Methods for Quantitatively Describing Tree Crown Profiles of Loblolly Pine (*Pinus taeda* L.)

by

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(ABSTRACT)

Physiological process models, productivity studies, and wildlife abundance studies all require accurate representations of tree crowns. In the past, geometric shapes or flexible mathematical equations approximating geometric shapes were used to represent crown profiles. Crown profile of loblolly pine (*Pinus taeda* L.) was described using single-regressor, nonparametric regression analysis in an effort to improve crown representations. The resulting profiles were compared to more traditional representations. Nonparametric regression may be applicable when an underlying parametric model cannot be identified. The modeler does not specify a functional form. Rather, a data-driven technique is used to determine the shape a curve. The modeler determines the amount of local curvature to be depicted in the curve. A class of local-polynomial estimators which contains the popular kernel estimator as a special case was investigated. Kernel regression appears to fit closely to the interior data points but often possesses bias problems at the boundaries of the data, a feature less exhibited by local linear or local quadratic regression. When using nonparametric regression, decisions must be made regarding polynomial order and bandwidth. Such decisions depend on the presence of local curvature, desired degree of smoothing, and, for bandwidth in particular, the minimization of some global error criterion. In the present study, a penalized PRESS

criterion (PRESS*) was selected as the global error criterion. When individual-tree, crown profile data are available, the technique of nonparametric regression appears capable of capturing more of the tree to tree variation in crown shape than multiple linear regression and other published functional forms. Thus, modelers should consider the use of nonparametric regression when describing crown profiles as well as in any regression situation where traditional techniques perform unsatisfactorily or fail.

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