

Clear need to act on global warming

Sir — David Victor¹ correctly points out reasons why M. I. Hoffert *et al.*² may have overstated the future need for carbon-free power, perhaps most significantly due to the vast potential for increasing energy efficiency. But I am troubled by Victor's conclusion that "taking action on global warming is akin to buying insurance with an unknown premium against unknown hazards" and that "what to do is unclear".

This neglects two important issues. First, there are widely accepted 'no regrets' strategies that improve the economy and help solve other environmental problems while simultaneously providing insurance against climate change. Such strategies, in particular improving energy efficiency, are often achieved at no net cost (or even with net savings)^{3,4}. So the 'premium' is zero, or

close to zero, and the hazards, although not precisely known, are insured against while providing other benefits.

Second, recent work on decision-making under uncertain conditions provides guidance for taking action on global warming. R. J. Lempert *et al.*⁵, for example, have modelled an adaptive strategy that makes midcourse corrections based on observations of the climate and economic systems. They find that such a strategy helps avoid the pitfalls of policies based on best estimates. Without knowing with certainty the climate sensitivity, the damages that will result from climate change, or the rate of technological innovation, we cannot choose the optimal policy and should instead create a strategy that allows for adaptation based on new learning. Problems for the

present thus include developing better options for massive greenhouse-gas reductions than are currently available and determining what observations ought to trigger their implementation.

"What to do" is not so unclear as Victor implies. Aggressive and immediate implementation of 'no regrets' efficiency improvements plus more research on carbon-free energy sources seems a responsible and conservative approach.

Susan Hassol

Aspen Global Change Institute, 100 E. Francis Street, Aspen, Colorado 81611, USA

1. Victor, D. G. *Nature* **395**, 837–838 (1998).
2. Hoffert, M. I. *et al.* *Nature* **395**, 881–884 (1998).
3. Reichhardt, T. *Nature* **389**, 429 (1997).
4. National Academy of Sciences. *Policy Implications of Greenhouse Warming* (National Academy Press, Washington DC, 1992).
5. Lempert, R. J. *et al.* *Climatic Change* **33**, 235–274 (1996).

Region-based citation bias in science

Sir — R. M. May¹ ranked countries according to their share of articles and the share of citations the articles received. As the ratio of the two indicators is less than unity in France, Germany, Italy and Japan, he claimed a lower-than-average quality of their publications. This might be the case if most of their papers were published in journals with low impact factor (IF); instead, however, we think that most papers receive less citations than they deserve even if they appear in journals with good IF.

To this end we have considered 206 international journals in 14 environment-related categories of the Institute for Scientific Information database and have analysed the citations received by Italian scientists. For each category, we have computed the Italian papers' IF as the weighted sum of the journal IFs according to the number of Italian papers in each journal. In 12 cases out of the 14 (94% of the journals), the Italian papers' IF is either equal to, or significantly higher than, the mean IF of the journals in the respective category. This shows that Italian scientists tend to publish in high-quality journals.

We then compared the number of citations received by each Italian article with the expected citation rate (XCR), that is, the average citation per paper based on the journal title, year of publication and type of document. As suggested by Barreto² and May³ himself, if there were no bias, the number of citations per article would not be significantly higher or lower than the XCR. However, this is not so (see Table 1).

Table 1 Statistics of undercitation for Italian environmental scientists

IF class	No. of papers	Proportion undercited	Significance, P
<0.4	314	0.67	<0.005
0.4–0.6	519	0.68	<0.0001
0.6–0.8	939	0.69	<0.0001
0.8–1.2	1,032	0.74	<0.0001
1.2–2	1,099	0.72	<0.0001
2–4	364	0.78	<0.0001
4–28	45	0.84	<0.0001

The number of papers in each IF class are shown along with the proportion of undercited papers (that is, XCR greater than total citations). Significance, Wilcoxon test.

A further clue to bias comes from analysing the scientific productivity at Ispra (Italy), the Joint Research Centre of the European Commission comprising mostly non-Italian environmental scientists. Although the IF is not higher than average, the number of citations significantly exceeds the XCR (Wilcoxon matched-pairs test, $P < 0.05$).

It is difficult to pinpoint the causes of the bias highlighted by our analysis. There are many motivations behind the citation process — for example, acknowledging pioneers, giving credit to related work and providing background reading. We believe that, while the process of accepting a paper on a journal is reasonably objective, with several referees commenting on the quality and merits of the paper regardless of its country of origin, that of citing a paper is more subjective and certainly more open to considerations of career and funding opportunities. As English-speaking countries produce 49.2% of the world's papers¹, they have a dominant position in the scientific world. Not citing their scientists' work would produce negative feedback, while the converse would not. In

other words, awareness of the citation game can influence the choice of citations.

Gianmarco Paris*‡, Giulio De Leo*, Paolo Menozzi†, Marino Gatto*

**Dipartimento di Elettronica e Informazione, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milano, Italy*

†Dipartimento di Scienze Ambientali, Università degli Studi, Viale delle Scienze, 43100 Parma, Italy

‡Fondazione Lombardia per l'Ambiente, Foro Bonaparte 12, 20121 Milano, Italy

1. May, R. M. *Science* **275**, 793 (1997).
2. Barreto, G. R. *Science* **276**, 882–883 (1997).
3. May, R. M. *Science* **276**, 885 (1997).

Subtle error on sea floor

Sir — In the otherwise excellent article¹ "Subtle minds and mid-ocean ridges", it is erroneously stated that Earth's fastest seafloor spreading occurs in the 15°–18° S East Pacific Rise "MELT" area.

Spreading rates are known to increase further south along this ridge^{2,3}, although exactly where the fastest spreading occurs is complicated by the presence of duelling propagating rifts and microplates, where total plate separation is accommodated on dual active spreading centres. The fastest spreading known today (some 149 mm yr⁻¹) thus occurs near 31° S, south of the large-scale duelling propagators between the Easter and Juan Fernandez microplates⁴.

Richard N. Hey

School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu, Hawaii 96822, USA

1. Cann, J. *Nature* **393**, 625–628 (1998).
2. DeMets, C. *et al.* *Geophys. Res. Lett.* **21**, 2191–2194 (1994).
3. Naar, D. F. & Hey, R. N. in *Evolution of Mid Ocean Ridges* (ed. Sinton, J. M.) (Am. Geophys. Un, Washington DC, 1989).
4. Hey, R. N. *et al.* *Nature* **378**, 167–170 (1995).