DRAFT

Wisconsin's Forestland Woody Biomass Harvesting Guidelines

Wisconsin Council on Forestry
Wisconsin Department of Natural Resources, Forestry Division

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A Note About the Draft: This document is a work in progress. When the proposed Guidelines are approved in final form, a booklet-sized version will be developed.

Introduction

Higher energy prices and incentives to produce renewable energy have increased interest in sources of bioenergy. The expansion of a wood-based bioenergy industry could potentially benefit Wisconsin's economy by expanding markets for forest products, creating jobs and reducing reliance on fossil fuels. However, concerns have also been raised about sustainability and the environmental impacts of increased removal of woody biomass from Wisconsin's forests. Understanding these impacts and assuring that the harvest of woody biomass is done within the framework of sustainable forest management is a priority of the Wisconsin Council on Forestry. The Forestland Woody Biomass Harvesting Guidelines were developed to forestall impacts that could adversely affect forest ecosystem sustainability.

These guidelines focus on the sustainable harvest of woody biomass from forested areas within the context of generally accepted forestry practices, and provide considerations and recommendations applicable to stand and site-level management based on best available information. The guidelines address the impacts of increased biomass harvesting on biodiversity conservation, soil nutrient depletion, physical properties of soil, and water quality. The objective is to provide guidance to forest resource managers, loggers, equipment operators, contractors, and landowners in Wisconsin, and to facilitate operational analysis and informed decision-making regarding the harvest of woody biomass from forestland.

The guidelines are a tool to enable sustainable forest management by presenting users with practical and reliable recommendations that are easy to understand and implement. Implementation of the Forestland Woody Biomass Harvesting Guidelines is voluntary. Furthermore, the guidelines should be considered a "work-in-progress" based on best available information; they will be subject to periodic review and revision as additional information becomes available.

There are many issues concerning woody biomass production that go beyond the scope of these guidelines. Key issues not addressed herein include: resource availability, economics, short rotation intensive culture (SRIC) of woody biomass plantations, landscape planning and management, and monitoring of impacts. There are current documents and analyses in progress that will address resource availability and economics. SRIC could provide a focused strategy for production of woody biomass, but statewide strategies and guidelines have not been developed. Landscape planning and management are critical to effective allocation and conservation of resources and benefits, but decisions require complex socio-political processes. Monitoring will be required to evaluate the effectiveness of guidelines. Although research to address the many information gaps and uncertainties is not addressed in the guidelines, a list of research needs has been incorporated into the Rationale supporting the Guidelines.

The guidelines were drafted at the request of the Wisconsin Council on Forestry by a technical team comprised of WDNR staff using best available information. The completed guidelines underwent technical review by a select group of experts, and a stakeholder review by an Advisory Committee selected by the Wisconsin Council on Forestry. After review and approval by the Advisory Committee, the guidelines will be presented to the Wisconsin Council on Forestry. If the draft guidelines are accepted, the Council may solicit public input prior to final approval.

The Forestland Woody Biomass Harvesting Guidelines are divided into two categories: general, and site specific. General guidelines are designed to be applicable to and should be implemented at any site where fine woody debris will be harvested. Site specific guidelines address specific conditions which are not present at all sites, and should be implemented only on sites which exhibit the conditions referenced in the guideline.

Guidelines

General Guidelines

These guidelines are generally applicable to any site. It is expected that these guidelines will be implemented in addition to any applicable silvicultural guidelines, forest management guidelines (FMGs) and best management practices (BMPs). In cases where these guidelines are modified or not applied, then documentation of the rationale, including the expected impacts of the deviation, is recommended. Examples of where a deviation may be warranted include site preparation to facilitate tree regeneration operations, control of invasive or exotic species, fuel reduction treatments, barrens/savanna restoration, or prescribed fire.

1.A Reminder: Follow Silviculture Handbook – Chapter 24 – Marking Guidelines.

Recommendations for tree and snag retention in managed stands are:

- Even-aged rotations
  - ✓ Retain ≥3, preferably large, snags per acre.
  - ✓ Retain reserve trees and patches at 5-15% crown cover or stand area, including large vigorous trees, mast trees, and cavity trees. Reserve trees and patches are not cut during stand rotation. Harvesting may occur in the future or may be foregone to achieve other benefits.
- Even-aged intermediate treatments
  - ✓ Retain ≥3, preferably large, snags per acre.
  - ✓ Retain ≥3, preferably large, cavity trees per acre.
  - ✓ Retain ≥3, preferably large, mast trees per acre.
  - ✓ If previously established, manage reserve trees and patches. Management may include timber harvesting or passive retention. Consider retaining ≥3 trees per acre to develop into large, old trees and to complete their natural lifespan. These trees may also satisfy cavity and mast tree recommendations. These trees will often become large snags and coarse woody debris.
- Uneven-aged systems
  - ✓ Retain ≥3, preferably large, snags per acre.
  - ✓ Retain ≥3, preferably large, cavity trees per acre.
  - ✓ Retain ≥3, preferably large, mast trees per acre.
  - ✓ Consider retaining ≥3 trees per acre to develop into large, old trees and to complete their natural lifespan. These trees may also satisfy cavity and mast tree recommendations. These trees will often become large snags and coarse woody debris.

When applying retention guidelines, be sure to consider:

- ✓ Individual trees can satisfy multiple benefits. For example, three large oak trees with cavities could satisfy the mast tree and cavity tree recommendations, as well as the large, old tree consideration.
- ✓ Retention of both vigorous and decadent trees will provide an array of benefits.
- ✓ In general, species diversity is encouraged when selecting trees to retain
- ✓ Large trees and snags are >12 inches dbh, and preferably >18 inches dbh.
- ✓ Trees retained can be scattered uniformly throughout a stand or irregularly dispersed, as single trees, groups, and patches. Retention in aggregated patches (0.1-2 acres) generally provides the most benefits. The general recommended strategy is to retain irregularly distributed patches along with scattered groups and individuals.
- ✓ Patches retained can satisfy multiple benefits. For example, at stand rotation, an unharvested buffer along a stream may satisfy BMP (water quality) and reserve tree retention guidelines.
- ✓ Retain as many snags as possible. Retention of snag diversity (species and size) can potentially provide the greatest array of benefits. Snags that are determined to be a threat to human safety can be cut and retained on site as coarse woody debris.
- ✓ Clearly designate, in writing and/or by marking, which trees should be retained (not cut) prior to any cutting operations.

2.A Retain and limit disturbance to down coarse woody debris (CWD) already present, except on skid trails and landings.
Exception: For complete salvage operations, follow Guideline 2.B.

3.A Retain fine woody debris (FWD) on site following harvest.

- Retain down fine woody debris (FWD) already present (before cutting) except on skid trails and landings.
- Even-aged rotations and complete salvage operations
  - Retain a minimum of 5 oven-dry tons/acre FWD.
    FWD can be comprised of a combination of pre-existing and cut during harvest material (including incidental logging residue <4 inches diameter).
    FWD present in tree retention patches is included as pre-existing FWD.
- Even-aged intermediate treatments and Uneven-aged systems
  - Retain a minimum of 1 ton/acre oven-dry FWD cut during harvest (including incidental logging residue <4 inches diameter), but not including pre-existing FWD.
- Considerations
  - In an average forest in Wisconsin, tree crowns contain 8-16 oven-dry tons/acre of fine woody material (FWM).
  - The average forest in Wisconsin has 3 oven-dry tons/acre of pre-existing FWD on the ground. See Table X for average crown weights by forest type.
  - Some forests lack woody debris because of past management; consider retaining additional amounts of FWD and/or CWD in these areas.
  - If possible, leave most of the FWD well-distributed throughout the site to maintain nutrient cycles. Retaining some small slash piles may benefit some animals and plants.

4.A Do not remove the forest litter layer, stumps, and/or root systems.

5.A No more than 3% of the harvest area should be occupied by permanent roads and landings that remove forestland from production. Roads, landings and skid trails should not occupy more than 15% of the harvest area.

Site Specific Guidelines

These guidelines will be applicable only to sites which contain these specific conditions. These guidelines are not applicable to all sites. It is expected that these guidelines will be implemented in addition to any applicable silvicultural guidelines, forest management guidelines (FMGs) and best management practices (BMPs). In cases where these guidelines are modified or not applied, then documentation of the rationale, including the expected impacts of the deviation, is recommended. Examples of where a deviation may be warranted include site preparation to facilitate tree regeneration operations, control of invasive or exotic species, fuel reduction treatments, barrens/savanna restoration, or prescribed fire.

1.B Protect and sustainably manage species of greatest conservation need and sensitive ecosystems

- Do not harvest fine woody material from sites where Federal or State Endangered or Threatened Species are known to exist or are discovered during operations.
  - Exception: If harvests of fine woody material have been demonstrated to maintain or improve habitat for the species present, then follow appropriate management guidelines to sustain the occurrence or condition. Limit, to the extent possible, the establishment of landings and roads in these areas.
- Before harvesting woody biomass, determine the presence (and location) of and potential impacts on:
  - State Special Concern Species and Species of Greatest Conservation Need (those not listed as Federal or State Endangered or Threatened)
  - Element Occurrences (EO) of Wisconsin Natural Heritage Inventory (WNHI) Community Types
  - Designated High Conservation Value Forests (HCVF)
  - Communities demonstrating exceptional composition or structure, and sensitive sites (those not listed as WNHI EO or HCVF), including:
    - Relict forests, old-growth forests, old forests, large bogs, vernal pools, seeps, cliffs, rock outcrops, ravines, and caves

  Follow management strategies to protect and conserve species of greatest conservation need and sensitive ecosystems. Limit, to the extent possible, the establishment of landings and roads in these areas.
- Consult specialists, management guides, and databases to assess occurrence, habitat requirements, community characteristics, potential impacts of proposed management activities, and management alternatives and recommendations.
  - Specialists are those who have in-depth knowledge regarding conservation and management of the species or ecosystem of concern, and may include wildlife biologist, conservation biologist, community ecologist, and forest ecologist.

2.B Salvage: If salvage operations that include the harvest of fine woody material are intended in stands that have been severely disturbed (e.g. following crown fire or complete blowdown):

- Retain at least 5% of area in unsalvaged (no harvest) patches 0.1-2 acres in size. These should include large diameter reserve trees, mast trees, cavity trees, snags, and down coarse woody debris if present.
- Exceptions:
  - Retention is deemed a threat to human health and safety
  - Retention would interfere with effective sanitation methods to control pathogen outbreaks

3.B Do not harvest fine woody material on shallow soils where bedrock is within 20 inches of the surface.

- Areas with shallow soils are identified by using soil survey maps produced by the Natural Resources Conservation Service (NRCS). A list of soil map units appears in Appendix 2. See the Web Soil Survey for soil maps: http://websoilsurvey.nrcs.usda.gov/app/

4.B Do not harvest fine woody material on nutrient-poor soils.
Exception: Jack pine stands may be harvested for woody biomass at rotations of 40 years or longer.

- Nutrient-poor soils are components of soil map units that meet certain criteria, such as low clay content. See Appendix 2 for a complete list of criteria.

- Areas with nutrient-poor soils are identified by using soil survey maps produced by the Natural Resources Conservation Service (NRCS). A list of soil map units appears in Appendix 2. See the Web Soil Survey for soil maps: http://websoilsurvey.nrcs.usda.gov/app/

5.B Do not harvest fine woody material on soils classified as dysic Histosols. These are wetland soils with at least 16 inches of organic material that are nutrient-poor with a low pH.

- Areas with dysic Histosols are identified by using soil survey maps produced by the Natural Resources Conservation Service (NRCS). A list of soil map units appears in Appendix 2. See the Web Soil Survey for soil maps: http://websoilsurvey.nrcs.usda.gov/app/

Appendix 1: Definitions

Biological Diversity (biodiversity): The spectrum of life forms and ecological processes that support and sustain them. Biological diversity occurs at four interacting levels: genetic, species, community, and ecosystem.

Biological Legacy: An organism, a reproductive portion of an organism, or a biologically derived structure or pattern inherited from a previous ecosystem. Biological legacies often include large trees, snags, and down logs left after harvesting to provide refugia and to structurally enrich the new stand.

Cavity (den) Tree: A (partially) hollow living tree used by wildlife.

Coarse (down) Woody Debris (CWD): Dead woody material, greater than or equal to 4 inches diameter inside bark at the small end, on the ground in forest stands or in streams.

Community: An assemblage of plants and animals living together and occupying a given area.

Dysic Histosols: Histosols are soils made up of organic material that accumulates in wetlands where restricted drainage slows decomposition. 'Dysic' is a reaction class, indicating that these Histosols have a pH of 4.5 or less, characteristic of acidic peatland bogs.

Element Occurrence (EO): An area of land and/or water in which an element (a natural community, a rare plant population, a rare animal population, or other feature tracked by the Natural Heritage Inventory program) is, or was, present. For natural community elements, the EO may represent a stand or patch of a natural community, or a cluster of stands or patches of a natural community. Because they are defined on the basis of biological information, EOs can cross jurisdictional boundaries.

Endangered Species: (Wisconsin): Any species whose continued existence as a viable component of Wisconsin's wild animals or wild plants is determined by the Department to be in jeopardy on the basis of scientific evidence. These species are protected by state law (see State Statute 29.604 and Administrative Rule NR27). There are additional species that receive protection under the federal Endangered Species Act that are not listed as endangered or threatened by the state of Wisconsin.

Federally-listed Species: Species federally-listed as endangered or threatened (legally protected) and those proposed for federal listing or candidates for federal listing, or their proposed or designated critical habitats. Impacts to federally-listed species are subject to requirements of the U.S. Endangered Species Act.

Fine (down) Woody Debris: Dead woody material, less than 4 inches diameter inside bark at the large end, on the ground in forest stands or in streams.

Fine Woody Material: Woody material, living or dead, less than 4 inches diameter inside bark at the large end; including fine woody debris and portions of standing living and dead shrubs and trees.

Forest: An ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, age class, and associated processes. Typically, tree cover will exceed 50% crown cover, except following a severe disturbance and during stand (re)establishment. Productive forest stands are capable of growing wood volume at an average rate of at least 20 cubic feet per acre per year.

Forest Litter Layer: A layer that lies above the mineral soil, made up of organic debris including leaves, needles, bark, and wood, in different stages of decomposition, with a variety of insects, microbes, and fungi that feed on the litter.

Habitat: The place (environment) where an animal, plant, or population naturally or normally lives and develops.

High Conservation Value Forest (HCVF): A term used by Forest Certification organizations. These areas possess exceptional ecological qualities and have been specifically designated as HCVF in property management plans. For some ownerships, such as Wisconsin State Forests, HCVF may be referred to using a different designation (e.g. State Natural Area or Native Community Management Area), but a crosswalk has been provided for use by certification organizations.

Logging Residue: The unused portions of trees cut or killed during logging and left in the woods.

Mast: Fruit and nuts consumed as food by wildlife.

Old Forest: Forests which are older than the typical managed forest (beyond traditional rotation age), but are not biologically old. They are beyond economic maturity, but are not senescent.

Old-growth Forest: Forests which are relatively old and relatively undisturbed by humans. The forest is biologically old, containing some trees which are nearing or beyond their average expected lifespan. The original even-aged overstory, established following a catastrophic disturbance, is becoming senescent, is senescing, or has senesced.

Passive Management: A deliberate decision to not manipulate forest vegetation.

Relict Forest: Forests which appear never to have been manipulated, exploited, or severely disturbed by humans of European origin; in Wisconsin, the stand and site should show no evidence of significant human disturbance since about 1800 AD.

Reserve Tree (standard, legacy tree, green tree retention): Living trees, ≥5 inches dbh, retained after the regeneration period under even-aged or two-aged silvicultural systems.

Salvage Cutting: The removal of dead trees or trees damaged or dying because of injurious agents other than competition, to recover economic value that would otherwise be lost. Note: complete salvage refers to salvage operations following extensive stand injury that requires subsequent reforestation, whereas partial salvage follows light to moderate disturbance events that do not result in stand re-initiation.

Slash: The residue left on the ground after logging or accumulating as a result of storm, fire, girdling, or delimbing.

Snag: Standing dead tree.

Special Concern Species (Wisconsin): Any species with some problem of abundance or distribution suspected but not proved. The main purpose of this category is to focus attention on certain species before they become endangered or threatened. The Wisconsin Natural Heritage Inventory program maintains a list of species currently tracked by the WDNR. Some species listed as Special Concern are federally-listed and thereby protected under the U.S. Endangered Species Act. In addition, several other state and federal laws may apply to some of these species (see http://dnr.wi.gov/org/land/er/laws/ for more information).

Species of Greatest Conservation Need (Wisconsin): Animal species identified as at risk or declining in the
Wisconsin Wildlife Action Plan (WDNR 2006). They include threatened and endangered species, as well as many other species whose populations are of concern. Designation of a species as SGCN does not, alone,

offer legal protection; however, many of the SGCN are either state or federally-listed. In addition, several other state and federal laws may apply to some of these species (see http://dnr.wi.gov/org/land/er/laws/ for more information).

Sustainable Forest Management (sustainable forestry): 1) WDNR: The practice of managing dynamic forest ecosystems to provide ecological, economic, social, and cultural benefits for present and future generations. 2) SAF – UN: The practice of meeting the forest resource needs and values of the present without compromising the similar capability of future generations. 3) SAF – EU: The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and potential to fulfill, now and in the future, relevant ecological, economic, and social functions at local, national, and global levels, and that does not cause damage to other ecosystems.

Threatened Species (Wisconsin): Any species which appears likely, within the foreseeable future, on the basis of scientific evidence, to become endangered. These species are protected by state law (see Statute 29.604 and Administrative Rule NR27). There are additional species that receive protection under the federal Endangered Species Act that are not listed as endangered or threatened by the state of Wisconsin.

Variable Retention Harvest System: An approach to harvesting based on the retention of structural elements or biological legacies from the harvested stand for integration into the new stand to achieve various ecological objectives.

Whole-tree Harvesting: Cutting and removing an entire upper portion of a tree consisting of trunk, branches, and leaves or needles.

Wildlife: All non-domesticated animal life.

Woody Biomass: Wood materials, such as wood, bark, sawdust, timber slash, and mill scraps. **Note: The woody biomass harvesting guidelines refer to woody biomass that comes directly from forestland harvest, i.e. wood, bark, etc. This definition is for the purpose of this document and is not meant to supplant or conflict with the definition of sustainable woody biomass approved by the WI Council on Forestry.**

Appendix 2: Soil map units where harvest of fine woody material is limited (Guidelines 3B, 4B, and 5B).

Harvest of fine woody material is limited or partially limited on three categories of soils: 1) shallow soils (lithic bedrock within 20 inches of the surface), 2) nutrient-poor sandy soils, and, 3) soils classified as dysic Histosols. Lists of soil map unit components that fall into these categories are presented in this appendix, organized by county.

Nutrient-poor sandy soils are components of soil map units that meet the following criteria in the NRCS database:

a) Low percent clay (generally 3% or less, but some soils have a range of characteristics that includes 4-5%)
b) Low CEC (3-4 meq/liter)
c) Drainage classes of well-drained and drier (excludes moderately well-drained and wetter)
d) No lamellae, or loam or heavier textural layers below 100 cm
e) No carbonates or water tables described within the profile
f) Not classified as Alfisols or Mollisols by Soil Taxonomy

Consideration: Vilas soils are borderline nutrient-poor. They are not restricted, but nutrient-demanding forest types may not be the best choice for these soils. Harvesting FWM on this soil could contribute to nutrient depletion over several rotations.

Soil map units that are limited or partly limited for harvest of fine woody material

Adams County (draft example – not an actual list)

Shallow soils

- BpF - Boone-Rock outcrop complex, 25 to 45 percent slopes

Nutrient-poor soils

- BnB - Boone sand, 2 to 6 percent slopes
- BnC - Boone sand, 6 to 12 percent slopes
- BnD - Boone sand, 12 to 25 percent slopes
- PfA - Plainfield sand, 0 to 2 percent slopes
- PfB - Plainfield sand, 2 to 6 percent slopes
- PfC - Plainfield sand, 6 to 12 percent slopes
- PfD - Plainfield sand, 12 to 35 percent slopes

Dysic Histosols

- None