FIA BULLETIN

Weighing tree branches on the Superior National Forest near Ely, MN. Photo courtesy of Philip J. Radtke.

Tree Volume, Biomass, and Carbon Models

The **Forest Inventory and Analysis** (FIA) program of the USDA Forest Service conducts the national forest inventory of the U.S. FIA is committed to achieving a high level of consistency through well planned Quality Assurance (QA) activities in all stages of its national core inventory system – planning, data collection, photo and image interpretation, information management, compilation, and analysis.

Issue Overview

FIA is the sole provider of consistent and spatially explicit forest resource information across the U.S. In many instances, data users desire information related to tree volume, biomass, and carbon content. As these attributes cannot be directly measured practically, their values are commonly determined as predictions from statistical models. Due to the increasing emphasis on spatially explicit analyses at various scales, a consistent and accurate approach for tree volume, biomass and carbon prediction is needed at the national level for increased transparency and credibility of FIA estimates.

Background

The evolution of FIA program implementation via regional work units inevitably resulted in a wide range of statistical models being used for prediction of tree volume and biomass. Understanding the array of model sources is often confusing to data users and can produce inconsistencies in reported results across spatial domains. Circa 2009, FIA developed the component ratio method (CRM) to nationally standardize calculations of tree biomass attributes. Although the methods were national in scope, (sub)regional volume models still provided the underlying basis. Thus, it was recognized that a large-scale effort was needed to develop a new modeling framework with nationwide applicability.

Recommendation/Upcoming Action

Research Study: In 2012, FIA embarked on a research study to collect new tree volume, biomass, and carbon data to be used in the development of a national modeling system. This study included U.S. Forest Service personnel, collaborations with seven university investigators, and partnerships with various forest industry representatives. To facilitate model development, field operations were conducted to fell trees and obtain volume, biomass, and carbon information on over 3,000 trees across the U.S. Additionally, substantial effort was made to find existing tree data from other studies and organize these data into a common database format. The results of this latter effort are publicly available via www.legacytreedata.org. The amassed data were used by university collaborators to develop and test various modeling approaches to determine appropriate methods that would be most suitable for FIA in terms of model accuracy and operational feasibility.

Implementation of Results: The modeling framework that resulted from this research will be used by FIA to calculate volume, biomass, and carbon of individual trees. While FIA will use standard definitions of tree components for reporting purposes, the models are of sufficient flexibility such that predictions for any tree section(s) can be obtained. This allows data users to tailor volume, biomass, and carbon estimates for their respective analytical needs, as well as provide the capability for FIA to adapt to evolving needs such as changing merchantability standards without the necessity of developing new models. Attributes based on the new modeling system will appear in the publicly available FIA data (FIA DataMart) in the summer of 2022.

Impacts on Urban FIA: This change will also affect volume estimates for updated species that are present in urban FIA.