Multiple environmental stresses, future climate and germination of Caatinga endemic *Cenostigma* sp. seeds

Barbara França Dantas[1], Samara Elizabeth Vieira Gomes[2], Janete Rodrigues Matias[3]
[1]Embrapa Semiárido, Petrolina, Brasil; [2]Universidade do Estado da Bahia, Juazeiro, Brasil; [3]Universidade Federal Rural do Semi-Árido, Mossoró, Brasil (barbara.dantas@embrapa.br; samaraelizabethvg@yahoo.com.br; janete07@hotmail.com)

The Caatinga is predicted to be the most vulnerable Brazilian biome in a future climate scenario of global warming and decreased rainfall. Climate projections for the region in 2100 indicate significantly hotter conditions and a decrease of almost 50% in rainfall , thus worsening the water deficit in the region. Cenostigma pyramidale (Tul.) Gagnon & G.P. Lewis and *C. microphyllum* (Mart. ex G. Don) E. Gagnon & G. P. Lewis are endemic Fabaceae from the Brazilian Caatinga. The objective of this study was to evaluate the influence of combined environmental stresses (temperature x water restriction or temperature x salinity) on the germination of seeds of *C. pyramidale* and *C. microphyllum*. Seeds were germinated at constant temperatures between 10 to 40 °C combined with osmotic potentials from 0 to -1.0 MPa (in polyethylene glycol 6000 or NaCl solutions). Germination data were then analysed using thermal, hydro and halo time models, and future germination responses projected according to climate change scenarios predicted by IPCC (International Panel for Climate Change) and PBMC (Brazilian Panel for Climate Change). The germination thermal thresholds ranged from 5 to 55 °C. The germination base osmotic threshold (using polyethylene glycol or NaCl) were decreased in higher temperatures. According to the predictions for future climate (RCP 8.5), the reduced rainfall volime and increased temperature by 2100 will directly affect seed germination and seedling development of *C. pyramidale* and *C. microphyllum*.

Stomatal uptake to improve air pollution mitigation in urban tree species

Myeongja Kwak[1], Jongkyu Lee[1], Suyoung Woo[1], Sanghee Park[1], Yeaji Lim[1], Handong Kim[1]
[1]University of Seoul, Seoul, Republic of Korea (010na8349@hanmail.net; gpl90@naver.com; wsy@uos.ac.kr; parksanghee0930@gmail.com; oxlf1@naver.com; blasterkhd92@gmail.com)

Urban forests interact directly with air pollution abatement, local microclimate changes, pollen dispersal, and volatile organic compounds (VOCs) emissions. Therefore, it is necessary to understand the interactions of trees and air pollutants to improve air quality. The aim of the present study was to investigate the stomatal uptake, photosynthetic carbon assimilation, and stomatal physiological control in major tree species response to urban air pollution such as ozone (O_3) and sulfur dioxide (SO2). Trees exposed to air pollution generally showed excellent ability to absorb O_3 and SO2 due to their abilities to improve air pollution tolerance through the positive regulation of stomatal movement. Among the main tree species used in this study, it is resistant to atmospheric pollutants (O_3 and SO2) by maintaining photosynthetic ability and stomatal conductance in treatment compared to control, even though it has high ability to absorb air pollutants. This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (No; 2018R1D1A1A02044683).

B7q: PHYSIOLOGICAL AND BIOGEOCHEMICAL RESPONSE OF FOREST ECOSYSTEMS TO CLIMATE CHANGE AND AIR POLLUTION

Nitrogen (NO_3^-) input from rainfall in *Eucalyptus saligna* plantations / *Input de nitrogênio (NO_3^-) via precipitação pluviométrica em plantação de Eucalyptus saligna*

Grasiele Dick[1], Mauro Valdir Schumacher[1], Monique Pimentel Lagemann[1], Claudinei Garlet[1]
[1]Universidade Federal de Santa Maria, Santa Maria, Brasil (grasidick@hotmail.com; mauro.schumacher@ufsm.br; moniquelagemann@gmail.com; claudineigarlet@gmail.com)

A precipitação pluviométrica é uma importante via de aporte dos nutrientes em plantações florestais. Por meio da água que incide sobre as árvores, lava o dossel e escoa pelo tronco, muitos nutrientes são carreados até o solo, ou são absorvidos diretamente pelas folhas. Neste estudo avaliamos a entrada de nitrogênio via precipitação pluviométrica incidente e precipitação interna em uma plantação de *Eucalyptus saligna*, cultivada na região central do bioma Pampa, Rio Grande do Sul, Brasil. O monitoramento ocorreu durante o ano de 2012, onde o volume de precipitação médio foi de 1.224,7 mm. Através da precipitação pluviométrica houve a entrada de 2,25 kg ha^{-1} ano^{-1} de nitrogênio (NO_3^-) e, após a água passar pelo dossel, a quantidade foi de 3,98 kg ha^{-1} ano^{-1}. Ou seja, com a lavagem das copas das árvores houve aumento de 76,8% na quantidade de nitrogênio depositada no interior da plantação. Considerando este valor anual, para um ciclo de corte das árvores após sete anos de cultivo, a precipitação interna representa mais de 25 kg ha^{-1} nitrogênio (NO_3^-). Visando a redução de impactos ambientais decorrentes da contaminação hídrica e edáfica, causada pelo excesso de nitrogênio, além de economia de recursos financeiros, esta quantidade deverá ser reduzida da aplicação via fertilizante mineral. O nitrato é preferencialmente absorvido pelas árvores e, este estudo evidencia a importante contribuição da precipitação pluviométrica na nutrição florestal. Ressaltamos que, além do fornecimento deste elemento às plantações florestais, também há possibilidade de redução de custos e impactos ambientais.

Adaptation of Agro-IBIS model for *Eucalyptus* carbon budget estimation at regional level – a case study in São Paulo State, Brazil

Michel Anderson Almeida Colmanetti[1], Santiago Vianna Cuadra[2], Ahmed Attia[1], Yann Nouvellon[3,4,5], Joannès Guillemot[3,4,5], Otávio Campoe[6,7], Osvaldo Cabral[8], Jean-Paul Laclau[3,4], Marcelo Galdos[9], Rubens Augusto Camargo Lamparelli[1], Jair Bortolucci[1], Bruno Pereira[1], Guerric le Maire[1,3,4]
[1]Universidade de Campinas, Campinas, Brasil; [2]Embrapa Cima Temperado, Campinas, Brasil; [3]CIRAD, UMR Eco&Sols, Montpellier, France; [4]Eco&Sols, Univ Montpellier, CIRAD, INRA, IRD, Montpellier, France; [5]Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Piracicaba, Brasil; [6]Universidade Estadual Paulista "Júlio de Mesquita Filho", Botucatu, Brasil; [7]Universidade Federal de Santa Catarina, Curitibanos Brasil; [8]Embrapa Meio Ambiente, Jaguariúna, Brasil; [9]Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds, Leeds, United Kingdom (michelcolmanetti@gmail.com; santiago.cuadra@embrapa.br; ahmedatia80@gmail.com; yann.nouvellon@cirad.fr; joannes.guillemot@cirad.fr; otavio.campoe@ufsc.br; osvaldo.cabral@embrapa.br; jean-paul.laclau@cirad.fr; mvgaldos@gmail.com; lamparel@unicamp.br; jairbortolucci@hotmail.com; zehwallace@gmail.com; guerric.le_maire@cirad.fr)

Highly productive fast-growing *Eucalyptus* plantations cover more than 5 million hectares in Brazil and exhibit very dynamic carbon fluxes throughout their 6-7 year rotations. These plantations quickly shift from C sources at the beginning of the rotation to large C sinks until harvest. In order to get a model simulating carbon pool and fluxes for both *Eucalyptus* plantations and other crops, we integrated several sub-models of the *Eucalyptus*-dedicated Generic Decomposition And Yield Model (G'DAY) into the large scale and multi-cover model Agro-IBIS (Integrated Biosphere Simulator). The G'DAY model was

previously parametrized and validated using large experimental datasets obtained in commercial eucalypt plantations in the state of São Paulo. Implementing an *Eucalyptus* plantation cover type within AgroIBIS, which had no Plant Functional Type dedicated to fast-growing forest plantations, required important changes in the carbon allocation turnover sub-models. This study included three phases: (1) the computational modification of AgroIBIS; (2) the model parametrization, calibration and validation using data fromintensively monitored sites or inventories datasets; and (3) model application at regional scaleusing sets of parameters which were considered to be constant in space and/or time based on data from the local experiments, and other sets of parameters which could vary spatially. Carbon fluxes of *Eucalyptus* plantations were simulated at the regional scale, and their inter-annual and spatial variabilities were analysed. Such spatial and multiannual quantification of carbon fluxesat large scalesbrings a better understanding of these forest ecosystems on global carbon cycling, which is a prerequisite to support policy decisions.

Shoot water potential of saxaul trees *Haloxylon ammodendron* (C.A.Mey.) Bunge from two distinctive populations of Mongolia

Enkhchimeg Tsedensodnom[1,2], Batkhuu Nyam-Osor[2]
[1]Institute of Geography and Geoecology, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia; [2]Laboratory of Forest Genetics and Ecophysiology, Department of Environment and Forest Engineering, National University of Mongolia, Ulaanbaatar, Mongolia (enkhii_smile@yahoo.com; nbatkhuu@gmail.com)

Haloxylon ammodendron (C.A. Mey) Bunge, Amaranthacaeae (saxaul) is grows in the desert and semi-desert regions of Mongolia forming southern Saxaul forests. This species is of great ecological and economic importance, not only because it can survive in harsh environmental conditions but also because it can reduce wind erosion and sand movement. The objectives of this study were to determine the water potential of assimilation shoot of Saxaul trees of natural stands.This study was conducted in the two distinctive population differing geographical location, vegetation and climate condition. The BZ population, Bayanzag (103°42′ E,44°05′N, 1,100 m, asl) is situated in the southern part of Mongolia, Umnugobi province and DU poluation, Dulaan uul (44°12′N,110°01′E, 700-1,000 m, asl) is located in the southeastern part of Mongolia, Dornogobi province. Shoot water potential were measured using a Pressure Chamber (Model 1505DPMS Instrument Company, U.S.A.) following the method of Scholander. The assimilation shoot water potential was measured in trees differing in their age classes, mature tree (200 ≤ cm), young tree (80 - 200 cm) and juvenile (≤ 80 cm) according to their stem height classes. Generally, trees BZ population trend to have higher water potential at predawn, while DU population had higher in midday. According to measurement of water potential the young and juvenile trees are more subjected water stress than that of mature trees, which shows their adaptation performance in drought conditions.

Nitrogen and sulfur deposition by rainfall and throughfall in *Pinus taeda* L. in Southern Brazil

Mauro Valdir Schumacher[1], Grasiele Dick[1]
[1]Universidade Federal de Santa Maria, Santa Maria, Brasil (mauro.schumacher@ufsm.br; grasidick@hotmail.com)

Soil fertility in areas planted with Pinus taeda is closely associated with nutrient input by atmospheric deposition, mainly with rainfall and throughfall. The objective of the present study is to quantify the input of nitrogen-NO_3^- and sulfur-SO_4^{2-} in Pinus taeda stand, in Cambará do Sul, Southern Brazil. For the quantification and sampling of water from rainfall, three funnels surrounded by a bird ring were installed. In order to evaluate the throughfall, nine funnels were installed. Sampling was biweekly for a period of four years. After the samples were filtered and analyzed for $N\text{-}NO_3^-$ and $S\text{-}SO_4^{2-}$. The average total annual rainfall and throughfall was 2081.5 mm and 1280 mm, respectively. Rainfall added 2.70 kg ha^{-1} year^{-1} and 4.97 kg ha^{-1} year^{-1} of $N\text{-}NO_3^-$ and $S\text{-}SO_4^{2-}$, respectively. The amounts added by throughfall were 2.81 kg ha^{-1} year^{-1} of $N\text{-}NO_3^-$ and 6.53 kg ha^{-1} year^{-1} of $S\text{-}SO_4^{2-}$. The $S\text{-}SO_4^{2-}$ presented an increase of 28% in the value of its quantity, after the interaction with the canopy of the trees.

Nitrogen return to soil by litterfall in Semidecidual Seasonal Forest and *Pinus taeda* L.

Mauro Valdir Schumacher[1], Grasiele Dick[1], Monique Lagemann[1], Claudinei Garlet[1]
[1]Universidade Federal de Santa Maria, Santa Maria, Brasil (mauro.schumacher@ufsm.br; grasidick@hotmail.com; moniquelagemann@gmail.com; claudineigarlet@gmail.com)

The dynamics of litter and nutrients is essential to maintaining the productive capacity of native forests and commercial plantations with tree species. The objective of the present study is to characterize the return of total nitrogen, via litterfall, in a semideciduous seasonal forest and a *Pinus taeda* stands, in Quedas do Iguaçu, Paraná, Brazil. In each ecosystem three plots of 21 m x 20 m were demarcated, in which four traps with 1 m^2 of area were systematically distributed to quantify the litterfall. The amount of litterfall in native forest and pinus stands is 7.76 and 7.15 mg ha^{-1} year^{-1}, respectively. In the native forest the amount of N was 147.19 kg ha^{-1} year^{-1}, about 191.3% higher than the value found in pinus, which presents 50.53 kg ha^{-1} year^{-1}. This difference in the values obtained is explained by the presence of legume species in the native forest, which by symbiosis with bacteria of the genus Rhizobium, can fix the atmospheric nitrogen and increase the values of this element in its biomass. Litterfall is the most important source of nitrogen return to the soil.

Using process-based modelling to better understand the impact of mineral (N, P, K) cycles and climate change on stand growth and resource-use in Eucalypt plantations

Ivan Cornut[1], Nicolas Delpierre[1], Otávio Campoe[2,3], Joannès Guillemot[1,3,6], Jean-Paul Laclau[4,5], Louis Mareschal[4,5], Yann Nouvellon[4,5], José-Luiz Stape[2,7], Guerric le Maire[4,5,8]
[1]Ecologie Systématique Evolution, Université Paris-Sud, CNRS, AgroParisTech, Université Paris-Saclay, Orsay, France; [2]Universidade Estadual Paulista "Júlio de Mesquita Filho", Botucatu, Brasil; [3]Universidade Federal de Santa Catarina, Curitibanos, Brasil; [4]UMR Eco&Sols, CIRAD, Montpellier, France; [5]Eco&Sols, Univ Montpellier, CIRAD, INRA, IRD, Montpellier, France; [6]Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo, Piracicaba Brasil; [7]Suzano Pulp and Paper, Suzano, Brasil; [8]Universidade Estadual de Campinas, Campinas, Brasil (ivan.cornut@u-psud.fr; nicolas.delpierre@u-psud.fr; otavio.campoe@ufsc.br; joannes.guillemot@cirad.fr; laclau@cirad.fr; louis.mareschal@cirad.fr; yann.nouvellon@cirad.fr; stape@suzano.com.br; guerric.le_maire@cirad.fr)

In addition to wood production services, forest ecosystems play an important role in the mitigation of anthropogenic climate change. However the role of forests as future C sinks is being discussed since there is increasing evidence of a progressive shift from carbon-limited growth to nutrient-limited growth as demonstrated in FACE experiments. The development of mechanistic models, including the main nutrient balance and their relationship with the carbon and water balances, is necessary to evaluate the future response of forests to climate change. In this contribution, we present the first joint evaluation of a coupled C-water-N-P-K model on a large number of biogeochemical measurements collected in fast-growing eucalyptus plantations in Brazil along entire rotations, including trials with variable levels of fertilisation and water availability. We have first adapted the CASTANEA ecophysiological model, primarily designed for