line with national/sub-national specifics. Although all three case studies take the analytical focus of the analytical framework into account, we had to adjust the focus for each case study so that we were able to highlight instead of cover-up country-specifics. The case study findings have been documented in four instead of three publications (see below).

WP3: Once the case studies have been completed we conducted overall three instead of two comparisons. The additional comparison we published already as a journal paper compares the Flood-Adapt findings on Austria with findings on mitigation policies in Austria from the CLIP-IN project. The comparison on the science-policy interfaces in the three countries has been conducted as planned: it covers all three countries, and it highlights the role science plays in flood protection policy making. The comparison focussing on these policies covers Austria and Switzerland only because the analytical focus for the German case study had to be adjusted to German circumstances, i.e. the German case study focuses on the implementation of the "Climate change factor" in Southern Germany. Since this focus deviates

from the other two country studies in several respects we decided to exclude Germany from the comparison of water management policies.

Overall, the three research WPs have been implemented in line with the proposal. However, as outlined in section 4 in more detail, the deliverables produced in the Flood-Adapt project surpass the publications as planned in the project proposal as follows:

- Journal manuscripts: 5 planned, 6 delivered
- Book chapters: 0 planned, 1 delivered
- Conference presentations: 3 planned, 6 delivered

The main findings of the six journal manuscripts are summarised in the following section paper by paper. For further details, see the manuscripts in the annex to this report. Once the manuscripts are published in journals we will make them available as working papers on our website.

4 Projektinhalt und Ergebnisse

Since the main project milestones are the six journal manuscripts produced by the Flood-Adapt project team, the results of the project are summarized based on the six papers (for further details, see the full papers attached to this report). A synthesis of the results is provided in section 5 below.

WP1: Analytical Framework

The analytical framework provided orientation for all subsequent WPs. It addresses in particular spatio-temporal aspects of flood risk management, based on the following definition of flood risk: it is the combination of the probability of a flood event and its potential adverse consequences (UNISDR 2009). As both aspects of risk – hazard and vulnerability – are non-stationary (see Figure 1 below), flood risk is a “dynamic entity” (Merz et al. 2010). This changeable characteristic of flood risk is emphasized in the EU flood directive (2007/60/EC), which specifies that “...human activities (such as increasing human settlements and economic assets in floodplains...) and climate change contribute to an increase in the likelihood and adverse impacts of flood events” (EU 2007).

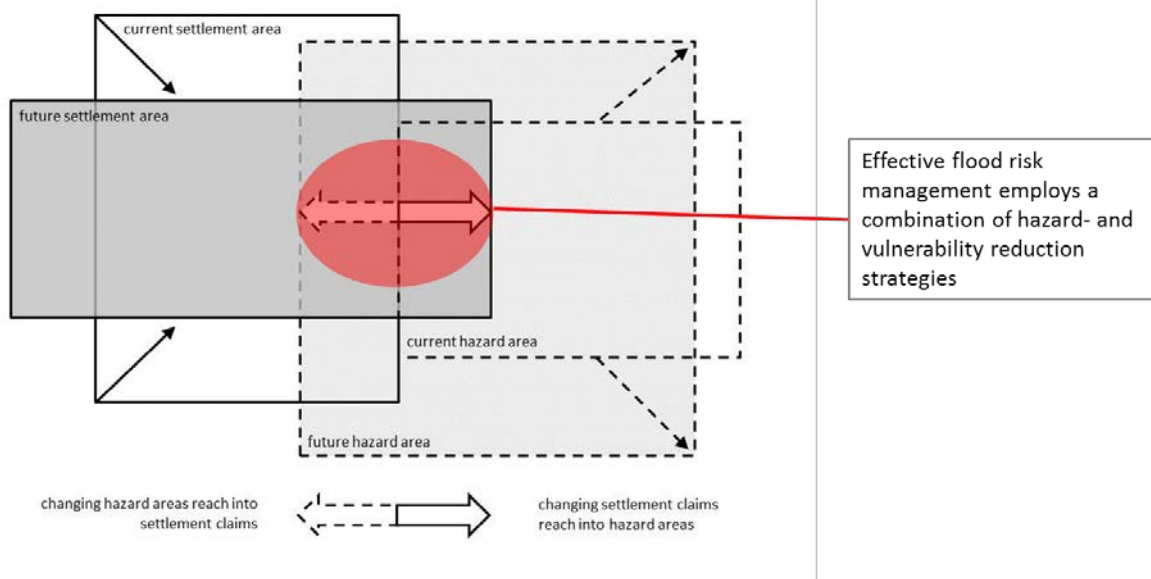


Figure 1: Spatio-temporal dynamics of flood risk and scope of adaptive flood risk management (Source: adapted from BAFU, 2005).

WP2: Case studies on AT, CH, DE

- 1) Nordbeck, R.; Löschner, L. & Steurer, R. (2019): *The future orientation of Austria's flood policies: from flood control to anticipatory flood risk management*; in: *Journal of Environmental Planning and Management*, online first, DOI: 10.1080/09640568.2018.1515731.

This paper analyses the future orientation of flood risk management in Austria. Framed by systematic review of risk reduction measures we assess to which extent Austrian policies are characteristic of an anticipatory, forward-looking flood management approach to cope with expected future stresses on flood risk, in particular climate change and land development. The analysis shows that risk reduction measures build on status quo assessments and do not explicitly consider future changes in flood hazard or vulnerability. However, new design standards for extreme events, the proliferation of large-scale flood retention, tightened land development and building restrictions, or novel planning instruments indicate that Austrian policies are increasingly forward-looking to more effectively mitigate future increases in flood risk. This temporal reorientation is a consequence of the wider policy shift from flood control to integrated flood risk management. Faced with an increasing spatial interplay of risk reduction measures (e.g. securing land for flood runoff and flood retention), our analysis shows that inter-sectoral cooperation between water management and spatial planning can support long-term flood management decisions and maintain the ability to adapt to changing future conditions.

In this paper we analysed to what degree Austrian flood risk management has shifted (i) from mainly structural hazard reduction to a broader, more integrated approach of risk reduction, and, (ii), from responsive to anticipatory policies that take not only past but also likely future developments into account. Regarding the first focus our findings show that after the extreme flood events of 2002 and 2005, Austrian flood policies have shifted from structural flood defence to a broader portfolio of vulnerability-oriented flood risk management measures. This shift entails new horizontal and vertical governance approaches, stricter land use and building regulations considering flood risks, and last but not least, a massive increase of flood-related expenditures. Regarding the future-orientation of Austrian flood policies, the second focus of this paper, our empirical findings lead to more differentiated conclusions. We see that flood protection standards are (i) designed in reference to the status quo, i.e. no consideration of future demographic or land use changes, and (ii) in reference to the statistical probability of occurrence (based on runoff data available at gauge stations or in river catchments). After extreme events, design standards are often adapted to account for the changes in statistical runoff (cf. Land Vorarlberg 2015). However, due to ambiguous climate signals (see section 1), neither the majority of scientists nor policy-makers see the need to account for possible future climate-induced increases in flooding, e.g. by adding a climate allowance to flood discharge levels. Nevertheless, design and safety standards for structural flood defence measures were reinforced using different kinds of “buffers” and “airbags” as precautionary means to accommodate uncertainties about future developments and to ensure the technical robustness over the course of the design life span. In this vein, several experts stressed that potential climate change impacts are already incorporated into planning practice as safety margins, and they worried that adding a climate allowance would divert attention from non-structural measures back to traditional flood defence.

The findings presented above indicate an apparent paradox that anticipatory policies are also a response to past events, implying that reactive and anticipatory approaches represent a continuum with hybrids in between rather than diametric opposites. We also see that adaptation to (likely future) flood risks is a multi-causal process in which uncertain climatic factors are by far overshadowed by highly likely socio-economic trends, such as land use change induced by population and/or economic growth. However, we can conclude that temporal orientation of many policies is underway towards mitigating future increases in flood damage. This shift towards anticipatory adaptation actually marks a necessary consequence of the wider policy shift from flood control to integrated flood risk management. Faced with an increasing spatial interplay of risk reduction measures, e.g. securing land for flood runoff and flood retention, we see that the future-oriented policies analysed above are at the same time ideal-type examples for horizontally integrated flood risk management between water management and spatial planning. In other words, future-oriented flood risk management as an integrated, multi-sectoral endeavor can support long-term flood management decisions and maintain the ability to adapt to changing future conditions.

- 2) Lukas Löschner, Ralf Nordbeck (2019): *Switzerland's transition from flood defence to flood-adapted land use: A policy coordination perspective*, in: *Land Use Policy*, forthcoming, <https://doi.org/10.1016/j.landusepol.2019.02.032>

This contribution examines Switzerland's shift towards integrated flood risk management from a policy coordination perspective. The study applies a heuristic framework of policy coordination to explore how adaption needs promoted cross-sectoral policy coordination between hydraulic engineering and land use planning and enhanced coherence in flood policies targeting extreme flood events. To account for the temporal dimension in policy coordination, the article traces Swiss flood policies back to the early 1800s and distinguishes four phases of policy coordination. Across the four periods, the analysis focuses on (a) the drivers of policy coordination, (b) the manifestation of policy coordination in terms of policy frames, goals, instruments and subsystem involvement, and (c) the performance of policy coordination. Complemented by an in-depth case study of cross-sectoral flood policies in the Swiss canton Nidwalden findings show that the coordination between flood and land use policies has primarily been driven by three factors: (i) extreme floods as focusing events, (ii) an increasing problem pressure, and (iii) strategic reorientations in flood and land use policies. Today, flood risk management in Switzerland displays a high degree of sectoral interplay between hydraulic engineering and spatial planning. By fostering flood-adapted land uses Switzerland's coordinated flood policies reduce the vulnerability to uncertain future changes in flood risk and strengthen the country's capacities to mitigate damage in extreme floods events.

Regarding the main drivers of policy coordination, the study shows that the motivations to promote integrative measures were based on functionalistic as well as strategic considerations (Tosun and Lang, 2017). Our analysis suggests that coordination between flood and land use policies in Switzerland was driven by a combination of three factors. First, throughout its history damaging floods can be regarded as "focusing events" for policy action and thus constitute external drivers for the better alignment of sectoral policies (Birkland, 2006). Secondly, the long-term analysis also shows that "external demands" from stakeholders and pressure groups were an important factor in phase two for the shift toward nature-oriented hydraulic engineering, but otherwise cannot be regarded as a major factor underlying policy coordination efforts (Peters, 2018). Third, the analysis reveals a strong "internal motivation" for promoting policy coordination in order to put common strategies into action (Braun, 2008). In particular the anticipation of increasing problem pressure, i.e. higher flood risks in the future due to climate and land use changes, marks a key factor for coordinated flood and land use policies.

This study also contributes to the understanding of the performance of policy coordination, a dimension which generally receives too little attention in the policy

coordination literature (Tosun and Lang, 2017). It shows that the increasing sectoral interplay between hydraulic engineering and spatial planning fostered flood-adapted land uses and supported the development of “adaptive spatial patterns” (Birkmann et al., 2013). As we empirically substantiate by the example of flood corridors and their implementation in the Canton Nidwalden, the alignment of sectoral policies provides the necessary means to effectively reduce the vulnerability to uncertain future changes in flood risk and to mitigate damage in extreme floods events. Despite its success, the example however also sheds some light on the current limits of cross-sectoral policy coordination in flood risk management. Our study highlights that the “implementation of space of the rivers is hampered by the lack of available rights on land” (Ruiten and Hartmann, 2016, p. 700) and thus points to the need to better incorporate the agricultural sector in policy coordination processes.

Finally, while the idea that water management and spatial planning need to collaborate in the field of flood risk management is established and widely accepted (Wiering and Immink, 2006), more encompassing studies of policy coordination are needed to better understand the implementation challenges related to anticipatory flood risk management. In general, it is surprising that the shift towards integrated flood policies has not received more scholarly attention from a policy coordination perspective. This study highlights that such an approach can build a better understanding for the opportunities and limits of coordinated policies to address a cross-cutting problem. The process-related framework of Candel and Biesbroek (2016) is a helpful heuristic to gain insights into the multidimensional process of policy coordination. It can provide a basis for further research to explore performance-related aspects of policy coordination in greater depth.

3) *Pelaez-Jara, M. (2019): The Ascending and Fading of a progressive policy instrument: the Climate Change Factor in Southern Germany, submission in June 2019.*

The Climate Change Factor (CCF) is a precautionary instrument for technical flood protection introduced in Southern Germany in the early 2000s. The CCF was designed as a surcharge value to be added to all new technical flood facilities such as dams, protection walls, and retention areas. This paper deconstructs the conditions and processes that led to the creation of this new policy instrument. Following the Instrument Choice Framework, the paper analyses in a heuristic manner the institutions, actors, discourses, and decision context that were part of this process from the early 1990s to 2004, when the instrument was introduced. In order to better understand the scope of this regional instrument, the paper also shortly depicts four exemplary cases of flood risk and protection management, where the instrument was either applied or avoided. The article closes with an assessment of the CCF concluding that the innovativeness of this instrument faded

once the overarching sectoral paradigm had shifted from technical flood protection to more comprehensive flood risk management.

This paper strove to reconstruct the creation of the CCF as a – by the time of its formulation – innovative instrument of flood risk policy. Building on the instrument choice framework by Böcher & Töller (2007, 2012), the paper argued that the elaboration of the CCF can be understood along the interplay of five different factors: institutions, problem structure, discourses on instrumental alternatives, actors and their interactions, and the decision situation (see Figure 1 above).

The CCF was introduced in BW and BY in 2004. By that time, the flood risk community of the two Länder was still operating largely in a classical safety paradigm of technical flood protection (Nordbeck et al., in review). The ruling Federal Water Act of 1957 had been reformed in 1996 and again in 2002, and both reforms introduced only first notions of integrated flood protection and restoration of natural retention areas. By the time the CCF was introduced, Germany had not yet introduced the EU Flood and Water Directives into its national and federal legislation. Therefore, the institutional setting reinforced the traditional definition of floods and their impact as problems that can be measured, monitored, and contained, and where technical solutions provides necessary tangible protection. This made the CCF with its “technical markup logic” the perfect fit.

The early 1990s saw a high public and scientific awareness for climate change, however, at the regional level climate change was not yet strongly been associated with extreme flood events. A discursive shift was only brought with the scientific publications by Caspary and Bárdossy on connections between climate change, atmospheric circulation patterns, and extreme flood events for South Germany (Bárdossy and Caspary 1990; Caspary and Bárdossy 1995). The debate kicked off by these publications resulted in a major reconfiguration of the actor landscape with the creation of KLIWA as a joint research project that scientifically examined the connections between climate change and extreme water and flood events but, at the same time, also provided an effective hybrid platform of knowledge exchange between policymakers and experts. It was, in the end, KLIWA in the context of which the CCF had been technically forged and politically legitimized. The pathway of influence was a staged one: First, KLIWA engaged, in more technical terms, in the compilation of historical flood data series and the promotion of regional hydro-meteorological modelling; next, it derived policy-relevant conclusions, which eventually materialized in the CCF as a concrete technical instrument. For this technical instrument to be accepted by policymakers and the public, it was discursively linked to the precautionary principle as a well-known and approved principle of German environmental policymaking in the context of high uncertainties. So, by way of summary it can be said that the CCF was, by the time of its creation, a quite progressive policy instrument that – by means of its straightforward design – promised to have high impacts on flood risk management.

As the above analysis of four exemplary projects in BW and BY showed, the implementation of the CCF did not live up to the high expectations of the early years.

Neither of the two Länder has systematically evaluated or followed up on the impact of the CCF's implementation, and there is no official data on its effectiveness. The case studies analyzed in this paper indicate that the instrument is (only) used when political or public pressure and risk awareness are high, e.g. after a major flood event, and when the extra costs linked to the factor's implementation are low or costs are covered by a third party. So, while regional experts and policy-makers still argue that the CCF remains a valid and relevant climate change adaptation instrument, its implementation (or the lack thereof) rather indicates the fading of a progressive instrument.

WP3: Comparisons

- 4) *Ralf Nordbeck, Lukas Löschner, Melani Pelaez Jara, Michael Pregernig (2019): Exploring science-policy interactions in a technical policy field: climate change and flood risk management in Austria, Germany, and Switzerland, under review.*

This paper analyses the science-policy interactions in the field of flood risk governance against the background of climate change. By the example of three neighbouring Alpine regions (Switzerland, South Germany and Austria) the study strives to shed further light on how flood risk governance regimes embrace the possible impacts of climate change. It builds on the assumption that flood risk management, as a 'technical' policy field, is strongly influenced by scientific evidence and that differences in how countries incorporate climate change can be explained by the way science and policy are brought together in the respective national arenas. We structure the empirical analysis along three dimensions: (i) dynamics of knowledge creation; (ii) institutionalization of the science-policy interface; and (iii) pathways of influence of expertise on policy development. Findings show that there is a mixed, though increasing influence of climate change on flood risk governance in the three selected Alpine regions. Climate adaptation has become an important issue of flood policy in all three study areas and this shift has been strongly supported by evidence-based arguments.

Concerning our first analytical dimension, i.e. the dynamics of knowledge creation, our case studies indicate that there has not yet been scientific closure on the impact of climate change on flood hazards. In the 1990s and early 2000s studies were often afflicted by methodological problems and data gaps. This created dissent in the Austrian and German scientific communities, when the findings of some studies were criticised. In the last ten years, many of these problems were solved due to more comprehensive historical data and better climate and hydrological models. Nowadays, there is a broad consensus among scientists in all three regions about the potential impact of climate change. Nevertheless, epistemological and methodological uncertainties remain, in particular with regard to major flood events, which are difficult to predict in the Alpine region. This can, inter alia, be

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seen when comparing insights derived from historical trend analyses with those of modelling approaches: For Austria and Germany those insights converge, however, content-wise they point into opposite directions (with Austrian studies seeing few and German studies seeing numerous indications of climate change signals). In contrast to that, for Switzerland historical trend analyses show a weak signal, whereas models indicate a strong(er) influence based on heavy rainfall events. This strong variation on the regional and sub-regional level in both the observed and expected changes in flooding is somewhat surprising, but can be explained by the topographic effects of the Alps and the countries' different susceptibility to cyclone tracks (cf. Frei et al. 2000).

The case studies further indicate that scientists adjusted their expertise to political expectations: When climate change emerged prominently on the political agenda, the production of application-oriented expertise followed suit. This can be interpreted as an effort of experts to ensure that they remain a valid source of knowledge for decision-makers. Strassheim and Kettunen (2014) denote this phenomenon with the concept of "policy-based evidence" – as compared to the classical notion of "evidence-based policy" in a more linear understanding of science-policy interactions.

However, the case studies still show some variance in the degree to which experts lend themselves as advisors for policy: In Austria and Germany, experts provided quite explicit recommendations, with German scholars recommending the introduction of an explicit climate change instrument, i.e. the Climate Change Factor, and Austrian scholars explicitly recommending not to implement such an instrument. In Switzerland, scientists provided more cautious and partly ambiguous recommendations, thereby leaving the final decisions to policy makers. These divergent patterns between countries are notable in various respects: On empirical grounds, it is interesting to see that even though the expert communities of the three regions regularly exchange views and experiences, we observe convergence neither on the level of recommended policy instruments nor on the level of advisory styles. As regards the latter, the comparative science-policy literature would have made us expect that the three regions, because they share a similar neo-corporatist policy culture, would show similar patterns of interaction between science and policy-making (Halffman and Hoppe 2005; Brand and Pawloff 2014; Hermann et al. 2015, 2017). Similarities can, for sure, be seen as regards knowledge actors and organizational formats (see Table 1), however, not for the way scientists wriggle into politics.

As regards relevant knowledge actors, the science-policy interfaces have been characterized in all three regions by a rather narrow set of actors consisting of scientists, public administrators, and political decision-makers. In the last decade, the scientific networks expanded and now include hydrology, meteorology, and spatial planning. Scientists play an important role in particular for risk assessments, while professionals and practitioners become more important when the discussion turns to risk management. In all three regions, we see a close cooperation between scientists and policy-makers, often including double roles and

changes of roles. This is also reflected in hybrid platforms of knowledge exchange: In Austria and Switzerland, hybrid platforms mostly consist of scientists, administrative officials and political decision-makers, while in Germany those platforms are largely confined to scientists and administrative officials. The degree of institutionalization of those exchange platforms varies in the three regions, with the highest level of institutionalization in Switzerland, followed by South Germany, and the prevalence of more ad hoc, often event-driven, formats in Austria. Overall, there is a broad spectrum of science-policy interfaces: First, we have highly specialized organizations and research frameworks with a long continuity, such as ÖWAV in Austria, KLIWA in Germany, and PLANAT in Switzerland; second, we have specific research programs to generate focused research, such as FloodRisk in Austria and the pilot programme on climate adaptation in Switzerland, which are more event-driven and temporary, and finally, we have short-term contract research for ministries that delivers studies on the impact of climate change, such as the Blöschl study in Austria.

Our case studies further show that experts had an important influence on flood policy-making in Austria, South Germany and Switzerland and that flood risk governance in these regions is to a great extent evidence-based. The close relationship between scientists and policy-makers described above creates policy frames that, by identifying the potential impact of climate change on flood hazards and specifying policy solutions for adaptation, constructed a coherent story around the “problem of future flood risks”. Policy-makers in all three regions to a certain extent depend upon scientific expertise to act, which provides experts with an important source of influence in the policy-making process. At the same time, our case studies also reveal that policy-makers set limits on the influence of those experts: Scientists had to “tailor” their knowledge to the new political issue of climate adaptation to get their expertise recognized. This can most explicitly be seen using the example of the Climate Change Factor in South Germany, where a generally high political sensitivity for climate change questions led scientists to recommend the Factor in spite of a very uncertain scientific basis.

In conclusion, the influence of experts on flood risk governance can best be understood as being “socially embedded” (Strassheim and Kettunen 2014) or “contextually embedded” (Bergsma 2018). With the notion of “social embeddedness” Strassheim and Kettunen (2014) emphasise that “expertise and evidence [need to be seen as] socially embedded in authority relations and cultural contexts” (p. 259). In the case of flood risk management, this embeddedness most prominently played out in the flood paradigms that the three regions embrace: Switzerland was an early mover towards integrated risk management (“risk-based spatial planning”), a shift primarily caused by the extreme flood event in 1987. Climate change became an issue in the early 1990s, but the explicit consideration of climate adaptation in the form of planning for the overload was driven by the 2005 extreme flood. In Germany, the flood community discovered climate change as a problem also in the early 1990s, embedded in a national debate in which climate change is of high importance. Based on the precautionary principle, Germany introduced an

explicit instrument (CCF) for hazard mitigation already in 2004, yet the CCF was still embedded in the classical safety paradigm of technical flood protection. More integrated approaches were developed later on in Germany, and with that, the CCF took a back seat and became one among many other measures. In Austria, the new integrated paradigm of flood risk management was adopted somewhat later as in Germany and Switzerland, specifically after the extreme flood events in 2002 and 2005. The new flood paradigm has been consistently implemented since then through the avoidance of new risk and the reduction of existing risks. The discussion about the impact of climate change emerged also relatively late in 2006/2007 in Austria, and until today has yielded only a few specific climate change related measures.

5) *Ralf Nordbeck, Lukas Löschner (2019): Towards Policy Regimes in Flood Risk Management? Exploring the sectoral interplay between flood protection and spatial planning in Austria and Switzerland, submission in June 2019.*

Flood policies across Europe and beyond are shifting from a security-oriented approach of flood defence towards a more integrated approach of flood risk management. While traditional flood protection aimed at controlling river and “keeping water out”, the nascent policy paradigm seeks to provide “more room for the rivers” and to prevent the accumulation in damage potential. Spatial planning assumes a critical role to legally secure the necessary land resources for flood mitigation measures and to ensure flood-adapted land management, demanding a stronger alignment of sectoral policies with flood protection, the traditionally dominant policy sector. Against this ongoing policy shift, this contribution explores the sectoral interplay between flood protection and spatial planning for the case of Austria and Switzerland, two neighbouring, federal countries in central Europe who pioneered spatial planning approaches in flood risk management in response to devastating floods. On the basis of document analysis and semi-structured expert interviews, we first characterise the underlying ideas, institutional arrangements and actor-related interests in the two countries’ flood policies, and then discusses the extent of the vertical and horizontal sectoral relations and the empirical evidence for the establishment of boundary-spanning flood policy regimes.

In the above empirical analysis, we characterised the flood policy regimes in Austria and Switzerland according to their underlying ideas, institutional arrangements and actor-related interests. But what does that tell us about the sectoral interrelations between jurisdictions and organisations in the two policy domains hydraulic engineering and spatial planning? In an effort to explore this fundamental question for the given boundary-spanning policy regimes we now apply the framework of (Trein, 2017) outlined above (see section 2.1), to determine the vertical relations (i.e. to which extent one sector dominates the other) as well as the horizontal relations (i.e. the extent of cooperation between the sectors) for Austria and Switzerland (see Figure 2).

In terms of the vertical relations the comparison indicates some striking similarities but also differences between the two countries. Concerning the similarities, in both cases we see an increasing mutual dependence of the two policy sectors as flood policies shifted from a defence-oriented approach of flood protection towards a more integrated approach of managing flood risks. Common aims in hazard reduction and exposure/damage reduction can only be achieved if the respective institutions and actors work together. As land resources become a decisive factor for the realisation of flood alleviation measures (in particular flood storage) but also for preventing the further accumulation of damage potential in floodplains, spatial planning is assuming a pivotal role in the practical implementation as water management authorities are somewhat dependent on spatial planning to pursue the nascent flood policy paradigms (i.e. “more room for the rivers”), notwithstanding the fact that flood protection schemes are overwhelmingly funded by water management authorities and a comparatively small share of the overall budget is allocated to spatial planning measures (Ralf Nordbeck et al., 2019).

Secondly, vertical relations in the flood policy regimes in Austria and Switzerland are determined by a similar distribution of responsibilities between hydraulic engineering and spatial planning across the different levels of government. In both countries, water management is generally a federal task, while spatial planning is in the responsibility of the states/cantons and municipalities. This makes it difficult (i) to implement coherent spatial planning policies across the federal territories of both Switzerland and Austria, and (ii) to align spatial planning policies with federal directives in water management and hydraulic engineering, as becomes evident with regard to risk-based spatial planning and the wider implementation of flood spillways and securing corridors for extreme runoff.

In the division of competences, however, also lies one of the fundamental differences between the flood policy regimes in Austria and Switzerland. In contrast to Austria, spatial planning in Switzerland has a more prominent status at the national level, both legally (i.e. Federal Act on Spatial Planning) and organisationally, as spatial planning agendas are developed in the Federal Office for Spatial Development (ARE) and coordinated with natural risk management agendas within the Federal Office for the Environment (BAFU). This institutional framework provides the basis for a non-hierarchical sectoral relationship, where cross-cutting policy agendas and instruments can be co-developed by the two sectors.

Concerning the horizontal relations, both countries made significant progress towards more formally aligned flood protection and spatial planning policies since the seminal flood events, not least as a result of comprehensive flood hazard/flood risk mapping, which provides the basis for flood-adapted land development in floodplains. However, the case comparison also shows that the flood policy regime in Switzerland clearly has a higher extent of integration across the sectors hydraulic engineering and spatial planning. This becomes evident not so much in the legal frameworks but in the organisational setting of flood risk management, such as PLANAT, which provides a “boundary-spanning structure or overarching authority that oversees, steers and coordinates the problem as a whole” (Candel &

Biesbroek, 2016, p. 223). PLANAT thus provides the guiding framework for (flood) risk management in general and the development of coordinated flood policies. Here the comparative analysis also shows that Switzerland disposes of more nuanced policy approaches (such as risk-based spatial planning, extreme runoff corridors), to jointly work towards mitigating future risks, also in the light of possible climate change related increases in future flooding.

Summing up, as a result of extreme events (1987/2002), in both Switzerland and Austria we see an increasing awareness of the cross-cutting nature of the issue of flooding as the policy focus generally shifted from flood defence towards flood-adapted land use. Legislative and programmatic changes in both policy sectors indicate an increase in mutual sectoral dependency to meet the overarching policy objectives in flood risk management. Specifically in Switzerland, however, these changes were led to a more regular and formal exchange between the two sub-systems, the establishment of cross-sectoral administrative units and interdisciplinary platforms to promote coordination, as well as aligned flood policies that demand concerted action between the two policy domains hydraulic engineering and spatial planning. Switzerland made a greater progress towards more formally (and informally) integrated flood policy regime (although, to be fair, this transition began about 15 years earlier than in Austria). As regards future developments, it is expected that ongoing efforts towards deepening horizontal and vertical institutional relations will continue, with significant steps being undertaken especially in terms of the alignment of sectoral policies and legal instruments.

6) *Steurer, R. & Clar, C. (2018): The ambiguity of federalism in climate policy-making: how the political system in Austria hinders mitigation and facilitates adaptation; in: Journal of Environmental Policy and Planning, 20/2, 252-265.*

Although the impacts of federalism on environmental policy-making are still contested, many policy analysts emphasise its advantages in climate policymaking. This applies to the mitigation of climate change, in particular when federal governments (as in the US) are inactive. More recently, federalism is also expected to empower sub-national actors in adapting to local impacts of climate change. The present paper analyses the role federalism in Austria played in greening the decentralised building sector (relevant for mitigation) on the one hand, and in improving regional flood risk management (relevant for adaptation) on the other. In line with the so-called matching school of the environmental federalism research strand we conclude that Austrian federalism proved to be more appropriate for regional flood protection than for mitigating climate change. We highlight that it is not federalism per se but federalism embedded in various contextual factors that shape environmental policy-making. Among these factors are the spatial scale of an environmental problem, the nitty-gritty of polity systems, and national politics (such as federal positions on climate change mitigation).

In the adaptation case study, the strong vertical fragmentation of responsibilities in flood risk management was not in the way of stepping up respective policies for several reasons. First and foremost, the problem of flooding was pressing and the federal polity setup matched comparatively well with the regional variations of flooding events (the same applies to all kinds of climate change impacts). Second, all relevant actors from whatever level of government were from the same sector (water management), and they shared a strong common interest that was identical with the adaptation agenda, i.e. strengthen resilience by preventing damages from future floods. Third, a federal polity setup characterised by co-funding facilitated intense coordination and cooperation among like-minded experts instead of reciprocal blockades or joint decision-traps. Consequently, the fragmentation of responsibilities in flood risk management was offset by a dense network of cooperation and a strong consensus on policy contents. This finally fostered experimentation, mutual learning, and a race to the top rather than the opposite.

In the mitigation case, the detrimental effects of federalism were not offset but amplified by the following factors. First and foremost, climate change is a global problem that requires policy changes at all levels of government, but Austrian provinces showed little interest in the issue, inter alia because the federal government adopted national obligations without consulting and/or compensating them for provincial contributions. In other words, the global problem structure and national target setting both mismatched with the federal polity setup of the building sector. Second, CPI in the Austrian building sector required not only vertical coordination between levels of governments but also horizontal coordination between environmental and building policymakers. Since the latter are not interested in environmental issues, this diagonal polity setup is far more demanding than the purely vertical one in flood risk management. For climate change mitigation in Austria and Switzerland we conclude elsewhere that federalism further complicated an already complex (horizontal) coordination challenge by adding a vertical dimension (Casado-Asensio & Steurer 2016; Steurer & Clar 2015). Third, while the fragmented polity setup in the water management case enhanced interdependencies and coordination between levels, the decentralisation of building policies made it difficult for federal policymakers to push CPI. While co-decision-making provides venues for promoting CPI top-down, federalism in the sense of regional autonomy shuts the national level (and its mitigation targets) out. Consequently, provincial building policies were not greened via bottom-up experimentation, mutual learning, and an innovation-friendly race to the top but through a series of piecemeal national and EU interventions.

Overall, at least three analytical conclusions can be drawn from these findings. First, the comparison of the two cases shows that matching or mismatching government levels and problem scales is an important but not the only explanation behind diverging policy performances. Other key factors are national political positions, the concurrence (or conflict) between climate and sectoral policy aims, problem characteristics (e.g. local and visible versus global and abstract), and the degree of interdependence embodied in the federal polity setup (i.e. co-decision-

making versus provincial autonomy). Thus, it is not federalism per se but certain types of federal polity setups in combination with various contextual factors that determine policy outputs and outcomes. Second, since the (mis-)matching of governmental levels and problem scales proved to be important for policy outputs/outcomes, our cases contradict the key assumption of the dynamic federalism school, i.e. that every level of government is equally important for solving any environmental problem. While federalism enables sub-national mitigation in countries where federal governments are inactive (see section 1), the Austrian case shows that provincial building policies were inadequate to meet national mitigation obligations. Third, despite the advantages of the matching school over the dynamic federalism school it is important to note that single levels of government cannot address complex environmental problems adequately, even not if their spatial scales match. Since the present paper summarises findings from two case studies on the same country, our conclusions can be generalized analytically to similar cases but not empirically or statistically (Yin 2003). Based on a similar mitigation case study on Switzerland that produced similar findings (Casado-Asensio & Steurer 2016) we are confident that the mitigation case can be replicated for most federal countries that adopted climate change mitigation targets but failed to share them with sub-national authorities. Thus, future research should explore in particular various issues of climate change adaptation in federal settings.

5 Schlussfolgerungen und Empfehlungen

Flood-Adapt aimed to better understand what factors determine the degree to which possible climate change impacts are mainstreamed into flood protection policies and how adaptation measures are integrated horizontally into key sectors and vertically across levels of government in federal state settings.

Concerning the first part, the main finding derived from the project is that possible climate change impacts on future floods are still uncertain and show strong regional variations. Furthermore, climate change interacts with other factors that influence potential adaptation strategies. Determining future flood risks is a multi-causal process, in which uncertain climatic factors are often overshadowed by highly likely socioeconomic trends such as land-use change induced by population and economic growth. As a result of extreme events (1987, 2002, 2005) in the Alpine region, we see an increasing awareness of the cross-cutting nature of the issue of flooding in Austria, Germany and Switzerland as the policy focus generally shifted from flood defence towards flood-adapted land use. Legislative and programmatic changes in both policy sectors indicate an increase in mutual sectoral dependency to meet the overarching policy objectives in flood risk management.

The adaptation strategies differ in the three countries, but also show growing similarities in recent years. Germany introduced the Climate Change Factor (CCF) early on in 2004/5, but this instrument had a rather limited impact on flood policy

practice in the following years. The limited impact may reflect the broad discussion among scientist and practitioners if this kind of climate allowances is really the best adaptation strategy. More recently, Germany has introduced several other measures such as the “Bavarian Polder Program”. Yet, the sector is still oriented towards a more technical approach of flood protection. Austria has deliberately not added a climate change allowance to its design values, but it would be short-sighted to conclude that until now Austria has not actively factored-in the effects of future climate change into its flood risk management strategies. Policy makers and scientific experts stress that in many areas potential climate change influences are already incorporated into planning practice, as extreme events lead to an adaptation of the design values for flood protection measures. The federal government also improved design standards such as the safety allowance (called “free-board” in Austria), which is added to the calculated design of flood defence infrastructure as a “buffer” to accommodate for epistemic and modelling uncertainties. On the state level, water management authorities started to take the issue of local intensive rainfall more seriously. Facing an increase in heavy rainfall, as a likely result of climate change, for instance the Governments of Lower Austria and Styria have recently developed a state-wide hazard map for surface runoff, which could provide a comprehensive hazard information base for flood proofing measures in areas prone to pluvial floods.

Switzerland’s flood policy adopted a proactive stance regarding the possible climate-related effects on flooding at an early stage in the late 1990s. Despite – or rather given – the lack of hard evidence of climate change effects on flooding, scientific studies nevertheless supported the shift from hazard defence towards an integrated approach in flood risk management. Following the 1987/2005 flood events Switzerland’s flood policies were oriented towards reducing flood discharge and increasing the “robustness” of technical defences against flood overload. The integrated approach in Swiss flood policy aims at planning for extreme events irrespective of the actual influence of climate on flood discharge.

In sum, Switzerland displays a strong alignment between climate change adaptation and flood risk management. Flood policy’s active stance in implementing Switzerland’s Climate Change Adaptation Strategy as well as the involvement of administrative authorities in the assessment and monitoring of climate change demonstrates that policy actors in this field consider adaptation increasingly on equal terms with other sectoral policy objectives. To support the implementation of future-oriented risk management strategies, flood policy, however, also relies on expertise from other disciplines (e.g. spatial planning), while non-scientific knowledge actors, in particular technical experts and municipalities are important partners for implementing in practice the nascent paradigm of integrated flood risk management.

Flood-related research can support the policy shift towards integrated flood risk management by exploring two issues in further detail. A fundamental issue is the sectoral interplay between water management and spatial planning. While the idea that water management and spatial planning need to collaborate in the field of

flood risk management is established and widely accepted (Wiering and Immink 2006), more in-depth studies of policy coordination between the two sectors are needed to better understand the implementation challenges related to anticipatory flood risk management. This includes, on the one hand, output-oriented approaches to explore in further detail the possibilities and limitations of “[adjusting] sectoral policies in order to make them mutually enforcing and consistent” (Stead and Meijers 2009, 322). On the other hand, there is also need for process-oriented perspectives to cross-sectoral flood policy-making, which investigate the origins, the driving forces and the actors that promote flood policy change. Such approaches could help explain how, in the aftermath of a shock event, a redistribution of resources and power occurs and how advocacy coalitions in flood risk management translate their beliefs into actual flood policies (Meijerink 2005). Secondly, there is a need to build a better understanding about possibilities and constraints of mobilizing land for flooding. While land resources are emerging as a critical factor in flood risk management, the provision of the necessary land (e.g. for flood storage, emergency flood runoff or river widening) is often hampered by the lack of availability and accessibility of the often privately owned land. Fundamentally, policy efforts are overridden by a conflict of interest between the public aim to provide land for flooding and the private interest (to limit infringements to private property rights and maintain opportunities for land development) (Kenyon, Hill, and Shannon 2008). Further research is needed to explore this policy delivery gap (Moss 2008) and the instruments by which to overcome it.

The Flood-Adapt findings are particularly relevant for policymakers from the federal and the provincial levels in Austria, Germany and Switzerland. We have been in touch with them throughout the project and we will continue to inform them about the project findings as they are being published. The results of Flood-Adapt are also important for the future implementation of the EU Floods Directive in Austria, in particular for the Bund-Länder Working Group on this issue. The project members have provided policy advice to the federal, provincial and local administrations at various occasions and will continue to do so in the future.

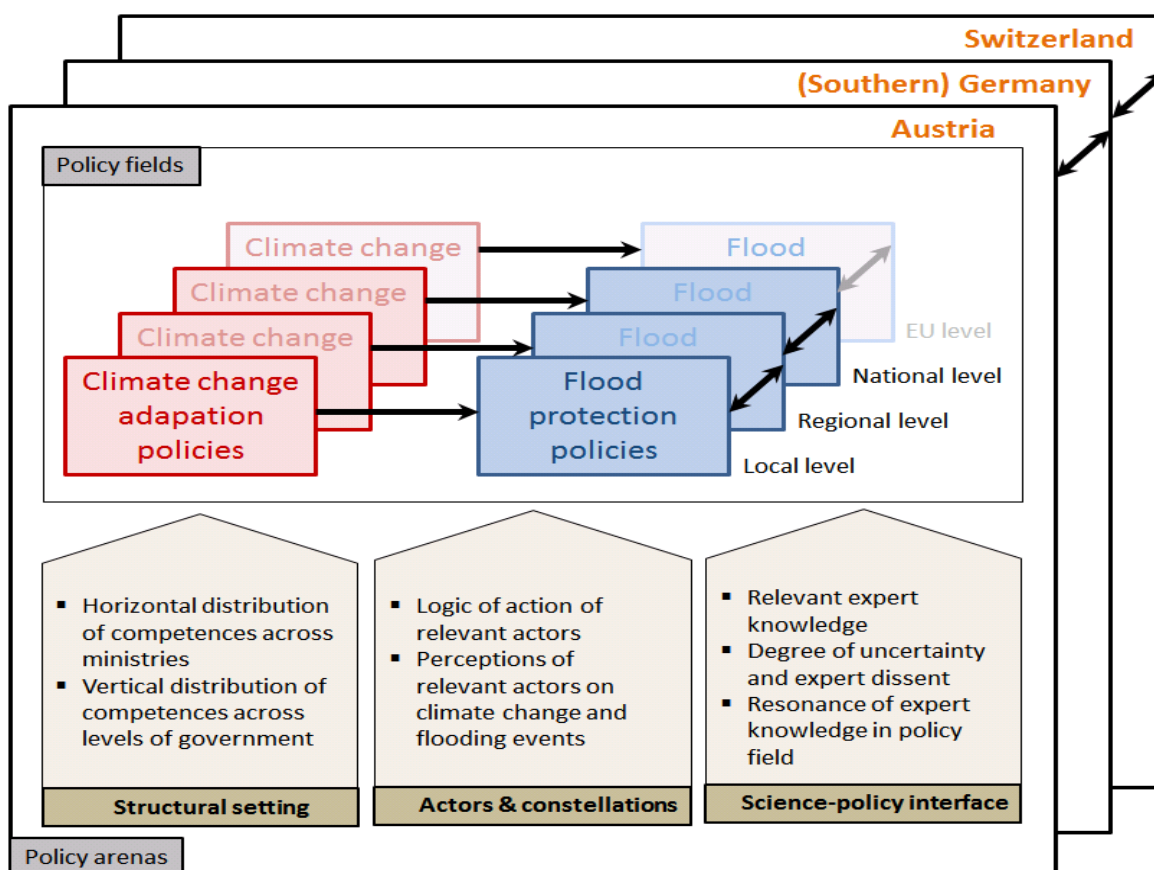
The project findings regarding the science-policy interface and the sectoral coordination are also relevant for scientist from various fields, including water management, spatial planning and climatology.

C) Projektdetails

6 Methodik

By comparing flood protection and adaptation policies in similar institutional and environmental settings, Flood-Adapt stood in the tradition of comparative public policy research that employs a qualitative case study design. Respective research usually analyses how and why policies across different countries are different (Gupta 2012, 12ff). With regard to “how”, we focus our analysis on the horizontal and vertical mainstreaming of flood protection and climate change adaptation. With regard to “why”, we aim to analyse in particular the relevance of structural/institutional settings (such as the federal political system and respective horizontal and vertical distributions of competencies), actors (including their political interests, values and problem framings), and the role science and science-policy interfaces play (for an illustration of the proposal logic see figure 1). To guarantee that the case studies of the three countries are comparable we will conduct them based on a coherent analytical framework. The analytical framework has been developed in WP1, the three case studies constituted WP2 and their comparison has been conducted in WP3 (for an illustration of the WP structure see figure 2).

Figure 2: Logic of the Flood-Adapt proposal



The research conducted in the Flood-Adapt project was based on the repertoire of qualitative social science research methods. The analytical framework in WP1 has been developed based on desk research during which we reviewed the general as well as the case-specific scholarly literature on adaptation mainstreaming into flood protection in Europe. It aimed to summarise existing research on key issues of flood protection and integrated flood risk management in the three case study countries, the aspects of the federal political systems that are relevant for flood protection, and EU programmes and policies that (aim to) shape national policies (such as the EU Floods Directive from 2007). Based on the desk research the analytical framework has elaborated the details of the case studies (including interview guides). To make sure that the German and the Swiss cases address the issues relevant from an Austrian perspective in a comparable way, they have been conducted after the Austrian case, based on a revised analytical framework that reflected the findings of the Austrian case study.

The case study research in WPs 2 and 3 marked the core of Flood-Adapt. As Eisenhardt (1989, 532ff) notes, case studies are exceptionally good in scrutinising good practices and building novel theories. By drawing on Eisenhardt's (1989) and Yin's (2003) methodological work, the case study research design employed here can be described as follows.

Case selection:

The case studies resemble "case research with a purpose", i.e. we entered the case study process with specific research questions (see above) and a deliberate case study design, where the selection of cases was based on a deliberate decision (Harrison & Freeman 1999, 482). As outlined above in detail, we focused on Austria, Germany and Switzerland for good reasons. To consider the fact that flood protection policies are a multi-level endeavour that spans across different levels of government (in particular in federal states), we looked not only at national policies but also at two selected provinces (Länder/Kantone). The case study regions have been chosen mainly based on their topography and their vulnerability with regard to flooding. They are characterised by Alpine Spaces and/or by Alpine foothills and hilly countryside. The similarities of their political systems and their topographies imply that the selected case studies are "most similar" in character. This allowed us to understand and explain variances of our dependent variable, i.e. the degree to which climate change adaptation is integrated in flood protection policies at different levels of government.

Research steps:

The analysis of each country has been framed as a single case study on national as well as regional flood protection and adaptation policies. Thus, the case study research design employed here distinguished two consecutive research steps:

- Three within-case analyses (one for each country) in WP2 and

- Two (finally three) cross-case comparisons in WP3 (one focussing on climate change adaptation in flood protection in general, one on the design of science-policy interfaces in the three countries more specifically, and one comparing the role of the Austrian federal system in climate change mitigation and flood protection policies).

The within-case analyses and the cross-case comparisons have been conducted based on Yin (2003), with the details to be elaborated in the analytical framework.

Data collection methods and documentation:

By drawing on different sources of information in the case studies, a “chain of evidence” enhanced the construct validity of the research (Yin 2003, 35f, 97-106).

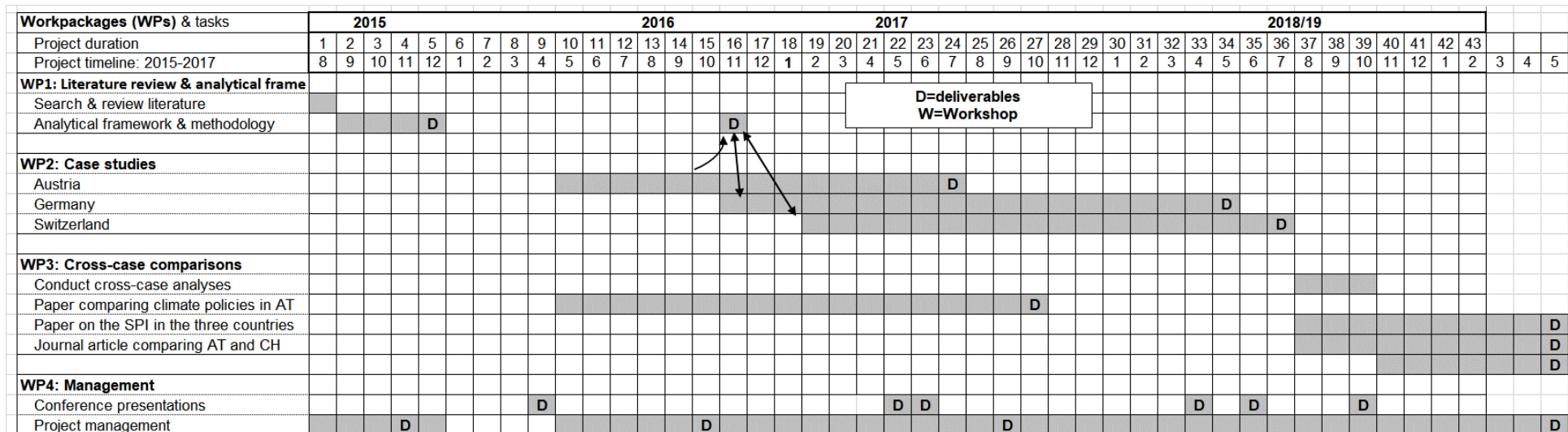
The case studies combined

- Desk research covering internet sources, policy documents and academic literature;
- Qualitative semi-structured interviews with government officials responsible for flood protection policies and/or climate change adaptation at federal, provincial and local levels of government;
- Qualitative semi-structured interviews with stakeholders that are involved in or have expertise in flood protection and/or climate change adaptation.

Obviously, interviews with policy makers at all levels of government and relevant stakeholders have played a key role in answering the research questions. We conducted around 10 interviews per country (i.e. 2-3 interviews at the federal level and 4-6 interviews per selected region), summing up to 33-42 interviews in total. The interviews have been recorded, transcribed selectively and interpreted qualitatively. The interview guides have been developed as part of the analytical framework in WP1, and they have been refined for the German and Swiss case studies once the Austrian case has been finalised.

7 Arbeits- und Zeitplan

The work and time schedule of the Flood-Adapt project has been characterised by a cost-neutral extension of the project duration to 43 months. This rather unique extension enabled us to cope with the complexities of the case studies, to conduct three instead of two comparisons, and to produce more deliverables as initially planned. The following Gantt chart illustrates the work and time schedule of the Flood-Adapt project.



8 Publikationen und Disseminierungsaktivitäten

The main purpose of the Flood-Adapt project was to deliver high-quality journal manuscripts, to be presented at international conferences and published in internationally recognized environmental policy journals. As indicated here, the publications and presentations that have been delivered surpass those envisioned in the proposal as follows:

Journal papers and paper manuscripts: planned 5, delivered 6

- 1) Steurer, R. & Clar, C. (2018): The ambiguity of federalism in climate policy-making: how the political system in Austria hinders mitigation and facilitates adaptation; in: Journal of Environmental Policy and Planning, 20/2, 252-265.
- 2) Nordbeck, R.; Löschner, L. & Steurer, R. (2019): The future orientation of Austria's flood policies: from flood control to anticipatory flood risk management; in: Journal of Environmental Planning and Management, online first, DOI: 10.1080/09640568.2018.1515731.
- 3) Lukas Löschner, Ralf Nordbeck (2019): Switzerland's transition from flood defence to flood-adapted land use: A policy coordination perspective, in: Land Use Policy, forthcoming, <https://doi.org/10.1016/j.landusepol.2019.02.032>
- 4) Pelaez-Jara, M. (2019): The Ascending and Fading of a progressive policy instrument: the Climate Change Factor in Southern Germany, submission in June 2019.
- 5) Ralf Nordbeck, Lukas Löschner, Melani Pelaez Jara, Michael Pregernig (2019): Exploring science-policy interactions in a technical policy field: climate change and flood risk management in Austria, Germany, and Switzerland, under review.
- 6) Ralf Nordbeck, Lukas Löschner (2019): Towards Policy Regimes in Flood Risk Management? Exploring the sectoral interplay between flood protection and spatial planning in Austria and Switzerland, submission in June 2019.

Book chapter: planned 0, delivered 1

- 1) Lukas Löschner, Walter Seher, Ralf Nordbeck, Manfred Kopf (2019): Blauzone Rheintal: a regional planning instrument for future-oriented flood management in a dynamic risk environment, in: Hartmann, Thomas; Slavíková, Lenka; McCarthy, Simon (eds), Nature-based Flood Risk Management on Private Land. Berlin: Springer, forthcoming.

Presentations and Posters: planned 3, delivered 6

- 1) Löschner, L.; Nordbeck, R.; Pregernig, M. & Steurer, R. (2016): Flood Protection Policies and Climate Change Adaptation in Austria, Germany and Switzerland (Flood-Adapt), 17. Klimatag 2016, 6-8 April 2016, Graz/Austria.
- 2) Löschner, L.; Nordbeck, R. & Steurer, R. (2017): Climate change adaptation in flood protection; 18. Klimatag, 21-23 May 2017, Vienna/Austria.
- 3) Löschner, L.; Nordbeck, R. & Steurer, R. (2017): Adaptive flood risk management in Austria: Risk reduction strategies under dynamic flood risk conditions; 3rd European Climate Change Adaptation Conference/ECCA, 5-9 June 2017, Glasgow/UK.
- 4) Löschner, L. & Nordbeck, R. (2018) Extreme flood events and spatial adaptation: the Swiss approach; EGU General Assembly 2018, 8–13 April 2018, Vienna, Austria. Geophysical Research Abstracts Vol. 20, EGU2018-PREVIEW.
- 5) Löschner, L (2018): Policies and Instruments: Mobilising Private Land for Flood Risk Management. IWRA Webinar - N°15. How Private Land Matters in Flood Risk Management. International Water Resources Association, June 20, 2018, Riga, LATVIA
- 6) Löschner, L (2018): River Flooding in Austria: Natural Processes and Strategies of Human Adjustment. Architekturentwurf 1: Studio Kazuyo Sejima, October 31, 2018, Universität für Angewandte Kunst Wien.

All of our dissemination activities were either in line with or have surpassed what we have promised in the project proposal, i.e. we have produced more journal paper manuscripts (six instead of five), we wrote an additional book chapter we did not plan for in the proposal, and we presented project findings at six instead of three conferences.