BUILDING GENERALIZED TREE MASS / VOLUME COMPONENT MODELS FOR IMPROVED ESTIMATION OF FOREST STOCKS AND UTILIZATION POTENTIAL

David W. MacFarlane[1]

Abstract— Accurately assessing forest biomass potential is contingent upon having accurate tree biomass models to translate data from forest inventories. Building generality into these models is especially important when they are to be applied over large spatial domains, such as regional, national and international scales. Here, new, generalized whole-tree mass / volume component models are discussed and tested. The models integrate principles of tree branching architecture and stem taper into compatible equation systems for estimating whole-tree mass or volume components across a range of species and site conditions. The models were tested using data collected in Michigan, USA, as part of a national effort by the Forest Inventory and Analysis (FIA) Program of the US Department of Agriculture to improve estimation of tree mass components, including the merchantable mass of the tree.

The results suggest that the new variable-form variable-density models will provide superior predictions of tree mass components and whole-tree mass, as compared to standard allometric models, across a range of tree species and forest conditions, even when tree density is held constant within the tree and derived from published values. Whole-tree volume and stem taper models, derived from the biomass equation system, could provide flexible characterization of whole-tree mass utilization potential under different local, regional or national merchantability standards for industrial round wood production. The generality of the model system, in terms of accommodating a wide range of tree forms, might also allow it to be used across many forest types and growing conditions, including urban forests, agroforestry systems and plantation forests.

[1] Department of Forestry, Michigan State University, East Lansing, MI, USA. Phone: (517) 355-2399; email: macfar24@msu.edu