41. Adaptation
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INTRODUCTION

While much of the policy effort to date has been devoted to mitigation policy, adaptation policy is quickly becoming an important part of the climate governance discussion, at the international, national and even local scales. Because it was at best seen as a 'morally inferior' choice, and at worst seen as admitting defeat on mitigation, adaptation was for many years a 'taboo' subject among many climate policy actors and scholars (Pielke et al. 2007). However, it gradually became clear that no matter how aggressive or successful climate mitigation policies might become in reducing emissions, in the short term, the world was committed to some level of climate change, and adaptation would be a prudent strategy to consider.

The past 15 years have seen a veritable explosion of scholarship on adaptation, and its cousins vulnerability (Forsyth this volume) and resilience (Adler et al. this volume). Smit and Wandel (2006) trace the history of the use of the term 'adaptation' within global change studies and suggest it has emerged both from biology, where it is a classic element of evolutionary theory, and elements of cultural anthropology that focus on what enables cultures to succeed in the face of environmental (or other) change. Smit and Wandel contrast four different approaches to adaptation research: comparing how adaptation can offset climate impacts; characterizing adaptation measures themselves; starting with and ranking the vulnerability of societies to climate change; and 'practical studies' that focus on community-based, 'bottom-up' research designed to assist specific communities but that are not necessarily able to be scaled up to enable comparison and generalization. Smit et al. (2000) provide a concise typology of questions to ask in studying and characterizing adaptation for analytical purposes: what is adaptation? Who or what adapts? How does adaptation occur? How good is the adaptation? In addition, adaptation can be categorized as autonomous, or proactive, where actions are taken in anticipation of eventual change. The bulk of adaptation scholarship has focused on defining and refining the theoretical underpinnings of the concept, with fewer studies focused on empirically based case studies of adaptation, and very few studies so far that can draw broader generalizations, simply because of the newness of the issue and the context-specific nature of most adaptation studies. In the meantime, some cities, states and nations have moved forward with adaptation planning and in rare cases, implementation of proactive adaptation measures in anticipation of climate change.

As adaptation becomes more commonplace in international and local discussions of climate policy, it is timely to revisit how the concept has been theorized, and how concepts such as adaptive capacity and adaptive governance have evolved. This chapter begins with a review of how adaptation itself has been theorized, goes on to consider various ways of conceptualizing governance for adaptation, and examines additional work on adaptive governance as a collective action problem. It concludes with an exploration

of fundamental disagreements on the way forward for adaptive responses, and whether adaptation itself can be seen as an imperative or normative ideal, subject to competing foundations for its legitimacy.

HOW IS ADAPTATION THEORIZED?

Adaptation as Climate Response

Adger et al. (2005, p. 77) define adaptation as 'adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of change or take advantage of new opportunities.' In this theoretical framing, the main function of climate adaptation efforts is to respond to changes in expected or actual climate impacts, and the stimulus is placed on the climate signals themselves, while the response is linked to the changes that are expected or experienced. The other important element is that the efforts in the end should reduce harm or even produce a net gain to society. There are no single metrics or easy answers for judging when adaptation has been successful in this view, only that outcomes must be judged with full awareness of the context of communities across spatial and temporal scales, and with attention to equity, legitimacy and economic efficiency (Adger et al. 2005). Empirical study of the limited experiments and evaluations of adaptation efforts have led experts to conclude that thus far, there are 'no easy scientific or political answers' to what is successful adaptation (Moser and Boykoff 2013, p. 1). The implication of this framing of adaptation is that the most preferred end state is one in which society has adjusted in a way that can better accommodate any new states that may come with climate change.

Adaptation as Additional

In the early 2000s, when the funding of adaptation began to be discussed in the international policy scene, there was a specific effort to draw a distinction between funds raised that would support adaptation to climate change and funds that might be already being used to fund work on reducing vulnerability to climate variability, in order to show the 'global benefit' of such adaptation measures and to explicitly call out the new measures required for climate change (Huq and Burton 2003). Some have objected to this framing of adaptation funding for climate change as needing to be additional, pointing out the illogicality of paying for only a part of a seawall, or a fraction of a heatwave mitigation strategy, given that many of the actions needed for climate change are more generally needed for building adaptive capacity across the board or addressing the adaptation 'deficit' (e.g., Burton 2009; Huq and Burton 2003; Pielke et al. 2007; Smit and Wandel 2006).

Adaptation as Development

Many scholars have built upon the deficit argument to suggest that in fact 'adaptation is development,' meaning that the best way for societies to be prepared and adapt to

climate change is to develop their fundamental capacities to cope with adversity, such as by improving healthcare, education and literacy, providing access to microfinance programs and strengthening local institutions (Eakin and Patt 2011; Huq and Burton 2003). Others have argued that developing countries that are understandably focused on poverty alleviation, economic growth, food security and so on must include climate change considerations into their planning in order for any development efforts to be sustainable and successful (Kok et al. 2008). While conversations regarding the logic of compensation for adaptation costs are evolving, it is still fair to say that there is some wariness of the thought of fully combining climate change and development agendas (Ayers and Huq 2009).

Just Adaptation

The threads of adaptation research touch on the theme of winners and losers, although whether winners and losers are assumed to emerge as a natural result of environmental and social systems or to be produced deliberately by inequitable social and political processes affects how these are studied and conceptualized (O'Brien and Leichenko 2003). Some have argued that adaptation is fundamentally an issue of social justice, involving both distributive and procedural aspects (Page this volume; Paavola and Adger 2006). Questions of who is responsible, both for causing the environmental change and for paying for the consequences, and who will bear the burden of having to adapt (perhaps with little responsibility for the problem) speak to the importance of the fairness and legitimacy of adaptation processes. Paavola and Adger (2006, p. 602) suggest four principles that should underpin adaptation efforts: 'avoiding dangerous climate change, forward-looking responsibility, putting the most vulnerable first, and equal participation for all.' Unfortunately, some policies designed to relieve vulnerability such as providing technology or knowledge can exacerbate inequities due to unequal ability to access the improvements (Eakin and Patt 2011; Lemos and Dilling 2007).

The Barriers to Adaptation

Barriers to adaptation are theorized to be stumbling blocks or challenges, which, with the right circumstances, can be overcome. While planning has been a common adaptation response, several assessments have reported limited progress on the implementation of adaptation in practice (e.g., Berrang-Ford et al. 2011; Bulkeley 2010). Moser and Ekstrom (2010) have theorized that barriers to adaptation can occur at any point in the decision process such as during the information gathering, problem definition, developing options, implementing and evaluating aspects of the process. These barriers can arise from many of the same issues that plague other types of policy change processes: lack of leadership, inadequate attention to cross-system connections, mismatches in organizational missions and jurisdictions, and lack of adequate preparation for 'policy windows' that might occur to allow for a change in direction toward adaptive decisions. While some have assumed that developed countries will have higher adaptive capacity and thus undertake adaptation policy more easily, in fact, barriers to adaptation can occur in both developed and the developing world, and barriers in the implementation stage are particularly pervasive (Biesbroek et al. 2011; Dupuis and Knoepfel 2013).

The Limits to Adaptation

While barriers can potentially be overcome, the notion of limits implies a hard threshold beyond which adaptation is not possible (Adger et al. 2009). While a climate science framing of adaptation might suggest that uncertainty in climate predictions is a limit to adaptation (Dessai et al. 2009), Adger et al. (2009) instead suggest that adaptation limits may be reached as a result of both individual and social factors, as well as subjective values and place attachments that may be difficult to anticipate from a researcher's outside perspective. Attitudes, perceptions and tolerance for risk are important determinants of adaptation limits. For example, Grothmann and Patt (2005) found that how communities perceived their own capacity to adapt to flood risk affected whether or not they actually possessed adaptive capacity and felt empowered to make changes to adjust to environmental risks. Similarly, Wolf et al. (2009, p. 190) found that elderly people often felt helpless in the face of heatwave risk, stating, 'there's nothing you can do'—a perception with serious implications for vulnerability. Dow et al. (2013) propose an actor-centric definition of adaptation limits. They point out that actors, whether individuals, corporations or governments, have different perceptions and experiences with risk, and these will influence the way they categorize risks with respect to climate change and the need to adapt. Intolerable risks (threats to a valued outcome) combined with lack of adaptation alternatives become defined as an adaptation limit. Dow et al. (2013) further suggest that attitudes toward risk for valued objectives can be categorized as acceptable, tolerable and intolerable, and propose that adaptation limits are reached when an individual or community can no longer achieve valued outcomes in the face of intolerable risk even with any available adaptive action. A closely related concept is that of the adaptation 'frontier,' which Preston et al. (2013) describe as the 'domain between a socio-ecological system's safe operating space and its unsafe operating space' where it is still possible for adaptation decisions to affect how the system evolves, whether toward safety or danger. Moreover, the physical system has been characterized as having 'tipping points' (Lenton et al. 2008) where key climate system or ecosystem values irreversibly shift from one state to another, potentially leading to the need for societal transformation rather than simply incremental adaptation (Kates et al. 2012). While not explicitly linked to the literature on adaptation limits, the recent development of the concept of 'planetary boundaries' and a 'safe operating space for humanity' would imply as well that there are sets of conditions under which humanity will no longer thrive, and that our governance mechanisms should strive to keep the earth within these boundaries (Rockström et al. 2009).

HOW MIGHT THESE DIFFERENT WAYS OF THEORIZING ADAPTATION AFFECT GOVERNANCE?

Adapting Lemos and Agrawal's (2006, p. 298) definition of environmental governance, we might say that governance for adaptation is 'the set of regulatory processes, mechanisms and organizations through which political actors influence [adaptation] actions and outcomes. Governance is not the same as government. It includes the actions of the state and, in addition, encompasses actors such as communities, businesses, and NGOs.' As much of this volume has stated, governance relevant to climate more generally is

occurring through a wide variety of actors at different levels and in many different types of venues (Lederer, Dingwerth and Green this volume). The same is true for adaptation specifically (Adger et al. 2005).

While the importance of the nation-state and international policy processes has been acknowledged in moving forward action on climate adaptation (Adger 2001; Lemos and Agrawal 2006; Liverman and Billett 2010), it is clear that many of the actions and actors involved in accomplishing adaptive actions are situated at the subnational scale (Adger et al. 2005; Urwin and Jordan 2008). Theory and practice in adaptation governance have focused on two main scales thus far: the nation-state (in the context of National Adaptation Programmes of Action, participation in the United Nations Framework Convention on Climate Change and Kyoto Protocol) and the local, whether in an urban or rural setting. Actors and decisions at these two disparate scales are often connected in the case of adaptation—while 'adaptation is necessarily local' (Corfee-Morlot et al. 2010, p. 170), laws, funding, mandates and actors beyond the local level can greatly influence whether or not adaptation actions can be implemented (Urwin and Jordan 2008). However, a survey of cities currently undertaking adaptive actions for climate change found that most cities that are pursing adaptation do so for internal reasons, and not as a result of a higher directive or requirement (Anguelovski and Carmin 2011). Motivations for climate adaptation include perception of a threat, desire to achieve internal agendas, or a desire to show leadership or enhance the reputation of the city (Janković this volume; Anguelovski and Carmin 2011).

It is not known whether completely *new* institutions or forms of governance are necessary to achieve adaptation, but Huntjens et al. (2012) have suggested that *successful* governance of adaptation depends on institutions that embody certain characteristics such as flexibility, reflection, learning and innovation in order to deal with the uncertainty, complexity and surprise that climate change will bring. The fact that many of the institutions and organizational structures currently in place to manage fluctuations in existing environmental resources and hazards have often been found to be rigid or unable to incorporate new information (e.g., many in the water supply arena, flood management, etc.) or reach different outcomes suggests that new forms of governance or at least new institutions might indeed be warranted. Non-governmental actors have been essential to the process of climate policy development and governance for both mitigation and adaptation, especially at the local scale (Bulkeley 2010). Learning and support can come from the formation and activation of informal or even formal networks such as ICLEI (in the case of climate mitigation and adaptation) and often serve to link actors across scales (Bulkeley 2010; Birkmann et al. 2010).

HOW HAVE EFFECTIVE RESPONSES FOR CLIMATE ADAPTATION BEEN THEORIZED?

In the context of adaptation, much has been theorized about adaptive capacity, or the *potential* or *ability* of societies to adapt to the effects or impacts of climate change (Smit et al. 2001). Adaptive capacity is seen as a key determinant of vulnerability (vulnerability in turn defined as susceptibility to harm, in other words the condition that signals the

need for adaptation), and 'societies which are able to respond to or cope with change quickly and easily are considered to have high "adaptability" or "capacity" to adapt' (Smit et al. 2001, p. 283). Yohe and Tol (2002) suggest that there are several determinants to adaptive capacity, including the range of technological options, the distribution and availability of resources, the structure of institutions, the allocation of authority for making decisions, human capital, social capital, access to risk-spreading processes, ability to manage and decipher the credibility of information, the credibility of decision-makers and public perceptions of local impacts.

Governance and institutional mechanisms are thought to be especially critical elements of adaptive capacity, although empirical evidence supporting this supposition is rare (Engle and Lemos 2010). In the water sector, a set of design principles for the governance of climate adaptation has been put forward by Huntjens et al. (2012). These principles include clearly defined boundaries of who is involved and entitled to use the resource, equal and fair distribution of risks, costs and benefits, mechanisms to enhance participation in collective choice decisions, conflict resolution and prevention mechanisms, polycentric governance, robust and flexible processes and policy learning. In an empirically based case study in Brazil, Engle and Lemos found that there are likely tradeoffs among desirable governance characteristics, and that some elements might be maximized at the expense of others but still lead to higher adaptive capacity overall. Pahl-Wostl (2009) has emphasized the importance of social learning, flexible mechanisms and contextually specific solutions developed with all affected parties as necessary to effectively design and deploy adaptation governance mechanisms in the face of the reality of complex situations on the ground. She states, however, 'it is still an open question how to overcome the state of single loop learning [incremental improvement of established routines] that seem to characterize many attempts to adapt to climate change' (Pahl-Wostl 2009, p. 354).

THE NEED FOR ADAPTATION: IRRECONCILABLE DIFFERENCES?

Does climate change pose an imperative for adaptive action to reduce the likelihood of harm to humans and non-human species? Or is adaptation a normative ideal that exists as a theoretical construct but a difficult concept to reconcile with the reality of a diverse population with divergent values and experiences of risk? Looking to analogs of how civilizations have adapted to changing climates over the centuries, one would expect a range of answers to this question. The most challenging aspect of adaptation in the face of intolerable risk in particular, is how much society is able to take on as anticipatory action, versus simply engaging with adaptive or transformative adaptation as they emerge in reaction to climate events and underlying trends in mean climate. Even if populations accept the risk as understood by technical experts, some will take the view that no action is necessary in advance.

While many approaches to analyzing and informing adaptation theory and practice recognize the diversity of participants and perspectives within each context, the challenge this poses to collective action for adaptation cannot be understated. As Mike Hulme eloquently asserts in his book, *Why We Disagree About Climate Change*:

from different vantage points [. . .] the idea of climate change carries quite different meanings and seems to imply quite different courses of action [. . .]. If we are to understand climate change and if we are to use climate change constructively in our politics, we must first hear and understand these discordant voices, these multifarious human beliefs, values, attitudes, aspirations and behaviors. (Hulme 2009, p. xxvi)

These underlying differences are not necessarily reconcilable or resolvable by providing more science or information, and are fundamental to our makeup as people. By inference, adaptation to climate change may well take on very different forms and shapes depending on the location, and success may look very different in different places. Attitudes toward particular solutions may differ as well among populations, and make convergence to any single solution extremely unlikely (Verweij et al. 2006; Hulme 2009). Kahan and colleagues (2012) have demonstrated that opposing worldviews rather than scientific literacy explain differences in perception of the risk that climate change poses. They suggest as long as climate change is inextricably linked with cultural meanings (Hulme this volume), it will be challenging to reach collective solutions that address the risks posed by climate change and therefore secure the common interest.

How are actions then to be reconciled across such a diverse set of views about nature, climate and humans' role in adaptation? While diverse values may place limits on adaptation options (Adger et al. 2009), O'Brien (2009) identifies the importance of values in determining which adaptation options or stances might be preferred, and notes how widely value stances can diverge as well as change over time. She suggests that 'the challenge then is to identify adaptation strategies that acknowledge and address a spectrum of values. If this is not feasible, it is important to identify value conflicts and consider whose values count' (O'Brien 2009, p. 177). While that latter conclusion is not necessarily unique to adaptation, to satisfy other criteria for both effective and equitable adaptation it may be a new imperative to make those conversations about 'whose values count' explicit and transparent.

The core dilemmas for adaptation governance are nicely described by Nicholson-Cole and O'Riordan (2009, p. 368) for the case of communities located on the eastern coast of the United Kingdom, where the central government's former policy to engineer the coast with structures to defend against coastal erosion has shifted in recent years to one of maintaining a 'more naturally functioning coastline.' This policy shift pitted national interests in becoming more adaptive to environmental changes against local communities who preferred the status quo, left the affected coastal communities with few alternatives and resulted in near universal local rejection of the policy, accompanied by a feeling of distrust in the process, powerlessness and increasingly combative public dialogue.

Consideration of tradeoffs between alternatives is a natural component of policy analysis, but rarely are the full extent of tradeoffs between efficiency, equity and long-term ecological integrity discussed explicitly in policy development (Eakin et al. 2009). The lessons from experience in developing adaptive strategies on the ground in the UK (Nicholson-Cole and O'Riordan 2009), Pacific Island states (Barnett et al. 2013) and the Netherlands (Roth and Warner 2007), to name a few, suggest that outcomes for various groups in society are not equal.

CONCLUSION

This short review of the state of adaptation theory and practice suggests that the governance challenge for adaptation is neither straightforward nor easy, nor will it be necessarily 'no regrets.' It has been suggested that climate change is not a 'solvable' problem, but rather one that we live with, engage with, learn from, and apply clumsy solutions to (Verweij et al. 2006; Hulme 2009). Clumsy solutions are those that manage to triangulate among the various value sets and preferences to emerge with a decision that may not be elegant, but may allow some movement toward a less vulnerable society. Clumsy solutions also imply another critical element of public decision-making and communication—the need to shift to a more transparent and interactive form of interaction between decision-makers and members of the public about conceptions of risk, preferences for various tradeoffs and the real state of knowledge about future conditions and our ability to estimate consequences of current decisions. Rather than confidently choosing courses of action that are labeled 'no regrets,' can we envision a governance environment of experimental trial and error, being able to revisit decisions and attempting adaptive management? How would communication change in such an environment? Would decisions still seek to be 'robust' or would we move to a language infused with concepts of flexibility and adjustment? Decisions would still need to thread a delicate path between accountability and flexibility, effectiveness and fairness, inclusiveness and context-specificity. But a transparent, flexible, learning-by-doing approach by decision-makers attempting to govern for adaptation to climate change may be the only practical way forward in the face of deep uncertainty and fundamentally irreconcilable value differences.

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