

CORRESPONDENCE:

Boundary work

To the Editor — Extending the debate on interactions between climate science and policy, Morecroft *et al.*¹ provide a useful view from those who advise policymakers and environmental managers. Their point about turning policy into practice more often should be welcomed as part of a plan to communicate tangible examples of success, and ‘good news’ stories, to policymakers. This is particularly vital in light of Viner and Howarth’s Commentary², which highlighted the lack of practitioners’ knowledge in IPCC reports.

In combination with my recent Commentary³, these contributions warrant a careful unpacking of the concept of ‘boundary work’. In the context of enhancing the impact of climate science, boundaries may briefly be described as ‘socially constructed and negotiated borders between science and policy’⁴. Whilst researchers in science and technology studies originally tended to use boundary work in a defensive sense, where scientists keep out disciplines considered to be unscientific⁵, later scholars recognize the fluidity of a boundary, arguing that its position can be constructively coordinated⁶. Although not assessed in detail here, the concept of boundary work holds much resonance for climate scientists struggling to reconcile their role in policy negotiations.

Morecroft *et al.*¹ seem to argue for the maintenance of the scientific boundary, rigidly defending the traditions and methods of science against calls to be policy prescriptive. To keep the boundary between science and policy firmly in place, the authors suggest improving communication of science to non-experts, yet this is precisely what I contend is inadequate in isolation³.

I argue that policymakers widely understand the threat of climate change, but find it difficult to forge a policy agenda purely based on this realization in the midst of competing concerns. In my Commentary³, I promoted a constructive approach to boundary work: specifically, I suggested moving beyond merely defending scientific and technical rigour (which of course remains important), and called for the production of policy-relevant science. In doing so, I was clear to point out that better communication of knowledge alone is rarely influential, as the relationship between science and policy is seldom linear.

Researchers in science and technology studies recognize that constructive boundary work might sit uncomfortably with other scientists⁷, particularly those who consider that an inherent paradox results from promoting evidence to policymakers⁸.

Whilst acknowledging that there is a fine line between brokering, advocacy and being prescriptive⁹, I argue for a close engagement with the concept of boundary work from the scientific community. Further empirical testing and engagement with this topic will help illuminate more clearly what the role of the modern scientist should be in relation to policy formation, a question that has not been adequately answered thus far¹⁰. □

References

1. Morecroft, M. D., Crick, H. Q. P., Duffield, S. J., Macgregor, N. A. & Taylor, S. *Nature Clim. Change* **4**, 842–843 (2014).
2. Viner, D. & Howarth, C. *Nature Clim. Change* **4**, 848–850 (2014).
3. Rose, D. C. *Nature Clim. Change* **4**, 522–524 (2014).
4. Cash, D. *et al. Salience, Credibility, Legitimacy and Boundaries: Linking Research, Assessment, and Decision-Making* (Faculty Research Working Paper Series, John F. Kennedy School of Government, 2002).
5. Gieryn, T. *Am. Sociolog. Rev.* **48**, 781–795 (1983).
6. Bijker, W. E. *et al. The Paradox of Scientific Authority: The Role of Scientific Advice in Democracies* (MIT Press, 2009).
7. Jasanoff, S. in *Future Directions for Scientific Advice in Whitehall* (eds Doubleday, R. & Wilsdon, J.) 62–68 (Univ. Sussex, 2013).
8. Pullin, A. S. & Knight, T. M. *Environ. Evid.* **1**, 15 (2012).
9. Spierenburg, M. *GAEA* **21**, 125–134 (2012).
10. Sutherland, W. J. *et al. PLoS ONE* **7**, e31824 (2012).

David C. Rose

Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, UK.

e-mail: dcr31@hermes.cam.ac.uk

CORRESPONDENCE:

A new social contract for the IPCC

To the Editor — Castree *et al.*¹ call for a new social contract that rethinks global environmental change research. Their “new intellectual climate” would encompass a deeper analysis of societies affecting and affected by global environmental change, as well as incorporating the often-overlooked focus of environmental humanities research on issues of values, rights, perceptions, trust and fear, among many other topics. These innovations hinge on a richer, more invigorated engagement of the environmental social sciences and humanities in global environmental change research, thereby yielding more diverse understandings and perspectives of Earth

systems. Castree *et al.* make excellent points, but their recommendations are unlikely to trigger changes in the climate change community without fundamental restructuring of the IPCC.

Disciplinary bias and organizational structure of the IPCC Working Groups for the Fifth Assessment Report (AR5) tend to inherently divide (rather than couple) natural and human systems. They are also dominated by natural scientists, while the humanities are almost entirely absent, and the participating social scientists are predominantly economists. The three IPCC Working Groups (WGI=science/nature; WGII=science/society;

and WGIII = economics/policy) do not promote integrative, transdisciplinary approaches in line with more than a decade of research on coupled natural–human systems or social–ecological systems^{2,3}. Instead, the structure separates nature from culture and privileges the natural sciences by making WGI solely about the physical science basis, authored predominantly by natural scientists. This arrangement will not yield the new intellectual climate Castree *et al.* promote. It also ignores previous pleas, including those in this journal⁴, that call for more humanities in global environmental change research, that critique the IPCC’s physical science and

economics bias in the Third Assessment Report⁵, and that highlight AR5's neglect of indigenous knowledge⁶.

Our analysis of the Coordinating Lead Authors (CLAs) of the IPCC's AR5 exposes this continued bias towards natural scientists and economists, as well as the persistent absence of humanities research. As expected, CLAs for WGI consist almost entirely of natural scientists. Focused on human impacts, vulnerabilities, and adaptation, WGII is dominated by natural sciences, with 39 natural scientists (including 5 engineers working on physical environments), 25 social scientists, and zero humanities researchers as CLAs, according to our analysis. To put this in perspective for WGII on human systems, imagine if 61% of WGI CLAs on the scientific basis were from environmental social sciences and humanities disciplines. WGIII on climate change mitigation has stronger social sciences representation among CLAs, with 12 fitting broadly into natural sciences, 23 in social sciences, and zero in humanities. Yet, 18 of the 23 social scientists are economists, demonstrating the IPCC's narrow conception of social sciences. Overall, of the 99 CLAs in WGII and WGIII, there are none detected from the humanities. At a lower level of authorship, the WGIII AR5 methods chapter (Chapter 3) — which

outlines the principles, theories, and values underlying WGIII — does have one humanist (philosopher) as a lead author. This philosopher is among 16 CLAs, lead authors, and review editors, 13 of whom are economists.

The IPCC might yield broader impacts if it included environmental social sciences and humanities researchers from a much wider diversity of fields and approaches, as Castree *et al.* explain. Philosophers such as Dale Jamieson⁷, who analyses humans' cognitive capacity to grapple with global environmental change ethics and causation in climate change, and musicologists such as John Luther Adams⁸, who introduces weather through an ecology of sounds and emotions, can effectively uncover humanity's experiences with climate change and thus help adaptation and mitigation. But the IPCC's current disciplinary bias and organizational disjuncture is unlikely to change because IPCC authorship is by invitation only, from a group of natural scientists and economists who may not embrace the work of most environmental social sciences and humanities fields and who lack an understanding of which disciplines and individuals' credentials are valuable to climate change research. Such a transformation in the IPCC leadership and structure — to include environmental

social sciences and humanities researchers on equal footing with natural scientists and economists — would be a step towards implementing the goals of Castree *et al.* It would also provide a useful starting point for deciding how to communicate climate change research to a diversity of human populations living in profoundly different cultures, political-economic systems, and communities. □

References

1. Castree, N. *et al.* *Nature Clim. Change* **4**, 763–768 (2014).
2. Adger, W. N. *Prog. Hum. Geog.* **24**, 347–364 (2000).
3. Turner, B. L. *et al.* *Proc. Natl Acad. Sci. USA* **100**, 8080–8085 (2003).
4. Hulme, M. *Nature Clim. Change* **1**, 177–179 (2011).
5. Björström, A. & Polk, M. *Climatic Change* **108**, 1–22 (2011).
6. Ford, J. D., Vanderbilt, W. & Berrang-Ford, L. *Climatic Change* **113**, 201–213 (2012).
7. Jamieson, D. *Reason in a Dark Time: Why the Struggle Against Climate Change Failed — and What It Means for Our Future* (Oxford Univ. Press, 2014).
8. Adams, J. L. *The Place Where You Go to Listen: In Search of an Ecology of Music* (Wesleyan Univ. Press, 2009).

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Mark Carey*, Lincoln C. James and Hannah A. Fuller

Robert D. Clark Honors College, University of Oregon, Eugene, Oregon 97403, USA.

*e-mail: carey@uoregon.edu

COMMENTARY:

Facing the diversity crisis in climate science

Adam R. Pearson and Jonathon P. Schuldt

The climate movement is failing to engage a diverse set of stakeholders in efforts to address climate change, and a lack of diversity within the climate community itself may be, in part, to blame. Research-informed solutions are urgently needed to address the problem and help build a more inclusive and influential movement.

On 28 July 2014, a team of researchers led by Dorceta Taylor at the University of Michigan released a new report¹ on the state of diversity in the United States environmental sector. Their message is clear: despite rapidly growing racial and ethnic diversity within the United States and Europe on the whole, substantial racial and ethnic disparities

persist in the climate sector, even relative to other science and engineering fields.

The problem is urgent. According to US census estimates, racial and ethnic minorities now account for a majority of US births and 93% of the nation's population growth. And the United States is not alone. Nations within Europe and Australasia have experienced similar

demographic shifts² with the arrival of skilled migrants and humanitarian entrants. In the very near future, many developed nations will have a more diverse demographic makeup than ever before, at a moment when broad-scale cooperation to address climate threats is paramount — at both the national level, as countries consider major climate legislation, and at