

# Very deep rooting in tropical eucalypt plantations: consequences for management under climate changes

Jean-Paul Laclau <sup>\*† 1</sup>, Amandine Germon <sup>2</sup>, Rafael Pinheiro <sup>2</sup>, George Lambais <sup>3</sup>, Bruno Bordron <sup>4</sup>, Mathias Christina <sup>5</sup>, Jean-Pierre Bouillet <sup>1</sup>, Yann Nouvellon <sup>1</sup>, José Leonardo Gonçalves <sup>4</sup>, Agnès Robin <sup>1</sup>, Joannès Guillemot <sup>1</sup>, Gueric Le Maire <sup>1</sup>, Christophe Jourdan <sup>1</sup>

<sup>1</sup> UMR EcoSols (Univ Montpellier, Cirad, Inra, IRD, Montpellier SupAgro) – CIRAD – 34060 Montpellier, France

<sup>2</sup> São Paulo State University (UNESP) – School of Agriculture, Botucatu, São Paulo, Brazil

<sup>3</sup> Universidade de São Paulo (CENA) – Piracicaba, SP CEP13416-000, Brazil

<sup>4</sup> Universidade de São Paulo (ESALQ) – Piracicaba, SP CEP13418-900, Brazil, Brazil

<sup>5</sup> Aida (Cirad) – CIRAD – 34398 Montpellier., France

Global models predict that the occurrence of extreme climatic events will increase in the next decades, while the depletion timeline of phosphorus and potassium reserves will strongly affect fertilization regimes. There is therefore an important concern about the future productivity and survival of crops and planted forests. The exploration of deep soil horizons by the root systems could be a crucial plant feature in order to mitigate and adapt to these global changes. Recent studies have shown that the root system of eucalypt seedlings and clones reach very deep soil layers the first years after planting. Changes of fine root behavior with soil depth have been studied down to 17 m in Brazil using various methods: soil coring, permanent trenches equipped with minirhizotrons, in-growth cores, analyses of rhizosphere soil and root anatomy, sampling of greenhouse gases, application of isotopic tracers, monitoring of soil water contents, as well as modeling approaches. These recent studies improved our understanding of the role of very deep roots for tree water and nutrient uses. They show in particular that very small densities of deep fine roots play a key functional role in tree survival during extreme drought periods and allow taking up nutrients leached from upper soil layers. An unexpectedly low mortality of fine roots after clearcutting in stands managed in coppice contributes to limit carbon and nutrient losses before canopy closure. After a brief presentation of recent findings showing the role of deep roots in eucalypt plantations, silvicultural guidelines will be proposed to reduce mortality risks under increasing abiotic stresses. The depth of the soil should be a major criterion for the selection of future afforestation areas, weed control practices, as well as fertilization regimes (type and timing of fertilizer applications). Research avenues will be proposed to gain insight into the role of deep rooting on tree functioning in eucalypt plantations.

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\*Speaker

†Corresponding author: jean-paul.laclau@cirad.fr

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