

THE NATIONAL INVENTORY OF DOWN WOODY MATERIALS: METHODS, OUTPUTS, AND FUTURE DIRECTIONS

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ABSTRACT. The Forest Inventory and Analysis Program (FIA) of the USDA Forest Service conducts a national inventory of forests of the United States. A subset of FIA permanent inventory plots are sampled every year for numerous forest health indicators ranging from soils to understory vegetation. Down woody material (DWM) is an FIA indicator that refines estimation of forest structural diversity, forest area fuel loadings, and national carbon sources. DWM comprise fine woody debris, coarse woody debris, slash piles, duff, litter, and shrub/herbs. Components of DWM are sampled using planar intercept methodologies, fixed-radius sampling, and point sampling. DWM data analyses produce core tables, regional/national reports, wildlife habitat assessments, and fuel maps. The DWM inventory began in 2001 and is currently implemented in 38 states.

KEY WORDS. Forest inventory, down woody materials, fine woody, coarse woody, planar intercept

INTRODUCTION

DWM are the dead materials on the forest floor in various stages of decay. Down woody components estimated by the FIA program are: coarse woody, fine woody, litter, herb/shrubs, slash, duff, and fuelbed depth. As defined by the FIA program, coarse woody debris (CWD) are downed logs with a transect diameter of 3-inches or greater and a 3-foot or greater length. Fine woody debris (FWD) are downed woody materials with a transect diameter between 0- and 2.99-inches. Slash piles are collections of downed coarse woody debris, whether from logging operations or natural disturbance events. Shrubs are defined as non-tree woody vegetation. Herbs are non-woody herbaceous plants, but also include ferns, moss, lichens, sedges, and grasses. Litter is dead plant material on the forest floor excluding CWD and FWD. Duff is decomposed plant material beneath the litter layer with no identifiable plant parts (i.e. stems and leaves) included. The fuelbed is the accumulated mass of dead, woody material on the surface of the forest floor. The fuelbed begins at the top of the duff layer and includes: litter, FWD, CWD, and dead woody shrubs.

A national inventory of DWM is conducted to benefit numerous aspects of forest inventory and management at regional and national scales. The DWM survey provides critical data to the forest sciences of fire, carbon estimation, and wildlife biology. A national inventory of DWM provides the data necessary to produce national fuel loading maps. National fuels maps assist assessments of forest fire hazards and fire ecology. DWM is an important component of national carbon estimates and could serve to refine estimation of national carbon sources as defined by international protocols. Lastly, a

DWM inventory estimates the structural diversity of wildlife habitats critical to threatened and endangered wildlife species.

DWM SAMPLING METHODOLOGY

FIA Phases

The FIA sampling design consists of three phases. The first phase superimposes an hexagonal grid across forest/non-forest maps of the United States. All hexagons (approximately 6,000 acres in area) have one sample point located within the hexagon. If the sample point falls on a forested area then a field crew will visit the location and establish a permanent sample plot (a phase two plot). All phase two plots are measured for tree and site attributes. Phase two plots are sub-sampled (phase three) (approximately 1/16th of all phase two plots) for forest health indicators such as DWM. During the phase three inventory, DWM sampling procedures are applied to the phase two plot. Only accessible forestland is sampled for DWM. If an FIA subplot contains non-forest conditions, then the affected DWM transects are ended and mapped accordingly.

Coarse Woody Debris

Coarse woody debris, otherwise termed 1000-hr + fuels, is sampled using transects (Figure 1) (Brown 1974). Three, 24-foot horizontal distance, transects radiate from each FIA subplot center at 30, 150, and 270 degrees. Every down woody piece with a intersecting transect diameter of at least 3-inches and at least 3-feet in length is tallied. Information collected for every CWD piece is: transect diameter, length, small-end diameter, large-end diameter, decay class, species, evidence of fire, and presence of cavities.

Fine Woody Debris

Fine woody debris, otherwise termed 1-hr, 10-hr, and 100-hr fuels, is sampled on the 150 degree transect on each sub-plot (Figure 1). FWD with a transect diameter of 0 to 0.99 inches (1-hr and 10-hr) is tallied on a 6-foot slope distance transect (14 to 20 feet on the 150 degree transect). FWD with a transect diameter of 1.00- to 2.99-inches is tallied on a 10-foot slope-distance transect (14- to 24-feet on the 150 degree transect).

Duff/Litter/FuelBed

The duff and litter are sampled using a point estimate of depth at a 24-foot slope distance along each CWD transect (for a total of 12 sample points). The depth of the fuelbed (from the base of the litter layer to the highest point of fuel) is also measured at the duff/litter sample points.

Shrub and Herbs

The shrub and herb fuel complex is sampled on the microplot (6.8-ft radius) (Figure 1). The percentage cover (10% classes) of dead and live shrubs, dead and live herbs (including grasses), and litter is estimated. A total height of the shrub and herbaceous layers is estimated for each fuel category, except litter.

Slash Piles

Slash piles with centers that are within 24-feet of any subplot center are sampled using methodology developed by Hardy (1992). The shape of each slash pile is classified into four slash pile shapes. Based on the pile shape classification, appropriate dimensions of the slash pile are measured along with an estimate of pile density.

DATA MANAGEMENT AND PROCESSING

Data from the DWM inventory will be available in two forms. First, raw field data will be available both through regional FIA contacts and through a national FTP site. The field survey data is organized in seven tables according to DWM component and sampling design: FWD, CWD, transect information, slash pile, duff/litter, microplot, and plot information.

Secondly, data will be available in a processed form from the national indicator advisor and on future FTP sites. Although numerous methodologies exist for processing the DWM inventory data to produce a number of various estimates, a selection of plot estimates (i.e. tonnage/acre) will be available for analysis.

CURRENT STATUS

At the conclusion of the 2002 phase three inventory season, the DWM inventory system has been implemented in 38 states. States where the DWM inventory has not been implemented are: Alaska, Hawaii Montana, Idaho, Wyoming, Nevada, New Mexico, Oklahoma, Mississippi, West Virginia, Maryland, Delaware, Connecticut, Rhode Island, Massachusetts, and Vermont. The DWM inventory system will be implemented in these states when periodic inventories are ended and annual inventories begun.

FUTURE DIRECTIONS

There are numerous future directions for the DWM indicator that will help facilitate ensured data quality, accessibility, and compatibility with other resource inventories. Data connectivity between phase two and phase three inventories will be enhanced in order to improve cross-survey analyses. Analyses between the DWM inventory and other phase three indicators will be fostered in order to address multi-resource forest issues. New mapping technologies will be developed in order to produce reliable maps of forest fuel loadings estimates. National/regional/state outputs will be formalized in order to produce consistent DWM estimates. DWM data will be incorporated into fire and carbon models in order to produce value-added products (post-data processing output). Finally, DWM data access will be enhanced through an improved web presence.

LITERATURE CITED

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HARDY, C.C. 1996. Guidelines for estimating volume, biomass, and smoke production for piled slash. GTR-PNW-364. USDA Forest Service, Portland, OR.

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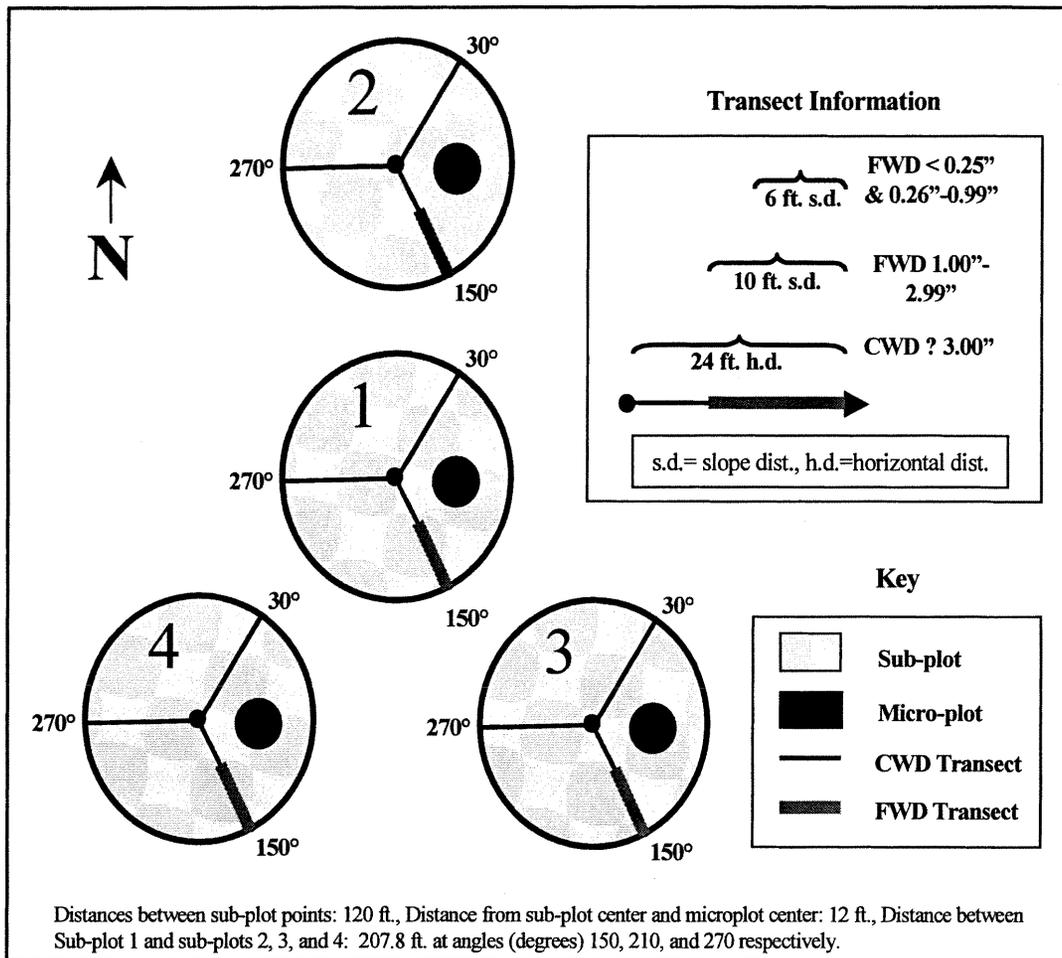


Figure 1. The Forest Inventory and Analysis Program's (USDA Forest Service) Down Woody Materials sampling design