

Title: Fuel Characterization in the Southern Appalachian Mountains – A Test of FIA’s Down Woody Material Indicator for Regional Fuel Estimation

Location: Southern Appalachian Mountains (Southeastern US)

Duration: Year 2 of a two-year project (2006-2008)

Funding Source: Fire Plan

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Cooperators: Aaron D. Stottlemyer, Department of Forestry and Natural Resources, Clemson University; Dr. Thomas A. Waldrop, Research Forester, USDA Forest Service, Southern Research Station

Project Objectives: The objective of this project is to test whether regional fuel estimations derived from the Phase 3 (P3) plots of Forest Inventory and Analysis Program (FIA) capture multiple and distinct fuel complexes of the southern Appalachian Mountains. Specifically, we will compare the FIA’s down woody material (DWM) estimations with the estimations derived from intensive fuel sampling to determine whether FIA’s DWM sampling intensity is sufficient. If FIA’s current DWM sampling intensity is not adequate, minimum sampling intensities will be determined for the study region.

Justification: Because of past fire management policy, many of today’s forests have accumulated unprecedented levels of fuel. Both the National Fire Plan and the Healthy Forest Initiative call for reduction of hazardous fuels. Consequently, estimations of forest fuel loading at various scales become necessary. With objectives such as fuel reduction, site preparation, wildlife habitat improvement, and maintaining extant populations of threatened and endangered species, prescribed fire has become an increasingly widespread management tool in the southern Appalachian Mountains. However, fuel loading information is not readily available to fire managers in this region. The FIA program is currently assessing the Forest Health and Monitoring (FHM) indicators at its P3 plots. Within this assessment, the DWM indicator is sampled, in part, to produce regional-scale estimations of fuel complexes (Woodal 2003). The FIA’s inventory of downed forest fuel utilizes a subset of approximately 1/16 of FIA’s Phase 2 (P2) plots. At this intensity, DWM sampling occurs every 96,000 acres as one FIA’s P2 plot is located approximately every 6,000 acres. However, multiple fuel complexes may exist at a much smaller scale, at which the FIA’s P3 plots are not able to capture. Consequently, it is not clear if the FIA’s current DWM sampling intensity would produce good estimations of regional fuel loading. Unreliable estimations of fuel loading could lead to unintended fire effects and/or misallocation of resources during prescribed fire or hazardous fuel reduction operations.

Our project will take advantage of intensive fuel sampling data that have already been collected from four locations (Sumter National Forest, South Carolina; Chattahoochee National Forest, Georgia; Nantahala National Forest, North Carolina; Great Smoky Mountain National Park, Tennessee) within the southern Appalachian Mountains. Estimations derived from these intensive sampling data will serve as the criteria for testing the FIA’s DWM Indicator. The availability of these intensive fuel sampling data will greatly reduce the amount of field work necessary for this project.

Description:

a. Background: Land use history and ecologically significant events such as the decline in American chestnut (*Castanea dentata*) and suppression of fire perpetuated current species assemblages in the southern Appalachian Mountains (Buckner 1989). Much of this second-growth forest is approaching maturity while research suggests that (1) some species highly demanded by society (e.g., oaks) will not be

important components of future forests, (2) that overall plant diversity will be negatively impacted, and (3) hazardous fuel loading will remain high (Elliot and Hewitt 1997). Current silvicultural research in this region largely focuses on understanding these phenomena and developing methods to restore target forest conditions (Elliot et al. 1999). These studies suggested the importance of fire in these ecosystems.

Prescribed fire is a relatively inexpensive and highly versatile management tool for ecosystem restoration. Despite the growing use of fire, virtually no fuel loading information is available to fire managers in the region. The few fuel models and photographic guides that are available are outdated, assume spatially homogeneous fuel complexes, and do not account for large and ericaceous fuel types (Stottlemeyer et al. 2004). The FIA's DWM sampling is intended, in part, to produce regional fuel estimations (Woodal 2003). However, it is not clear if, with the current protocol and sampling intensity, the FIA DWM sampling plots will capture the diversity of fuel complexes in the Southern Appalachian Mountains.

b. Methods: The study area, approximately 2.7 million acres, consists of three national forests (Sumter National Forest, South Carolina; Chattahoochee National Forest, Georgia; Nantahala National Forest, North Carolina) and one national park (Great Smoky Mountain National Park, Tennessee) in the southern Appalachian Mountains. Within the study area, four 10 square mile areas were selected and intensively sampled in a previous study funded by the National Fire Plan and Joint Fire Science Program (Dr. Tom Waldrop, Principal Investigator). These four intensively sampled areas represent two lower- (less than 2000 feet; Sumter and Chattahoochee National Forests), one middle- (2000 to 3600 feet; Nantahala National Forest), and one upper- (3600 to 4500 feet; Great Smoky Mountain National Park) elevation forests. With each intensively sampled area, 250 plots were established for sampling DWM (1-, 10-, 100-, and 1000-hour fuel), litter, duff, and live ericaceous fuel loading. Fuel loading data derived from these intensive samples will be available to our study. Based on these data, estimations of DWM and other fuels will be calculated for the study area.

Within the study area, data from existing FIA's plots will be obtained and compiled. Based on the size of the study area, there will be about 450 P2 plots and 28 P3 plots. We will randomly locate 20 plots within each intensively sampled area. DWM, litter, duff, and live ericaceous fuel loading will be assessed at each of the 20 plots using the FIA's P3 methodology. Based on the existing FIA's P3 plots and the simulated FIA P3 plots sampled in the study, a series of subsets of plots will be selected, following a stratified random procedure, to represent various sampling intensities ranging from one plot per 96,000 acres (FIA's P3 sampling intensity) to 20 plots per intensively sampled area (6,300 acres).

Results from the intensive sampling data will serve as the basis for testing various DWM sampling intensities. The numbers of distinct fuel complexes captured by the different sampling intensities will be compared and contrasted against those derived from intensive sampling. A minimum sampling intensity needed to capture all fuel complexes will be determined. Estimations derived from various sampling intensities will also be compared to the estimations derived from the intensive samples. Based on these comparisons, the estimation reliability of FIA's current DWM sampling intensity will be assessed, and a minimum sampling intensity for adequate DWM estimation will be suggested.

c. Products: Soon after funding approval, an outline of the research project will appear on the Clemson University website. A poster will be presented at the 14th Biennial Southern Silvicultural Research Conference in March 2007. By the end of the project, a MSc. thesis will be completed by a graduate student working on the project. A manuscript will be submitted for publication at a refereed journal (e.g., the International Journal of Wildland Fire), and a summary of research findings will be published on the Clemson University website. This project concerns the national FIA protocol for assessing DWM. Therefore, we anticipate FIA planners nationwide will be interested in the results of this project, and we intend to produce a USDA Forest Service technical report from the study.

d. Schedule of Activities:

- 01-03/2006 – Acquire relevant data from the previous intensive study and FIA database
- 04-05/2006 – Selection / establishment of new sampling plots in the four study locations
- 06-12/2006 – Field studies and data acquisition
- 01-06/2007 – Data processing / analysis; prepare a poster presentation for the 14th Biennial Southern Silvicultural Research Conference
- 07-10/2007 – Thesis preparation
- 11-12/2007 – Write a manuscript and a technical report.

e. Progress/Accomplishments: We are on task with our originally proposed schedule of activities. During the first year of our two-year project, we have successfully recruited highly qualified personnel to work for this project. By working with Dr. Thomas Waldrop (our cooperater), we have acquired and processed the intensively sampled data from the four proposed study areas (three national forests and one national park), which serves as the criteria to test estimates from FIA data. We have also acquired FIA P3 plots for the 4 proposed study areas. Currently, we are selecting/establishing new sample plots in our study areas, and collecting data from these plots. We anticipate that field studies and data acquisition will be completed by December 2006, and the entire project will be wrapped up by December 2007.

Costs: (Total = \$42,564)

	Item	Requested FHM EM Funding	Other-Source Funding	Source
Year 2				
Administration	Salary	\$28,903		
	Overhead	\$12,161		
	Travel	\$1,000		
Procurements	Supplies	\$500		

Budget Narrative: Salary: graduate assistantship = \$18,000 /year plus 2.9% fringe (2.9% fringe = \$522) = \$18,522/ year. One month summer salary = \$8,392 plus 23.7% fringe (23.7% fringe = \$1989) = \$10,381. Overhead = 40% of total direct costs. Travel = \$1,000. Supplies = \$500.

Literature Cited:

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