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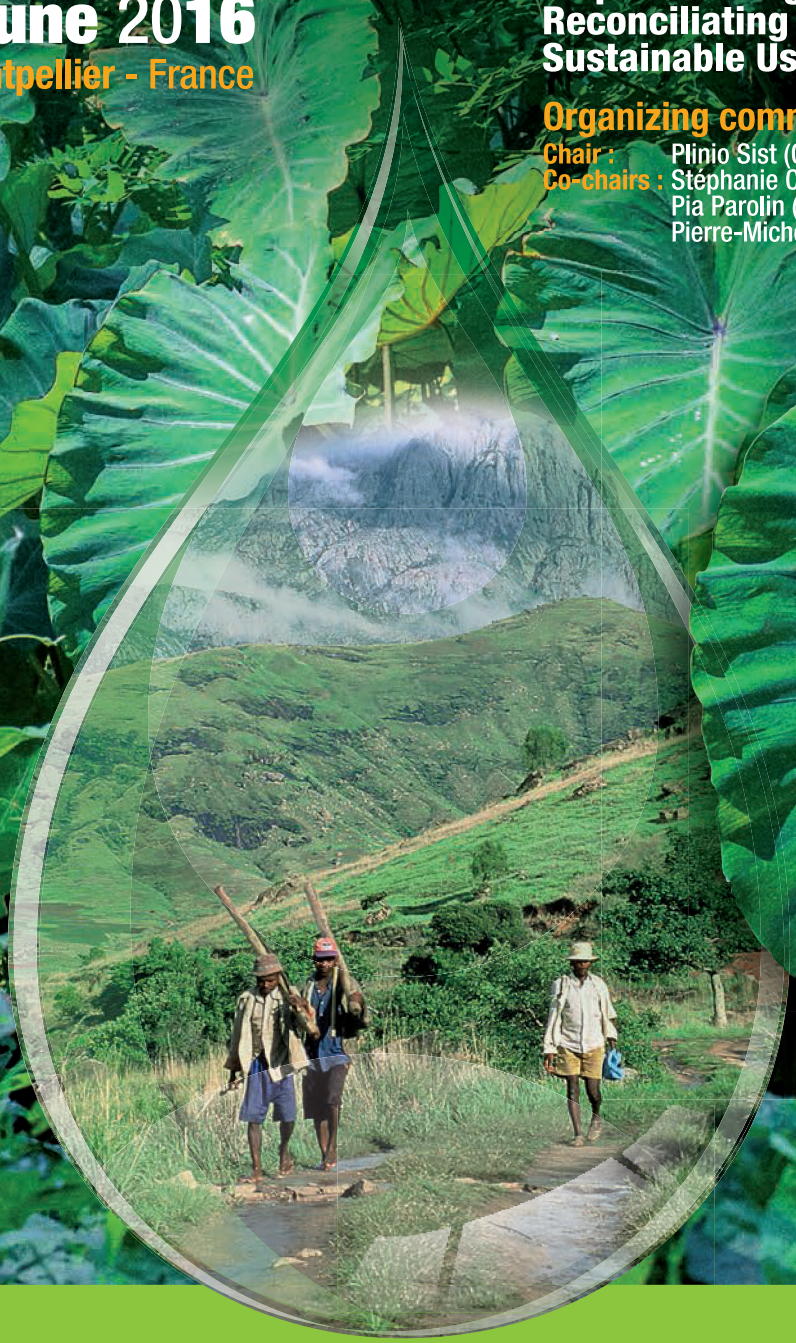

PROGRAM & ABSTRACTS

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O29-07 – S29 *Impacts of drought on tropical forests: processes and tipping points*
Tuesday 21 June / 10:00-15:30 – Barthez

The effects of drought on respiration in tropical rainforest

PATRICK MEIR[1], LUCY ROWLAND[2], ANTONIO CL DA COSTA[3], MAURIZIO MENCUCCINI[4], RAFAEL OLIVEIRA[5], OLIVER BINKS[6], STEEL VASCONCELOS[7], ALEX DE OLIVEIRA[3], YANN SALMON[6], LEANDRO FERREIRA[9], PATRICK MEIR[6]
[1]Australian National University, Research School of Biology, 2601, Canberra, Australia
[2]Exeter University, Geography, EX1, Exeter, UK
[3]Universidade Federal de Para, Geociencias, PA 555-10, Belem, Brazil
[4]ICREA, CREAF, BA2, Barcelona, Spain
[5]Universidade de Campinas, Inst. de Biologia, SP234, Sao Paulo, Brazil
[6]University of Edinburgh, School of Geosciences, EH93FF, Edinburgh, UK
[7]EMBRAPA, Ecologia, PA555-07, Belem, Brazil
[8]Museu Goeldi, Botanica, PA121-1, Belem, Brazil

The likelihood of future drought and warming threatens the functioning and stability of tropical rainforests, which themselves are responsible for a large fraction of global terrestrial productivity and land-atmosphere energy exchange. Understanding the response by trees to drought is central to our attempts to predicting its long term effects on tropical forests, and also to understanding why the tropics appear to dominate the large observed El Nino-related inter-annual variability signal in the annual rise in atmospheric concentration of carbon dioxide. Process-level insight into these globally important flux responses and flux anomalies is needed to advance fundamental understanding of the Earth system, and to improve the reliability of model-based predictions of tropical forest ecosystem properties. Process-based insight is best obtained by combining observation with manipulative experimentation. Recent results from the world's only long-running ecosystem-scale rainfall exclusion experiment in tropical rainforest have led to a focus on hydraulic vulnerability of branch xylem and gas exchange capacity in the canopy in relation to mortality risk and productivity. Here we examine the role of autotrophic respiration, reporting significantly increased rates of respiration under long term drought. How does respiration respond to soil moisture deficit over long and short time periods? What are the carbon sources of respiration during drought? Can temperature sensitivity explain El Nino impacts on land-atmosphere interactions with respect to CO2 emissions from tropical forest? We use direct and derived measurements of respiration from plant tissue to address these questions and integrate them with the preceding related questions concerning drought effects on mortality and productivity.

O29-08 – S29 *Impacts of drought on tropical forests: processes and tipping points*
Tuesday 21 June / 10:00-15:30 – Barthez

The diversity of drought tolerance, as predicted by leaf water potential at turgor loss point, within an Amazonian forest.

ISABELLE MARÉCHAUX[1], MEGAN K. BARTLETT[2], LAWREN SACK[2], JÉRÔME CHAVE[1]
[1]CNRS/Université Paul Sabatier/ENFA, Laboratoire Evolution et Diversité Biologique UMR5174, F-31062, Toulouse cedex 9, France
[2]University of California Los Angeles, Department of Ecology and Evolution, 90095, Los Angeles, California, USA

Background: Amazonian forest communities have already been seriously impacted by extreme natural droughts, and intense droughts are predicted to increase in frequency. However, our knowledge of Amazonian plant species' responses to water stress remains limited, as current plant trait databases include few drought tolerance traits, impeding the application and predictive power of models.
Methods: We estimated leaf water potential at wilting or turgor loss point (TLP), a determinant of leaf drought tolerance, using a recent method based on the measurement of leaf osmotic water potential at full hydration. This method was applied for 165 trees (of 71 species) and 15 lianas in a forest in French Guiana during the dry season. We repeated this sampling during a wet season on 79 trees, 39 tree saplings, 16 understory plants and 43 lianas (of respectively 10, 5 and 3 species and more than 10 families). We also measured other commonly measured functional traits, such as leaf mass per area, nutrient content and carbon isotopic ratio, on the same leaves. We explored (i) the diversity of TLP values across plant types and species, (ii) intra-specific variability across tree size and season and (iii) the relationships between TLP and other traits.
Results: We found that TLP varied widely across tree species, with early-successional species having less drought-tolerant leaves than late-successional ones. Species identity was the major driver of TLP variation in trees, whereas season, canopy tree size and leaf exposure explained little variation. Lianas had less drought tolerant leaves than trees during the wet season but not during the dry season, owing to a stronger seasonal adjustment in liana leaves. Values of TLP across species and plant types were weakly or not correlated with other commonly measured plant functional traits.
Discussion: The broad spectrum in TLP suggests a potential for diverse responses to drought within tropical forest communities, both among species and plant types. Vegetation models seeking to predict forest response to drought should integrate improved quantification of drought tolerance traits among plant species. We discuss the integration of our findings within an individual-based and mechanistic model of tropical forest dynamics.