Cascading effects in tropical (agro)forests

Delphine Clara Zemp[1,4], Henrique Barbosa[2], Dirk Hölscher[3], Nathaly Guerreiro Ramirez[4], Holger Kreft[4], Vannesa Montoya[1,4], Anja Rammig[5], Carl Schleussner[6]

[1]Conservation Biology, Institute of Biology, University of Neuchâtel, Switzerland
[2]Instituto de Física, Universidade de São Paulo, Brazil
[3]Tropical Forest Ecology and Silviculture, University of Göttingen, Germany
[4]Biodiversity, Macroecology and Biogeography, University of Göttingen, Germany
[5] TUM School of Life Sciences, Technical University of Munich, Freising, Germany
[6]Climate Analytics, Berlin, Germany

Tropical (agro)forests are complex systems whose biotic and abiotic components interact at a range of spatial scales. As a consequence, perturbations such as climate and land-use changes can trigger cascading effects in the ecosystem that are difficult to predict. Here, we present two study cases of such dynamics analyzed using a complex network approach. First, cascading recycling of rainfall by the Amazon forest [1] (Fig. 1a) leads to self-amplified Amazon forest loss with increasing drought [2] and deforestation [3]. Second, correlation networks of beta-diversity in experimental agroforests in Indonesia suggest that biotic interactions shape biodiversity at landscape scale (Fig. 1b). In summary, complex networks improve understanding of cascading effects in tropical (agro)forests, urgently needed to guide conservation and restoration strategies of tropical forests facing global changes.

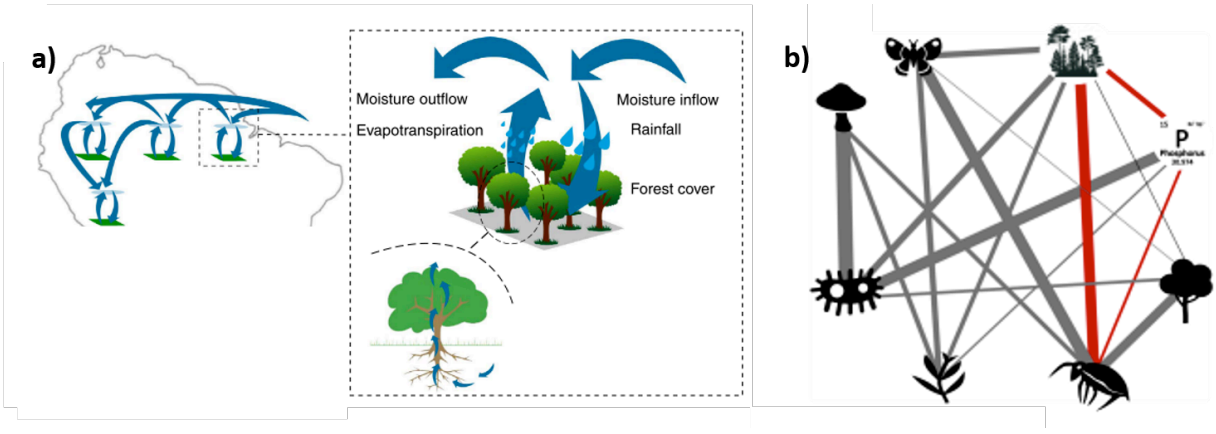

Figure 1: Two examples of cascading effects in tropical (agro)forests.

[1] Zemp, D. C., Schleussner, C. F., Barbosa, H. M. J., Van Der Ent, R. J., Donges, J. F., Heinke, J., Sampaio, G., & Rammig, A. Atmospheric Chemistry and Physics **14**, 13337–13359 (2014)

[2] Zemp, D. C., Schleussner, C., Barbosa, H. M. J., & Rammig, A. (2017). Geophysical Research Letters **44,** 10.1002/2017GL072955 (2017)

[3] Zemp, D. C., Schleussner, C.-F., Barbosa, H. M. J., Hirota, M., Montade, V., Sampaio, G., Staal, A., Wang-Erlandsson, L., & Rammig, A. Nature Communications **8**, 14681 (2017)