

Slideshow used for public meetings. Note that the guidelines apply to forested land; not brushland or openland.

# Development of Guidelines

- ▶ Process
- ▶ Current status
- ▶ Scope of project
- ▶ Introduction to proposed Guidelines



Outline for talk

## **Impetus for the Guidelines**

- ▶ The Wisconsin Council on Forestry initiated the effort to develop biomass harvesting guidelines because of:
  - Projected demand. Proposed new industries, if they became operational, could require nearly a million additional dry tons of wood within the next four years.
  - Other states processes. Minnesota completed biomass harvest guidelines in 2007.
  - Governor's initiatives: *Clean Energy Wisconsin, a Plan for Energy Independence*, announced March, 2008
  - In 2007 FSC auditors issued a CAR for state to develop retention guidelines for coarse woody debris within 2 years
  - The need to understand environmental impacts of increased removal of woody biomass
  - Wisconsin's policy to sustainably manage forests, protecting soil, water and biological diversity

CAR is a corrective action request. FSC is Forest Stewardship Council, a certifying group for sustainably managed forests.

## Woody Biomass

- ▶ Terminology:
  - “Biomass harvest” in general usage refers to wood harvested for energy production
  - “Biomass” is a measure of the weight of any part of a tree or a whole tree; typically given in oven-dry tons (for example, in FIA measurements)
- ▶ Guidelines use “fine woody material (FWM)” to refer to wood of 4” diameter and smaller
- ▶ Focus on woody biomass at the point of harvest
  - Stemwood/boles, including trees of small-diameter or poor form
  - Bark, branches, twigs
  - Timber residue (slash), breakage
- ▶ Does not address sawdust or mill scraps

Definitions – clarify the usage of “biomass harvest” and “biomass”. “Biomass harvest” is a term commonly used when the wood product (whole tree or tree crown) is taken for energy use. The term “biomass” can refer to any part of a tree. These guidelines do not specify what type of wood should be used for energy production vs. other uses. Guidelines use FWM to avoid confusion about what is considered “biomass”.

## **Process**

### ▶ **September 2007**

- Council initiated the effort to develop biomass harvesting guidelines for Wisconsin's forestlands
- Staff work to be done by Division of Forestry
- Timeline for completion - December 2008

### ▶ **November 2007**

- DNR Technical Team formed; uses MN's guidelines as basis for WI

Initiation of the process by WI Council on Forestry.

## **Advisory Committee**

- ▶ Advisory Committee selected to represent key stakeholders
- ▶ Committee formed – Dec. 2007
- ▶ Meetings held:
  - February 2008
  - April 2008
  - June 2008
  - August 2008



Advisory Committee of stakeholders – members were invited by the Council.

## **Members of the Advisory Committee**

- ▶ Jane Severt, WCFA
- ▶ Geoff Chandler, USDA Forest Service
- ▶ Marshall Pecore, MTE
- ▶ Jeff Barkley, WDNR
- ▶ Stacey Olson, Olson Bros. Enterprises
- ▶ Mark Fries, NewPage
- ▶ Earl Gustafson, WI Paper Council
- ▶ Matt Dallman, TNC
- ▶ Neil Paisley, WDNR Wildlife
- ▶ Ed Moberg, WWOA
- ▶ Dave Hvizdak, NRCS
- ▶ Don Peterson, WI Consulting Foresters Assoc.
- ▶ Gary Wyckoff, Plum Creek
- ▶ David Mladenoff, UW-Madison

Members of the Advisory Committee.

## Process, cont.

### ► April 2008

- First draft of rationale and proposed guidelines completed; sent to expert reviewers for comments on technical and scientific aspects

### ► May 2008

- Guidelines revised based on experts' comments



Process – first draft was reviewed by subject matter experts and revised to reflect their comments.

## **Subject Areas for Expert Reviews**

- ▶ Wildlife ecology and management
- ▶ Endangered resources
- ▶ Silviculture
- ▶ Forest management
- ▶ Forest economics
- ▶ Harvest systems
- ▶ Wood utilization
- ▶ Forest health
- ▶ Forest hydrology
- ▶ Forest soils
- ▶ Microbiology
- ▶ Fire management



Experts in these subject areas reviewed the first draft of guidelines and the accompanying “Rationale” document that contains the literature review and analysis.

## **Process, cont.**

### **▶ June – July 2008**

- 2nd draft guidelines reviewed by Advisory Committee

### **▶ July 2008**

- Subcommittee of forest soils experts developed recommendations for nutrient-poor soils

### **▶ August 2008**

- 3rd draft presented to Advisory Committee

### **▶ September 2008**

- 3rd draft presented to Council; minor revisions for clarification

Process – 2<sup>nd</sup> draft to Advisory Committee. Subcommittee of forest soils experts formed to review draft guidelines for nutrient-poor soils because this was an item of potential significant impact. Subcommittee included soil scientists from the Forest Service, Universities, and NRCS. 3<sup>rd</sup> draft guidelines presented to Advisory Committee and most members agreed to accept and forward the guidelines to the Council, except for 3 members who disagreed with guideline 3.A.

## Process, cont.

### ► **October – November 2008**

- 4th draft posted for public review; public listening sessions scheduled
  - Oct. 27 – Spooner
  - Oct. 28 – Rhineland
  - Nov. 3 – Madison
  - Nov. 5 – Stevens Point



### ► **December 2008**

- Advisory Committee to conduct final review
- Presentation to Council

Public listening sessions currently in progress. Comments will be summarized by themes and presented to the Advisory Committee, and changes to the guidelines will be discussed. Council will decide whether to accept the guidelines.

## Public comments

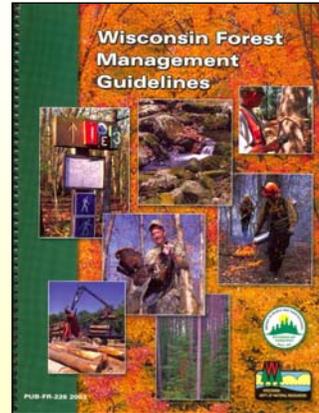
- ▶ 4th draft Guidelines & background material posted at Council on Forestry website:  
<http://council.wisconsinforestry.org/biomass/>
- ▶ Download comment form at website; send to DNR address shown.
- ▶ Pick up form here & hand in, or mail.
- ▶ On-line comments



Options for submitting comments – on-line, or hard copy. Hard copy may be picked up at meeting, or downloaded from website.

## Forest Management Guidelines

- ▶ After guidelines are complete, the Council will decide whether they should be incorporated into the FMG.
- ▶ Other FMG updates may be needed at same time.
- ▶ FMG is considered NRB policy and subject to their review and public comment.



How these guidelines may be used, & what might become of them after approval.

## **Scope of Guidelines**

- ▶ Focus on sustainable harvest of woody biomass from forested areas within the context of generally accepted forestry practices
- ▶ Applicable at stand and site level
- ▶ Goal to protect soil, water and biodiversity that characterize sustainable forest ecosystems
- ▶ Apply precautionary principle; when there is scientific uncertainty, be conservative in protecting resources

The Scope was agreed upon by the Advisory Committee and the Council early in the process.

## **Topics not addressed**

- ▶ A number of important topics were beyond the scope of the current project, including:
  - woody biomass resource availability
  - economics and energy balances for harvesting, transporting, and processing woody biomass for energy
  - potential effects on carbon storage and climate change
  - short rotation intensive culture of woody biomass plantations
  - landscape planning and management
  - monitoring strategies
- ▶ The need to develop initial guidelines targeted at the most significant current activity did not allow for addressing these additional topics at the same time.

These items are not within the scope of the current project as set forth by the Council. It is possible that they will be addressed in the future, or by another process.

## Guideline Structure

- ▶ **General exception:** if guidelines are not followed, document the rationale (e.g. tree regeneration operations, control of invasive species, fuel reduction, restoration, prescribed fire). For example, a large blowdown tips many stumps out of the ground making replanting problematic. Stumps may be pushed to the edge of the site to allow planting equipment to operate.
- ▶ **General Guidelines**
  - Generally applicable to any site
- ▶ **Site-Specific Guidelines**
  - Applicable under certain conditions
  - Not applicable to all sites
- ▶ **There are only 10 guidelines; 5 general and 5 site-specific.**

This slide describes the way the Guidelines document is structured. At this point, the audience may want to follow along from handouts; the language presented in this powerpoint is shortened from the actual Guidelines document.

The general exception is intended to give flexibility in application; if the user can document a reasonable argument for doing something different from the guidelines, this is acceptable.

5 of the guidelines are “General” and apply to all forested sites where FWM is being harvested. The other 5 apply to sites where FWM is being harvested that also have with specific conditions as noted in the guideline.

## **Goals of the Guidelines**

### **► Address concerns for:**

- Wildlife habitat; role of dead wood as shelter and foraging sites
- Dead wood as a site for decomposition and nutrient cycling
- Nutrient loss through additional product removal
- Increased vehicle traffic

These are the most significant sustainability concerns that surfaced during lit review & in comments from experts. Some guidelines address only one of these concerns; others may address the need for dead wood as well as helping maintain site nutrients.

## **General Guideline 1.A – Recommendations for tree and snag retention**

- ▶ Follow Silviculture Handbook – Chapter 24 – Marking Guidelines
- ▶ Even-aged rotations
  - Retain  $\geq 3$ , preferably large, snags/acre
  - Retain reserve trees & patches at 5-15% crown cover
- ▶ Even-aged intermediate treatments, and Uneven-aged systems
  - Retain  $\geq 3$ , preferably large, snags/acre
  - Retain  $\geq 3$ , preferably large, cavity trees/acre
  - Retain  $\geq 3$ , preferably large, mast trees/acre
  - Consider retaining  $\geq 3$  trees/acre to develop into large, old trees and to complete their natural lifespan

This guideline applies to all harvests, including harvests of FWM as well as traditional harvests. It was under development as part of Silviculture Handbook due to a CAR from FSC, prior to the initiative for biomass harvest guidelines (August 2007). It is being proposed for inclusion in the guidelines because it is relevant to sustaining biological diversity and nutrient capital after an intensive harvest.

-This guideline is for all harvests. Other guidelines are only for harvests where FWM is being removed.

-Snags are dead trees.

-Mast trees produce food for wildlife.

-Large trees can develop larger cavities and meet the needs of more wildlife species, both large and small.

-Note considerations: an individual tree can satisfy multiple benefits. So a tree that has cavities and also produces mast counts in both categories. If you had 3 cavity trees that produce mast, the minimum requirement for retaining live trees would be met. Some sites would have 6 trees.

-Why a minimum of 3 trees? Wildlife guides often use this as a lower limit. Other state's guides are similar. Optimal number of trees and snags, and size of cavity, varies by species; Ontario's lengthy marking guides have numbers for different species. Why not an upper limit? Wildlife bios will say the more the better.

-There is no harvesting in retention patches. The patches can be combined with areas needed for water quality BMP's if they are not thinned. The patch is intended for biological diversity, where we would leave an undisturbed area that has more dead wood, and perhaps some species can maintain themselves within the patch. The patch should be able to retain microbial populations that would eventually repopulate the larger area as the stand regrew.

**General Guideline  
2.A – Retain and  
limit disturbance to  
down coarse woody  
debris (CWD)  
already present,  
except on skid trails  
and landings**



CWD's importance to wildlife is well documented, used for denning sites and other shelter/protection, and provides sites for foraging. It also functions in nutrient cycling, carbon storage, as a site for decomposition and N-fixation, and a site favorable to regeneration of some tree species. Most of our forests have little CWD due to past management practices. Some stakeholders want to see the guidelines specify a minimum amount of CWD that should be on site.

Firewood cutting: these guidelines are for situations where FWM is harvested as part of a sale, so bole harvests would not be under these guides and firewood could be considered.

## **General Guideline 3.A – Retain fine woody debris (FWD)**

- ▶ Retain FWD already present except on skid trails and landings.
- ▶ Even-aged rotations & complete salvage:
  - Retain a minimum of 5 oven-dry tons/acre FWD; can be made up of pre-existing and FWD cut during harvest, including incidental material.
- ▶ Even-aged intermediate treatments and uneven-aged systems:
  - Retain a minimum of 1 ton/acre oven-dry FWD cut during harvest (including incidental material) but not including pre-existing FWD.

This guideline is intended to provide for retention of some site nutrients, and also to maintain some FWD for habitat, although there has not been enough research on habitat roles of FWD to identify the amount needed.

This has been the most controversial guideline; the Advisory Committee did not reach consensus on this one (3 people did not agree; one thought the amount was too small, one thought it was too high, and one was concerned about shifting demand).

The technical team attempted to draft a science-based guideline, but ecological roles of FWD are not as well-documented as those of CWD. It is known that FWM contains a disproportionate share of nutrients as compared with bole wood and is important in providing available forms of nutrients as it breaks down. Decomposing organisms act upon this fine material relatively quickly after it falls to the forest floor, releasing nutrients over the next 4-10 years. It is believed important to leave some FWD on site after harvest to supply nutrients to the regenerating stand, & provide a minimum amount of cover for the forest floor and soils to maintain some shade and moisture. We think there are also likely habitat roles for this fine woody material that have not yet been studied.

The 5 T/ac (oven-dry equivalent) figure for rotation harvests is based on data for amounts of FWD typically found in forests. Forest Inventory and Analysis (FIA) data were used, as well as data from Gore & Patterson (1986) that indicate 4-6 T/ac of 3" or smaller fine woody debris is typical of older managed and unmanaged stands. These data were considered important because they represent older forests that may have amounts of FWD more typical of forests at rotation-age than the average site represented by FIA data. If we had data for 4" material this number would be larger than 4-6 T/ac, so our guideline for 5 T/ac is still on the low side.

The 5 T/ac guideline refers to the total of pre-existing and added material. To be able to count the pre-existing FWD would require some kind of visual evaluation or a measurement.

The 1 T/ac at thinnings was based on the idea that thinnings over the same time period as a rotation would end up leaving about as much in total as they would under the 5 T/ac guideline for rotation harvest. Now that we have all the FIA data and the conversion table, it appears that the rotation harvest would require less material than the thinnings.

MN guides – leave 20% of tops, leave incidental breakage for a total of 1/3. Our draft guidelines allow for more removal of FWD than Minnesota's guides, because they count material already on the ground. However, we have been more conservative in proposing protection for nutrient-poor sites as will be seen later. Also – MN cannot easily monitor to see whether the right amt was left.

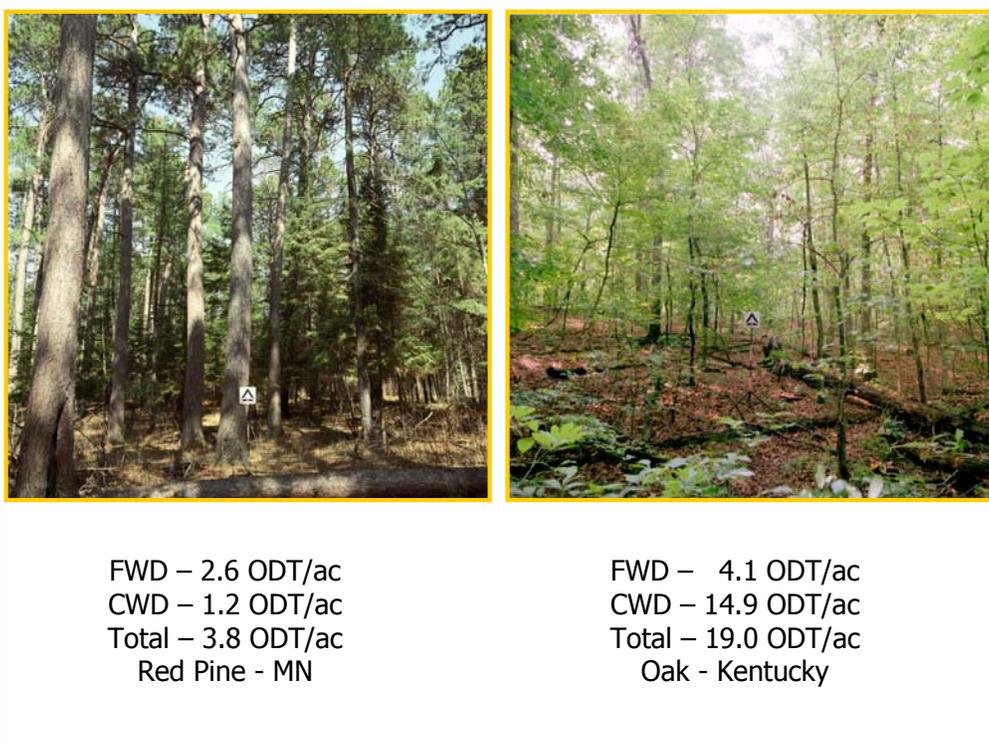
### **Other states guidelines for retention of cut material:**

Pennsylvania: Leave up 15 to 30% of harvestable biomass as coarse woody debris. While harvesting as much biomass as possible increases profits and satisfies some management objectives, minimizing coarse woody debris might reduce habitat for small mammals, reptiles, amphibians, and beneficial insects.

Minnesota: The overall goal of FWD retention is to retain about one-third of the FWD on a site. This goal is achieved by intentionally retaining 20% of the FWD (tops and limbs from one "average sized" tree out of every five trees harvested), with an additional 10-15% achieved by incidental breakage during skidding. (Usually, more breakage occurs in winter than in summer.)

Missouri: CWD RECOMMENDED BEST MANAGEMENT PRACTICES

- Debris from a variety of tree species and of different sizes should be left. In general, bigger is better.
- In thinning and commercial harvests with a chainsaw, retain a minimum of 1/3 of the harvest residue (tops, branches, etc) on site. In thinning and commercial harvests using a feller buncher or other mechanized harvester, leave 1/3 of treetops from sawtimber harvest and 1/3 of the typical size small trees cut on the site.
- Leave as many of the leaves and twigs (fine woody debris-FWD) as possible on the harvesting site to encourage nutrient recycling and habitat for small animals.



Visuals of down woody debris. The figures are reported in oven-dry tons/acre. This is one idea for developing tools to assess the amount of woody debris on site. Users would compare a photograph with their site to estimate the amount of fine and coarse woody debris. Another option is to work on a simple transect measurement for determining the amount of fine woody debris.



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

Rationale is similar to 2A.

This woody material is important in nutrient cycling & nutrient retention on site, & carbon storage. The forest floor is particularly important as a site for decomposition and nutrient release, and regeneration of some tree species.

- Note the general exception allows the stumps to be moved if necessary for tree regeneration operations.
- In Finland, stumps are removed but they also quite commonly fertilize their forests to compensate for nutrient removal.

**General Guideline 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.**



It's anticipated that harvest of FWM may often involve increased vehicle traffic, and this guideline is intended to protect stands from detrimental compaction and loss of productivity. The 15% number is repeated from the FMG; minimizing permanent infrastructure to 3% is a new proposed guideline.

Monitoring completed in 2006 on 30 Wisconsin state land timber sales showed, on average, 4.25% of the timber sale area was devoted to roads, landings and primary skid trails. Values ranged from 0.4% to 18.6%. Monitoring completed in MN has found that the average amount of land in roads and landings is 3.8% (2004-2006), up from 3% (2000-2002). It is believed the average has gone up because of the large landings required for chipping operations.

It is important to note that the guideline only deals with permanent roads and landings. Roads and landings that are used and then closed do not count towards the 3% guideline.

**Site Specific Guideline 1.B – Protect and sustainably manage species of greatest conservation need and sensitive ecosystems**

- ▶ Do not harvest FWM where Federal or State Endangered or Threatened species are known to exist or are discovered.
  - Exception: If harvest of FWM maintains or improves habitat for the species, follow appropriate management guidelines.
- ▶ Before harvesting woody biomass, determine presence & location of & potential impacts on:
  - State Special Concern & Species of Greatest Conservation Need
  - Element Occurrences of WNHI Community Types
  - Designated HCVF
  - Communities of exceptional composition & structure, and sensitive sites, including relict forests, old-growth forests, large bogs, vernal pools, seeps, cliffs, rock outcrops, ravines, caves.
- ▶ Consult specialists, management guides, and databases for occurrence, habitat requirements, community characteristics, potential impacts, and mgmt alternatives and recommendations.

This guideline restricts harvest of FWM where federally or state listed Endangered or Threatened species occur. It encourages consideration of special concern species, Species of Greatest Conservation Need, element occurrences of NHI community types, and exceptional or sensitive sites.

**Site Specific Guideline 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 for health & safety; sanitation to control pathogens.

This guideline is similar to 1A, and would retain some patches within a salvage operation.



**Site Specific Guideline 3.B – Do not harvest fine woody material where bedrock is within 20 inches of the surface.**

**Site Specific Guideline 4.B – Do not harvest fine woody material on nutrient-poor soils.**

- ▶ Exception for jack pine stands at rotations of  $\geq 40$  years.



The last 3 guidelines deal with soil nutrients and are discussed all together.

These guidelines are designed to maintain a level of site nutrients that will support more than 2-3 rotations according to nutrient balance calculations. The sandiest soils do not have enough calcium and other nutrients to support even these few rotations, and so we are proposing that FWM not be harvested from them.

Criteria used by the subcommittee of soils experts appears in Appendix 2 of the guidelines. These criteria would restrict FWM harvest on sites with: 3% or less clay in the upper 100 cm, no carbonates or water table within the profile, & no loam or heavier layers beneath 100 cm. Subcommittee went through the list provided by NRCS based on the criteria, and agreed on the nutrient-poor soils where FWM would not be harvested unless the cover type is jack pine. Jack pine is less nutrient-demanding.

Shallow soils have half the assumed nutrient supply (in deep soils, a 40 inch depth is considered the rooting zone where trees can access nutrients). Shallow soils are also more susceptible to physical damage from equipment, as soil is squeezed between the bedrock and equipment.

\*Harvests of bole wood are not affected. Under these proposed guidelines, boles can always be used for biomass/energy production if desired.

**Site Specific Guideline 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.**



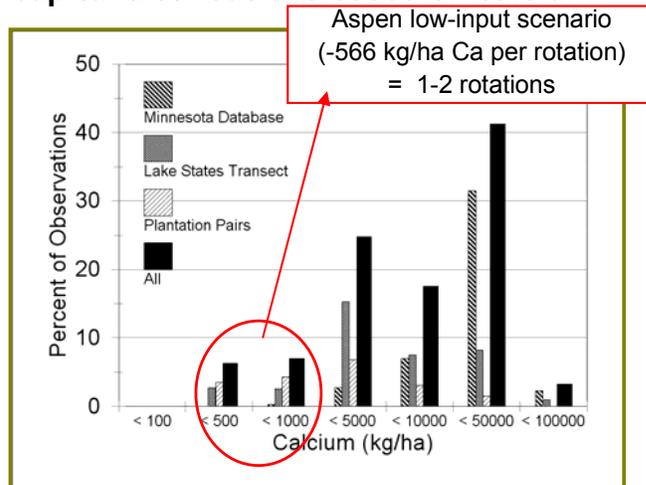
Photo by A. Clark, WI DNR

Dysic Histosols are nutrient poor wetland soils. NRCS soil scientists use vegetation differences to map these areas.

Note photo – this is typical of the vegetation on dysic Histosols. It has little biomass and sites like this are not typically accessed.

## Soil nutrient capital

- Lake States database (~400 soils) analyzed by Dr. Grigal to show soil nutrient capital distributions based on calcium.



Calcium by ammonium acetate extraction, averaged to 40" depth, for Lake States soils. For an aspen whole-tree harvest on sites with low nutrient capital and low nutrient inputs, 1-2 rotations could deplete Ca. These sites with less than 1000 lbs/acre of Ca are the ones we propose to restrict from FWM removal. Some have proposed fertilization, but it is beyond the scope of our current project. Fertilization is expensive.

**Soils guidelines would limit or partially limit harvest of FWM on about 2.2 million acres (14% of the 15.8 million forested acres in Wisconsin). Traditional (bole wood) harvest is not limited on the 2.2 million acres & jack pine FWM harvest is not limited.**

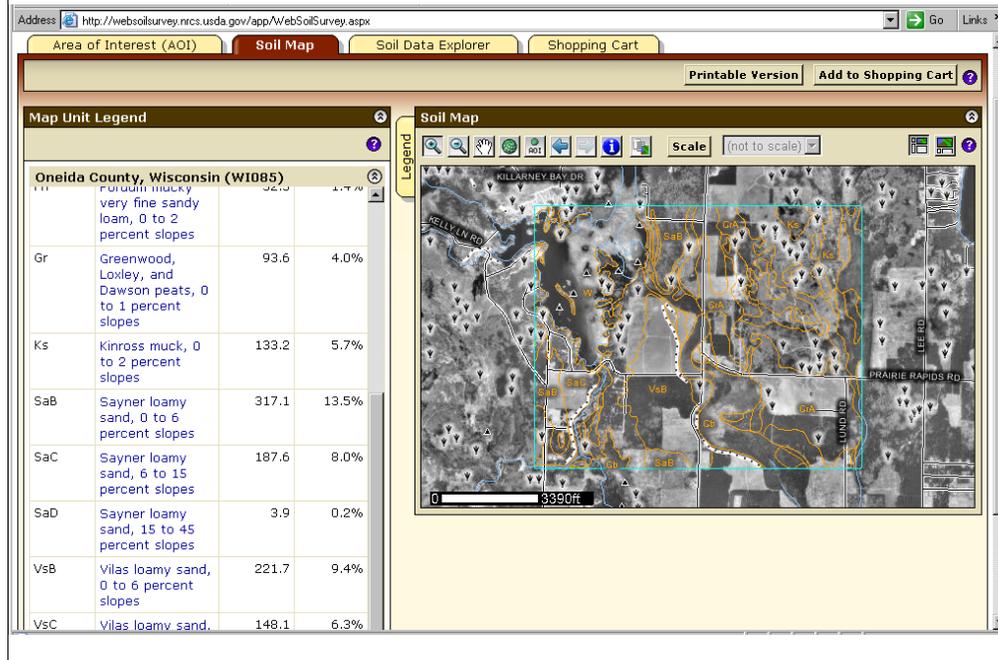
| Aboveground live biomass on all timberland (million dry tons) | Estimated biomass in tree crowns on land affected by draft biomass guidelines (million dry tons) | Aboveground biomass on land not affected by draft biomass guidelines (million dry tons) | Area of jack pine forest from various estimates (thousand acres) |
|---|--|---|--|
| 602   | ~20  | 582   | 200 to 400   |

FIA data

This slide shows approximately how much woody biomass would be restricted by guidelines for nutrient-poor soils – it is about 20 million dry tons, or 3.1% of the total aboveground woody biomass on forest land in Wisconsin.

Calculations: Average aboveground biomass for pine types = 36.5 tons/acre. For average pine forest types, crowns make up 8.6 tons/acre. 8.6 tons/acre x 2.2 million acres = 18.9 million tons.

## Implementing the soils guidelines



This slide shows how users would determine whether they have a nutrient-poor soils. This is an example of a soils map that can be found at the NRCS “Web Soil Survey” site, for an area of Oneida County. The user would display the soils map for their area, and look to the column on the left for the map unit code. If the map unit is listed in Appendix 2 of the guidelines (when this section is complete), it would be considered nutrient-poor.

In this example, map unit Gr is a complex of euic Histosols (wetland soils, NOT nutrient-poor) with no limitations on biomass harvest. SaB, SaC, and SaD are nutrient-poor sandy soils where FWM would not be harvested but bole wood could be used, or if the forest was jack pine there would be no restriction on harvesting FWM. VsB is the borderline Vilas soil, where a consideration about nutrient issues has been noted.

## **Issues Forwarded to the Water Quality BMP Advisory Committee**

The Biomass Advisory Committee recommended, and the Council concurred, that the following topics be forwarded to the Forestry Best Management Practices (BMPs) for Water Quality Advisory Committee, for consideration in updating BMPs to address biomass harvesting concerns.

- Protecting erosion prone sites (based on soil and slope characteristics)
- Clarifying existing RMZ standards on retaining fine woody materials
- Establishing riparian management zones (RMZs) on dry washes
- Utilizing filter strips around wetlands
- Proposed timeline: end of 2009. If the Advisory Committee decides to take on additional BMP issues, a longer timeframe would be acceptable.

The Advisory Committee felt that some topics covered in Minnesota's biomass harvesting guidelines would be better dealt with as water quality issues, and recommended that they be taken up by the BMPs for Water Quality Advisory Committee.

## Differences from MN's Guidelines

- ▶ Scientific basis for amount of FWD to retain
- ▶ Addressing sustainability concerns for:
  - Shallow soils
  - Nutrient-poor soils
  - Organic soils
- ▶ Removed approximately 15 of MN's guidelines – duplicates of existing WI guidelines, or better fit with BMPs, FMG, or Handbooks



This slide is for people who may be interested in knowing how and why the WI guidelines differ from the MN guidelines. Note that MN guides require 20% of tree crowns to be retained after harvest, in addition to breakage, for a total of about 1/3 of FWM left on site after harvest. Our proposed guideline for FWM is less restrictive, but we are proposing to limit FWM harvest on nutrient-poor soils where we think there is a greater concern for sustainability.

## Research Needs

- ▶ Coarse and fine woody debris:
  - Variation by forest and site types, age
  - Deposition and decomposition rates
  - Effects of retention levels and patterns on habitat and biodiversity; soil nutrient cycling
- ▶ Tree and snag retention:
  - Effects on biodiversity, regeneration, stand growth and yield
- ▶ Better information on nutrients removed by different harvesting systems, forest types, seasons, and sites
- ▶ More information on soil nutrient capital
- ▶ Biomass harvesting life cycle analysis - different harvesting options, biodiversity factors, carbon, & nutrients
- ▶ Refine measurement protocols for amounts of down woody debris
- ▶ Long-term monitoring: soil nutrients, presence/abundance of selected animal & plant species

A list of research needs was developed by the technical team, expert reviewers, and the Advisory Committee. We attempted to identify areas where there are information gaps in the scientific literature that would be important to address for future updates of the guidelines.

## Summary and Next Steps

- ▶ Draft Guidelines developed and supported by a majority of the Advisory Committee
- ▶ Research Needs identified
- ▶ Some issues sent to the Water Quality BMP Advisory Committee for their consideration
- ▶ Public listening sessions in progress
- ▶ Advisory Committee & Council review in December

### **Potential steps following guideline completion**

- ▶ Training
- ▶ Incorporation in Forest Management Guidelines
- ▶ Monitoring of implementation
- ▶ Ongoing review of new information, guideline revision

