

Adaptive management of the global climate problem: Bridging the gap between climate research and climate policy

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1. The Global Climate Problem: A Role for Adaptive Management?

Like many environment and resource issues facing policymakers, the problem of climate change is plagued with uncertainty regarding its precise causes, severity, and long-term implications. Feeding this uncertainty is the sheer complexity of the climate change challenge, with manifold causes and consequences that range from the individual and local to the regional and global levels. Effective policy responses—in terms of both mitigation (reduction of greenhouse gas concentrations) and adaptation (responses to inevitable changes to come)¹—are therefore difficult to formulate, and at best are often based on educated guesses.

The way in which climate scientists and policy makers have traditionally viewed the relationship between these three issues—uncertainty, adaptation, and mitigation—is quite clear. Uncertainty in the context of the climate problem falls within the domain of scientific research, and efforts aimed at reducing it have spanned the oceans (e.g., the development of large-scale ocean circulation models), atmosphere (e.g., models of atmospheric circulation), and land (e.g., measuring the carbon storage capacity of agricultural and forested land). Adaptation and mitigation, on the other hand, have been within the purview of the climate policy community and are largely reactive in nature to an ever widening, often conflicting, and essentially rudderless (from a policy making perspective) array of scientific studies. Viewing the relationship between uncertainty, adaptation, and mitigation in this way is problematic because it discounts the importance of climate policies themselves as a means of reducing uncertainty about the overall climate system. Much like laboratory research in biology complements field studies in ecology, so too can relatively large-scale manipulations of the climate through the implementation of “experimental” policies complement the fleet of more traditional research being conducted by climate scientists.

The concept of “adaptive management” (Holling 1978; Walters 1986) provides a theoretically appealing framework for strengthening the relationship between climate policy and climate science. Adaptive management proceeds based on “experimentation” through simultaneously implementing varied management efforts and then comparing their results to test clearly formulated hypotheses about the behavior of complex systems. Experimentation in this sense goes beyond management through trial and error and casual observation; it is structured and

¹ Climate change policy has traditionally focused on mitigation, however slow progress in this area has placed adaptation squarely on the agenda. For the first time, adaptation was given equal status at the latest Conference of

theoretically driven, designed to elicit specific responses from systems under study such that new knowledge can be incorporated systematically into future treatments and, more importantly, policy decisions. Briefly, adaptive management can be thought of in two phases: the challenging task of institutionalizing a framework in which intentional and varied policies may be implemented, and the relatively easier task of learning over time by monitoring the responses of the system on which the varied experimental “probes” have been enacted.

The appeal of adaptive management rests on its ability to inform the judgments of managers and policy makers faced with complex problems and high levels of uncertainty. The management objectives of adaptive management, therefore, go beyond simply maximizing utility (environmental or human) relative to a previous baseline under a given management option to also include learning over time about complex and uncertain systems. While this experimental focus might be especially appealing to scientists, it is not an effort to develop abstract scientific models divorced from real people. In contrast, adaptive management recognizes that managed systems present moving targets influenced largely by human drivers and, therefore, explicitly incorporates human factors into management experiments (Holling 1993).

There are at least three reasons to believe *a priori* that adaptive management is a useful way to approach the problem of global climate change. First, any policy approach to global warming must incorporate the interaction of human behavior with the atmosphere, and vice versa. This point is obvious insofar as global warming is anthropogenic, but, more importantly, it is also true that mitigation and adaptation strategies themselves will interact with each other and with natural variables, creating a complicated dynamic of cause and effect where most important variables are both exogenous and endogenous. Adaptive management is well suited to incorporating this concern with the human-environment nexus.

Second, adaptive management is appealing because of the sheer complexity of the climate change problem coupled with the need to make management decisions under uncertainty. Even after over a quarter century of intense research, questions linger regarding the magnitude of the climate change, how large those impacts will be, who will be affected, and what mitigation and adaptation schemes will be most effective. Applying adaptive management to climate policy could provide policymakers with the flexibility needed to proceed and to learn over time, a

preferable alternative to the current stalemate in many countries where uncertainty leads to incrementalism or inaction. Adaptive management may be especially valuable since many regulators have no past experiences with climate change and its consequences from which to draw analogies and lessons.

Finally, adaptive management is inclusive and flexible in terms of the precise goals of climate change policy and the means used to achieve those goals. By definition, the approach seeks to apply a variety of policy treatments to a problem. As such, it could be used to pursue a range of policy goals in the areas of both mitigation (e.g., emissions reductions, farming practices and forestry) and adaptation (e.g., accommodating changes in temperature and precipitation patterns, planting new crops and protecting biodiversity, building seawalls to protect coastal areas from flooding). This flexibility and inclusiveness is appealing from a political and practical standpoint insofar as different managers—at the international, national, sub-national, and individual levels—have different goals when it comes to climate change policy depending on their distinct values and incentives.

2. Challenges to Adaptive Management

Despite its theoretical potential, even those who advocate adaptive management in principle recognize that its actual implementation, irrespective of context, poses considerable practical and political challenges (Lee 1999; Walters 1997; McLain & Lee 1996). These challenges stem from potentially high costs associated with developing initial global, regional, and local frameworks for the implementation of adaptive management and take three fundamental forms: spatial variability in political, social, and economic systems; political inertia; and the implications of inequitably distributing the costs and benefits of alternative management efforts.

First, successfully implementing adaptive management involves overcoming the tendency in more traditional resource management to focus on temporal rather than spatial variation in policy treatments. Most resource management efforts tend to be remarkably similar over broad temporal scales, which are punctuated by relatively rapid paradigm shifts. These shifts are accompanied by relatively little or no attention to monitoring and comparison across both spatial and temporal scales. Subsequently, future changes in management occur only with the arrival of additional crises. The World Bank, for example, has gone from neglect of forest issues to front lining them in the early 1990s (Wade 1997), only to neglect them again in more recent years. As

with most lending and planning, rather than spatially diverse but temporally long-lived objectives, there has been a tendency instead towards encouraging implementation of fairly specific, and sometimes fad-driven management options. In the climate change debate, this tendency is institutionalized call for no-till agriculture despite significant concerns about its short and long-range effectiveness, and in current incentives in the Kyoto Protocol to initiate weakly defined "clean" growth and forestry projects in the developing world. Further, the existing treaty does not provide clear direction for incorporating the learning that can occur over space, as policies adopted today reveal diverse results in differing areas. For example, while individual countries are developing national level emissions monitoring systems, and numerous governments and non-government organizations are developing methodologies to measure carbon abatement and mitigation, the inertia of the Kyoto framework virtually guarantees that policies will not be adjusted before the next negotiating period.

In contrast, adaptive management requires simultaneous implementation of varied treatments in different places over long periods of time (Walters 1986). Reorganizing the institutions of resource management from an emphasis on temporal, rapidly changing strategies to those which emphasize spatial variability over a longer time period requires a retooling of an entrenched and difficult-to-move management ethos and bureaucratic structure. While climate change policy in general, and the Kyoto Protocol process specifically, could embrace and potentially benefit from applying the principles of adaptive management, the structure of Kyoto provides no inherent incentive for nations to adopt it them.

From a political perspective, concerted action—and by extension adaptive management—on a global scale is made virtually impossible by the fact that national political leaders are naturally protective of their sovereignty, preferring to maintain as much policy autonomy and control as possible. This is natural in the face of both international competition and domestic demands on the state, which interact to shape the ever-changing incentives of state leaders (Putnam 1988). So, too, the long-term nature of consistent policy treatments in adaptive management exceeds the typical terms of most political regimes. In sum, elected officials are notorious for their short time horizons and their greater concern with personal gain (votes and "rents") than with effective policy, thereby limiting the potential for implementing adaptive management (Lee 1993).

Distributive and ethical issues also inhibit the transition from ad hoc policy making to a framework for adaptive management. By implementing intentionally varied management

practices, local communities may be compelled to adopt policies that may or may not be beneficial for them. Indeed, by definition some would be asked to pursue strategies that are designed to produce unknown or even harmful effects (or such strategies may be imposed upon them). This is especially risky in areas where local communities are fragile and vulnerable (van Eeten & Roe 2002). Imposing potentially detrimental policies on communities makes sense from the perspective of a grand, controlled experiment that produces national- and international-scale gains, but does not accord with norms of social justice.

3. Climate Change: The Ideal Adaptive Management Scenario

Although the barriers to implementing adaptive climate management appear insurmountable, interestingly, current climate policy actually has already overcome many of the most difficult of barriers. Spatially varied management “probes,” or experiments, are already in place as a result of the multitude of competing and overlapping sovereign political actors and institutions. Likewise, the global economy in combination with regional variability in climate already distributes costs and vulnerability across communities and places. For example, different types of climate mitigation projects have already been undertaken in different regions of the world (i.e. forestry projects in the tropics versus energy projects in China). In contrast to the active implementation of experimental treatments called for by adaptive management purists, these spatially varied experimental probes are not the result of thoughtful and intentional manipulation. Instead, the experiments have been stumbled into quite by accident. Still climate scientists and policy-makers ought to take advantage of the happenstance that has created the wide-ranging series of global experiments on climate policy by instituting an intentional, international effort aimed at learning from these experiments.

This effort, we argue, is the relatively easier to implement component of adaptive management: a way of thinking that proceeds based on the imaginative synthesis of information obtained by studying the effects of existing, quasi-experimental climate policy probes. Take Canada, for example, where in December 2002 the Parliament ratified the Kyoto Protocol. Rather than designing innovative and experimental policies that may help to advance knowledge gleaned from similar global systems, a view from within Canada’s climate change plan (Government of Canada 2002) reveals what amounts to little more than incremental changes to existing Canadian climate policies. But, viewing the Canadian plan from the outside does reveal policy treatments that differ substantially from other nations with similar geographic and physical

features; examining these differences within the framework of adaptive management can enhance social learning.

Likewise, varying community vulnerabilities, both to climate change and climate policy, have led to a range of locally developed responses and practices. What remains absent is a responsive information network that would allow communities to track and communicate their experiences—especially with distant, equally vulnerable groups—and to defend such local experimental decisions in national and international arenas. The results of carbon sequestration experiments in Indian social forestry, for example, championed precisely because of local community vulnerabilities (Poffenberger et al. 2002), are unknown to those conducting similar efforts elsewhere or even to those coordinating national and international climate governance regimes. As a result, such experiments are more vulnerable to elimination and change in an ad hoc national context, despite calls in the scientific literature for just these sorts of interventions (Niles et al. 2002).

The key to adaptive management rests on overcoming the tendency to defer difficult decisions and radical departures from existing policies until either more information is available or natural events produce more favorable outcomes. Climate managers and policy makers must develop new ideas by explicitly seeking out analogies or similarities between problems of current concern and others where advances have been possible (Walters 1986). A coordinating body working at the international level could facilitate this process by playing the role of an information clearing-house, advisory board, and monitor for climate management. Such an institution would foster long-term consistency and help translate varying experiences with climate management into new policy recommendations.

The Intergovernmental Panel on Climate Change holds considerable promise as the reporting body for assessing the wide range of experiments that have occurred around the world. The IPCC and the Secretariat of the UN Framework Convention on Climate Change both should be strengthened to provide concrete guidance on methods and approaches for adaptation and management. Currently, the IPCC essentially mimics the non-adaptive policy world by concentrating huge amounts of effort from key scientists around state of the science reports every 5 years, and special reports that react to whatever current issues are deemed important. Instead, the IPCC should re-tool to provide a continuous stream of interpretation of adaptive management experiments that are occurring. Beyond specific IPCC and UN initiatives, what is

called for at a minimum is a new and more adaptive approach to decision-making amidst climatic uncertainty. Since the nations of the world have long since paid the bulk of the steep initiation fee for implementing adaptive management, the opportunity to learn from it can and should be seized.

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