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Adaptation to climate change at local level in Europe: An overview

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ABSTRACT

Europe's climate change vulnerability pushes for initiatives such as the European Adaptation Strategy and the associated Covenant of Mayors for Climate and Energy. What are the triggers and barriers, for which sectors and for which risks and how is adaptation funded? This paper examines 147 Local Adaptation Strategies in Europe. Key triggers were incentives via research projects, implementation of EU policies and the increasing frequency of extreme climate events. Insufficient resources, capacity, political commitment and uncertainty were the main barriers. Prioritized sectors reflected the main local vulnerabilities - flood protection and water management, built environment and urban planning. Differing patterns of adaptation planning and adaptive capacity were identified among different regions in Europe. Large municipalities generally fund adaptation locally, whereas international and national funding appears to be more important for adaptation in less urban or densely populated territories. The database of LAS described in the present study can be expanded and used to increase the understanding of and promotion of local adaptation action in Europe and beyond.

1. Introduction

Humans have transformed the Earth for millennia, only during the past centuries, the impacts of these transformations have become visible on a global scale (Steffen et al., 2015, 2011). Climate change, in combination with other environmental changes, is now contributing to profound changes in the Earth system, including changes in ice cover, sea level, ecosystems, species distributions, and extreme events (IPCC, 2014). The recognition that climate change is already affecting ecosystems and human security led to a sharp increase of adaptation research, planning and practice over the last decade and to analyses on how households, communities, sectors and society in general can respond to changing conditions and new risks (e.g. Biesbroek et al., 2010; Ford et al., 2011; Lesnikowski et al., 2015; Fazey et al., 2018). Adaptation policies are rapidly being adopted by governments, particularly in Europe, but few studies have been conducted to explore the driving forces behind this (Massey et al., 2014).

1.1. Framing adaptation

Due to the wide range of adaptation research and practice, the meanings of the term vary. We use the International Panel on Climate Change (IPCC) definition: "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014). This commonly used adaptation approach seeks to reduce vulnerability to present and future change by minimizing the direct and indirect impacts and increasing adaptive capacity, meaning the ability to adjust to climate change in order to moderate damages or cope with consequences (Smit and Wandel, 2006). Focusing on climate change vulnerability is seen as helpful for better comprehending the cause/effect relationships behind climate change and its impact on people, economic sectors and socio-ecological systems (Fritzsche et al., 2014). Vulnerability is commonly characterized as "the degree to which a system is susceptible to and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity" (Parry et al., 2007).

Research has also highlighted that focusing on vulnerability reduction is often challenged by the difficulty of capturing the complexity of factors affecting vulnerability (Ford and King, 2015). Further, the adaptation approach has been criticized for accommodating change, rather than contesting it (Cameron, 2012; Pelling, 2011) and for not questioning the structures, systems, and behaviours that contribute to social vulnerability (O'Brien, 2012; Ribot, 2014).

Several research studies have addressed the limits and barriers to

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adaptation and how to overcome them (Adger et al., 2009; Biesbroek et al., 2014; Ford and King, 2015; Fuhr et al., 2018; Moser and Ekstrom, 2010). Limits are the obstacles that tend to be absolute and which constitute thresholds beyond which existing activities or land uses cannot be maintained (Parry et al., 2007). Barriers, on the other hand, are obstacles that can be overcome with concerted effort, creative management, prioritization and shifts in resources and institutions (Moser and Ekstrom, 2010). Barriers to adaptation are, for example, lack of leadership and resources, insufficient or poor communication and information as well as deeply held values and beliefs that influence how people interpret and think about climate change and how to approach it (Fuhr et al., 2018; Moser and Ekstrom, 2010).

1.2. Local adaptation action

Understanding the limits and barriers of large-scale adaptation approaches, as well as recognition of the local impacts of climate change, have led to increasing support of local, community-led adaptation initiatives (in contrast to national, top-down strategies) (e.g. Amundsen et al., 2018; Campos et al., 2016; EEA, 2014; Fazey et al., 2018; Fuhr et al., 2018; Ng et al., 2016; Walker et al., 2015). Local authorities play a key role in public functions that are central to adaptation including land use regulation, infrastructure protection, and inspection as well as emergency planning (Vogel and Henstra, 2015). Local authorities and actors are also considered to better agree on cooperative solutions through proximity to stakeholders and face-to-face communication (Ostrom, 2010). The proximity to stakeholders and communities gives local decision-makers access to knowledge about place-based vulnerability enabling them to develop tailored approaches to community needs (Corfee-Morlot et al., 2011; Smit and Wandel, 2006).

In Europe, the European Commission Green Paper “Adapting to climate change in Europe – options for EU action” (European Commission, 2007) acknowledged the importance of comprehensive adaptation strategies at national as well as local levels. The subsequent White Paper (European Commission, 2009) and the publication of the European Adaptation strategy in 2013 (European Commission, 2013a) paved the way for Member States and municipalities to design and implement integrated and effective adaptation policies.

1.3. Challenges for local adaptation

The growing understanding that climate change impacts are experienced mainly locally (Hunt and Watkiss, 2011) led to the fact that many municipalities started designing and implementing adaptation strategies, however with a number of challenges. These include the complex interactions between different scales and levels of governance (Juhola and Westerhoff, 2011; Tompkins et al., 2010). Local policy-makers also have difficulties with addressing the long-term nature of climate change. While in some countries local governments are guided by a national adaptation strategy, others lack such a policy mandate, which can weaken the support for local adaptation initiatives (Swart et al., 2009). Although citizens increasingly see climate change as a problem, it is still perceived as a distant issue and therefore lacks the urgency to prompt intervention (Hulme, 2009). Moreover, whereas the costs of adaptation are immediately visible, the benefits are often intangible or in the future. Therefore decision-makers focus often on more pressing issues (Vogel and Henstra, 2015). Local adaptation initiatives are also faced with equity considerations, namely the questions about winners and losers of decisions taken, or how adaptive capacity is distributed (O’Riordan et al., 2014; Patterson et al., 2018).

1.4. Comparing local adaptation action

There is still limited understanding of the scale and depth of current adaptation activities and of the preparedness of governance systems (Araos et al., 2016; Ford and King, 2015; Vogel and Henstra, 2015). The ability to track adaptation is also often challenged by the lack of measurable outcomes or adequate monitoring and evaluation schemes (Ford and King, 2015; Klostermann et al., 2018). Finally, the overall ‘messiness’ of adaptation has hindered a comparative analysis of adaptation action - it might be virtually impossible to separate adaptation measures from other policies that are tackling the underlying determinants of vulnerability (Ford et al., 2015).

Notwithstanding the difficulties to analyse and compare adaptation action, research has increasingly focused on documenting adaptation initiatives around the world, yet the predominant focus has been the national scale (Berrang-Ford et al., 2014; Biesbroek et al., 2010; Heidrich et al., 2016; Swart et al., 2009; Tompkins et al., 2010). Adaptation is a relatively novel topic on the political agendas of municipalities, usually complementing mitigation (Berry et al., 2015; Campos et al., 2017). Only a few studies have compared local adaptation action on a broader scale (Reckien et al., 2015). A study by Reckien et al. (2014) analyzed climate change plans from 200 European cities and observed that only 56 had a dedicated adaptation plan or strategy. Reckien et al. (2014), as well as others, recognized the need for a European or international database to gain a better understanding of climate change adaptation actions, and to enable a more consistent comparison of climate plans over time (Castán Broto and Bulkeley, 2013; Geneletti and Zardo, 2016). Comparative analyses contextualize knowledge about local adaptation and enable the formulation, refinement, and testing of relationships between indicators which can provide guidance for improved local responses (Vogel and Henstra, 2015; Grandin et al, 2018).

With the aim to contribute to closing this research gap, this paper reports on a study that compares 147 local adaptation processes in 20 countries, the main barriers and enablers, vulnerable sectors and key responses. The goals of this paper are to (1) provide a consistent pan-European comparison of Local Adaptation Strategies (LAS) and their development over time and space, (2) elicit patterns of relationships among LAS and (3) provide a publically available database on European LAS.

2. Material and methods

2.1. Collection of Local Adaptation Strategies

We consider as LAS all adaptation strategies and plans at the level of municipalities. We consider as municipalities the political units with local governments such as cities, towns and villages, which also encompass small settlements and their rural areas. Case studies also include metropolitan areas and small counties. The study covered the 28 European Union countries and the three European Free Trade Association (EFTA) countries: Iceland, Liechtenstein, and Norway.

We used a two-phase approach, namely: Phase 1. Assess the existence of relevant LAS; Phase 2. Collection of the physical documents (Fig. 1; see Appendix A. for more details).

The final list counted 147 LAS from 19 European Union member states and Norway (Fig. 2). Portugal (*n* 28 LAS), Germany (*n* 24), UK (*n* 19), France (*n* 13) and Hungary (*n* 11) represented around 60%. For each of the remaining countries, we found less than nine LAS. For Iceland, Liechtenstein and nine EU member states we did not find any LAS, namely Austria, Bulgaria, Cyprus, Estonia, Latvia, Luxembourg, Malta, Poland, Slovenia, which was also confirmed by national focal points or other responsible authorities, with exception of Luxembourg. Some countries empowering regions to develop and implement regional action plans for this reason were less represented in our LAS database. Municipalities having LAS are distributed across Europe as shown in Fig. 2. We searched for LAS in 21 different languages using the translation of the keywords ‘plan’, ‘adaptation’, ‘strategy’, ‘city’, ‘municipality’, ‘local’, ‘climate change’. Of course, notwithstanding our very intensive search also in local languages, LAS in some countries may have been missed, also because they may not be easily findable through