Do more complex agroforestry systems have higher biomass production and carbon stocks?

Sandra A. Santos*[1], Maria L. F. Nicodemo[1], José R. M. Pezzopane[1], André F. Pedroso[1], Ana C. B. Marcondelli[2], Waldomiro Barioni Junior[1]
[1]Embrapa, São Carlos, SP; [2]Uniara, Araraquara, SP
*Researcher – sandra.santos@embrapa.br

Land-cover change has been the major cause of biodiversity loss and can cause a decrease in ecosystem services. Agroforestry systems can improve the efficiency of land use by providing several ecosystem services including biomass production and increase in carbon stock. The objective of this study was to evaluate biomass production and carbon stock potential in two silvopastoral production systems (with exotic and native tress) and in a native forest and thus subsidize in the definition of strategies to increase production while maximizing environmental benefits. The study was carried out in São Carlos, SP, in 2017 and beginning of 2018 in two silvopastoral systems, one with eucalyptus trees (*Eucalyptus urograndis* clone GG100), in single rows, and *Urochloa brizantha* cv. Piatã (EFS), established in 2011 on dystrophic red latosol. The other system was established in 2008 with native forest species (*Anadenanthera colubrine*, *Cariniana estrellensis, Croton floribundus, Guazuma ulmifolia, Piptadenia gonoacantha, Peltophorum dubium, Zeyeria tuberculosa*), in triple lines, and *Urochloa decumbens* (NFS) on dark red latosol. These systems were compared with a fragment of semideciduous seasonal forest (SSF). Aboveground biomass ($Mg.ha^{-1}$) was estimated using plot (20 x 20m) inventories, for the following compartments: standing dead trees, living trees, pasture, lianas, necromass, palm trees and litter. In each plot, information of diameter at breast height and tree height (H) were registered. Standing dead tree biomass was estimated through the sum of two volumes. Allometric equations were used to estimate aboveground biomass of live trees. Litter, lianas, necromass and pasture aboveground biomasses were sampled during the four seasons of the year for biomass estimative. Carbon content for total biomass was estimated using the 47% value of the biomass, indicated by IPCC. Kolmogorov, Shapiro-Wilks and Kruskal Wallis statistical tests were used to analyze the data. The average aboveground biomass ($Mg.ha^{-1}$) of standing dead trees, living trees, pasture, lianas, necromass, palm trees and litter were respectively of 5.2; 112.9; 0; 9.3; 7.3; 1.6 and 9.7 for SSF; 0; 48.3; 2.6; 0; 0.7; 0 and 8.6 for EFS and 0.3; 55.2; 1.3; 0; 0.3; 0 and 6.9 for NFS. The total average aboveground biomass (AGB) and carbon stock (CS) in SSF (145.9 and 68.6 Mg.ha-1) were higher (p-value≤0.05) than in NFS (64.0 and 30.1 Mg.ha-1) and EFS (60.2 and 28.3 Mg.ha-1) in all evaluated compartments, except pasture. Compared with natural systems, NFS had a higher biodiversity and complexity than EFS. However, the highest density of trees in NFS (413 trees.ha-1) versus EFS (167 trees.ha-1) probably had influence in light interception, affecting pasture production as well as biomass and carbon sequestration. These results were probably influenced by local conditions, management (species, spacing, age and density of trees) and interaction among system components, showing the importance to design systems with major complexity. When well-managed, silvopastoral systems can also contribute to preserve forests and pasture productivity with sustainable economic production.

Keywords: aboveground biomass, native trees, silvopastoral systems
sustainable systems.