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The diffusion of climate change adaptation policy

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Abstract

Adapting to some level of climate change has become unavoidable. However, there is surprisingly limited systematic knowledge about whether and how adaptation policies have diffused and could diffuse in the future. Most existing adaptation studies do not explicitly examine policy diffusion, which is a form of interdependent policy-making among jurisdictions at the same or across different levels of governance. To address this gap, we offer a new interpretation and assessment of the extensive adaptation policy literature through a policy diffusion perspective; we pay specific attention to diffusion drivers and barriers, motivations, mechanisms, outputs, and outcomes. We assess the extent to which four motivations and related mechanisms of policy diffusion—interests (linked with learning and competition), rights and duties (tied to coercion), ideology, and recognition (both connected with emulation)—are conceptually and empirically associated with adaptation. We also engage with adaptation policy characteristics, contextual conditions (e.g., problem severity) and different channels of adapation policy diffusion (e.g., transnational networks). We demonstrate that adaptation policy diffusion can be associated with different mechanisms, yet many of them remain remarkably understudied. So are the effects of adaptation policy diffusion in terms of changes in vulnerability and resilience. We thus identify manifold avenues for future research, and provide insights for practitioners who may hope to leverage diffusion mechanisms to enhance their adaptation efforts.

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KEYWORDS

climate change adaptation, policy diffusion, policy innovation, policy learning, public policy

1 | INTRODUCTION

Some level of adaptation to climate change has become inevitable, even when traveling into the future along the most stringent viable mitigation pathways. Specific climate change impacts that require attention include a greater frequency of extreme weather events such as heavy rainfall, heat waves, and sea level rise, as well as associated effects like the spread of vector-borne diseases to new areas (Noble et al., 2014). Communities will have to adapt to such impacts, preferably before experiencing them. According to the Intergovernmental Panel on Climate Change (IPCC), climate change adaptation refers to "the process of adjustment to actual or expected climate and its effects" (IPCC, 2014, p. 118). Public policy, that is, the principles and courses of action taken by governments and legislatures in response to societal problems, plays a key role in this process. Adaptation policy may therefore be understood as the 'decisions and activities taken and carried out by public and private actors dealing intentionally with present or anticipated climate change impacts with a view to substantially limiting the negative effects of climate change and maximizing beneficial ones' (Dupuis & Biesbroek, 2013, p. 1480; Hallegatte et al., 2011, p. 5; Smith & Lenhart, 1996). Strictly speaking, our review focuses on *public adaptation policy*, which concerns decisions and activities of public actors (private actors may also be involved)—as opposed to *adaptation policy* in general, which may refer to the adaptation decisions and activities of any organization including for example nongovernmental organizations (NGOs) or private businesses.

In the process of adapting to climate change, communities will hardly develop all their adaptation policies independently. Rather, they may orient their own activities to those of others, a course of action that produces policy diffusion. Policy diffusion emerges when the policy choices in one jurisdiction (a country, a state, a municipality, etc.) are influenced by the policy choices in other jurisdictions. The sine qua non of policy diffusion is thus *interdependent* policy-making; that is, jurisdictions have to observe each other and condition their policy choices accordingly, regardless of whether they eventually make their choices anticipatorily, simultaneously, or subsequently (Berry & Berry, 2018 p. 256; Blatter et al., 2021, p. 2; Braun & Gilardi, 2006, p. 304; Graham et al., 2013, p. 675; Maggetti & Gilardi, 2016, p. 1; Simmons et al., 2006, p. 787).[1]

Conceptual and empirical explorations of policy diffusion have revealed many different alternative diffusion mechanisms, including learning, competition, coercion, and emulation (Berry & Berry, 2018; Graham et al., 2013). Moreover, policy diffusion can unfold both horizontally and vertically. Horizontal diffusion refers to diffusion among jurisdictions at the same level of governance, for example among municipalities, whereas vertical diffusion refers to policies flowing top-down or bottom-up, that is from higher governance levels, such as the international level, to lower ones, such as the national level, or vice versa (Shipan & Volden, 2006).

Many scholars and practitioners of climate mitigation and, to a lesser extent, adaptation policy have highlighted that different actors frequently count on diffusion mechanisms to spread policy innovations (Jordan & Huitema, 2014; Kammerer & Namhata, 2018; Massey et al., 2014). For instance, the United Nations Framework Convention on Climate Change (UNFCCC) and its 2015 Paris Agreement "rel[y] on soft instruments and mechanisms, such as learning and mimicry, and so seek [...] a gradual diffusion of adaptation across space and time" (Lesnikowski et al., 2017, p. 828). Many scholars have indeed begun to detect evidence of the growing spread of adaptation policies at various levels of governance, including the municipal level (Aguiar et al., 2018; Bausch & Koziol, 2020; Hunt & Watkiss, 2011; Otto et al., 2021; Reckien et al., 2014), the subnational or state level (Rai, 2020), the national level (Massey et al., 2014), the international level (Dellmuth & Gustafsson, 2021; Remling, 2018), and combinations thereof (Tompkins et al., 2010). In so doing, adaptation scholarship frequently engages with the established diffusion mechanisms implicitly and partially, rather than explicitly and systematically with support of the available theoretical diffusion perspectives—a gap that we begin to address with this review. Early findings suggest that much is to be gained by analyzing the spread of adaptation policy through a diffusion lens. For example, Hughes et al. (2018) showed that coercion or learning tend to drive regional climate adaptation responses such as watershed management while this does not appear to be the case with global issues such as climate mitigation (see also Steurer & Clar, 2018).

Before going further, a fundamental challenge to mind is the difficulty of agreeing on what adaptation policy is and hence what constitutes the objects (or targets) of diffusion. This is important in order to assess diffusion processes but also to understand the potential contribution of policy diffusion to enhance adaptation. In general, policy diffusion is predicated on conscious policy decisions (*policy outputs*) made by the responsible authorities at numerous levels of governance.[2] The study of adaptation policy diffusion therefore focuses on planned adaptation; that is, conscious and reflective responses to actual or anticipated climate change impacts (Smit et al., 2000). However, even planned adaptation policies may be more or less intentionally put in place to deal with climate change impacts, and may produce more or less substantial *policy outcomes* in terms of changes in vulnerability and resilience (Dupuis & Biesbroek, 2013).[3]

Moreover, adaptation is a quintessentially cross-sectoral endeavor answering to diverse climate change impacts that affect many different aspects of human and nonhuman life, including, for example, the built and natural environment, infrastructures, resources, as well as health and human behavior (Hunt & Watkiss, 2011). This broad range of potential areas for adaptation actions makes it difficult to conceptualize and measure adaptation policy. Many policy scholars have thus begun with cataloguing adaptation strategies or other high-level policy documents, but more recent efforts have also commenced to differentiate individual adaptation policy instruments and their features (Biesbroek & Delaney, 2020; Lesnikowski et al., 2019).

In this review, we recognize these debates and that many conceptual and empirical accounts of adaptation policy change now incorporate notions of policy diffusion. We therefore offer a new reading of the climate change adaptation policy literature, bringing together multiple—and thus widely scattered—perspectives on internal and external drivers and barriers, motivations and mechanisms, channels, outputs and outcomes of adaptation policy diffusion. We aim to advance the debates on adaptation policy spread and diffusion by increasing their depth and breadth, and by highlighting productive synergies between policy studies and adaptation research. We conclude with a discussion of challenges and solutions in the empirical study of adaptation policy diffusion, and offer suggestions for practitioners as well as future research.

2 | DRIVERS AND BARRIERS OF ADAPTATION POLICY DIFFUSION

There are multiple reasons why jurisdictions might (not) adopt and implement adaptation policies, ranging from internal to external drivers and barriers. For example, within a jurisdiction, a climate-friendly lobby may advocate for more ambitious adaptation (internal driver), while a lack of political awareness might hinder adaptation action (internal barrier). Analogously, efforts by international organizations may stimulate adaptation in a jurisdiction (external driver), while a lack of transnational networks can limit adaptation efforts (external barrier) (Biesbroek et al., 2013; Massey et al., 2014). Policy change and innovation models often integrate both internal and external drivers and barriers (Berry & Berry, 2018; Kammerer & Namhata, 2018; Tosun, 2018). In these models, only the external drivers and barriers reflect genuine diffusion explanations because they relate a jurisdiction's policy choices to those of others, that is interdependent policy-making.

That said, internal drivers can be linked to policy diffusion in various, sometimes indirect, ways. In the area of adaptation, extreme weather events may for example stimulate policy-making by increasing internal problem pressure through highlighting vulnerabilities and the severity of climate change (Amundsen et al., 2010; Giordono et al., 2020).[4] However, for adaptation policy diffusion to emerge, such events have to lead policy-makers to consider the adaptation efforts of others in their own policy-making. A diffusion model compatible with this idea is *isomorphism*. Accordingly, jurisdictions could be more likely to take cues from similar jurisdictions, such as those experiencing comparable events. Feinberg (2021), for instance, found that Washington counties tend to adopt hazard mitigation strategies from other counties with similar physical vulnerabilities irrespective of other shared characteristics. The quality of adaptation plans (a policy output) also tends to improve with the severity of their peers' hazard experience (Feinberg, 2021). However, lessons from problem-laden peers do not necessarily produce effective adaptation outcomes as policy-makers could also imitate symbolic and/or small-scale action if it helps them to avoid blame (Weaver, 1986). This could lead to the diffusion of under-reactive behavior or even non-action if jurisdictions notice that others are also inactive in mitigating or adapting to climate change (Howlett & Kemmerling, 2017).

In addition to problem pressure, adaptive capacities, which are associated with financial, organizational, and societal resources, play a role in enabling or disabling adaptation (Adger et al., 2005; Dolšak & Prakash, 2018; Siders, 2019). For example, communities with greater resources are more likely to adjust their cities by introducing greenery, which enhances resilience, than communities with less resources (Siders, 2019). But resource constraints can also drive interdependence and thus policy diffusion. Diffusion comes into play as policy-makers strive to reduce their resource needs by drawing on the ideas of others and by learning from earlier successes and failures elsewhere. However, as with problem severity, actors might not necessarily look for solutions from others with similar internal capacities or lack thereof as isomorphism models would predict. Jurisdictions might instead search for peers with different characteristics to complement their own capacities or the lack thereof. Kalesnikaite and Neshkova (2021) observed such "complementary collaboration" in the case of US local governments' responses to sea-level rise, where public organizations sought partners that were less similar to them.

Besides internal drivers and barriers, many policy change and innovation models include external drivers. External drivers, which concern what others do, comprise the core of policy diffusion—our main focus in this review—and link with different motivations, mechanisms, and channels. We organize the following discussion based on the newly developed paradigmatic typology of policy diffusion from Blatter et al. (2021), which underscores agency in policy-making and connects well with debates on adaptation policy. According to Blatter et al. (2021), policy diffusion originates from different motivations, including internally derived *interests*, established and expected *rights and duties*, shared *ideologies*, and widely *recognized* solutions. These motivations set in motion different causal mechanisms that are discussed in the policy diffusion literature, such as learning, competition, coercion, and emulation (Benson & Jordan, 2011; Braun & Gilardi, 2006; Graham et al., 2013; Simmons et al., 2006). The motivations and mechanisms find expression and operate in empirically observable diffusion channels, such as climate policy networks.

3 | MOTIVATIONS AND MECHANISMS OF ADAPTATION POLICY DIFFUSION

Having reviewed potential internal drivers and barriers of policy diffusion, we next develop the more detailed notion of diffusion motivations and mechanisms, and apply them to the specific case of adaptation policy.

3.1 | Interests

Interest-driven policy diffusion assumes that governments make strategic policy choices based on their domestically or—as it is often the case for adaptation policy—locally derived self-interests, and associates with two mechanisms: learning and competition (Blatter et al., 2021, p. 12). *Learning* is understood as the "updating of beliefs based on lived or witnessed experiences, analysis or social interaction" (Dunlop & Radaelli, 2013, p. 599). Seemingly successful policies tend to be particularly attractive diffusion objects because they promise lower transaction costs and probable public support (Shipan & Volden, 2008). In adaptation policy-making, learning is usually a response to increased climate impacts such as extreme weather events, which also affect other jurisdictions. Governments will then gather information about other governments' policies and decide whether to formulate similar ones.[5] Nohrstedt and Nyberg (2015), for instance, found that Swedish municipalities are more likely to develop adaptation policies when floods in neighboring municipalities have been more frequent, and when neighboring municipalities have adopted such policies, suggesting learning and diffusion effects (see also Feinberg, 2021).

Empirical evidence of learning in adaptation policy diffusion is not as frequent as one might expect, considering that many initiatives, networks, and information platforms have emerged at various levels of governance in recent decades that explicitly rely on this mechanism. These initiatives typically see knowledge exchange as one of their core missions (see Box 1). In Germany, Bausch and Koziol (2020) found that participation in municipal networks was one of the

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BOX 1 **Networks as channels of adaptation policy diffusion**

Networks typically aim to create, exchange and transfer knowledge and information among their participants, therefore constituting a potential diffusion channel for adaptation policy. While many networks focus on both adaptation and mitigation, specialized adaptation networks have also emerged around the world to facilitate learning, cooperation, and assistance for states, regions, and cities to reduce vulnerabilities and build resilience. For example, featuring a network of nation states, the **Africa Adaptation Initiative** brings together African heads of state to enable dialogues and strengthen collaboration to tackle transboundary challenges, share good practices, and enable learning to cope with the various adaptation challenges faced by African nations.[6] The **Resilient Cities Network** brings together cities from around the globe, aiming to build the capacity to increase resilience against acute shocks and chronic stresses such as climate change.[7] The innovative approach of the "water plaza," which combines floodwater capture infrastructure and recreational space in Rotterdam, was adopted by the city of Surat in India through the establishment of a partnership between the two cities, offering a prime example of network-based policy diffusion.[8]

driving factors of mitigation and adaptation policy activity among small Bavarian municipalities (see also Schulze & Schoenefeld, 2022). Similarly, Rai (2020) discovered evidence of a regional diffusion model of state adaptation plans within Environmental Protection Agency (EPA) regions in the United States, suggesting that information and resource sharing within such regions can drive adaptation policy diffusion. Learning may also emerge from comparative evaluations and showcasing best practices; that is, "yardstick competition," an approach that is also practiced with networks (Benz, 2012; Ward & John, 2013). However, learning is not a frictionless process. For instance, Storbjork (2010) identified substantial difficulties in reflexive learning processes for integrating adaptation in planning and decision-making in two Swedish municipalities, particularly in scaling up lessons and mediating tension between local interests. Comparing two municipal networks for adapation in Norway, Hauge et al. (2019) highlighted that networks need organizational commitment and competent participants to become sites for learning and knowledge transfer.

The European Union (EU) has to rely on soft policy instruments without a legally binding character such as recommendations, information and support to advance adaptation. Key developments and policy initiatives first emerged in the mid-2000s—including a Green Paper (2007), a White Paper (2009) and an overall EU Strategy (2013)—as some level of adaptation policy coordination and support came to be viewed as necessary (Rayner & Jordan, 2010). Empirical findings suggest that these nonregulatory instruments influenced national adaptation policy. For example, Massey et al. (2014) found that EU-level adaptation policy encouraged the EU member states to draw up their own adaptation strategies, particularly member states with lower income levels. In an attempt to actively stimulate policy diffusion by learning, the EU's updated 2021 adaptation strategy[9] seeks to enhance the Climate-ADAPT platform for knowledge exchange,[10] reinforce cooperation with non-EU partners, establish a new policy support facility integrated into the Covenant of Mayors (a city network), and a Horizon Europe Mission for local transformative adaptation.

Against this background, scholars are only just beginning to unpack how learning works in climate adaptation policy-making. Information may flow through many different channels and networks that are not well operationalized via geographic proximity, one of the standard operationalizations of policy diffusion (Carley & Nicholson-Crotty, 2018). Moreover, policy-makers might consider not only a policy's outcomes or effectiveness in other jurisdictions, but also the potential ease or difficulty of implementation; that is, they will assess whether certain policy options will also "work for them" (Nicholson-Crotty & Carley, 2016). Such details have yet to be explored in the field of adaptation policy-making.

The second interest-driven policy diffusion mechanism concerns *competition*. The general idea is that the policy decisions of jurisdictions produce externalities in other jurisdictions, which may in turn react with policy adjustments. In a competitive response, jurisdictions might therefore adopt policies with a view to attracting or securing mobile production factors to gain a comparative advantage or to prevent others from doing so (Berry & Berry, 2018). Jurisdictions may alternatively decide to cooperate because benefits arise from having compatible policies such as technological and other standards (Braun & Gilardi, 2006). Scholars have extensively studied whether competition-driven diffusion eventually leads to "races to the bottom" or "races to the top" in regulations and standards (e.g., Saikawa, 2013; D. Vogel, 1995). In adaptation policy-making, however, competition-driven diffusion has thus far been rarely documented. In one case, B. Vogel and Henstra noted that adaptation in Rotterdam, the Netherlands, "emerged as an economic strategy to reassure hesitant business investors that the city was resilient to flood risks" (B. Vogel & Henstra, 2015, p. 114). Here, a jurisdiction aims to entice existing firms to stay and potentially attract new ones by providing better adaptation than other jurisdictions.

3.2 | Rights and duties

The second type of motivation presumes that governments make policy decisions based on their established and expected rights and duties in so-called asymmetric constellations (Blatter et al., 2021). The mechanisms linked with this motivation have been widely referred to as *coercion*. Coercive mechanisms either build on hierarchical legal frameworks in multilevel governance environments or on conditionality that typically comes with aspirations to join international organizations (Blatter et al., 2021, p. 13), but are also enshrined in all kinds of funding schemes that create incentives for policy change.

At the international level, firm legal frameworks do not yet exist for adaptation policy. While the countries belonging to the UNFCCC have begun to set up a framework for an international adaptation policy, notably as part of the Paris Agreement with a global aim (Persson, 2019), its legal powers are extremely limited. While the EU has gradually developed more competences in the area of climate change adaptation, they do not yet amount to a fully-fledged legal framework either. However, besides the aforementioned update of its adaptation strategy, the EU also adopted the new

EU Climate Law in 2021, which contains an article on adaptation, which, for the first time, obliges the member states to produce adaptation plans.[11,12] While adaptation duties have only begun to emerge through the EU's legal framework, in some countries, national legislation obliges subnational jurisdictions to become active in adaptation (Bisaro, Bel, Hinkel, Kok, Stojanovic, & Ware, 2020b; Tompkins et al., 2010). For example, Keskitalo et al. (2016) illustrate that Danish municipalities are, per national regulation, required to set up adaptation strategies, even if the national government cannot enforce their implementation, whereas Finnish municipalities are not obliged to develop such strategies. Aguiar et al. (2018) found in a survey of local adaptation strategies in Europe that many originated from implementing European and/or national policy. Interestingly, however, the authors found no clear relationship between the timing of national and local adaptation strategies.

With few legal powers in the area of climate adaptation, rights-driven policy diffusion based on EU conditionality and a membership prospect is, unlike in other policy areas (Schimmelfennig & Sedelmeier, 2004; Schulze & Tosun, 2013), rather weak. Instead, *financial incentives*, or the "carrots and sticks of intergovernmental grants" (Graham et al., 2013, p. 692) may provide incentives for adaptation (Bisaro, Bel, Hinkel, Kok, Stojanovic, & Ware, 2020b). This is also expressed in the new 2021 EU Adaptation Strategy, which continues and extends EU funding to support the local implementation of adaptation measures in Europe. Looking back, Keskitalo et al. (2013) underscored the importance of EU-level funding for adaptation projects in Italy, Finland and Sweden. Kern (2019) suggested that the EU Mayors Adapt Initiative stimulated strategic adaptation planning and action in a range of EU cities, mainly by offering funding and research support.

Financial incentives for adaptation also emerge from national and subnational levels. In the Netherlands, national funds supported 34 projects to widen and deepen river beds and apply other, sustainable adaptation measures, such as in the city of Nijmegen (Bisaro, Bel, Hinkel, Kok, & Bouwer, 2020a; see also Bisaro, Bel, Hinkel, Kok, Stojanovic, & Ware, 2020b). In a Europe-wide analysis, the European Environment Agency (2014) highlighted that national financial support can drive local and regional adaptation whereas a lack of resources, including finance, was identified as one of the major barriers to adaptation (European Environment Agency, 2014, pp. 84–85). National funding also played an important role in stimulating local climate policies in Germany, where, after initial horizontal diffusion driven by city networks, further diffusion hangs together with financial support from the federal government, amounting to so-called "vertical upscaling" (Kern, 2019)

Moreover, financial incentives especially play a role for adaptation policy-making in developing countries, for instance through funds provided by the Global Environment Facility.[13] Accordingly, local governments may adopt climate change adaptation policies to satisfy conditions in order to access resources or to prevent sanctions from donor countries and international financial institutions (Musah-Surugu et al., 2018). For example, Persson and Remling (2014) analyzed the Adaptation Fund established under the Kyoto Protocol of the UNFCCC and argue that its support has enabled adaptation projects in developing countries.

3.3 | Ideology

Ideology-driven policy diffusion originates from collective actors who transcend the boundaries of jurisdictions and who share specific, substantial beliefs either in terms of *principled or policy beliefs* (Blatter et al., 2021, pp. 14–15). This view derives from the Advocacy Coalition Framework (ACF) (Sabatier & Weible, 2007) and emphasizes shared normative beliefs as a motor of diffusion. Thus, in contrast to interest-driven diffusion where actors rationally calculate policy consequences, actors in ideology-driven diffusion consider policy options appropriate if the policies realize the actors' internalized values and identities (Blatter et al., 2021, p. 8).[14]

Transnational party families (TPFs) connecting national policy-makers represent shared principled beliefs at the international level, whereas national or regional parties serve in this role at the subnational level. Their members are held together by "deep core beliefs" such as their left–right orientation, forming a potentially relevant network through which policies can diffuse. By contrast, advocacy coalitions or networks connecting different jurisdictions—whether transnational, national or subnational—share "policy core beliefs" such as common understandings of policy problems and appropriate solutions (policy instruments) and typically include different kinds of state and non-state actors, for example NGOs and private businesses (Blatter et al., 2021, p. 14; Keck & Sikkink, 1998; Sabatier & Weible, 2007, pp. 194–195).

The verdict on the extent to which ideology-driven diffusion plays a role in spreading adaptation policy remains very much open. In general, one might expect that ideology-driven diffusion of adaption policy would occur when

adaptation policy is politicized and controversial. However, research on the politicization of adaptation remains inconclusive. On the one hand, some results, such as those obtained by Bromley-Trujillo et al. (2016), imply that the development of adaptation plans is less politically driven than climate mitigation policies (see also Biesbroek & Lesnikowski, 2018). In a similar vein, Remling (2018) argues that the European Commission's framing of climate change adaptation actively depoliticizes it, by presenting adaptation as a technical, nonideological, and managerial issue within the existing governance framework. Doing so circumvents deeper social questions such as inequality, which may also hang together with climate adaptation (Hjerpe et al., 2014; Remling, 2018). On the other hand, adaptation is arguably deeply political and susceptible to many distributional issues and conflicts (Javeline, 2014). It may, for example, induce politicians to prefer more visible (hard) adaptation projects, such as damns and sea walls, as well as reactive policies in search of political payoffs (Dolšak & Prakash, 2018). Interestingly, adaptation seems to foment a desire for visible policies, whereas politicians tend to prefer policies with less visible costs for climate change mitigation (Schulze, 2021). Some early research demonstrates that party-based diffusion in local climate change mitigation policy is indeed happening. Abel (2021) found that such policies have diffused via party channels among German municipalities in the federal State of North-Rhine Westphalia, suggesting that municipalities with mayors from the same party are more likely to take hints about climate policy solutions from each other. However, the extent to which party channels also matter in the diffusion of adaptation policy requires further assessment.

Similarly, the extent to which advocacy coalitions or networks play a role for diffusing adaptation policy and governance has yet to be studied more systematically. For example, Juhola and Westerhoff (2011) describe how different social networks composed of scientists, NGOs and policy-makers at various scales in Finland and Italy have been instrumental in generating and spreading adaptation knowledge, mobilizing resources for adaptation, and building commitment among network members, also in the absence of formal and centralized support. A range of transnational initiatives also address adaptation, although still to a much lesser extent than climate mitigation. Per a 2014 stock take, compared to mitigation and mixed mitigation-adaptation approaches, only 3% of initiatives focused on adaptation only (Bulkeley et al., 2014, p. 24). However, on-the-ground effects of transnational initiatives in terms of climate policy diffusion have been rarely documented, let alone for adaptation policy diffusion. One exception is a study by Christoff and Sommer (2018), who found that Indian projects promoting climate change adaptation and gender equality profited substantially from transnational advocacy networks in increasing the scale and scope of these projects by building partnerships and receiving international funding and awards from the UNFCCC and others (Christoff & Sommer, 2018, p. 11).

A major challenge in assessing the mechanisms by which advocacy networks may diffuse adaptation policy lies in distinguishing, mainly empirically, between the role of *policy beliefs* and the role of *policy expertise* (see Section 3.4). While the former is associated with the pursuit of divergent values, the latter aims at legitimizing policies through reflective/scientific reasoning. In fact, in many climate policy networks such as city networks, policy-makers work hand in hand with scientists, NGOs, and private businesses, making it difficult to clearly distinguish between ideology- and recognition-driven diffusion pathways. One way forward may be to disentangle the diffusion effects of different types of networks, for instance depending on whether state or non-state actors initiate and lead them (Andonova et al., 2017; Hale & Roger, 2014). Ultimately, however, drawing the line between the role of policy beliefs and expertise also depends on the extent to which adaptation is politicized and on the availability of divergent policy options (Blatter et al., 2021, pp. 14–15). As adaptation is increasingly discussed, for instance, in terms of issues of justice and equity (Shi et al., 2016), it is more likely that different advocacy networks will also play a role in advancing the diffusion of specific solutions.

3.4 | Recognition

Recognition-driven policy diffusion emerges from shared convictions among collective actors regarding either (usually reflective/scientific) procedures for reaching policy solutions or, more instrumentally, the prospect associated with a particular solution (Blatter et al., 2021, p. 15). Policies thus diffuse either as a function of *policy expertise* and knowledge, such as through epistemic communities (Haas, 1992), or through *popular attention* to problems, which may lead policy-makers towards instrumental coalitions that promote specific policies to demonstrate responsiveness (Blatter et al., 2021, p. 16). Policy diffusion via both expert and instrumental coalitions is compatible with mechanisms of *emulation* where policy-makers face increasing pressures to justify their inaction. The former arguably relies more on shared norms and the latter more on imitation (Berry & Berry, 2018; Shipan & Volden, 2008).

As transnational climate governance proliferates (Hale, 2020), scholars are also increasingly recognizing the emerging transnational dimension in adaptation governance, involving international organizations as well as state and non-state actors (Persson, 2019; Persson & Dzebo, 2019; Schipper, 2006). For example, the 2015 Paris Agreement set a strong international norm for countries to address both mitigation *and* adaptation (Lesnikowski et al., 2017). Countries seen to contribute to these efforts may thus expect reputational gains at the international level. However, the evidence on the precise role of institutions and networks at the global, national, and subnational levels in diffusing adaptation policies remains patchy, making an exploration of recognition-driven mechanisms a key area for future research.

Transnational, national, and regional city and municipal networks are among the most prominent diffusion channels that the literature discusses in this context. They are usually associated with the diffusion mechanisms of either *emulation* or *learning*, and promise to spread innovative local climate policy by bringing together governments and other actors in institutionalized ways (Betsill & Bulkeley, 2004; Hakelberg, 2014; Kemmerzell & Hofmeister, 2019; Schulze & Schoenefeld, 2022; Vasi, 2006). For instance, Lee and Koski (2015) found that horizontal city-to-city networks in the United States had a stronger influence on cities' climate policy performance than vertical networks in the form of state-level climate initiatives. Similarly, Shi et al. (2015) detected no significant influence of US state-level adaptation policies on local adaptation planning. Bauer and Steurer (2014), however, discovered that vertical diffusion matters, showcasing the catalyzing effects of regional partnerships in Canada and England for adaptation policy innovation and diffusion (see also Dannevig & Aall, 2015; Taylor et al., 2013). Fisher (2013) showed that vertical diffusion may also emerge from the bottom up, with local climate initiatives inducing the setup of national schemes to support these initiatives. Lidskog and Elander (2010) argued that both vertical and horizontal networks and cooperation are desirable to strengthen the democratic legitimacy of adaptation policy.

The ultimate effects of municipal networks on adaptation policy-making and diffusion remain under-researched. Fuenfgeld (2015) discussed the extraordinary potential of networks in adaptation, but also noted that assessing the general impact of networks on proactive adaptation behavior at the municipal level would be difficult because many impacts depend on the characteristics of individual networks such as the degree of technical assistance they provide or their monitoring provisions (see also Hauge et al. 2019; Krause, 2012; Wood et al., 2014). Finally, city networks dealing specifically with adaptation policy and governance are a relatively new phenomenon. Papin (2019) found that the 100 Resilient Cities (100RC) network functions with both soft and hard instruments to advance local climate adaptation. Dzebo (2019) studied 40 transnational adaptation initiatives finding that many were effective in producing outputs and outcomes in line with their goals. However, neither of the two investigated the networks' effects in terms of policy diffusion among its members. For more examples of adaptation networks, see Box 1.

4 | OUTPUTS AND OUTCOMES OF ADAPTATION POLICY DIFFUSION

If policy diffusion is supposed to make a substantial contribution to adaptation, the policies that spread will need to contribute to reducing vulnerability to climate change impacts and/or increasing resilience. In this section, we discuss what we do and do not know about the outputs and outcomes of adaptation policy diffusion; that is, what diffuses and with what effects. Crucial to understanding diffusion impacts is therefore a distinction between policy outputs; that is activities and decisions producing adaptation laws, strategies, instruments, institutions, and others on the one hand, and policy outcomes in terms of eventual policy-induced changes in vulnerability and/or resilience on the other.

First, policy outputs that diffuse may differ in their substance, potentially impacting outcomes. The diffusion of merely symbolic adaptation policies is arguably insufficient, because it tends to prioritize demonstrating government activity over implementing meaningful change (Dupuis, 2017; Krause, 2011). What kinds of adaptation policies diffuse thus requires further study. For example, Rai (2020) found that learning from neighboring states drives the strength of targets in US states' adaptation plans, whereas the mere adoption of the plans depends on internal factors. In the related area of climate change mitigation, Abel (2021) revealed that German municipalities in North-Rhine Westphalia quickly adopted climate strategies (i.e., policy outputs), but not all of them put in place the institutional wherewithal to ensure effective implementation, suggesting that significant "window-dressing" can happen as local climate policies diffuse. The evidence points to emulation as the main policy diffusion mechanism. Municipalities want to appear like the others by producing climate change strategies, but seem to have less real interest in or ability to implement them.

Learning from others or emulating what they do also requires some level of resources to absorb information or even become aware of others' actions in the first place. As discussed, municipal networks have become settings where such lessons spread. However, several networks still primarily attract pioneers and larger, wealthier and, in other ways, well-

connected cities (Kern & Bulkeley, 2009; Lee, 2013). If this trend continues, then the potential of municipal networks to spread adaptation policies more widely and towards more vulnerable communities may be severely diminished. Evidence from the international level also shows that diffusion channels might de-facto not be equally open to everyone. For example, Okereke (2018) indicated that the UNFCCC has contributed to spreading adaptation activities across the globe; however, he also underlined the long-standing criticism that developing countries tend to be underrepresented at UNFCCC meetings. But inequalities in adaptation may also emerge within a country or region as a function of diffusion. For example, in Malawi, adaptation finance diffused selectively to districts with high administrative capacity and established aid networks, leading to a neglect of districts with low capabilities (Barrett, 2014). These examples suggest that who participates in diffusion channels may have severe consequences in determining the spread and the distribution of adaptation policies around the globe.

There is also emerging evidence on how diffusion outputs and outcomes hang together with other diffusion mechanisms and channels. Centering on the diffusion mechanism propelled by rights and duties, donor–recipient relationships in the area of adaptation in international development have been subject to multiple inquiries. Recipients frequently subscribe (or have to subscribe) to specific conditions in order to receive grants. Research suggests that internationally funded interventions can indeed reduce vulnerabilities and enhance adaptive capacity in developing states (Ayers & Huq, 2009; Mertz et al., 2009). Weiler et al. (2018), for example, found that donor organizations tend to prioritize vulnerable countries and therefore finance adaptation projects where climate change impacts are most severe. Sietz et al. (2011) outlined how donor investments successfully supported stand-alone adaptation projects in Mozambique's most vulnerable regions, which have been affected by severe floods and cyclones in the past.

However, international interventions, "despite good intentions and positive effects on some groups," can also produce maladaptive outcomes by "reinforcing, redistributing or creating new sources of vulnerability" (Eriksen et al., 2021, p. 6), particularly when adaptation projects do not fit local needs and circumstances. Challenges in developing countries may emerge from poor governance as a consequence of (neo)colonial legacies (Lockwood, 2013) or when adaptation policies embody other incompatibilities with local economic, political, and cultural contexts (Mohabbat & Shahriar, 2015). For example, Nunn et al. (2021) explain how island communities have frequently emulated internationally funded seawall construction, even though seawalls frequently produce negative side effects such as erosion, and even though viable alternatives such as nature-based solutions exist. This instance of emulation emerged because local actors pursued their own political gains and wanted to be recognized as modern. However, the cure ultimately did neither solve the short-term problem nor enhance future adapative capacities. Given the multifaceted legacies and recent developments in developing countries, the literature on the outcomes of internationally funded adaptation policy remains by and large inconclusive. This is not least due to the difficulty of agreeing on what constitutes successful adaptation and maladaptation and how to measure it (Ford & Berrang-Ford, 2016).

Finally, the jury is still out on the extent to which diffusion may drive adaptation beyond spreading individual policies and measures, and maybe even contribute to a profound transformation of existing systems, which a growing number of scholars deem necessary (Eriksen et al., 2015; O'Brien, 2013; Wise et al., 2014). Even if adaptation policies diffuse via networks, networks may not be able to ensure successful policy implementation when there is a lack of political support or capacity (Bednar et al., 2019; Hauge et al., 2019; Sowers et al., 2011). For example, the documented diffusion of adaptation plans across various countries and governance levels may indicate the spread of more comprehensive adaptation approaches, but the quality and implementation of such plans vary substantially (Bromley-Trujillo et al., 2016; Morgan et al., 2019; Preston et al., 2011; Woodruff & Regan, 2019; Woodruff & Stults, 2016).

Taken together, there is substantial evidence of the diffusion of adaptation policy outputs. However, the evidence of the outcomes of adaptation policy diffusion remains limited, sporadic and inconclusive. In some cases, municipal networks were found to promote the diffusion of policy outputs, but observed outcomes depend on both the policy diffusion process, that is, which types of policies diffuse and how, and on implementation including the possibility that the diffusing policies are not put into practice. Adaptation policy diffusion may also produce unjust consequences when certain actors with lower levels of resources do not have access to diffusion channels, such as networks, or when diffusion pressures lead to maladaptive responses. Finally, diffusion processes could also drain resources from potential adopters, for example, when they try to imitate others or engage with networks instead of mustering their own—maybe more effective—adaptation solutions.

5 | CHALLENGES AND SOLUTIONS IN THE STUDY OF ADAPTATION POLICY DIFFUSION

The sparse data and limited knowledge base on adaptation policy diffusion derive in part from unresolved methodological issues that relate to both the study of adaptation policy in general and policy diffusion in particular. One general criticism leveled at early adaptation policy scholarship focuses on its use of simplistic concepts and measures of adaptation policy outputs that rely, for instance, only on the (non-)existence of plans and strategies. However, more recent efforts have moved towards increasingly sophisticated dependent variables that hold potential to capture the details and substance of adaptation policy and its instruments. For instance, Rai (2020) called for more complex dependent variables in order to distinguish between symbolic and substantive adaptation policies, such as by examining the level of commitment in adaptation plans and strategies. While welcome, fully accounting for adaptation policy diffusion will certainly require even more comprehensive measures beyond plans and strategies (Berrang-Ford et al., 2019), and consideration of the plethora of different adaptation policy instruments (policy mixes) rather than individual actions (Lesnikowski et al., 2019).

However, developing more complex and aggregated dependent variables may also generate some challenges. The approach not only places a higher burden on data collection, but varying adaptation policies or policy instruments may also spread via different mechanisms and networks, therefore raising the bar for data analysis in diffusion studies. Using aggregate variables runs the risk of masking differences in diffusion processes across policy types, sectors, and so forth. Jurisdictions may be susceptible to diffusion in one subarea of adaptation, but less so in others. For instance, visible, "hard" adaptation measures such as seawalls may be more likely to diffuse than "soft" policies (see Dolšak & Prakash, 2018). However, the latter are essential for effective long-term adaptation and increasing adaptive capacity (Fankhauser & Burton, 2011; Sovacool, 2011).

The temporal dimension of adaptation policy diffusion presents another challenge. Policy diffusion is per definition a process that evolves over time. Explaining policy adoption thus requires longitudinal data that are not widely available for climate adaptation policy, particularly with a view to complex dependent variables (see above). Diffusion models also require identifying a starting point; that is, determining when a diffusion process potentially begins. This is a particular challenge for the study of adaptation policy, because adaptation exhibits both unclear starting and end points (Dupuis & Biesbroek, 2013). Determining when observations commence necessitates defining a policy baseline with respect to which changes can be assessed. Doing so involves distinguishing intentional from less intentional forms of adaptation policy, such as new flood management practices in response to anticipated climate change impacts from long-existing disaster risk management policies and practises. In sum, there is currently a remarkable lack of longitudinal data on adaptation policy change, especially comparative data, which also hampers the study of diffusion processes (see also Ford & Berrang-Ford, 2016; Tompkins et al., 2018). Current data collection efforts—such as those reported in the Adaptation Gap Report series by the UN Environment Programme (United Nations Environment Programme, 2021) and the Global Adaptation Mapping Initiative (GAMI),[15]—may eventually allow more comprehensive assessments of whether and how policy diffusion can advance adaptation.

Choosing independent variables in the study of adaptation policy diffusion has proven equally challenging. The run-of-the-mill solution in diffusion studies remains geographic proximity, but this approach cannot distinguish between different diffusion mechanisms (Desmarais et al., 2015; Maggetti & Gilardi, 2016). Similarly, membership and involvement in climate networks and international organizations are frequently associated with both learning and emulation. In addressing these challenges, the policy diffusion literature has developed various options for studying individual diffusion mechanisms, which have yet to be applied to adaptation policy diffusion. For example, in many cases, the spread of adaptation policies that are perceived to be successful may indicate learning mechanisms (Maggetti & Gilardi, 2016), but a full assessment would require more detailed attention to adaption policy outcomes. An additional challenge emerges from disentangling the effect of the different diffusion mechanisms such as those operating horizontally at the same governance level and those operating vertically across levels. For example, what are the combined local effects of national/state level policy and municipal networks, as has been discussed for German and US cities (Lee & Koski 2015; Otto et al., 2021) ?

Instead of using structural variables to measure relations between units and approximate diffusion mechanisms, it is also possible to ask policy-makers directly whether they have oriented their policy decisions on other actors and why. For example, Massey et al. (2014) surveyed 36 European countries and found that more than 50% had modeled their own adaptation activities on other countries. Furthermore, the results show that following the example of good institutions and organizations as well as perceived leaders in adaptation were primary reasons for doing so (Massey

et al., 2014), suggesting that emulation played a major role as a diffusion mechanism. Similarly, respondents in a survey of small municipalities in Bavaria, Germany, indicated that network memberships played a role in starting local climate policy processes (Bausch & Koziol, 2020). In addition to quantitative research, qualitative work also holds potential for exploring adaptation policy diffusion across and within cases (Motta, 2018; Starke, 2013). Taken together, the study of adaptation policy diffusion stands to gain substantially from methodological advances that innovatively combine emerging approaches from diffusion and adaptation studies.

6 | CONCLUSION AND FUTURE DIRECTIONS

Rapidly advancing climate change has generated enormous adaptation challenges around the world. In response, numerous initiatives such as networks and information platforms aim to spread adaptation actions and promote best practices, in short, to stimulate adaptation policy diffusion (see Box 1). Policy diffusion has also been heralded as an important ingredient of the UNFCCC Paris Agreement (Lesnikowski et al., 2017). This conceptual and practical reliance on policy diffusion contrasts with limited existing and structured knowledge about diffusion processes, their underlying mechanisms, and their effects in the field of climate change adaptation. Bringing together the cutting-edge adaptation and policy diffusion literatures, we have demonstrated the value of viewing developments in adaptation policy from a diffusion perspective.

While the diffusion of adaptation policy, understood as interdependent policy-making, has been detected in many different settings around the globe, not all diffusion mechanisms have received equal scholarly attention, resulting in veritable knowledge gaps. For instance, a call still has to be made regarding the role of ideology for the diffusion of adaptation policies. Other motivations and mechanisms appear more prominently in the adaptation literature, especially diffusion via learning and emulation (Fuenfgeld, 2015). However, even in these areas, scholars report mixed findings on *who learns what from whom and why* (e.g., Feinberg, 2021; Kalesnikaite & Neshkova, 2021). Network analyses, for instance, could offer additional insights into the "senders and recipients" of adaptation knowledge (Lee & van de Meene, 2012). Rights and duties-based diffusion features particularly strongly in development studies, where scholars have focused on the positive and negative impacts of international funding on adaptation actions (Eriksen et al., 2021).

Similarly, as adaptation remains a voluntary task for local actors in most advanced industrialized countries, scholars have focused on the role of multilevel funding incentives rather than hierarchical regulations for advancing adaptation (e.g., Bisaro, Bel, Hinkel, Kok, & Bouwer, 2020a). The role of networks at various levels of governance has also been increasingly recognized (e.g., Dannevig & Aall 2015), but their ultimate effects on adaptation policy diffusion remain understudied. Finally, currently available evidence of adaptation policy diffusion mostly relates to adaptation plans and strategies (Aguiar et al., 2018; Keskitalo et al., 2016; Massey et al., 2014; Rai, 2020), but most work still lacks details on the actual policies and measures (actions) contained therein. Information about the content of adaptation plans and their implementation is necessary to determine the substance of diffusing adaptation policy as well as associated outcomes in terms of lower vulnerability and greater resilience.

There are numerous additional avenues for future research. Especially the outcomes of adaptation policy diffusion demand more attention. For policy diffusion to be a promising way of governing adaptation, understanding when and under what conditions policy diffusion produces the desirable and undesirable (i.e., maladaptive) outcomes is essential (see Schipper, 2020). Doing so includes assessing whether outcomes differ as a function of the mechanism and pathways by which the associated policies have diffused as well as the characteristics of the diffusing policies. A major challenge in progressing from tracking policy outputs to assessing outcomes is a lack of consensus on central indicators of adaptation success across space and time (Bours et al., 2015; Dzebo, 2019; Persson, 2019). In addition, the range of adaptation policies that could diffuse is potentially large and might therefore require different assessment criteria such as effectiveness, efficiency, equity, and legitimacy (Adger et al., 2005). The evaluation of adaptation policy diffusion processes and outcomes is thus a core area for future research.

Another widely uncharted field concerns the extent of simultaneous diffusion of adaptation and mitigation policies. While we have focused on climate change adaptation in this review, scholars have long argued that there may be significant potential synergies, but also antagonisms, between mitigation and adaptation (Moser, 2012; Otto et al., 2021). The extent to which mitigation and adaptation policies diffuse in tandem or sequentially, or when diffusion of one may hamper the diffusion of the other, thus constitutes a relevant future research question. Finally, more research is required on the role of policy characteristics in the diffusion of adaptation policy (see Jordan and Huitema 2014). For example, how adaptation policies are framed may affect the likelihood of their diffusion. Early evidence suggests, for instance, that a hazard frame may be conducive to adaptation policy-making (Koski & Siulagi, 2016).

For adaptation policy practitioners, this review offers cause for hope, but also some caution. The good news is that some adaptation policies, notably plans and strategies, do indeed diffuse in various settings. The policy networks that have emerged in numerous places appear to play a relevant role in this process, offering practitioners a practical route towards advancing diffusion. However, the existing evidence cautions against uncritical reliance on adaptation policy diffusion as a mode of adaptation governance, given that much remains still unknown, especially on the precise effects that diffusion does and does not cause on the ground. Studying the extent to which effective adaptation policy implementation follows diffusion can therefore generate even better insights for practice. Doing so will be the litmus test of the efficacy of diffusing adaptation policy around the world.

CONFLICT OF INTEREST
The authors have declared no conflicts of interest for this article.

AUTHOR CONTRIBUTIONS
Jonas J. Schoenefeld: Conceptualization (equal); data curation (equal); methodology (supporting); project administration (lead); supervision (equal); writing – original draft (equal); writing – review and editing (equal). **Kai Schulze:** Conceptualization (equal); data curation (equal); funding acquisition (lead); methodology (lead); project administration (supporting); supervision (equal); writing – original draft (equal); writing – review and editing (equal). **Nils Bruch:** Formal analysis (supporting); project administration (supporting); writing – original draft (supporting); writing – review and editing (supporting).

DATA AVAILABILITY STATEMENT
Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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ENDNOTES
[1] In addition to policy diffusion, scholars have examined a number of related concepts, including policy transfer and policy convergence. Despite important differences, these concepts share a common interest in interdependent policy-making. A full discussion of the debate on their differences and commonalities is beyond the scope of this review, but various scholars have offered summaries, including conceptual and methodological aspects (Benson & Jordan, 2012; Dolowitz & Marsh, 1996; Marsh & Sharman, 2009; Starke, 2013).

[2] A strong focus on agency has also been at the center of the policy transfer literature (see Marsh & Sharman, 2009).

[3] The IPCC defines vulnerability 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" (Baede et al., 2008). By contrast, resilience is "the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change" (Baede et al., 2008).

[4] The jury is still out on the extent to which climate-related events and their severity stimulate adaptation policy development. The findings from a global comparison of disaster risk reduction policy development by Nohrstedt et al. (2021) do not support such a relationship. Their negative outcomes suggest that a number of factors such as political competition, media attention, and democratic institutions mediate responses to natural disasters. This mediation may lead to disproportionate or symbolic policy responses (see also Amundsen & Dannevig, 2021; Peters et al., 2017).

⁵ Even if often portrayed differently, there is nothing inherently good or beneficial about learning, particularly because the benefits of learning and policy success can be defined in different terms based on varying perceptions, judgments, and values (Dobbin et al., 2007; Dolowitz & Marsh, 1996). Actors may for example learn how to *prevent* policy diffusion if this suits their interests (see also Schoenefeld & Jordan, 2019).

⁶ https://www.africaadaptationinitiative.org/assets/aai_framework_en_2016.pdf

⁷ https://resilientcitiesnetwork.org/downloadable_resources/Press_Room/R_Cities_Brochure.pdf

⁸ https://resilientcitiesnetwork.org/urban_resiliences/resilient-water-management/

⁹ https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/eu_strategy_2021.pdf

¹⁰ The Climate-ADAPT platform is a partnership between the European Commission and the European Environment Agency to support adaptation policy in Europe by sharing data and information. Governmental decision-makers and supporting organizations can submit relevant information on climate change impacts, vulnerability and adaptation on the platform's website to exchange information with other actors. The platform also offers various tools, like the Adaptation Support Tool, to assist policy-makers in all stages of the adaptation policy process.

¹¹ https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0080&from=EN

¹² More precisely, the Climate Law prescribes that the EU member states shall make "continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change" and "adopt and implement national adaptation strategies and plans" (Article 5, Regulation 2021/1119).

¹³ https://www.thegef.org/what-we-do/topics/climate-change-adaptation

¹⁴ However, in many cases, empirical observations would also be compatible with a more rational political policy diffusion model in which policy-makers, who consider implementing a policy borrowed from elsewhere, evaluate both a policy's electoral consequences and substantial effects, and filter information about policies in other jurisdictions through their own ideological lenses (Butler et al., 2017; Gilardi and Wasserfallen, 2019).

¹⁵ https://globaladaptation.github.io/index.html

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REFERENCES

Abel, D. (2021). The diffusion of climate policies among German municipalities. *Journal of Public Policy*, *41*(1), 111–136.

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales. *Global Environmental Change*, *15*(2), 77–86. https://doi.org/10.1016/j.gloenvcha.2004.12.005

Aguiar, F. C., Bentz, J., Silva, J. M. N., Fonseca, A. L., Swart, R. J., Santos, F. D., & Penha-Lopes, G. (2018). Adaptation to climate change at local level in Europe: An overview. *Environmental Science & Policy*, *86*, 38–63. https://doi.org/10.1016/j.envsci.2018.04.010

Amundsen, H., Berglund, F., & Westskog, H. (2010). Overcoming barriers to climate change adaptation? A question of multilevel governance? *Environment and Planning C: Government and Policy*, *28*(2), 276–289. https://doi.org/10.1068/c0941

Amundsen H., Dannevig H. (2021). Looking back and looking forward—adapting to extreme weather events in municipalities in western Norway. *Regional Environmental Change*, *21*(4). https://doi.org/10.1007/s10113-021-01834-7

Andonova, L. B., Hale, T. N., & Roger, C. B. (2017). National policy and transnational governance of climate change: Substitutes or complements? *International Studies Quarterly*, *61*(2), 253–268. https://doi.org/10.1093/isq/sqx014

Ayers, J. M., & Huq, S. (2009). Supporting adaptation to climate change: What role for official development assistance? *Development Policy Review*, *27*(6), 675–692. https://doi.org/10.1111/j.1467-7679.2009.00465.x

Baede, A. P., van der Linden, P., & Verbruggen, A. (2008). Climate change 2007: Appendix to synthesis report. In L. Bernstein, P. Bosch, O. Canziani, Z. Chen, R. Christ, O. Davidson, W. Hare, S. Huq, D. J. Karoly, V. Kattsov, Z. Kundzewicz, J. Liu, U. Lohmann, M. Manning,

T. Matsuno, B. Meene, B. Metz, M. Mirza, N. Nicholls, et al. (Eds.), *Climate change 2007 synthesis report* (pp. 75–103). Intergovernmental Panel on Climate Change https://www.ipcc.ch/site/assets/uploads/2018/02/ar4_syr_appendix.pdf

Barrett, S. (2014). Subnational climate justice? Adaptation finance distribution and climate vulnerability. *World Development*, *58*, 130–142. https://doi.org/10.1016/j.worlddev.2014.01.014

Bauer, A., & Steurer, R. (2014). Innovation in climate adaptation policy: Are regional partnerships catalysts or talking shops? *Environmental Politics*, *23*(5), 818–838. https://doi.org/10.1080/09644016.2014.924196

Bausch, T., & Koziol, K. (2020). New policy approaches for increasing response to climate change in small rural municipalities. *Sustainability*, *12*(5), 1894.

Bednar, D., Henstra, D., & McBean, G. (2019). The governance of climate change adaptation: Are networks to blame for the implementation deficit? *Journal of Environmental Policy & Planning*, *21*(6), 702–717. https://doi.org/10.1080/1523908X.2019.1670050

Benson, D., & Jordan, A. (2011). What have we learned from policy transfer research? Dolowitz and Marsh revisited. *Political Studies Review*, *9*(3), 366–378.

Benson, D., & Jordan, A. (2012). Policy transfer research: Still evolving, not yet through? *Political Studies Review*, *10*(3), 333–338.

Benz, A. (2012). Yardstick competition and policy learning in multi-level systems. *Regional & Federal Studies*, *22*(3), 251–267. https://doi.org/10.1080/13597566.2012.688270

Berrang-Ford, L., Biesbroek, R., Ford, J. D., Lesnikowski, A. C., Tanabe, A., Wang, F. M., Chen, C., Hsu, A., Hellmann, J. J., Pringle, P., Grecequet, M., Amado, J.-C., Huq, S., Lwasa, S., & Heymann, S. J. (2019). Tracking global climate change adaptation among governments. *Nature Climate Change*, *9*(6), 440–449. https://doi.org/10.1038/s41558-019-0490-0

Berry, F. S., & Berry, W. D. (2018). Innovation and diffusion models in policy research. In C. M. Weible & P. A. Sabatier (Eds.), *Theories of the policy process* (4th ed.). Routledge.

Betsill, M. M., & Bulkeley, H. (2004). Transnational networks and global environmental governance: The cities for climate protection program. *International Studies Quarterly*, *48*(2), 471–493. https://doi.org/10.1111/j.0020-8833.2004.00310.x

Biesbroek, R., & Delaney, A. (2020). Mapping the evidence of climate change adaptation policy instruments in Europe. *Environmental Research Letters*, *15*(8), 083005.

Biesbroek, R., Klostermann, J. E. M., Termeer, C. J. A. M., & Kabat, P. (2013). On the nature of barriers to climate change adaptation. *Regional Environmental Change*, *13*, 1119–1129. https://doi.org/10.1007/s10113-013-0421-y

Biesbroek, R., & Lesnikowski, A. C. (2018). The neglected dimension of polycentric climate governance? In A. J. Jordan, D. Huitema, H. van Asselt, & J. Forster (Eds.), *Governing climate change: Polycentricity in action?* (pp. 303–319). Cambridge University Press https://books.google.de/books?hl=de&lr=&id=TElVDwAAQBAJ&oi=fnd&pg=PA303&dq=%22Adaptation+The+Neglected+Dimension+of+Polycentric+Climate+Governance%3F%22&ots=hD28dTolrm&sig=7YMMPUJn1QIGShV-X7JxJSPAsk8

Bisaro, A., Bel, M. d., Hinkel, J., Kok, S., & Bouwer, L. M. (2020a). Leveraging public adaptation finance through urban land reclamation: Cases from Germany, The Netherlands and the Maldives. *Climatic Change*, *160*(4), 671–689.

Bisaro, A., Bel, M. d., Hinkel, J., Kok, S., Stojanovic, T., & Ware, D. (2020b). Multilevel governance of coastal flood risk reduction: A public finance perspective. *Environmental Science & Policy*, *112*, 203–212.

Blatter, J., Portmann, L., & Rausis, F. (2021). Theorizing policy diffusion: From a patchy set of mechanisms to a paradigmatic typology. *Journal of European Public Policy*, 1–21. https://doi.org/10.1080/13501763.2021.1892801

Bours, D., McGinn, C., & Pringle, P. (2015). Editors' notes. *New Directions for Evaluation*, *147*, 1–12. https://doi.org/10.1002/ev.20127

Braun, D., & Gilardi, F. (2006). Taking 'Galton's problem' seriously: Towards a theory of policy diffusion. *Journal of Theoretical Politics*, *18*(3), 298–322. https://doi.org/10.1177/0951629806064351

Bromley-Trujillo, R., Butler, J. S., Poe, J., & Davis, W. (2016). The spreading of innovation: State adoptions of energy and climate change policy. *Review of Policy Research*, *33*(5), 544–565. https://doi.org/10.1111/ropr.12189

Bulkeley, H., Andonova, L. B., Betsill, M. M., Compagnon, D., Hale, T., Hoffmann, M. J., Newell, P., Paterson, M., Roger, C., & Van Deveer, S. D. (2014). *Transnational climate change governance* (pp. 1–212). Cambridge University Press. https://doi.org/10.1017/CBO9781107706033

Butler, D. M., Volden, C., Dynes, A. M., & Shor, B. (2017). Ideology, learning, and policy diffusion: Experimental evidence. *American Journal of Political Science*, *61*(1), 37–49. https://doi.org/10.1111/ajps.12213

Carley, S., & Nicholson-Crotty, S. (2018). Moving beyond theories of neighborly emulation: Energy policy information channels are plentiful among American states. *Energy Research & Social Science*, *46*, 245–251. https://doi.org/10.1016/j.erss.2018.07.026

Christoff, P. S., & Sommer, J. M. (2018). Women's empowerment and climate change adaptation in Gujarat, India: A case-study analysis of the local impact of transnational advocacy networks. *Sustainability*, *10*(6), 1–14. https://doi.org/10.3390/su10061920

Dannevig, H., & Aall, C. (2015). The regional level as boundary organization? An analysis of climate change adaptation governance in Norway. *Environmental Science & Policy*, *54*, 168–175. https://doi.org/10.1016/j.envsci.2015.07.001

Dellmuth, L. M., & Gustafsson, M.-T. (2021). Global adaptation governance: How intergovernmental organizations mainstream climate change adaptation. *Climate Policy*, *21*(7), 868–883. https://doi.org/10.1080/14693062.2021.1927661

Desmarais, B. A., Harden, J. J., & Boehmke, F. J. (2015). Persistent policy pathways: Inferring diffusion networks in the American states. *American Political Science Review*, *109*(2), 392–406. https://doi.org/10.1017/S0003055415000040

Dobbin, F., Simmons, B. A., & Garrett, G. (2007). The global diffusion of public policies: Social construction, coercion, competition, or learning? *Annual Review of Sociology*, *37*(33), 449–472.

Dolowitz, D., & Marsh, D. (1996). Who learns what from whom: A review of the policy transfer literature. *Political Studies*, *44*(2), 343–357. https://doi.org/10.1111/j.1467-9248.1996.tb00334.x

Dolšak, N., & Prakash, A. (2018). The politics of climate change adaptation. *Annual Review of Environment and Resources*, *43*, 317–341. https://doi.org/10.1146/annurev-environ-102017-025739

Dupuis, J. (2017). Climate change adaptation as a new global norm in the water sector? Between symbolism and dilution. In C. Bréthaut & R. Schweizer (Eds.), *Palgrave studies in water governance. A critical approach to international water management trends: Policy and practice* (pp. 177–200). Palgrave Macmillan. https://doi.org/10.1057/978-1-137-60086-8_8

Dupuis, J., & Biesbroek, R. (2013). Comparing apples and oranges: The dependent variable problem in comparing and evaluating climate change adaptation policies. *Global Environmental Change*, *23*(6), 1476–1487. https://doi.org/10.1016/j.gloenvcha.2013.07.022

Dunlop, C. A., & Radaelli, C. M. (2013). Systematising policy learning: From monolith to dimensions. *Political Studies*, *61*(3), 599–619.

Dzebo, A. (2019). Effective governance of transnational adaptation initiatives. *International Environmental Agreements-Politics Law and Economics*, *19*(4–5), 447–466. https://doi.org/10.1007/s10784-019-09445-8

Eriksen, S. H., Nightingale, A. J., & Eakin, H. (2015). Reframing adaptation: The political nature of climate change adaptation. *Global Environmental Change-Human and Policy Dimensions*, *35*, 523–533. https://doi.org/10.1016/j.gloenvcha.2015.09.014

Eriksen, S. H., Schipper, E. L. F., Scoville-Simonds, M., Vincent, K., Adam, H. N., Brooks, N., Harding, B., Khatri, D., Lenaerts, L., Liverman, D., Mills-Novoa, M., Mosberg, M., Movik, S., Muok, B., Nightingale, A., Ojha, H., Sygna, L., Taylor, M., Vogel, C., & West, J. J. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? *World Development*, *141*, 105383. https://doi.org/10.1016/j.worlddev.2020.105383

European Environment Agency. (2014). *National adaptation policy processes in European countries—2014*. European Environment Agency. https://doi.org/10.2800/21394

Fankhauser, S., & Burton, I. (2011). Spending adaptation money wisely. *Climate Policy*, *11*(3), 1037–1049. https://doi.org/10.1080/14693062.2011.582389

Feinberg, D. S. (2021). What factors predict the quality of hazard mitigation plans in Washington state? *Climatic Change*, *164*(1–2), 1–29. https://doi.org/10.1007/s10584-021-02987-4

Fisher, D. R. (2013). Understanding the relationship between subnational and national climate change politics in the United States: Toward a theory of boomerang federalism. *Environment and Planning C-Government and Policy*, *31*(5), 769–784. https://doi.org/10.1068/c11186

Ford, J. D., & Berrang-Ford, L. (2016). The 4Cs of adaptation tracking: Consistency, comparability, comprehensiveness, coherency. *Mitigation and Adaptation Strategies for Global Change*, *21*(6), 839–859. https://doi.org/10.1007/s11027-014-9627-7

Fuenfgeld, H. (2015). Facilitating local climate change adaptation through transnational municipal networks. *Current Opinion in Environmental Sustainability*, *12*, 67–73. https://doi.org/10.1016/j.cosust.2014.10.011

Gilardi, F., & Wasserfallen, F. (2019). The politics of policy diffusion. *European Journal of Political Research*, *58*(4), 1245–1256.

Giordono, L., Boudet, H., & Gard-Murray, A. (2020). Local adaptation policy responses to extreme weather events. *Policy Sciences*, *53*(4), 1–28. https://doi.org/10.1007/s11077-020-09401-3

Graham, E. R., Shipan, C. R., & Volden, C. (2013). The diffusion of policy diffusion research in political science. *British Journal of Political Science*, *43*(3), 673–701. https://doi.org/10.1017/S0007123412000415

Haas, P. M. (1992). Introduction: Epistemic communities and international policy coordination. *International Organization*, *46*(1), 1–35.

Hakelberg, L. (2014). Governance by diffusion: Transnational municipal networks and the spread of local climate strategies in Europe. *Global Environmental Politics*, *14*(1), 107–129. https://doi.org/10.1162/GLEP_a_00216

Hale, T. (2020). Transnational actors and transnational governance in global environmental politics. *Annual Review of Political Science*, *23*(1), 203–220. https://doi.org/10.1146/annurev-polisci-050718-032644

Hale, T., & Roger, C. (2014). Orchestration and transnational climate governance. *Review of International Organizations*, *9*(1), 59–82. https://doi.org/10.1007/s11558-013-9174-0

Hallegatte, S., Lecocq, F., & Perthuis, C. de (2011). *Designing climate change adaptation policies: An economic framework*. World Bank Policy Research Working Paper (5568).

Hauge, A. L., Hanssen, G. S., & Flyen, C. (2019). Multilevel networks for climate change adaptation—What works? *International Journal of Climate Change Strategies and Management*, *11*(2), 215–234. https://doi.org/10.1108/IJCCSM-10-2017-0194

Hjerpe, M., Storbjörk, S., & Alberth, J. (2014). "There is nothing political in it": Triggers of local political leaders' engagement in climate adaptation. *Local Environment*, *20*(8), 855–873. https://doi.org/10.1080/13549839.2013.872092

Howlett, M., & Kemmerling, A. (2017). Calibrating climate change policies: The causes and consequences of sustained under-reaction. *Journal of Environmental Policy & Planning*, *19*(6), 625–637. https://doi.org/10.1080/1523908X.2017.1324772

Hughes, S., Runfola, D. M., & Cormier, B. (2018). Issue proximity and policy response in local governments. *Review of Policy Research*, *35*(2), 192–212. https://doi.org/10.1111/ropr.12285

Hunt, A., & Watkiss, P. (2011). Climate change impacts and adaptation in cities: A review of the literature. *Climatic Change*, *104*(1), 13–49.

IPCC (2014). Annex II: Glossary. In R. K. Pachauri & L. A. Meyer (Eds.), *Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change* (pp. 117–130). IPCC.

Javeline, D. (2014). The most important topic political scientists are not studying: Adapting to climate change. *Perspectives on Politics*, *12*(2), 420–434. https://doi.org/10.1017/S1537592714000784

Jordan, A. J., & Huitema, D. (2014). Innovations in climate policy: The politics of invention, diffusion, and evaluation. *Environmental Politics*, *23*(5), 715–734.

Juhola, S., & Westerhoff, L. (2011). Challenges of adaptation to climate change across multiple scales: A case study of network governance in two European countries. *Environmental Science & Policy*, *14*(3), 239–247. https://doi.org/10.1016/j.envsci.2010.12.006

Kalesnikaite, V., & Neshkova, M. I. (2021). Problem severity, collaborative stage, and partner selection in US cities. *Journal of Public Administration Research and Theory*, *31*(2), 399–415. https://doi.org/10.1093/jopart/muaa040

Kammerer, M., & Namhata, C. (2018). What drives the adoption of climate change mitigation policy? A dynamic network approach to policy diffusion. *Policy Sciences*, *51*(4), 477–513. https://doi.org/10.1007/s11077-018-9332-6

Keck, M. E., & Sikkink, K. (1998). *Activists beyond borders: Advocacy networks in international politics*. Cornell University Press.

Kemmerzell, J., & Hofmeister, A. (2019). Innovations in climate change policy of German major cities the influence of trans-local action in comparison. *Politische Vierteljahresschrift*, *60*(1), 95–126. https://doi.org/10.1007/s11615-018-0134-4

Kern, K. (2019). Cities as leaders in EU multilevel climate governance: Embedded upscaling of local experiments in Europe. *Environmental Politics*, *28*(1), 125–145. https://doi.org/10.1080/09644016.2019.1521979

Kern, K., & Bulkeley, H. (2009). Cities, Europeanization and multi-level governance: Governing climate change through transnational municipal networks. *Journal of Common Market Studies*, *47*(2), 309–332. https://doi.org/10.1111/j.1468-5965.2009.00806.x

Keskitalo, E. C. H., Juhola, S., Baron, N., Fyhn, H., & Klein, J. (2016). Implementing local climate change adaptation and mitigation actions: The role of various policy instruments in a multi-level governance context. *Climate*, *4*(1), 7. https://doi.org/10.3390/cli4010007

Keskitalo, E. C. H., Juhola, S., & Westerhoff, L. (2013). Connecting multiple levels of governance for adaptation to climate change in advanced industrial states. In: J. Edelenbos, N. Bressers & P. Scholten, eds. *Water Governance as Connective Capacity* (pp. 69–88). Routledge.

Koski, C., & Siulagi, A. (2016). Environmental harm or natural hazard? Problem identification and adaptation in U.S. municipal climate action plans. *Review of Policy Research*, *33*(3), 270–290. https://doi.org/10.1111/ropr.12173

Krause, R. M. (2011). Symbolic or substantive policy? Measuring the extent of local commitment to climate protection. *Environment and Planning C-Government and Policy*, *29*(1), 46–62. https://doi.org/10.1068/c09185

Krause, R. M. (2012). An assessment of the impact that participation in local climate networks has on cities' implementation of climate, energy, and transportation policies. *Review of Policy Research*, *29*(5), 585–604. https://doi.org/10.1111/j.1541-1338.2012.00582.x

Lee, T. (2013). Global cities and transnational climate change networks. *Global Environmental Politics*, *13*(1), 108–127. https://doi.org/10.1162/GLEP_a_00156

Lee, T., & Koski, C. (2015). Multilevel governance and urban climate change mitigation. *Environment and Planning C: Government and Policy*, *33*(6), 1501–1517. https://doi.org/10.1177/0263774X15614700

Lee, T., & van de Meene, S. (2012). Who teaches and who learns? Policy learning through the C40 cities climate network. *Policy Sciences*, *45*(3), 199–220. https://doi.org/10.1007/s11077-012-9159-5

Lesnikowski, A. C., Ford, J. D., Biesbroek, R., & Berrang-Ford, L. (2019). A policy mixes approach to conceptualizing and measuring climate change adaptation policy. *Climatic Change*, *156*(4), 447–469. https://doi.org/10.1007/s10584-019-02533-3

Lesnikowski, A. C., Ford, J. D., Biesbroek, R., Berrang-Ford, L., Maillet, M., Araos, M., & Austin, S. E. (2017). What does the Paris agreement mean for adaptation? *Climate Policy*, *17*(7), 825–831. https://doi.org/10.1080/14693062.2016.1248889

Lidskog, R., & Elander, I. (2010). Addressing climate change democratically. Multi-level governance, transnational networks and governmental structures. *Sustainable Development*, *18*(1), 32–41. https://doi.org/10.1002/sd.395

Lockwood, M. (2013). What can climate-adaptation policy in sub-Saharan Africa learn from research on governance and politics? *Development Policy Review*, *31*(6), 647–676. https://doi.org/10.1111/dpr.12029

Maggetti, M., & Gilardi, F. (2016). Problems (and solutions) in the measurement of policy diffusion mechanisms. *Journal of Public Policy*, *36*(1), 87–107. https://doi.org/10.1017/S0143814X1400035X

Marsh, D., & Sharman, J. C. (2009). Policy diffusion and policy transfer. *Policy Studies*, *30*(3), 269–288.

Massey, E., Biesbroek, R., Huitema, D., & Jordan, A. J. (2014). Climate policy innovation: The adoption and diffusion of adaptation policies across Europe. *Global Environmental Change*, *29*, 434–443. https://doi.org/10.1016/j.gloenvcha.2014.09.002

Mertz, O., Halsnaes, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management*, *43*(5), 743–752. https://doi.org/10.1007/s00267-008-9259-3

Mohabbat, K. M., & Shahriar, I. M. (2015). Climate change adaptation in developing countries: Does globalization act as facilitator? *Journal of Globalization Studies*, *6*(2), 62–74.

Morgan, E. A., Nalau, J., & Mackey, B. (2019). Assessing the alignment of national-level adaptation plans to the Paris agreement. *Environmental Science & Policy*, *93*, 208–220. https://doi.org/10.1016/j.envsci.2018.10.012

Moser, S. C. (2012). Adaptation, mitigation, and their disharmonious discontents: An essay. *Climatic Change*, *111*(2), 165–175.

Motta, M. J. (2018). Policy diffusion and directionality: Tracing early adoption of offshore wind policy. *Review of Policy Research*, *35*(3), 398–421. https://doi.org/10.1111/ropr.12281

Musah-Surugu, I. J., Ahenkan, A., Bawole, J. N., & Darkwah, S. A. (2018). Diffusion of climate change adaptation policies among local governments in sub-Saharan Africa: Conceptual review. In F. Alves, W. Leal Filho, & U. Azeiteiro (Eds.), *Theory and practice of climate adaptation* (pp. 65–85). Springer International Publishing. https://doi.org/10.1007/978-3-319-72874-2_4

Nicholson-Crotty, S., & Carley, S. (2016). Effectiveness, implementation, and policy diffusion: Or "can we make that work for us?". *State Politics & Policy Quarterly*, *16*(1), 78–97. https://doi.org/10.1177/1532440015588764

Noble, I. R., Huq, S., Anokhin, Y. A., Carmin, J., Goudou, D., Lansigan, F. P., Osman-Elasha, B., & Villamizar, A. (2014). Adaptation needs and options. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate change 2014: Impacts,*

adaptation, and vulnerability: Part a: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the inter-governmental panel on climate change (pp. 833–868). Cambridge University Press.

Nohrstedt, D., Mazzoleni, M., Parker, C. F., & Di Baldassarre, G. (2021). Exposure to natural hazard events unassociated with policy change for improved disaster risk reduction. *Nature Communications*, *12*(1), 193. https://doi.org/10.1038/s41467-020-20435-2

Nohrstedt, D., & Nyberg, L. (2015). Do floods drive hazard mitigation policy? Evidence from Swedish municipalities. *Geografiska Annaler Series a-Physical Geography*, *97*(1), 109–122. https://doi.org/10.1111/geoa.12081

Nunn, P. D., Klöck, C., & Duvat, V. (2021). Seawalls as maladaptations along island coasts. *Ocean & Coastal Management*, *205*, 105554.

O'Brien, K. (2013). Adaptation to climate change: From resilience to transformation. *Progress in Human Geography*, *37*(5), 729–731. https://doi.org/10.1177/0309132512452500

Okereke, C. (2018). Equity and justice in polycentric climate governance. In A. J. Jordan, D. Huitema, H. van Asselt, & J. Forster (Eds.), *Governing climate change: Polycentricity in action?* (pp. 320–337). Cambridge University Press.

Otto, A., Kern, K., Haupt, W., Eckersley, P., & Thieken, A. H. (2021). Ranking local climate policy: Assessing the mitigation and adaptation activities of 104 German cities. *Climatic Change*, *167*(1–2), 1–23. https://doi.org/10.1007/s10584-021-03142-9

Papin, M. (2019). Transnational municipal networks: Harbingers of innovation for global adaptation governance? *International Environmental Agreements-Politics Law and Economics*, *19*(4–5), 467–483. https://doi.org/10.1007/s10784-019-09446-7

Persson, Å. (2019). Global adaptation governance: An emerging but contested domain. *WIREs Climate Change*, *10*(6), 1–18. https://doi.org/10.1002/wcc.618

Persson, Å., & Dzebo, A. (2019). Special issue: Exploring global and transnational governance of climate change adaptation. *International Environmental Agreements: Politics, Law and Economics*, *19*(4–5), 357–367. https://doi.org/10.1007/s10784-019-09440-z

Persson, Å., & Remling, E. (2014). Equity and efficiency in adaptation finance: Initial experiences of the adaptation fund. *Climate Policy*, *14*(4), 488–506. https://doi.org/10.1080/14693062.2013.879514

Peters, B. G., Jordan, A. J., & Tosun, J. (2017). Over-reaction and under-reaction in climate policy: An institutional analysis. *Journal of Environmental Policy & Planning*, *19*(6), 612–624. https://doi.org/10.1080/1523908X.2017.1348225

Preston, B. L., Westaway, R. M., & Yuen, E. J. (2011). Climate adaptation planning in practice: An evaluation of adaptation plans from three developed nations. *Mitigation and Adaptation Strategies for Global Change*, *16*(4), 407–438.

Rai, S. (2020). Policy adoption and policy intensity: Emergence of climate adaptation planning in U.S. states. *Review of Policy Research*, *37*(4), 444–463. https://doi.org/10.1111/ropr.12383

Rayner, T. J., & Jordan, A. J. (2010). Adapting to a changing climate: An emerging European Union policy? In A. J. Jordan, D. Huitema, H. van Asselt, T. J. Rayner, & F. Berkhout (Eds.), *Climate change policy in the European Union: Confronting the dilemmas of mitigation and adaptation?* (pp. 145–166). Cambridge University Press.

Reckien, D., Flacke, J., Dawson, R. J., Heidrich, O., Olazabal, M., Foley, A., Hamann, J. J.-P., Orru, H., Salvia, M., Hurtado, S. D. G., Geneletti, D., & Pietrapertosa, F. (2014). Climate change response in Europe: What's the reality? Analysis of adaptation and mitigation plans from 200 urban areas in 11 countries. *Climatic Change*, *122*(1–2), 331–340. https://doi.org/10.1007/s10584-013-0989-8

Remling, E. (2018). Depoliticizing adaptation: A critical analysis of EU climate adaptation policy. *Environmental Politics*, *27*(3), 477–497. https://doi.org/10.1080/09644016.2018.1429207

Sabatier, P. A., & Weible, C. M. (2007). The advocacy coalition framework: Innovations and clarifications. In P. A. Sabatier (Ed.), *Theories of the policy process* (2nd ed., pp. 189–220). Westview Press.

Saikawa, E. (2013). Policy diffusion of emission standards is there a race to the top? *World Politics*, *65*(1), 1–33.

Schimmelfennig, F., & Sedelmeier, U. (2004). Governance by conditionality: EU rule transfer to the candidate countries of central and Eastern Europe. *Journal of European Public Policy*, *11*(4), 661–679. https://doi.org/10.1080/1350176042000248089

Schipper, E. L. F. (2006). Conceptual history of adaptation in the UNFCCC process. *Review of European Community & International Environmental Law*, *15*(1), 82–92.

Schipper, E. L. F. (2020). Maladaptation: When adaptation to climate change goes very wrong. *One Earth*, *3*(4), 409–414.

Schoenefeld, J. J., & Jordan, A. J. (2019). Environmental policy evaluation in the EU: Between learning, accountability, and political opportunities? *Environmental Politics*, *28*(2), 365–384.

Schulze, K. (2021). Policy characteristics, electoral cycles, and the partisan politics of climate change. *Global Environmental Politics*, *21*(2), 44–72.

Schulze, K., & Schoenefeld, J. J. (2022). Parteiendifferenz in der lokalen Klimapolitik? Eine empirische Analyse der hessischen Klima-Kommunen [Do parties matter in local climate politics? An empirical analysis of the Hessian "Klima-Kommunen"]. *Zeitschrift für Vergleichende Politikwissenschaft [Comparative Governance and Politics]*, *15*(4), 525–550. https://doi.org/10.1007/s12286-021-00510-8

Schulze, K., & Tosun, J. (2013). External dimensions of European environmental policy: An analysis of environmental treaty ratification by third states. *European Journal of Political Research*, *52*(5), 581–607. https://doi.org/10.1111/1475-6765.12011

Shi, L., Chu, E., Anguelovski, I., Aylett, A., Debats, J., Goh, K., Schenk, T., Seto, K. C., Dodman, D., Roberts, D., Roberts, J. T., & VanDeveer, S. D. (2016). Roadmap towards justice in urban climate adaptation research. *Nature Climate Change*, *6*(2), 131–137. https://doi.org/10.1038/nclimate2841

Shi, L., Chu, E., & Debats, J. (2015). Explaining Progress in climate adaptation planning across 156 US municipalities. *Journal of the American Planning Association*, *81*(3), 191–202. https://doi.org/10.1080/01944363.2015.1074526

Shipan, C. R., & Volden, C. (2006). Bottom-up federalism: The diffusion of antismoking policies from U.S. cities to states. *American Journal of Political Science*, *50*(4), 825–843. https://doi.org/10.1111/j.1540-5907.2006.00218.x

Shipan, C. R., & Volden, C. (2008). The mechanisms of policy diffusion. *American Journal of Political Science*, *52*(4), 840–857.

Siders, A. R. (2019). Adaptive capacity to climate change: A synthesis of concepts, methods, and findings in a fragmented field. *WIREs Climate Change*, *10*(3), 1–18. https://doi.org/10.1002/wcc.573

Sietz, D., Boschütz, M., & Klein, R. J. (2011). Mainstreaming climate adaptation into development assistance: Rationale, institutional barriers and opportunities in Mozambique. *Environmental Science & Policy*, *14*(4), 493–502. https://doi.org/10.1016/j.envsci.2011.01.001

Simmons, B. A., Dobbin, F., & Garrett, G. (2006). Introduction: The international diffusion of liberalism. *International Organization*, *60*(4), 781–810.

Smit, B., Burton, I., Klein, R. J. T., & Wandel, J. (2000). An anatomy of adaptation to climate change and variability. *Climatic Change*, *45*, 223–251. https://doi.org/10.1007/978-94-017-3010-5_12

Smith, J. B., & Lenhart, S. S. (1996). Climate change adaptation policy options. *Climate Research*, *6*(2), 193–201. https://doi.org/10.3354/cr006193

Sovacool, B. K. (2011). Hard and soft paths for climate change adaptation. *Climate Policy*, *11*(4), 1177–1183. https://doi.org/10.1080/14693062.2011.579315

Sowers, J., Vengosh, A., & Weinthal, E. (2011). Climate change, water resources, and the politics of adaptation in the Middle East and North Africa. *Climatic Change*, *104*(3–4), 599–627. https://doi.org/10.1007/s10584-010-9835-4

Starke, P. (2013). Qualitative methods for the study of policy diffusion: Challenges and available solutions. *Policy Studies Journal*, *41*(4), 561–582. https://doi.org/10.1111/psj.12032

Steurer, R., & Clar, C. (2018). The ambiguity of federalism in climate policy-making: How the political system in Austria hinders mitigation and facilitates adaptation. *Journal of Environmental Policy & Planning*, *20*(2), 252–265. https://doi.org/10.1080/1523908X.2017.1411253

Storbjork, S. (2010). 'It takes more to get a ship to change course': Barriers for organizational learning and local climate adaptation in Sweden. *Journal of Environmental Policy & Planning*, *12*(3), 235–254. https://doi.org/10.1080/1523908X.2010.505414

Taylor, B. M., Harman, B. P., & Inman, M. (2013). Scaling-up, scaling-down, and scaling-out: Local planning strategies for sea-level rise in New South Wales, Australia. *Geographical Research*, *51*(3), 292–303. https://doi.org/10.1111/1745-5871.12011

Tompkins, E. L., Adger, W. N., Boyd, E., Nicholson-Cole, S., Weatherhead, K., & Arnell, N. W. (2010). Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Global Environmental Change-Human and Policy Dimensions*, *20*(4), 627–635. https://doi.org/10.1016/j.gloenvcha.2010.05.001

Tompkins, E. L., Vincent, K., Nicholls, R. J., & Suckall, N. (2018). Documenting the state of adaptation for the global stocktake of the Paris agreement. *WIREs Climate Change*, *9*(5), e545. https://doi.org/10.1002/wcc.545

Tosun, J. (2018). Diffusion: An outcome of and an opportunity for polycentric activity? In A. J. Jordan, D. Huitema, H. van Asselt, & J. Forster (Eds.), *Governing climate change: Polycentricity in action?* (pp. 152–168). Cambridge University Press.

United Nations Environment Programme. (2021). *Adaptation gap report 2020*. Nairobi.

Vasi, I. B. (2006). Organizational environments, framing processes, and the diffusion of the program to address global climate change among local governments in the United States. *Sociological Forum*, *21*(3), 439–466. https://doi.org/10.1007/s11206-006-9023-5

Vogel, B., & Henstra, D. (2015). Studying local climate adaptation: A heuristic research framework for comparative policy analysis. *Global Environmental Change*, *31*, 110–120. https://doi.org/10.1016/j.gloenvcha.2015.01.001

Vogel, D. (1995). *Trading up: Consumer and environmental regulation in a global economy*. Harvard University Press.

Ward, H., & John, P. (2013). Competitive learning in yardstick competition: Testing models of policy diffusion with performance data. *Political Science Research and Methods*, *1*(1), 3–25. https://doi.org/10.1017/psrm.2013.1

Weaver, R. K. (1986). The politics of blame avoidance. *Journal of Public Policy*, *6*(3), 371–398.

Weiler, F., Klöck, C., & Dornan, M. (2018). Vulnerability, good governance, or donor interests? The allocation of aid for climate change adaptation. *World Development*, *104*, 65–77. https://doi.org/10.1016/j.worlddev.2017.11.001

Wise, R. M., Fazey, I., Smith, M. S., Park, S. E., Eakin, H. C., Van Garderen, E. R. M., & Campbell, B. (2014). Reconceptualising adaptation to climate change as part of pathways of change and response. *Global Environmental Change-Human and Policy Dimensions*, *28*, 325–336. https://doi.org/10.1016/j.gloenvcha.2013.12.002

Wood, R. S., Hultquist, A., & Romsdahl, R. J. (2014). An examination of local climate change policies in the Great Plains. *Review of Policy Research*, *31*(6), 529–554. https://doi.org/10.1111/ropr.12103

Woodruff, S. C., & Regan, P. (2019). Quality of national adaptation plans and opportunities for improvement. *Mitigation and Adaptation Strategies for Global Change*, *24*(1), 53.

Woodruff, S. C., & Stults, M. (2016). Numerous strategies but limited implementation guidance in US local adaptation plans. *Nature Climate Change*, *6*(8), 796–802.