

World Conference on

Climate Change

October 24-26, 2016 Valencia, Spain

Carbon stocks and fluxes in the Andean tree line of *Polylepis reticulata* in Ecuador: Present balance and projected values for the 21st century

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Trees in the tropical and subtropical mountains of South America are able to develop at high elevation, with some species forming the highest tree-line in the world at 5200m. Under these unique environmental conditions, only evergreen trees of the genus *Polylepis* are able to subsist. *Polylepis reticulata* is a very slow growth tree. The strategy of these trees to survive in such unfavorable conditions has been analyzed in the Cajas National Park (Azuay, Ecuador). In this work we measure for the first time, the carbon stocks and fluxes, particularly GPP, NPP, respiration and carbon allocation of *Polylepis reticulata* growing over 4000 m of altitude. From dendrometric measurements we have estimated the age of some trees (around 30 cm in diameter) to be more than 400 years. The temperature increase and changes in the rainfall pattern in these areas of the Andean cordillera can modify substantially the carbon fluxes between the forest and the atmosphere. From the 1151gC.m⁻² year⁻¹ uptake as GPP, 888gC.m⁻² year⁻¹ is returned to the atmosphere as growth and maintenance respiration. Most of the carbon retained as NPP is allocated to the leaves (194 from the 263 gC.m⁻² year⁻¹). To produce one kg of dry biomass these trees transpire 5m³ of water. The physiological response of *P. reticulata* under different RCP scenarios (IPCC, 2013) has been simulated using the GOTILWA+ model. The results show drastic changes in all the scenarios. For example growing under the RCP 2.6, at the end of the present century the NPP is projected to increase up to 362 gC.m⁻² year⁻¹ but, at the same time, the carbon allocated to leaves increase up to 325 gC.m⁻² year⁻¹ or 90 per cent of the NPP. In that scenario the water used to grow 1 kg of dry matter is projected to increase up to 20 m³. The exploration of other climate scenarios shows more drastic changes that put at risk the survival of this emblematic species endemic of the Andean cordillera.

Biography

Carlos A Gracia is the Professor at the Department of Ecology, University of Barcelona. The ecophysiological responses of forest ecosystems to climate change, primary production, water and carbon balance are the core of his research work. He is the author of GOTILWA+, a process-based forest growth simulation model under different climate change scenarios. He has been the Vice-President of the Spanish Society of Terrestrial Ecology (AEET) and Member of the Directory Board of the Spanish Society of Forest Science (SECF), Member of the Scientific Advisory Board of the European Forest Institute (EFI). Since January 2014, he has joined the Prometeo fellowship from the SENESCYT (Secretaría Nacional de Educación Superior, Ciencia, Tecnología e Innovación) of Ecuador at the University of Cuenca (Azuay, Ecuador).

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