Assessing Fine Woody Debris in Post-harvest Biomass Stands

Companion Guide to

Forestland Woody Biomass Harvesting Guidelines Field Manual



Wisconsin Council on Forestry

Wisconsin Department of Natural Resources

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Funding for this project was provided by the Sustainable Forestry Initiative (SFI©), Wisconsin SFI Implementation Committee; Wisconsin DNR Division of Forestry; and the Wisconsin DNR Bureau of Science Services.

Laura Reuling, Rob Bessert, Logan Hahn, Curt Rollman, Beau Rudd, and Teresa Pearson provided field work and logistical support to the project.

Citation:
Bronson, D.R., G.J. Edge, C.R. Hardin, S.K. Herrick, and T.G. Knoot. 2014.
Assessing Fine Woody Debris in Post-harvest Biomass Stands
Companion Guide to *Wisconsin's Forestland Woody Biomass Harvesting Guidelines Field Manual*
PUB-FR-545-2014.
WI DNR Division of Forestry and Wisconsin Council on Forestry; Madison, WI.
36 pp.

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Preface

Wisconsin's Forestland Woody Biomass Harvesting Guidelines were implemented in 2008 to address potential impacts of woody biomass harvesting on the long-term productivity of Wisconsin's forestland. A goal of the guidelines is to retain at least 5 oven-dry tons per acre of fine woody debris ("FWD"; < 4" in diameter) on site following harvest. This companion guide is designed to accompany the Field Manual for Wisconsin's Forestland Woody Biomass Harvesting Guidelines and to serve as a tool for land managers to help improve their capacity to accurately assess the amount of FWD in post-harvest biomass stands. This companion guide does not lessen the need for technical skill, sound silvicultural judgment, and informed decision making when selecting proper management practices to achieve integrated resource management objectives





Chapter 1

Introduction

Wisconsin's Forestland Woody Biomass Harvesting Guidelines (BHG's) were developed to address potential impacts of biomass harvesting on the long-term productivity of Wisconsin's forestland and ensure that woody biomass is a sustainable forest product. In traditional timber harvesting, the smaller woody material from the tree (usually < 4" in diameter woody material) is typically left on site. In biomass harvesting, the entire aboveground portion of the tree, including the branches, bark, leaves, and needles may be removed, which can result in higher nutrient export from a site compared to traditional harvesting.

The BHG's were designed to be used with other forest management recommendations, including Wisconsin Forest Management Guidelines (FMGs), Wisconsin Forestry's Best Management Practices (BMPs), and the WDNR Silviculture Handbook. These recommendations and guidelines, when used in combination, can lessen the potential impacts of woody biomass harvesting on forest biodiversity, soil nutrients and the physical properties of soil, and water quality.

The BHG's include six guidelines, with guidelines 1, 2, and 3 applying only to sites with the specific soil conditions, and are not generally applicable to all sites, while guidelines 4, 5, and 6 are usually applicable to any site. The guidelines may be modified for specific site conditions or operational issues, or to meet specific management objectives. Therefore the BHG's require technical skill and sound silvicultural judgment to identify the proper management practices for different stand- and site-level conditions and appropriately apply the guidelines. **See *Wisconsin's Forestland Woody Biomass Harvesting Guidelines Field Manual* for a full description of each of the BHG's.**







Wisconsin's Forestland Woody Biomass Harvesting Guidelines Field Manual; http://www.wisconsinforestry.org/initiatives/other/woody-biomass

A goal of the BHG's (guideline #5) is to retain at least 5 oven-dry tons per acre of fine woody debris ("FWD"; material that is < 4" in diameter) on site following harvest. This target can be achieved by retaining down FWD already present on a site (before a harvest takes place), retaining FWD resulting from incidental breakage during a harvest, and retaining and scattering additional tree tops and limbs (recommended as 10%, or 1 in 10, of the harvested tops and limbs) in the harvest area if needed. However, forest resource managers, loggers, and other forest professionals have indicated uncertainty in identifying the amount of FWD remaining following a harvest and difficulty in determining whether the recommendation for retaining an additional 10% of the tops and limbs has been satisfied. The goal of this companion guide is to provide forest resource managers, loggers, equipment operators, contractors and landowners with a tool to help accurately assess the oven-dry mass of down FWD in a stand following a harvest, thereby allowing maximum flexibility in how best to achieve the required 5 oven-dry tons of FWD. Therefore this guide can help professionals ensure that the minimum fine woody debris criterion is met, while promoting overall forest productivity and economic sustainability.



An example of a plot (50 ft x 50 ft) set up in a harvested stand to assess amount of fine woody debris present.



An excavator used to help move woody material to be weighed on a platform.

Chapter 2

Measuring Fine Woody Debris

Due to the abundance of aspen and oak species used for woody biomass in Wisconsin, these two species groups were the focus of our fine woody debris assessment. Specifically, we selected three aspen stands and three oak stands, which comprised at least 50% or greater in basal area of the targeted species group. All of the six assessed stands occurred in different counties to ensure a representative range of geographical contrast, but also a range in potential site conditions. All stands included in this assessment were harvested during the winter of 2013/2014, with the on-plot FWD assessments occurring during the summer of 2014. This ensured that the FWD on site was as fresh as possible, with little decomposition, thereby providing a visual reference similar to when it was harvested. See the Appendix for the the six counties in which the assessments took place and the pre-harvest estimates (tons) for each stand.

Within each of the six forest stands, three plots measuring 50 ft x 50 ft in size were established to measure FWD. All plots had each cardinal direction corner staked and boundaries were flagged. After each plot was marked, a series of photos was taken to record the pre-disturbed appearance of FWD.

After photographing the pre-disturbed FWD, field technicians picked up all FWD inside the plot and placed the material on a large platform located off plot. An excavator and an industrial scale were used to pick up the platform and weigh the FWD for the entire plot.



Fine woody debris moved to a platform to be weighed.



Photo of the 50 ft x 50 ft plot taken from 8 ft above the ground.

The FWD mass measured per plot on site was fresh FWD with moisture content between 20-50%. The biomass guidelines recommend a minimum of five oven-dry tons per acre, which requires a moisture correction to convert fresh FWD with moisture to an oven-dry mass. To moisture correct the FWD, five representative samples were collected off-plot the week prior to assessment for each stand and dried in a large oven until a stable mass was achieved. These moisture corrected samples provided a moisture content of the FWD for each stand, and allowed for all FWD plot measurements to be converted to oven-dry masses. After each plot of fresh FWD was weighed and converted to oven-dry mass, a single oven-dry converted ton was weighed out and scattered back on to the plot.

After the equivalent of each moisture-corrected oven-dry ton per acre was placed on the plot, photos were taken to document the visual change in FWD. A photo series was collected for each plot, representing different amounts of FWD; from 1 oven-dry ton per acre through 10 oven-dry tons per acre.

Photographs were standardized across all plots and stands to ensure similar visual representation. Specifically photographs were collected from each of the four corner stakes. Two landscape-style perspectives for each corner stake were taken, with the first perspective taken at ground level looking across the plot. The second perspective was taken from 8 feet above the ground, to better simulate the perspective of an operator in a processor.

In addition to these landscape-style photographs, a second series of photographs was collected to provide a closer view. These ground view photographs focus inside a 5 ft x 5 ft marked area and document the changing amount with each increasing oven-dry ton amount.





Biomass removed and ready for processing, following a timber harvest.

Chapter 3

Photo Series

There are a variety of factors that can influence the amount of fine woody debris that remains on site following a biomass harvest. Such factors may include the type of tree species, understory conditions, and type of harvesting equipment used. For example, when harvesting aspen for biomass, there is usually sufficient existing fine woody debris (FWD) and incidental breakage during a harvest to reach the goal of 5 oven-dry tons per acre of fine woody debris (FWD) following a harvest. In contrast, when harvesting non-aspen systems, an additional retention of 10% FWD in harvested tops and limbs or other FWD material is typically required to achieve the FWD goal.

While the average stand in Wisconsin is estimated to contain about 3 oven-dry tons per acre of FWD prior to harvest, stands must be assessed to determine if enough FWD is already present. The following set of photos was taken to assist with visual estimates of fine woody debris following a biomass harvest. These photos depict different tree species as well as site conditions that existed during a biomass harvest event.

This chapter is arranged to depict different amounts of fine woody debris present at a plot (with the moisture correction applied), for oak and aspen dominated stands. We present photos of plots from six different stands, with 1, 3, 5, and 10 oven-dry tons per acre of fine woody debris present.






3 tons/ ac.




5 tons




10 tons/ac




SCH40
J-M MANUFACTURING 1-2" SCH40


MARATHON
BURN
PLOT 2
1 TON/AC


SCH40


MARATHON
LOT 2
3 TON/AC


5 tons
SCH40


MARATHON
PLOT 1
5 TONS/AC


10 tons/ac


MARATHON
PLOT 2
10 TONS/ACRE




Oneida
15-12
ONE TON




Oneida
18-12
3 TON




Oneida
BIO
5 TON/AC








FLORENCE
PLOT 2
1 TON /AC.




FLORENCE
PLOT 2
3 TONS/AC


5 tons
ac


FLORENCE
PLOT 2
5 TONS/AC


10 TONS/AC.

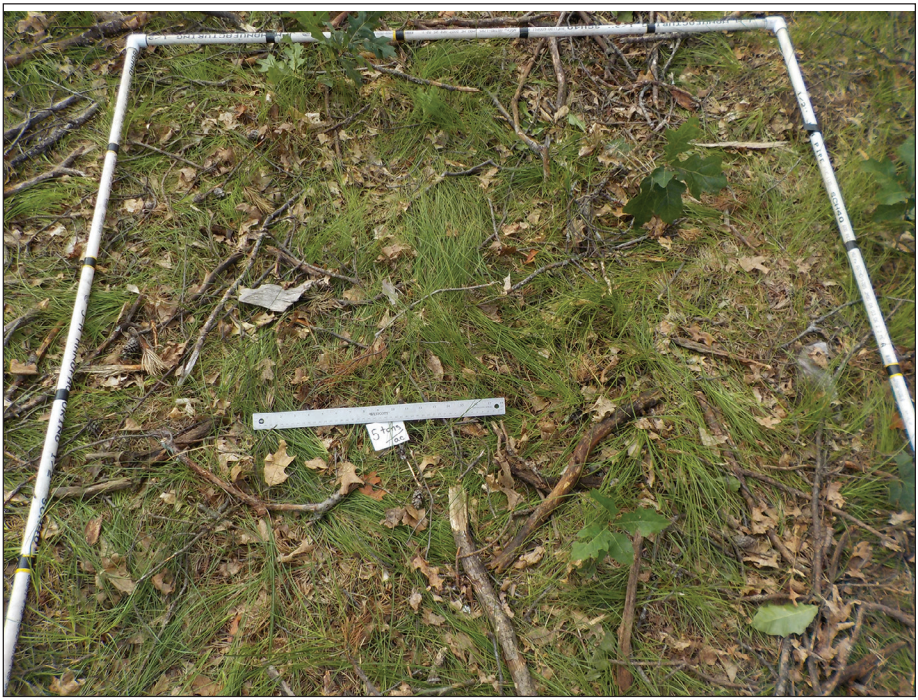

FLORENCE
PLOT 2
10 TONS/AC.


1-ton/ac








5 tons
Oak




10 tons/ac












5 tons
J-M MANUFACTURI
1 1/2" SCH40







Appendix

Harvested mass (tons)

	51 acres	103 acres	81 acres	41 acres	118 acres	203 acres
Species	**Oneida**	**Lincoln**	**Florence***	**Marathon**	**Wood**	**Juneau***
Aspen	802	2465	150	2078	850	170
Mixed hardwoods	619	1146	415	327	500	1290
Oak			1678		2338	4340
Dead oak						508
Red pine			31		50	610
White pine			10			460
Jack pine			70			710
White birch	449					
Basswood		272				
Hickory				153		
Balsam	841					
Mixed biomass		1679		701		
Total	2711	5562	2354	3259	3738	8088

* Post-harvest information was not available. Data provided are pre-harvest estimates.

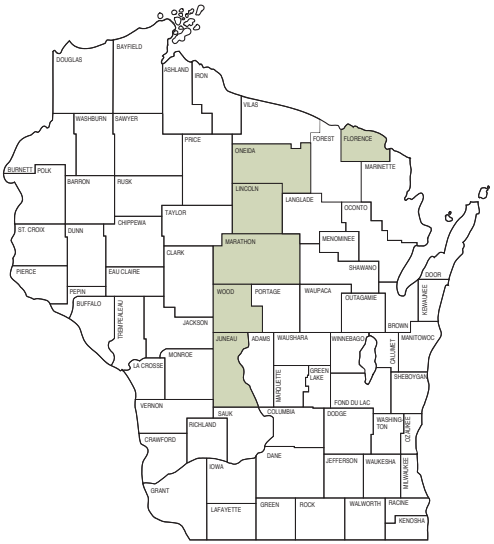




Photo from a plot in which 5 oven-dry tons per acre of fine woody debris is present.

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PUB-FR-545-2014