

The text that follows is a PREPRINT.

Please cite as:

**Fearnside, P.M. 2013. Vines, CO₂
and Amazon forest dieback.
Nature [online comment]
<http://www.nature.com/nature/journal/vaop/ncurrent/full/nature11882.html>**

Accepted 12 Feb. 2013

ISSN: 0028-0836

Copyright: Nature Publishing Group, a division of Macmillan Publishers Limited.

The original publication is available at:

<http://www.nature.com/nature/journal/vaop/ncurrent/full/nature11882.html>

Vines, CO₂ and Amazon forest dieback

The paper by Cox *et al.* (1) brings good news of a less-catastrophic dieback of Amazonian forest in the face of predicted climate change, as compared to that shown by the group's earlier models (2). However, it would be risky to conclude that climate-induced dieback would be cancelled out by increased growth rates stimulated by CO₂ fertilization. The paper emphasizes that the "magnitude of long-term CO₂ fertilization effects" is one of the "remaining uncertainties". I am wary of the global generalization that "carbon storage on land will increase ... under higher CO₂" being applied to Amazonia. Cox *et al.* (1) point out that recent increased growth of Amazonian trees (3) may be due to higher CO₂. This increased growth, which is primarily in forests on relatively fertile soils near the Andes at the western edge of Amazonia (4), does not mean that the effects of CO₂ fertilization are uniformly positive for Amazonian forest biomass, especially in eastern Amazonia where dieback is expected to begin and be most severe. Vines generally make better use of the extra CO₂ than do trees (*e.g.*, 5), with the result that increased vine loads could slow tree growth or kill trees outright (6). CO₂-enrichment may explain why vine loads have increased at five of the six locations for which measurements are available across tropical forests worldwide, leading to higher tree mortality rates and consequent turnover (7). Amazonian forests vary tremendously in terms of the prevalence of vines, and the extremes found in virtually impenetrable patches of "liana forest" (mostly in eastern Amazonia) really have to be experienced to be appreciated (Figure 1).

1. Cox, P. M. *et al.* Sensitivity of tropical carbon to climate change constrained by carbon dioxide variability. *Nature* Published online 06 February 2013. doi:10.1038/nature11882 (2013).
2. Cox, P. M., Betts, R. A., Jones, C. D., Spall, S. A. & Totterdell, I. J. Acceleration of global warming due to carbon cycle feedbacks in a coupled climate model. *Nature* 408, 184–187 (2000).
3. Baker, T. R. *et al.* Increasing biomass in Amazonian forest plots. *Phil. Trans. R. Soc. Lond. B* 359, 353–365 (2004).
4. Malhi, Y. *et al.* The regional variation of aboveground live biomass in old-growth Amazonian forest. *Global Change Biol.* 12, 1–32 (2006).
5. Condon, M. A., Sasek, T. W. & Strain, B. R. Allocation patterns in two tropical vines in response to increased atmospheric CO₂. *Funct. Ecol.* 6, 680–685 (1992).
6. Fearnside, P. M. Potential impacts of climatic change on natural forests and forestry in Brazilian Amazonia. *Forest Ecol. Manage.* 78, 51–70 (1995).
7. Phillips, O. & Gentry, A. H. Increasing turnover through time in tropical forests. *Science* 263, 954–958 (1994).

Philip M. Fearnside
 National Institute for Research in Amazonia (INPA)
 Manaus, Amazonas, Brazil
 Email: pmfearn@inpa.gov.br



Fig. 1. Vines cut in a forest-management experiment at Buriticupu, Maranhão, in eastern Amazonia (Photo: P.M. Fearnside).