Estimating the likelihood of an Amazon forest dieback and potential socio-economic impacts

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Almost 20 years ago, the Amazon forest-dieback hypothesis has been proposed indicating that a large-scale loss of Amazon rainforest may be caused by climate change which may lead to substantial changes in ecosystem functioning and structure. Here, we revise the likelihood of a potential Amazon forest dieback based on a systematic literature review. We find that still large uncertainties exist about the impacts and drivers of such event. These uncertainties include the effects of increasing temperature and atmospheric CO₂ concentration, and long-term drought on forest stability, the role of nutrient cycling and potential phosphorus limitation on forest productivity and potential climate feedbacks, in particular, the potential disruption of local rainfall recycling. We assess, in the light of these uncertainties, scenarios of potential socio-economic impacts that would result from a large-scale Amazon forest dieback. For our assessment, we consider the economic losses arising from changes in the provision of ecosystem services, decreasing crop yields, reduction of hydroelectric power generation potential, reduction of fish stocks and interruption of shipping waterways. Long-term economic losses are estimated between USD $1,367 to $6,928 billion (16%-80% of Gross Brazilian Amazon Product), arising mainly from changes in the provision of non-market value ecosystem services, decreasing crop yields and reduction of hydroelectric power potential. Trade-off gains coming from such a forest dieback would sum less than half of the losses (USD $576 to $2,880 billion). We conclude that, from a risk-analysis perspective, even with a low probability of occurrence, the high socio-economic impacts of an Amazon forest dieback make it, per se, a high-risk process.