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Effect of Environmental Factors on Productivity of *Guadua angustifolia* Stands in Coffee Region of Colombia

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Abstract

In order to promote the proper utilisation and management of *Guadua angustifolia* and the productivity options available to farmers in the Colombian coffee region, information on growth and productivity of this bamboo species was obtained. This study focused on the effect of environmental factors on stand productivity. The study sites were located in the Colombian coffee region. The aim was to assess differences in the productivity of *Guadua* stands due to environmental conditions and determine which response variables are the most sensitive to specific environmental conditions. An analysis of principal components provided information for the identification of key variables responsible for most of the variability between sites.

The final environmental variables selected for the construction of predictive models was defined considering the high loadings of variables in the principal components and their higher correlation with the respective response variable. These variables were used in multiple regression models. Average culm length and stand basal area can serve as indices of *Guadua* stand productivity. Average culm hardness is useful to determine culm quality within *Guadua* stands. According to the statistics evaluated, the regression models for these variables showed a reasonable goodness of fit for culm length ($R^2 = 0.54$, $MSE = 5.3$), for stand basal area ($R^2 = 0.51$, $MSE = 411$) and for culm hardness ($R^2 = 0.51$, $MSE = 7.6$). However, the variability in the productivity and quality of *G. angustifolia* could not be entirely described by the environmental set of independent variables measured and a significant proportion of the variability remains unexplained. In addition, factors that describe culm and stand characteristics were obtained. The “growth” factor showed a larger load of dendrometric culm variables whereas the “quality” factor exhibited a larger load of physico-mechanical variables. For *Guadua* stands, the “growing stock” factor showed the strongest correlation with variables such as average diameter at breast height and average culm length. The “dynamics” factor exhibited a strong correlation with harvest intensity, percentage of shoots and percentage of young culms. The “quality” factor was strongly correlated with physical and mechanical properties, especially with average compression strength.

Keywords: *Guadua* bamboo, multivariate analyses, site quality