

3 Thoughts on the context of adaptation to climate change

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Working Group II of the Intergovernmental Panel on Climate Change (IPCC 2007a) focused their attention on adaptation and vulnerability in their contribution to the IPCC's Fourth Assessment Report. It made the case that contemplating adaptation to climate change should no longer be dismissed as evidence that society is giving up on trying to ameliorate the problem at its source (by reducing emissions of heat-trapping gases of all sorts). Rather, the Working Group II report argued that adaptation must be included as an essential part of society's portfolio of responses to growing risks arising from climate change. Reports on adaptation to climate change released by the National Research Council of the United States (NRC 2010a) under the rubric of 'America's Climate Choices' adopted and reinforced this conclusion by, for example, recognising the evolving adaptation strategies of governments at all levels around the world. This is also true for the New York (City) Panel on Climate Change (NPCC 2010a, b) and the US National Climate Assessment. The latter contributed directly to President Obama's Climate Action Plan (White House 2013) by speaking of the necessity, if not the means, of increasing 'preparedness'.

*This essay relies heavily on Yohe (2010) and Yohe (2013), in thought as well as exposition.

Indeed, in language that was *unanimously* approved by all of the nations who have signed the United Nations Framework on Climate Change (word by word), the nations of the world closed their 'Summary for policymakers' for the Fourth Assessment Report Synthesis document by emphasising the necessity that decision-makers across the globe consider the concept of risk as their primary perspective in their international and national deliberations on responses to climate change. To be specific, they agreed that: 'Responding to climate change involves an *iterative risk management process that includes both adaptation and mitigation* and takes into account climate change damages, co-benefits, sustainability, equity and attitudes to risk' (IPCC 2007b, p. 22, emphasis added).

To be clear, national governments throughout the world have, by accepting this language, clearly stated their fundamental understanding of the urgency of responding with adaptation as well as mitigation *and* that managing risks associated with climate change must be the central theme in present and future planning and policy decisions concerning both. Moreover, they have identified critical criteria upon which they will weigh their options and they have recognised

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that 'mid-course corrections' must be anticipated as part of the process.

Societies notice many of the impacts of climate change by detecting increasingly intense and/or more frequent extreme weather events and attributing the observed change in weather to climate change. Long a part of the Reasons for Concern (beginning with IPCC 2001) under the title 'Risk of extreme weather events', modern analysis has carefully begun to assess relative confidence in statements of detection and attribution across extreme events by assessing evidence and agreement in the published literature (see Mastrandrea et al. 2010). These assessments are of course the foundation for using observed changes to support projections of further change over the next decades and centuries. Of particular importance here are extreme events such as heavier precipitation events (snow in the winter and rain in the summer), more intense coastal storms (at least with respect to their manifestation when they come ashore, impacts that are driven by observed and projected sea-level rise for all types of storms), and severe droughts, floods, wildfires and heat waves (with appropriate recognition of confounding factors, but also exposure of human and natural systems).

In these events, direct attribution to anthropogenic sources of climate change is difficult. The preponderance of evidence continues to lead IPCC and other assessments to focus on changes that can however, to some degree, be attributed to human activity. The magnitude of these changes will very likely be exacerbated over the near and more distant future as natural climate variability (through extreme events) is distributed around the increasingly worrisome central tendencies of climate change--especially since observed temperature increases driven by higher greenhouse-gas concentrations reflect only 50% of the corresponding equilibrium warming (Solomon et al. 2009). It follows that near-term decisions to mitigate climate change modestly (or not at all) may actually commit the planet to sudden, irreversible changes by the end of the century (Solomon et al. 2009; NRC 2010b).

Urgency in that regard is amplified by the emerging understanding that long-run equilibrium temperature is determined by the *maximum* of atmospheric concentrations (of greenhouse gases such as carbon dioxide calibrated in terms of carbon-dioxide equivalents; Solomon et al. 2009). Does this mean that converging to a lower concentration limit buys us very little? Probably, but to be clear the question raised here is 'Why should the planet waste resources to lower concentrations from an observed maximum if equilibrium temperature and therefore damages cannot be lowered significantly for thousands of years?' The answer is that even with a low discount rate, doing so would be a bad investment because temperature and associated damages will have been determined by higher concentrations. Investments designed to converge to a lower concentration target from above would produce only a few benefits that would likely be dwarfed by the mitigation costs of doing so.

Given this evidence, it is safe to say that climate *is* changing (the old normal is broken even if the new normal has not yet been established). In the absence of significant reductions in emissions of greenhouse gases designed to stabilise concentrations at some as-yet-undetermined (but higher than current) level, the climate will continue to change at an accelerating pace over the short run and into the longer run with growing, if uncertain, consequences. The manifestations of this change will therefore demand that more attention be paid to adaptation as part of plans to promote sustainable development, but without giving up on mitigation.

In interpreting this last point, it is essential to emphasise the fundamental linkages between adaptation (specifically with respect to climate change) and sustainable development more broadly defined (which includes responding to many other sources of societal stress). This point was made explicitly in chapter 20 of IPCC (2007a) where authors noted that then-recent work had confirmed the chapter 18 IPCC (2001) conclusion that any system's vulnerability to climate change, climate variability and/or any other external

stress is the product of exposure and sensitivity to that stress (or to multiple sources of multiple stress, for that matter). Nothing has really changed since. It is still the case that exposure and sensitivity can be influenced positively or negatively by individual or societal responses to climate change and/or other stresses. Reducing exposure and sensitivity as well as building capacity to adapt, in combination with reductions in greenhouse gases, remain among the essential elements of responses to manage climate risks.

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