Allometric Relationships of Frequently used Shade Tree Species in Cacao Agroforestry Systems in Sulawesi, Indonesia

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Abstract

Agroforestry systems carry great importance in the conservation of the tropical rainforests, particularly of the rainforest margins as they reduce the pressure on natural forests. Shade trees play an important role within the agroforestry systems by influencing radiation and wind regimes as well as nutrient and hydrological cycling. However, there is a lack of quantitative assessments of their functions. One of the reasons is the rare information on structural characteristics of shade tree species. Therefore, the aim of this study is to provide basic information on the structure of frequently used shade tree species for the implementation of models simulating the ecosystem processes in agroforestry systems. The investigation of the shade trees was conducted at two cacao agroforestry sites on Sulawesi, Indonesia. The measurements of the main structural parameters: diameter at breast height, tree height, trunk height, crown length and crown radius were carried out for the shade tree species *Aleurites moluccana*, *Cocos nucifera* and *Gliricidia sepium*. For data collection the National Forest Inventory Field Manual Template by FOA (2004) was applied whereas the height measurements were conducted with a Vertex IV ultrasonic hypsometer performing the trigonometric principle. Based on this information the allometric functions were derived for the correspondent shade tree species. The best significant relationships were obtained for the height-crown length relationship of the dicotyledonous tree species' *Aleurites moluccana* and *Gliricidia sepium* with a coefficient of determination $r^2 = 0.925$ and $r^2 = 0.738$, respectively and the height-trunk height relationship of the monocotyledonous palm *Cocos nucifera* with $r^2 = 0.807$. The transferability of the obtained allometric functions was examined using the results of the measurements performed in other sites in the region. Further research should be implemented to extend the knowledge on agroforestry systems by obtaining information on the same tree species from other regions and by measuring structural properties of other main shade tree species.

Keywords: Agroforestry system, allometric relationships, shade trees, tree architecture

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