**Modeling Height—Diameter Relationship Using Artificial Neural Network for Durango Pine species in Mexico**

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The relationship between tree height (*h*) and diameter at breast height (*dbh*) is important for forest management and planning. Various approaches have been used to study the height-diameter (*h*—*dbh*) relationship across different species worldwide. Nonlinear mixed effect modeling (NLMEM) has been widely utilized, and recently, the resilient backpropagation artificial neural network (RBPANN) approach has gained attention for modeling this relationship. In this study, both NLMEM and RBPANN approaches were employed to model the *h*—*dbh* relationship for Durango pine species (*Pinus durangensis* Martínez) in a mixed-species forest in Mexico. The dataset consisted of 1,000 randomly selected plots (11,472 measurements) from 14,390 temporary forest inventory plots. The dataset was divided randomly into two parts, with 50% allocated for training and 50% for testing. To analyze the dataset, a cluster analysis was performed using the *k*-means clustering method, grouping the data into 10 clusters. Plot variables such as density, basal area, mean *dbh*, mean height, quadratic mean diameter, altitude, and aspect were considered in the clustering process. The RBPANN approach was applied using tangent hyperbolicus (RBPANN-tanh) and logistic function (RBPANN-logistic) for the cross product of the covariate or neurons, along with the weights for the ANN analysis. For both the training and testing stages, 10 classical statistics, including RMSE, R2, AIC, BIC, and logLik, were computed to evaluate the performance of the approaches in modeling the *h*—*dbh* relationship. The results showed that the ANN approach outperformed the NLMEM approach in both training and testing. Thus, the ANN method was found to be more effective for modeling the *h*—*dbh* relationship for Durango pine species in the mixed-species forest of Mexico.

**Keywords**: artificial neural networks, diameter, height, modeling, training, validation.

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