Main overstory and understory species rhizosphere C:N:P stoichiometry of plantations in subtropical China

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Ecological stoichiometry is an important indicator of ecosystem nutrient limitations. Rhizosphere (a hotspot of nutrient cycling) soil C:N:P stoichiometry is useful for identifying the linkage of plant species and soil nutrient characteristics, which is particularly helpful for forest ecosystem management. However, there has been limited research on rhizosphere soil stoichiometry, especially for co-existing overstory and understory species. We investigated the rhizosphere soil C:N:P stoichiometry of dominant overstory trees and understory shrubs (Loropetalum chinense, Adinandra millettii and Eurya muricata) in three mainly pure plantations (Cunninghamia lanceolata, Pinus massoniana and Pinus elliottii) in subtropical China. The results found that rhizosphere soil C, N and P content and their ratios increased significantly compared to bulk soil. Rhizosphere soil C:N, C:P, and N:P of overstory trees significantly were higher than those of understory shrubs, indicating that overstory trees had more nutrient limitation, especially for P limitation. However, in most cases, rhizosphere soil C:N, C:P and N:P of L. chinense were similar with those of overstory trees, but higher than those of A. millettii and E. muricata. Soil pH significantly influenced the nutrient stoichiometry profiles of bulk soil and rhizosphere soil of different species, which implied the important role of root exudation. Our study indicated that the difference in nutrient limitation between overstory trees and understory shrubs was related to shrub species type, in which soil pH was the dominant driving factor. Thus, we suggest that understory shrub species type should be considered in plantation management to reduce resource competition among species.