

Is Woody Residue Part of Your Plan for Sustainable Forestry?

By **DEBORAH PAGE-DUMROESE**

The answer to the title question should be “yes”!



Currently, there is a lot of chatter about sustainable forestry and alternative fuels, including conversion of wood to bioenergy. At first glance it may seem like there is a conflict—how can removal of woody biomass be sustainable? Whether you are a small woodlot owner doing sustainable harvesting, looking for rotational forest products, chasing bioenergy products, or looking to use forest “waste” left from thinning or harvesting, one question I am repeatedly asked is: “How much woody material should I leave on my forest site?”

First, let’s look at the role of woody residues in forested ecosystems. Woody material basically comes in two forms: coarse woody residue (>7 inches in diameter) and all the smaller materials (fine woody residue). Understanding the ecological role of each component can help you form Best Management Practices (BMPs) for your particular site(s) and understand not only how much woody residue to leave, but why.

Coarse woody residues. Coarse woody residue is defined as wood

greater than seven inches in diameter and is usually laying on the soil surface. Coarse wood can be added to a site during logging or when a snag falls.

Ecologically, coarse woody residues function as habitat for a variety of organisms, including fungi, mosses, liverworts, insects, amphibians, reptiles, small mammals and regenerating plants. In cool climates, downed logs act as nurse logs for seed germination and establishment, and their absence could significantly alter natural regeneration patterns. Birds forage, nest and hunt in and on dead wood. Coarse wood affects ponding, sediment trapping and aeration in streams. In addition, coarse wood can alter site water balance and water quality, both through storage and release of water, and by reducing runoff and erosion. Coarse woody residue is commonly used during harvest operations to protect wet soil areas from compaction and rutting, and is used post-harvest to help limit runoff and erosion from skid trails and forest roads. Coarse wood amounts on any given site are naturally regulated by local climatic regimes, which determine decomposition rates. As woody debris decays, it eventually forms soil wood (covered by mineral soil and forest floor material), where it helps to improve cycling and increases water holding capacity. This slow incorporation of woody material into the mineral soil may improve soil properties over the long term and influence tree growth over time. However, many sites in the western U.S. have a short fire return interval that can consume a portion of the coarse woody debris along with other surface fuels, and therefore you may need to adjust the amount of residues left based on recent fire activity.

Fine woody residues. Fine woody residues are usually defined as that



PHOTO COURTESY OF BOB POWERS

Large woody material can hold moisture long into the growing season and may provide roots with an additional source of water to extend their growing season.

portion of harvest residue that is less than seven inches in diameter and often is less than three inches in diameter. Ecologically, it adds soil cover that can reduce soil erosion, moderate soil temperatures, and on some sites it may increase soil nutrients. However, there are few long-term studies on the role of fine woody residues and their importance in a variety of forest types and soils. The scattered results that are published indicate that in general, intensive harvesting and removal of small diameter residues do not universally reduce site productivity. However, on some sites, repeated harvest cycles that remove all of the fine woody residues can cause substantial growth declines if not mitigated.

On some Pacific Northwest forest sites, nitrogen (N) is limiting, but often have an adequate supply of other nutrients so that even repeated intensive removals of fine woody residues will not induce nutrient deficiencies. Therefore, in dry or cold forests where N cycling is slow due to climate, N losses in harvested materials may substantially reduce productivity by lowering decomposition and

Professional Forestry Services, Inc.

Forest Appraisal • Management
Expert Witness • Hazardous Trees

Mike Jackson, CF, ACF
360-943-1470

Since 1960

100 Ruby St. S.E., Ste. B Fax 360-943-1471
Turnwater, WA 98501 www.proforestry.com

N mineralization rates. In addition, for sites with little slope and little compaction concern there will likely be sufficient woody biomass on the soil surface to mitigate erosion and compaction concerns. This general lack of site-specific information is a topic for continued research to identify particular forest and soil types where potential nutrient deficiencies may be exacerbated by biomass harvesting or how forest residues might influence local site productivity.

Strategies to help offset biomass use or nutrient losses should also be developed on a site-specific basis. For instance, fertilization is a common treatment used primarily to increase forest growth, but can also be used to mitigate nutrient removals from biomass harvesting. Based on the ecological- and productivity-related roles of woody residues and the constraint that some forest landowners may not want or be able to fertilize to lessen potential productivity losses from biomass removals, some level of woody material (large and small) should be retained to protect these functions.

“How much should I leave?” One good rule of thumb is to retain the same amount of coarse and fine woody residue that is there pre-harvest. However, because dead wood is important for many ecological functions and the amounts of residue needed to perform these functions



PHOTO COURTESY OF DEB PAGE-DUMMOISE

Large material can remain on the soil surface for decades, depending on local climatic regimes.

varies widely across climatic, geologic and vegetation gradients, a single retention percentage or amount should not be used as an actual guideline; actual retention guidelines should be developed at the local level. It is relatively easy to determine how much coarse and fine woody residues are present on the soil surface before harvesting. If a site has been heavily impacted or is not subject to a short fire-return interval, than leaving additional material behind could help improve long-term soil quality.

Best Management Practices. There are numerous reasons to develop BMPs for site-specific land management objectives, but the bottom line

still comes down to “How much should I leave?” Opportunities for BMPs are mostly common sense: limit logging when the soil is wet, match equipment to the site, use winter logging to minimize ground disturbances, leave the stumps in place, and don’t create large slash piles for burning. Minimizing the size of slash

—Continued on next page—

Understanding Your Soil and Operability Risks

The NRCS website has a tool called the Web Soil Survey. You can find this tool at <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>. Once at this page, click the big green button in the center of the page (it says “Start WSS”). On the page that appears you can pick your state, county and area of interest (AOI—your land). Once an AOI has been selected you can ask for “soil property and quality data.” Look at “suitabilities and limitations for use” (you can select “land management” and then “harvest equipment operability”). This site also has an introduction to soils. The only word of caution is to note the scale of the map and to understand that because of this scale, the data might not match your site exactly. Your local NRCS soil scientist or soil conservationist can help if you have difficulties with this page.

WARREN R. WEATHERS, MBA, ACF

*Registered Professional Forester
Certified General Appraiser*



Forest and Rural Property Appraisal & Analysis Pacific Northwest and Alaska

Appraisals for:

- Estate Planning & Tax Reporting
- Dispute Resolution • Takings • Damages

541-937-3738

Post Office Box 39 • Lowell, Oregon 97452

piles to <15 percent of the total land area harvested will also help keep soil impacts confined. Long-term research indicates that the key to sustainable forestry is to keep the surface organic horizons (fresh and decaying organic matter) intact so you can maintain nutrient cycling and moisture retention, and prevent erosion.

Leaving coarse woody residues will likely not increase tree growth per se and fine woody residue removals can be altered relatively easily, so ecological, long-term forest sustainability and state forest practices acts are probably the most important considerations for how much residue to leave behind. Several states have released guidelines that address the functions of both coarse and fine woody residues. Most of the guidelines were developed for general timberland conditions, with some additional restrictions for special areas such as critical plant or animal habitat, shallow soils or steep slopes.



PHOTO COURTESY OF AL HARVEY

One of the key ecological functions of coarse wood is that many roots and fungal hyphae grow there.

For example, Maine requires all coarse woody material existing prior to harvest to be retained after harvest, and at least 20 percent of the finer-sized logging residues less than three inches in diameter should be retained. Minnesota requires 20 percent of the logging residues to be retained and scattered throughout the harvest tract. Pennsylvania's guidelines call for 15-30 percent of the harvestable biomass to be retained, while Missouri calls for 33 percent retention. Sensitive sites and soils are pro-

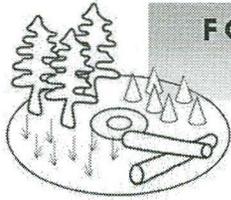
tected similarly. Minnesota suggests avoiding biomass harvesting in areas with threatened, endangered or otherwise sensitive plant or animal habitats, from within riparian management zones, on certain organic soils, and on shallow soils with aspen or hardwood cover types. In general, indications are that retaining 30 percent of fine woody residues on slopes less than 30 percent and 50 percent retention on steep slopes is a reasonable and conservative estimate of the

amount of material needed to maintain biodiversity, prevent erosion and compaction, and build soil organic matter where possible.

On many sites before harvest operations begin, you can develop your own BMPs based on soil nutrient levels, depth of the mineral soil, amount of rocks, and local climatic regimes (rainy, cool, hot, dry, etc.).

Ecologically, it is important to leave both coarse- and fine-woody residues after harvest operations, but you should understand why leaving this material on your site may or may not increase the inherent productivity of the soil or change tree growth during the current rotation. Knowing if your soil is limited in N or other nutrients can help you determine how much fine or coarse woody residue will benefit your land. You can also determine if compaction might be an issue, if your soils readily develop ruts, or if you have a drainage problem. Information on your soil type(s) is available from the Natural Resource Conservation Service (NRSC) locally or on their website (see sidebar), and you can use this information to develop your own risk rating system that assesses your soil type, topography and climatic regime. ■

DEBORAH PAGE-DUMROESE is a research soil scientist for the Rocky Mountain Research Station in Moscow, Idaho. She can be reached at 208-883-2339 or ddumroese@fs.fed.us.



FOREST MANAGEMENT SOFTWARE

Under Development...
Assisi Woodland™

User-Friendly Interface
Timber and Non-Timber Inventory
Cruise Compilation
Management History Tracking
Mapping and Reports

ASSISI SOFTWARE™
www.AssisiSoft.com

Free Trial Downloads Available Online!

PO Box 33815
Portland, OR 97292
www.AssisiSoft.com
info@AssisiSoft.com
+1.503.233.6417



GeneTechs

Richard W. Courter Professional Forester

FOREST

- Management Consultant
- Inventories and Appraisals
- Genetic Tree Improvement
- Feasibility Studies

1600 NW Skyline Blvd., Portland, Oregon 97229

(503) 297-1660