BOOK OF
ABSTRACTS

FORESTS & SOCIETY TOWARDS 2050

STOCKHOLM 2024

26th WORLD CONGRESS IUFRO

FORESTS & SOCIETY TOWARDS 2050

Stockholm, Sweden
23–29 June 2024

Dynamics of carbon storage in a tropical Eucalyptus plantation over multiple rotations

S1.3 Forests in a changing world – impacts on carbon and nutrient dynamics

Joannès Guillemot[1]
Guerric le Maire[1], Otávio Camargo Campoe[2, 3], Jean-Paul Laclau[1], José Luiz Stape[2], Ivan Cornut[1], Yann Nouvellon[1]
[1] CIRAD, UMR Eco&Sols, Montpellier, France
[2] Graduate Program in Forest Science, São Paulo State University (UNESP), Botucatu 901049-010, SP, Brazil
[3] Department of Forest Sciences, Federal University of Lavras (UFLA), Lavras, MG 37200, Brazil

Abstract: Eucalyptus is the most widely planted forest genus worldwide. In Brazil, Eucalyptus plantations rank among the world's most productive forests and cover more than 7.5 Mha. Improving our understanding of the dynamics of carbon storage in these anthropized ecosystems and how management practices, especially clear-cutting, affect it is important for future land sink projections. Here, we present an unprecedented 14-years series of continuous CO_2 fluxes (net ecosystem productivity, NEP) from Eddy-covariance measurements conducted in a commercial Eucalyptus plantation in Southern Brazil (the EUCFLUX project). The measurement period encompasses 3 rotations (including a full rotation of 9 years). Clear-cutting were followed by planting after a delay of 1.5 month after the first harvest and 5 months after the second harvest. NEP data were compared to the stem biomass exported at harvest to estimate the long-term C storage of the plantation (i.e., the net ecosystem carbon balance, NECB).

We show that NEP reached a maximum value of ~2 MgC/ha/month, totaling ~86 MgC/ha in a 9-year rotation. Clear-cuttings turned the plantation into a net carbon source for 7 and 12 months after the first and second harvest, corresponding to the emission of ~8 and ~11 MgC/ha, respectively. The payback period (the amount of time before the plantation recaptures as much CO_2 as was emitted after harvest) was 19 and 30 months, respectively. When using the time of planting as reference, the data was remarkably similar between rotations: the plantation turned into a net C sink 5.5 months after planting and emitted ~5MgC/ha during this period. Ten months after planting, the plantation already sequestered as much C as was emitted in the first months of the rotation. However, we found that NECB was close to zero. This suggests that despite having very high NEP, below-ground and litter C storage is low in this plantation and that the trunk export at harvest is a C flux of comparable importance as the NEP integrated between two consecutive harvests. Therefore, our results suggest that C storage in the soil stabilizes after successive rotations in highly productive commercial Eucalyptus plantations.