CORRESPONDENCE:

No reason for complacency

To the Editor — Papua New Guinea has some of the most pristine and diverse coral reefs on Earth. By investigating volcanic vents, where concentrations of carbon dioxide are naturally high, Fabricius *et al.* (*Nature Clim. Change* **1**, 165–169; 2011) showed that these reefs are profoundly degraded by the levels of ocean acidification predicted for the end of this century. Worryingly, however, their study may underestimate the impacts of future ocean acidification.

Some may breathe a sigh of relief that, despite major losses in biodiversity, the researchers found that the amount

of hard-coral cover remained constant with increasing carbon dioxide concentrations. However, the study areas were surrounded by highly diverse reefs that supply larvae from waters at normal pH. In addition, carbon dioxide concentrations near volcanic vents are variable, offering windows of opportunity for larval settlement when pH levels are high.

Some organisms, such as seagrasses, can tolerate ocean acidification, but even these species will not be ‘winners’ in a high carbon dioxide world unless increased efforts are made to protect

coastal habitats from other damaging human activities. The study by Fabricius *et al.* provides a worrying glimpse of the future of tropical coastal ecosystems, highlighting an urgent need for both lowering carbon dioxide emissions and increasing marine conservation efforts worldwide. □

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CORRESPONDENCE:

Not so sweet after all?

To the Editor — Loarie *et al.*¹ are to be congratulated in highlighting the need for a holistic approach when assessing the net climate impact of biofuels, including that of albedo change. However, their statement that “...expanding sugar cane into existing crop and pasture land has a direct local cooling effect that reinforces the indirect climate benefits of this land-use option” risks underplaying the importance of non-carbon dioxide emissions from sugar-cane cultivation.

Sugar-cane production is nitrogen-intensive, and the relatively high temperatures and soil water contents in the tropics — where most of it is cultivated — can enhance denitrification rates, boosting emissions of the greenhouse-gas nitrous oxide (N₂O)^{2,3}. Recent studies examining N₂O emissions from sugar-cane production

in Australia have reported very high N₂O emission factors (the proportion of nitrogen applied as fertilizer that is emitted as N₂O), predicting that an emission factor of 3–5% is common to sugar-cane cultivation across a wide range of environments in Australia³.

At present, the global coverage of field measurements of N₂O fluxes from biofuel cultivation is not sufficient to allow reliable bottom-up estimation of fluxes for all regions, land-management practices and crops. It may well be that the Intergovernmental Panel on Climate Change’s⁴ default N₂O emission factor of 1% for emissions arising directly from nitrogen addition is applicable to sugar cane in Brazil, but the uncertainty inherent in this figure is high (±300%). If an emission factor of 3–5% is more representative for

these systems, the N₂O ‘penalty’ in terms of the net climate-forcing impact of sugar-cane production may be substantial⁵. Wherever climate change mitigation is the primary objective of biofuel cultivation, the fullest possible picture in terms of net direct and indirect climate forcing is required. □

References

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