

## Limits and barriers to adaptation: four propositions<sup>1</sup>

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### Summary

Present understanding of processes of adaptation to climate change suggests that actions occur when risks are known and when resources are available to minimise these risks or reduce vulnerabilities. In this Briefing Note we examine whether there are limits to adapting to climate change utilising the concepts of thresholds and barriers. We *define thresholds* of change in physical and ecological systems as those beyond which irreversible change occurs and *define a barrier* as a political, social, or behavioural obstacle to change. We review insights from history, sociology and psychology of risk,

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economics and political science to *develop four propositions* concerning limits to adaptation. First, the definition of limits to adaptation depends on the goals of adaptation, which are underpinned by diverse and incommensurable values. Second, adaptation may be limited by uncertainty around future foresight of risk. Third, social and behavioural characteristics act as deep-seated barriers to action. Fourth, adaptation is limited due to irreversible loss of places and identities that people hold dear. We conclude that the implication of these propositions is the need for pluralist and inclusive decision-making to promote learning and legitimate decision-making.

### Adaptation to climate change ... and limits?

Individual and societal adaptation to climate is nothing new, neither as an empirical reality nor as a theoretical construct. Adaptation to climate change has become part of the contemporary discourse about the politics of global warming. It has been enshrined in the policy debate through its appearance in Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC), where the ultimate objective of the Convention concedes that adaptation to climate change in relation to food production, ecosystem health and economic development can and will occur. Although much of the earlier international climate policy debate in the 1990s and early 2000s was pre-occupied with mitigation, the past decade has seen a

growing attention given to adaptation – both its practice and its politics (e.g. Parry et al., 1998; Pielke et al., 2007). The EU released its first Green Paper on adaptation in July 2007, "*Adapting to climate change in Europe – options for EU action.*"

Notwithstanding the potential insights offered by historical antecedents of change in human societies and their environment (e.g. from Huntington, 1915, 2001; to Diamond, 2005), the contemporary discourse of climate change adaptation has two quite distinctive foci. First, how can adaptation to climate change be facilitated and enhanced, given that there are at least several generations in the twenty-first century which will experience progressively changing climates? Second, given that efforts at mitigating further global climate change are contested (in desirability, effectiveness and feasibility), are there limits to adaptation by society beyond which politically or ethically undesirable outcomes occur? This latter question is bound up in the discourse of 'dangerous climate change', where the implication is that adaptation by society is limited, in some way, once climate change crosses some danger threshold. Schellnhuber et al. (2006), Stern (2007) and Schneider et al. (2007) are three recent high profile reviews which have followed this line of reasoning. An important policy discourse, at least in Europe, suggests that such a threshold is 2°C of global warming above pre-industrial levels. This target is in effect chosen to induce urgent action, given the high likelihood that this threshold will be

crossed in coming decades (Schellnhuber et al., 2006).

This Briefing Note examines the assumptions that underlie current notions of limits to adaptation, referring to the concepts of thresholds and barriers. What do we mean by a limit and what do we mean by adaptation? Are limits immutable, imposed on society by physical reality, a form of environmental determinism, or are limits purely social constructions, infinitely renegotiable by each generation? And what is adaptation to climate change seeking to accomplish, for whom, by what means and at what cost?

#### **Four Propositions**

We review these questions from a range of perspectives, contending that many previous commentaries have considered adaptation from a narrower standpoint: predominantly ecological, physical or economic and technical. We put forward our case by articulating four propositions which are designed to interrogate the published literature on adaptation, but also to challenge the existing research in this area. Our purpose is for these propositions to open up a much broader debate about what we mean by the limits of adaptation to climate change; we suggest that they are defensible and justifiable.

We propose initially that it is useful to identify two aspects of potential limits to adaptation: thresholds and barriers. A *threshold* refers to a state in sensitive ecological or physical systems beyond which change becomes irreversible. Such

thresholds are beginning to be identified in ecological literature in particular and refer to habitat ranges, ecosystem functions and threats of extinction of particular species (Parmesan and Yohe, 2003; O'Neill and Oppenheimer, 2002; Fischlin and Midgeley, 2007). A *barrier* to adaptation exists as a constraint because of the way a society is organised or because of the values it propagates. These organisational arrangements and social values are likely to vary widely within and between societies and are likely to change over time. Values in this context refer to the personal or societal judgement of what is valuable and important in life. A *limit* to adaptation implies an absolute barrier, i.e. one that is unsurpassable. Values translate into action because they frame how societies develop rules and institutions to govern risk, social change and the allocation of scarce resources (Ostrom, 2005). Whether or not a threshold or a barrier should be seen as a *limit* on adaptation is, therefore, a contingent question. It all depends on goals, values, risk and social choice.

***Our first proposition is that any limits to adaptation depend on the ultimate goals of adaptation.***

We see an important distinction between (i) approaches that seek to define risks of climate change that are tolerable, and hence that avoid system failure and unacceptable cost, and (ii) other approaches that see adaptation as part of a wider process to enhance the well-being of society. Whatever the social goals of adaptation, the existence of diverse and incommensurable values held

by the actors involved in decision-making around adaptation can act as limits if these values are not deliberated. The values that underpin adaptation decisions become more diverse and contradictory as one moves from small-scales and single agents to larger-scales and multiple agents. The normative issues of whose values count, the prevalence of externalities and the changing preferences over time for well-being and risk avoidance need to be made explicit.

***The second proposition is that adaptation is limited by uncertainties associated with foresight of future climate change.***

These uncertainties may relate to the provisional nature of scientific knowledge about future climates or about the contested nature and status of such scientific foresight. Different social and organisational cultures, and sub-cultures, approach foresight in different ways. These differences in the status of knowledge claims about future climate can have an important bearing on the way in which adaptation decisions are made, and hence may act as limits to adaptation.

***The third proposition is that social and individual factors act as barriers to adaptation rather than as limits.***

These barriers operate at individual and at collective decision-making levels. There are various cognitive barriers to adaptation including, for example, the observation that vulnerable individuals perceive themselves to be powerless to act in the face of risk. At the policy level, adaptation policies, like

many other areas of public policy, are constrained by inertia, cultures of risk denial, and other phenomena well known in policy sciences. Even the nature of the opportunities for change is contested. On the one hand, the evidence is ambiguous that individual high profile events cause public demand for change and create policy windows for governments to exploit (Kingdon, 1995). On the other hand, Moser (2005) reviews the evidence that governments deal adequately with so-called 'creeping' environmental problems and finds governments' attempts wanting coherence and effectiveness. Whatever the empirical evidence on triggers of change, it is clear there are significant barriers to adaptation for both individual action and collective response.

We argue that these barriers are often not accounted for in programmes advocating technologically feasible, and apparently sustainable, adaptation. While lack of resources for the most vulnerable is often cited as a barrier to effective adaptation, other financial mechanisms and market failures reduce potential efficacy of adaptation. Uncertainty in impacts may lead to increasing upward pressure on insurance premiums and possible withdrawal of insurance cover in areas at risk from catastrophic impacts (Linnerooth-Bayer and Amendola, 2000; Mills, 2005).

***The fourth proposition is that threats to undervalued cultures, lifestyles, icons and places represent limits to adaptation.***

This proposition is based on the observation that cultural assets are unique in place and time and hence most impacts that result in loss are in some sense irreversible. This proposition also raises the issue of values that are largely independent of material assets, but rather rely on perceptions and representations of the world around us. This issue is under-researched and needs to be explored further, not least because culture is not static – all cultures and places change over time – and because what is deemed to have intrinsic social value also changes over time.

#### **Implications**

We have suggested that limits and barriers to adaptation are contingent and contextual in nature. We make this case through reference to cognitive, social and political process and to the limited understanding of how some of these operate. There are, however, real and increasingly identified thresholds in the impacts of climate change – these are non-linear changes in ecosystems and physical systems brought about through transitions in ecosystem function and process, often exacerbated by feedbacks at global and local scales (e.g. Vaughan et al., 2003; Scheffer et al., 2006). There are equally unknown feedbacks and uncertainties in societal responses to both marginal and non-linear change that may constitute limits to adaptation.

We have argued that these issues - associated with values, foresight and risk perception - and the contested goals of adaptation are likely to mean that

adaptation, even to smooth linear impacts, will themselves not be smooth or costless. These challenges represent, we argue, significant barriers to adaptation. Whether these barriers are in any sense immutable and act as limits to adaptation we suggest is largely an empirical question and dependent on context. Some policy issues and marginalised communities, for example, exhibit high inertia and climate change impacts are likely only to exacerbate already inequitable and unsustainable development. But other barriers to adaptation, for example, associated with uncertain foresight maybe more tractable to intervention and management.

What are the implications of this set of observations and propositions for policy and individual action to adapt to climate change?

The first implication arises from our observations that diverse and contested values underlie the adaptation response. Given diverse values of diverse actors, there is a compelling need to identify hidden values and interests in advance of purposeful adaptation interventions. As a consequence, **we suggest that there is a requirement for pluralism in recognising diverse values and the need for deliberative democratic platforms for adaptive action involving wide sets of stakeholders.** We have argued here that locality, place and cultural impacts and icons are likely to loom large in adaptation decisions.

This paper identifies social and individual characteristics as deep-seated barriers rather

than as limits to adaptation. **The second implication of our propositions is the requirement for pluralism in recognising the existence of diverse barriers to adaptation.** This could involve shaping communication about climate impacts and other initiatives so as to enable and empower individual and private adaptation. Moreover, to achieve systemic changes in attitudinal orientation, deep cultural adjustments may be required. Shared values centred around pro-environmental, ecocentric and altruistic orientations can and do give rise to community and individual initiatives.

Since such values currently neither reflect mainstream views nor underlie societal structures and institutional arrangements, making explicit the existing values shaping current preferences and underlying decisions may serve to foster more open debates about future choices, decisions and policies. Experience of such policy initiatives show that adaptive management is often expensive, open to capture by powerful groups, and unpredictable in outcome. **On balance, however, decentralised and small-scale decision-making concerning adaptation is likely to allow greater autonomy to resolve dilemmas around incommensurable values.**

We suggest that an adaptable society is characterized by foresight, flexibility, awareness, and the ability to change. **This ability to adapt is determined in part by the availability of technology and the capacity for learning, but is**

**fundamentally based on values of equality and social justice.** This includes issues of access to resources, knowledge and services and the negotiation of values. The issues we raise in this Briefing Note

represent, we argue, the core problems of adaptation decision-making at all institutional and political scales, and across all cultures.

## References

- Diamond J (2005) *Collapse: how societies choose to fail or survive*. London: Penguin.
- Fischlin A and Midgeley G (2007) Ecosystems, their properties, goods and services. In M.L. Parry, O.F. Canziani, J.P. Palutikof, C.E. Hanson, P.J. van der Linden (eds.) *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.
- Huntington E (1915, 2001) *Civilisation and climate*. Hawaii: Reprinted by the University Press of the Pacific, Hawaii, 333pp.
- Kingdon JW (1995) *Agendas, Alternatives and Public Policies*. New York: Harper Collins.
- Linnerooth-Bayer J and Amendola A (2000) Global Change, Natural Disasters and Loss-sharing: Issues of Efficiency and Equity *Geneva Papers on Risk and Insurance*, **25**: 203-219.
- Mills E (2005) Insurance in a Climate of Change. *Science* **309**: 1040-1044.
- Moser SC (2005) Impact assessments and policy responses to sea-level rise in three US states: An exploration of human-dimension uncertainties. *Global Environmental Change*, **15**: 353-369.
- O'Neill BC and Oppenheimer M (2002) Dangerous climate impacts and the Kyoto Protocol. *Science* **296**: 1971-1972.
- Ostrom E (2005) *Understanding Institutional Diversity*. Princeton University Press: Princeton.
- Parmesan C and Yohe G (2003) A globally coherent fingerprint of climate impacts across natural systems. *Nature* **421**: 37-42.
- Parry M, Arnell NW, Hulme M, Nicholls R and Livermore M (1998) Adapting to the Inevitable. *Nature* **395**: 741.
- Pielke R, Prins G, Rayner S and Sarewitz D (2007) Climate change 2007: Lifting the taboo on adaptation. *Nature* **445**: 597-598.
- Scheffer M, Brovkin V and Cox P (2006) Positive feedback between global warming and atmospheric CO<sub>2</sub> concentration inferred from past climate change. *Geophysical Research Letters* **33**, L10702, doi: 10.1029/2005GL025044.
- Schellnhuber HJ, Cramer W, Nakicenovic N, Wigley T and Yohe G (eds.) (2006) *Avoiding Dangerous Climate Change*. Cambridge: Cambridge University Press.

Schneider SH, Semenov S, Patwardhan A et al. (2007) Assessing Key Vulnerabilities and the Risk from Climate Change. In M.L. Parry, O.F. Canziani, J.P. Palutikof, C.E. Hanson, P.J. van der Linden (eds.) *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press.

Stern N (2007) *Economics of Climate Change: The Stern Review*. Cambridge: Cambridge University Press.

Vaughan DG, Marshall GJ, Connolley WM, Parkinson C, Mulvaney R, Hodgson DA, King JC, Pudsey CJ and Turner J (2003) Recent Rapid Regional Climate Warming on the Antarctic Peninsula. *Climatic Change* **60**: 243-274.

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