9 **Root biomass dynamics** (Soil respiration [CO_2] and its relationship with root biomass in tropical forest and post-forest systems of Central Amazonia)

Roberval Monteiro Bezerra de Lima

This study is part of the post-doctoral internship of the author; the first mission from the Brazilian side to work on the objectives of the project, part "Ecologically sustainable models to adjust the Brazilian Forest code in rural properties of Amazonas State (ModelCFAmazon)".

In central Amazônia, the first studies that investigated soil respiration (R_s) and its variability as a function of different land-cover types (natural forest, burnt areas and pastureland; Keppler et al. 1990) concluded that the elimination of vegetation by fires reduces R_s by half; and that the respiration rate increases by about 50% with establishment of pastureland in the average balance of pastureland versus forest. Other individual studies, performed at the Cuieiras biological reserve of INPA in central Amazonas, researched the efflux of CO_2 in forest and its relationship with environmental parameters (Sotta 2004; Zanchi 2012).

In eastern Amazônia studies were conducted on the effect of the amount of soil water on R_s in forest and pastureland (Davidson et al. 2000); the dynamics of fine roots with respect to soil respiration (Silver et al. 2005; Trumbore et al. 2006); the factors that control the spatio-temporal R_s variability with respect to litter, root mass and organic soil material at four sites in terra firme forests (Metcalfe et al. 2007); the efflux of CH_4. CO_2. NO and N_2O in agroforestry systems (SAFs; Verchot et al. 2008); and the temporal variation of CO_2 efflux in SAFs with palm oil plantation (Silva et al. 2016).

This study wishes to push our understanding in conjunction with those related studies in Amazônia on the contribution of fine root CO_2 and litter efflux under different types of land cover at a more expanded spatial scale and in direct comparison between central and southern Amazonas land, which is under tremendous deforestation pressure that comes with changes in land use.

The key objective is to study how CO_2 efflux relates to the production of fine roots (< 2 mm), organic material above the mineral soil (litter = ORG), physical and chemical soil properties; and how this efflux is influenced by the above ground vegetation in different forest and post-forest systems of Central Amazônia. For methods ▶ 4.

The first results of those exploratory analyses show a higher median value in the production of root biomass for forest (C, Caldeirão) prior to Brazil nut plantation (D), agroforestry (SAF, Manacapuru), J (Forest, Manaus) and K (Forest, Rio Preto da Eva); (Figure 14a).

In respect to ecosystem respiration (ERESP), the system C (Forest, Caldeirão), again present a higher median CO_2 efflux as compared to the systems A (Orange plantation, Caldeirão), D (Brazil nut), E (Forest, Itacoatiara), H (Forest. Manacapuru), K (Forest, Rio Preto da Eva) and L (Secondary forest, Rio Preto da Eva); ▶ Figure 14b.

From the eight systems that represent the highest ecosystem respiration, six are forest-covered, one shows a forest tree species (*Betholletia excelsa*) and one an orange plantation (*Citrus sp.*). Of those, three represent the highest root quantity.

More complex analyses can show other co-variables that may influence and explain differences in ecosystem respiration beyond the occurrence of roots.

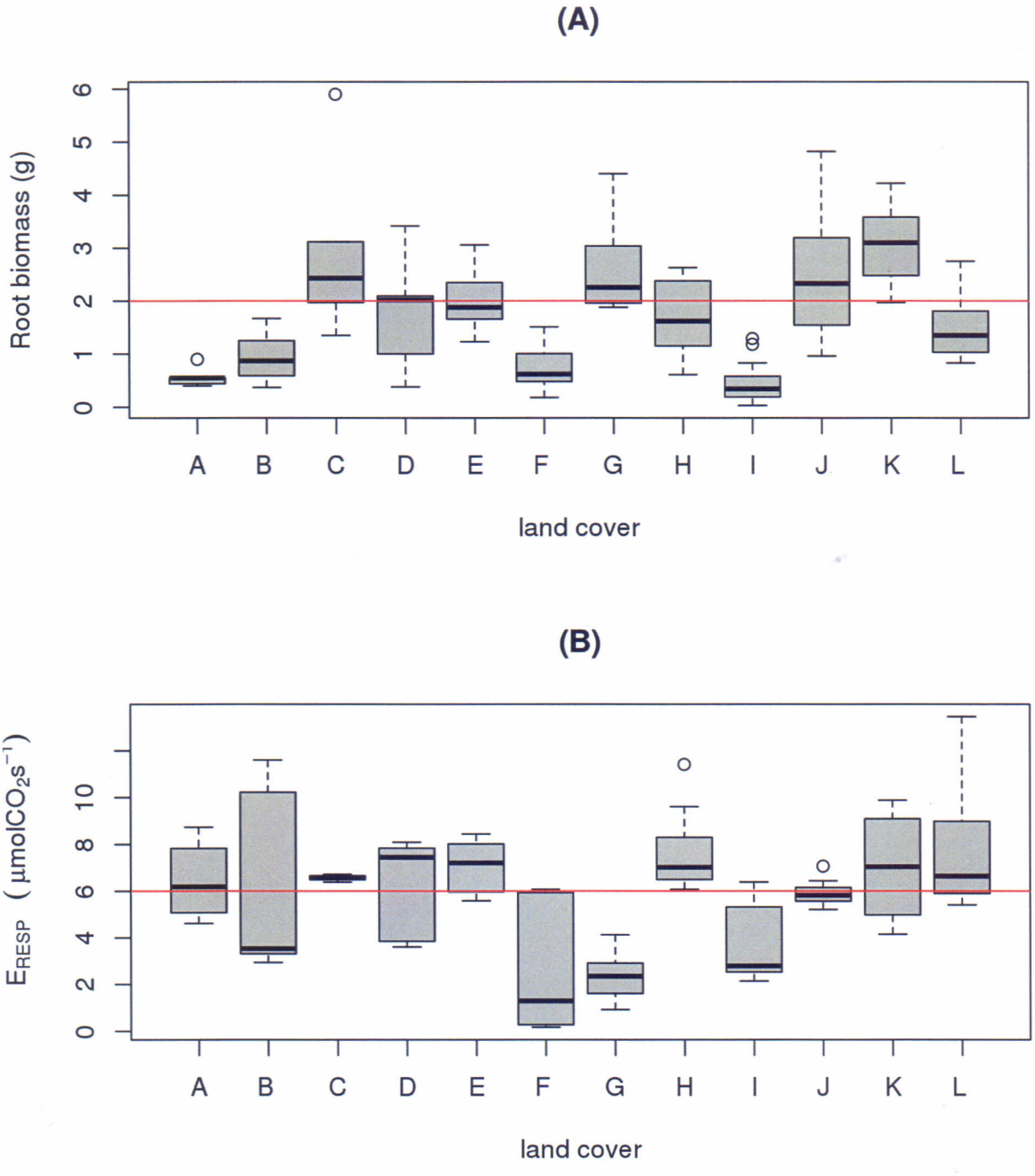

***Figure 14**. Root biomass and ecosystem respiration (ERESP) as a function of soil cover. A = Orange plantation (Caldeirão); B = Forest, terra preta do indío (Caldeirão); C = Forest (Caldeirão); D = Brazil nut (Itacoatiara); E = Forest (Itacoatiara); F = Orange (Manacapuru); G = SAF (Manacapuru); H = Forest (Manacapuru); I = Rubber tree plantation (Manaus); J = Forest (Manaus); K = Forest (Rio Preto da Eva); L = Secondary forest (Rio Preto da Eva)*