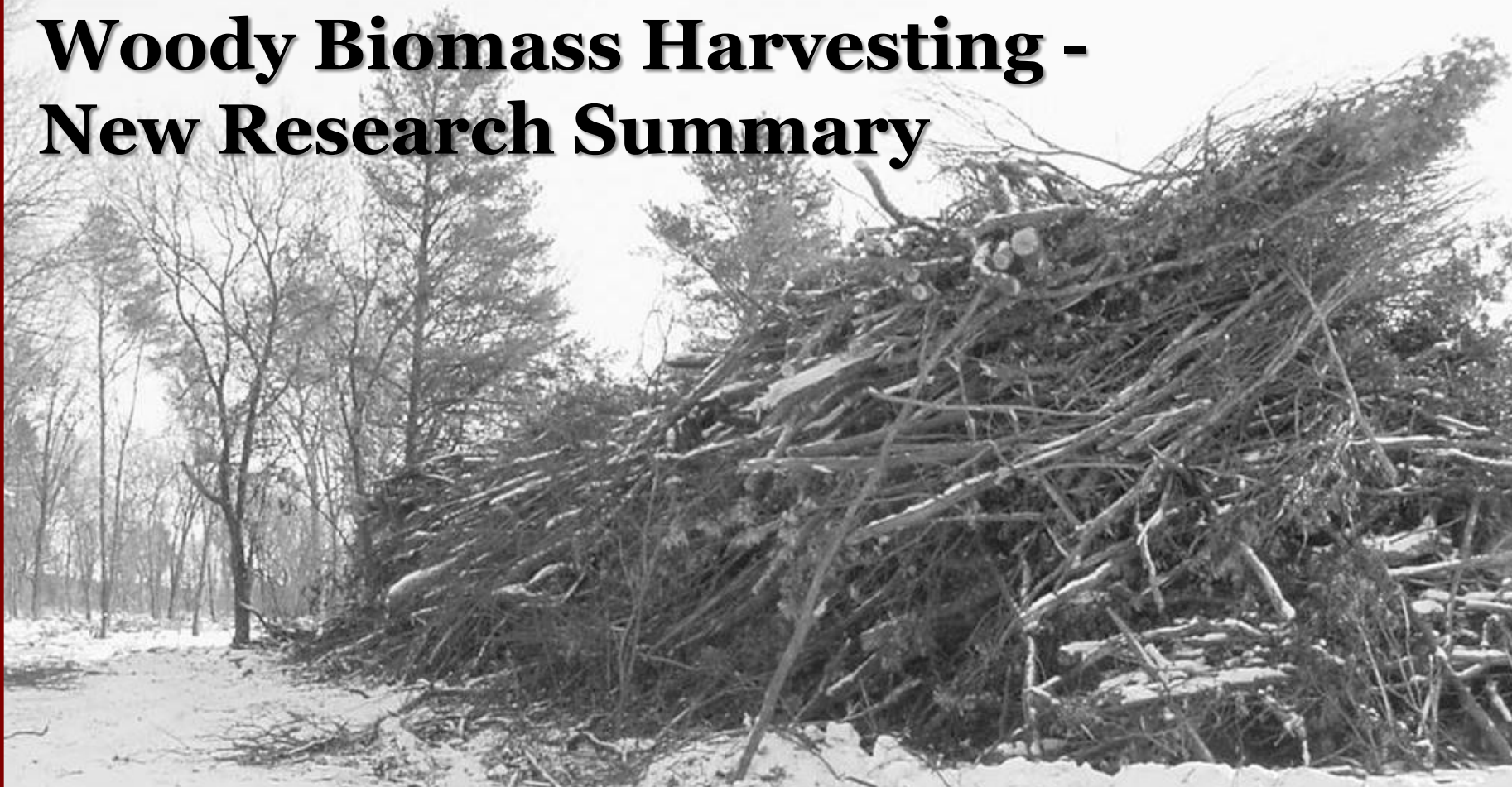


Woody Biomass Harvesting - New Research Summary



Dr. Dustin Bronson – WDNR Bureau of Science Services
Greg Edge – WDNR Division of Forestry



Research Review Criteria

- 1. Regionally specific research**
- 2. Similar forest types/soils/species**
- 3. Identified research priorities**



Research Priorities

- **Role of FWD in ecosystem sustainability**
- **How much FWD should be retained?**
- **Biomass harvesting impacts on dry nutrient-poor sandy soils**



Fine Woody Debris (FWD) Biodiversity



Fine Woody Debris (FWD) Biodiversity

- **Rittenhouse et al. (northern Wisconsin)**
 - ✓ **Vole abundance increased with more FWD and CWD**
 - ✓ **Residual wood not as important for mice**
- **Smith (northern Minnesota)**
 - ✓ **Shrew abundance increased with more FWD, but no treatment differences for voles**
 - ✓ **American toad abundance increased with more intensive harvesting, but wood frog abundance decreased**



Red-backed vole

Fine Woody Debris (FWD) Biodiversity

- **Brin et al. (France)**
 - ✓ **Certain beetle species only use FWD in temperate oak forests**
- **Castro et al. (Kentucky)**
 - ✓ **Spider density decreased with removal of FWD, but not all species affected the same**
- **Donner et al. (northern Wisconsin)**
 - ✓ **Beetle abundance decreased across all FWD harvest treatments**
 - ✓ **Understory plants less affected by FWD removal, including trees regeneration**



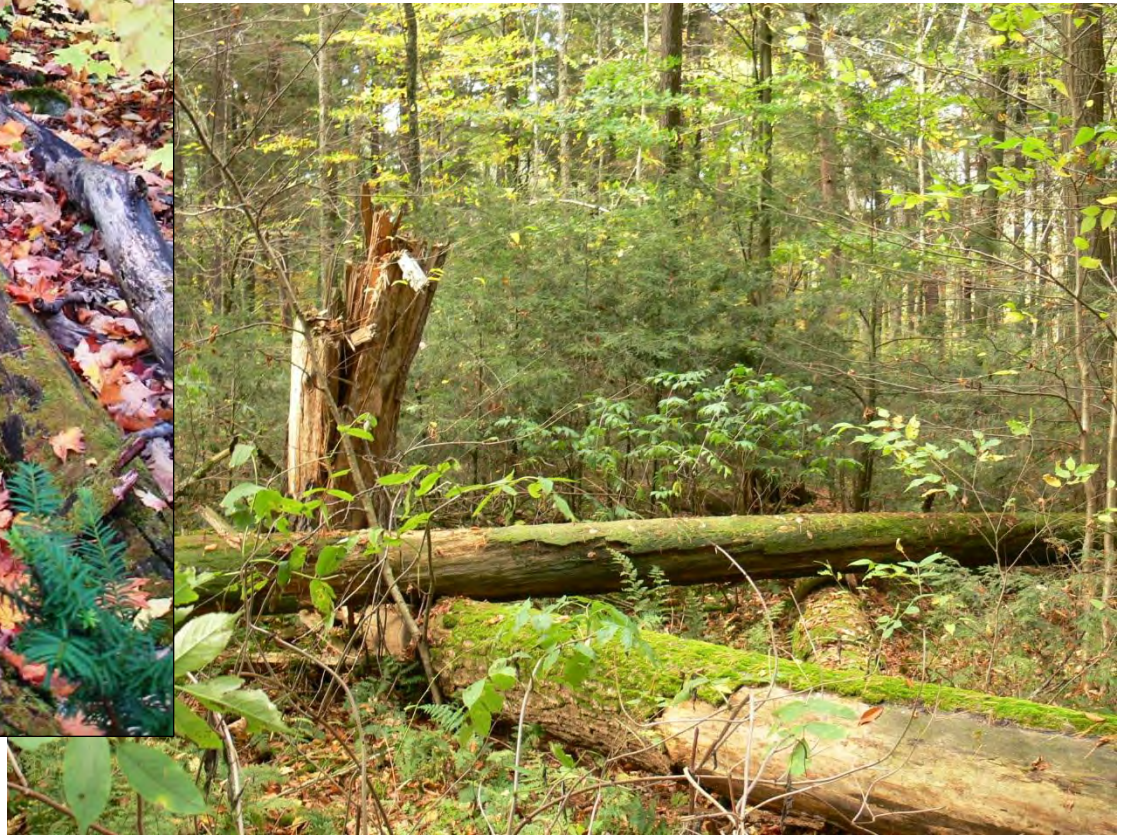
Ground beetle

Fine Woody Debris (FWD) Biodiversity

- **Kebli et al. (Canada)**
 - ✓ **Decaying aspen logs important for fungi diversity**
- **Juutilainen et al. (Finland)**
 - ✓ **FWD critical for some species of fungus**
- **Brazeo et al. (Minnesota)**
 - ✓ **Aspen FWD hosts a wide variety of Lake States' fungi, including potentially rare and threatened species**



Coarse Woody Debris (CWD) Biodiversity



Coarse Woody Debris (CWD) Biodiversity

- **CWD critical habitat for small mammal, amphibian, and reptile species but is often lacking in managed forests (Vanderwel et al. 2008, Littlefield and Keeton 2012, Briedis et al. 2011)**
- **Well decayed logs important habitat component (Fauteux et al. 2012)**
- **Increased structure, including CWD and snags, increased late-successional plant diversity (Smith et al. 2008)**
- **CWD important for certain species of fungi (Berglund and Jonsson 2008, Juutilainen et al. 2011, Kebli et al. 2012)**



Summary

- **FWD and CWD are important habitat components for biodiversity**
- **Importance varies by species**
- **Diverse structure is always better (FWD and CWD, piled and scattered)**
- **FWD is particularly important for certain fungi and invertebrate species**
- **Forested wetlands and connections between wetlands important for amphibian species**
- **Studies have not yet identified minimum amounts of FWD needed to maintain species**
- **Most research has looked at short-term responses to biomass harvesting, need more long-term studies**

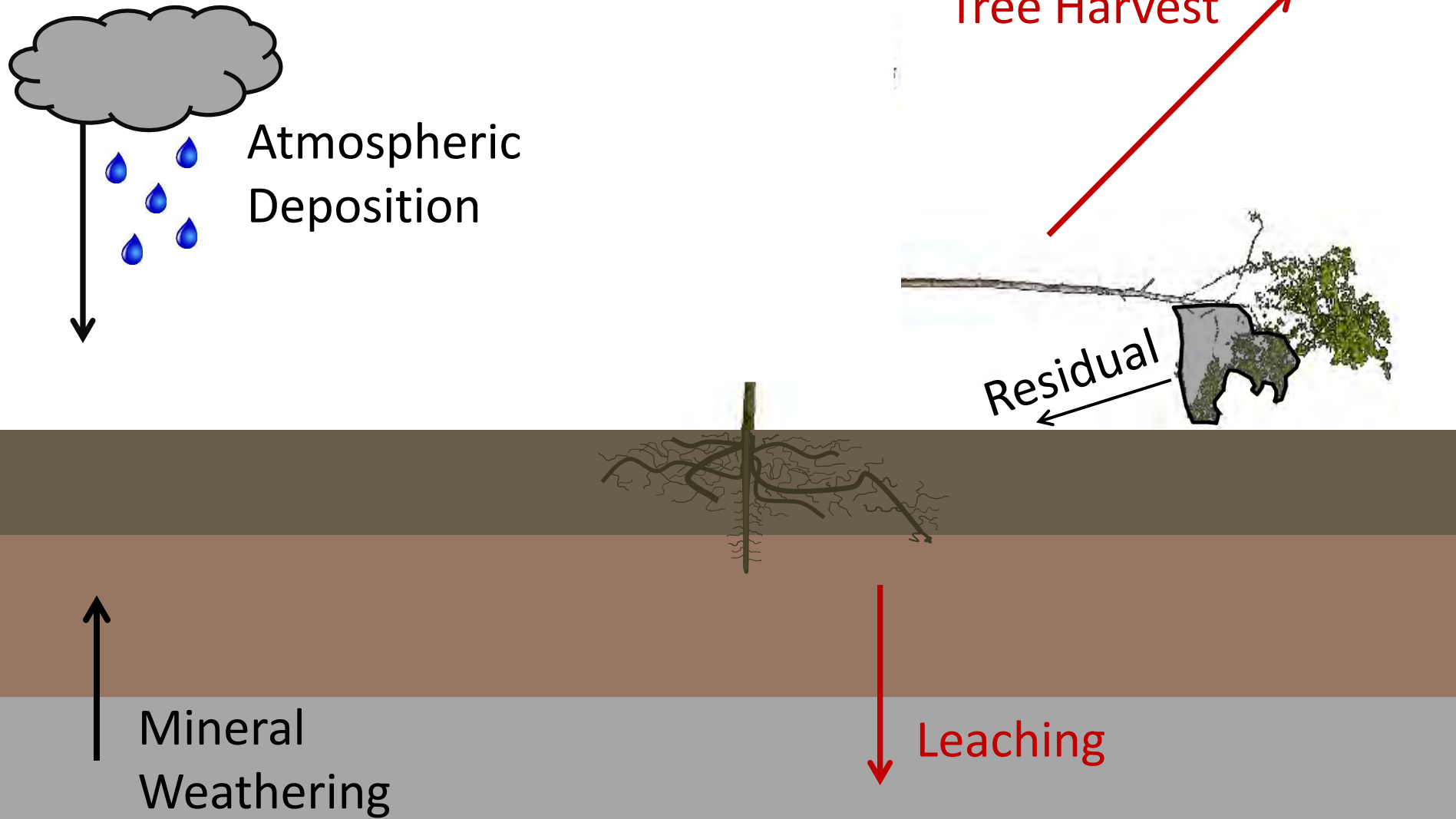


Soil Nutrients & Tree Growth

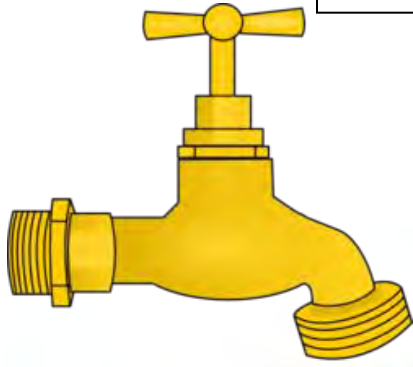
Research Questions

- **What are the short-term effects of WTH on soil nutrient pool?**
- **Does WTH affect growth of second rotation?**
- **How much incidental Down Woody Debris is left post-harvest?**

$$\text{Nutrient Balance} = (\text{Nutrient inputs} * \text{years}) - \text{Nutrient Loss}$$



Input = Atmospheric Deposition + Mineral Weathering



Soil Nutrient Pool

Removal = Harvest + Leaching



Effects of timber harvest intensity on macronutrient cycling in oak-dominated stands on sandy soils of northwest Wisconsin

Kelly Wilhelm*, Brittney Rathsack, James Bockheim

Department of Soil Science, 1525 Observatory Drive, University of Wisconsin, Madison, WI 53706-1299, USA

Image A: Unharvested



Image B: Whole-tree



Image C: <5 cm



Image D: <10 cm



All treatments showed net depletion of **phosphorus**.....

However, it would take many rotations to affect tree growth.

Ten-year results from the long-term soil productivity study in aspen ecosystems of the northern Great Lakes region

Richard Voldseth

Brian Palik

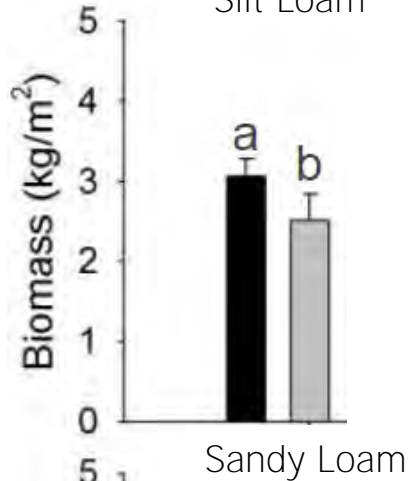
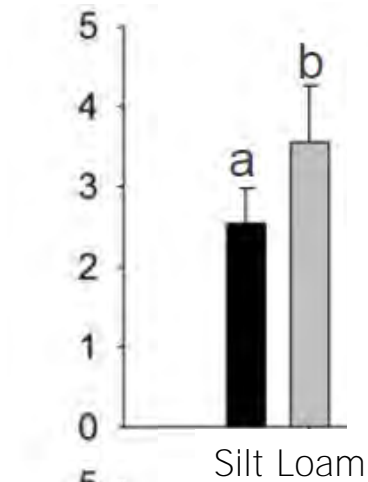
John Elioff



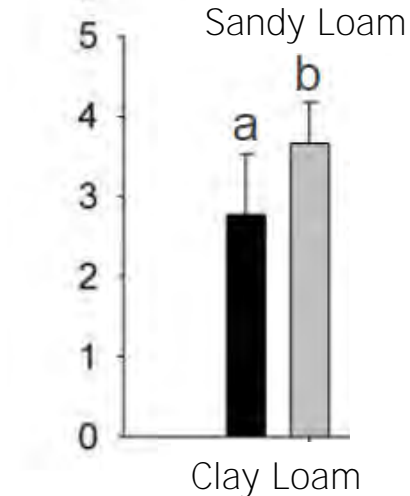
Whole Tree Harvest vs. Conventional "bole-only" Harvest

Soil Type	CECe	Ca	K	Mg	Na	Total C	Total N
Loamy Sand	no diff	no diff	no diff	no diff	no diff	no diff	no diff
Silt Loam	no diff	no diff	Sig Less	no diff	no diff	no diff	no diff
Clay Loam	no diff	no diff	no diff	no diff	Sig Less	no diff	no diff

Aspen Regeneration 15 years since harvest



More aspen in clay and silt loam
Less aspen in sandy loam

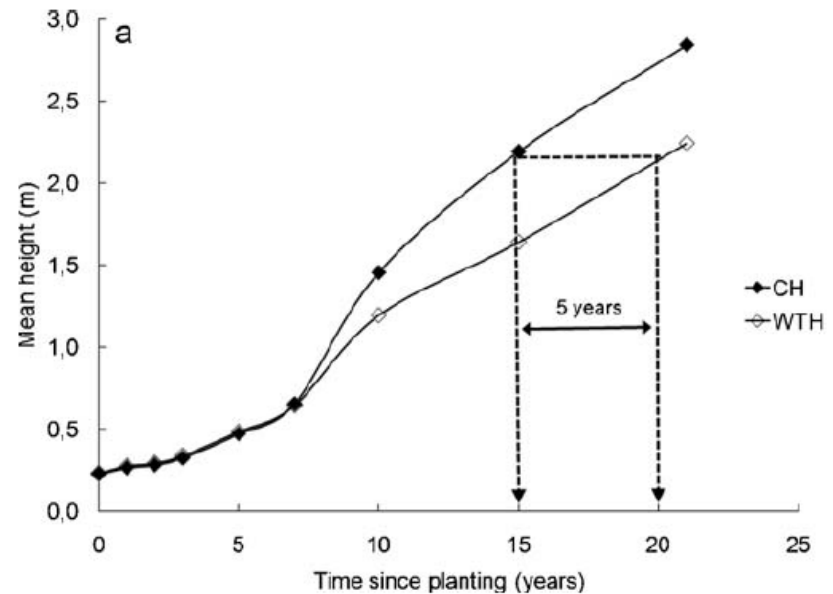


These differences are due to **suckering effects....not nutrients**

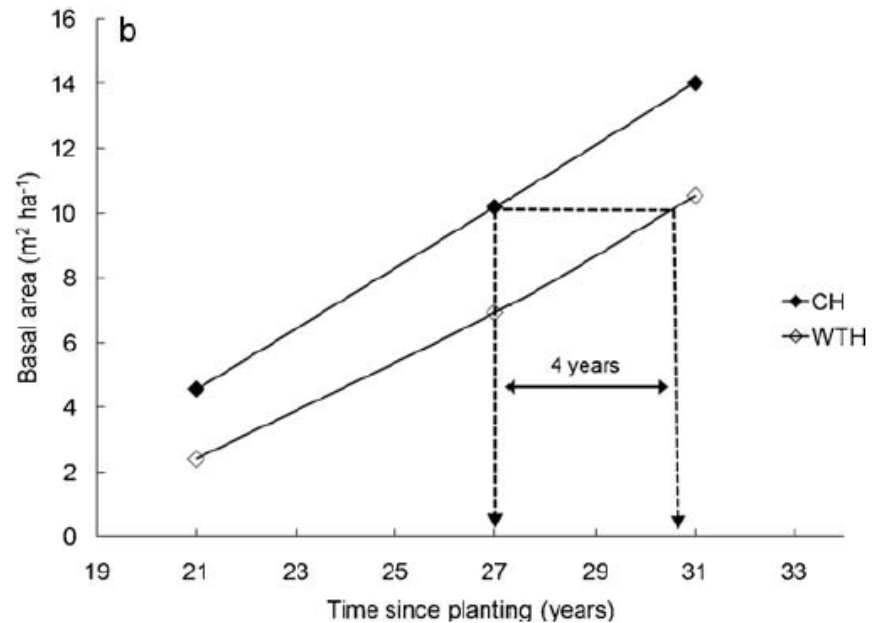
Swedish Experiment

Whole Tree Harvest,
then planted Norway spruce

Soil: Wet Orthic Podzol



4 to 5 years of lagged growth



Egnell (2011)

Research Questions

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Reductions in soil nutrients after WTH

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In most cases, No

- **How much incidental Down Woody Debris is left post-harvest?**

Downed wood associated with roundwood harvest, whole-tree harvest, and unharvested stands of aspen in Wisconsin

Tracy A.G. Rittenhouse^{a,*}, David M. MacFarland^b, Karl J. Martin^c, Timothy R. Van Deelen^a

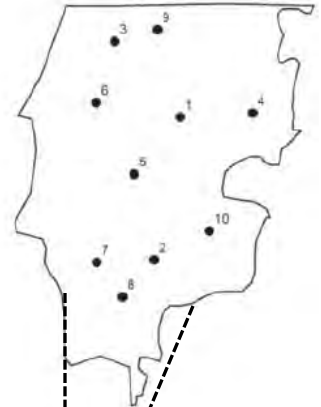
^aDepartment of Forest and Wildlife Ecology, University of Wisconsin, Madison, WI 53706, United States

^bWisconsin Department of Natural Resources, Rhinelander, WI 54501, United States

^cWisconsin Department of Natural Resources, Madison, WI 53716, United States



B. Stand

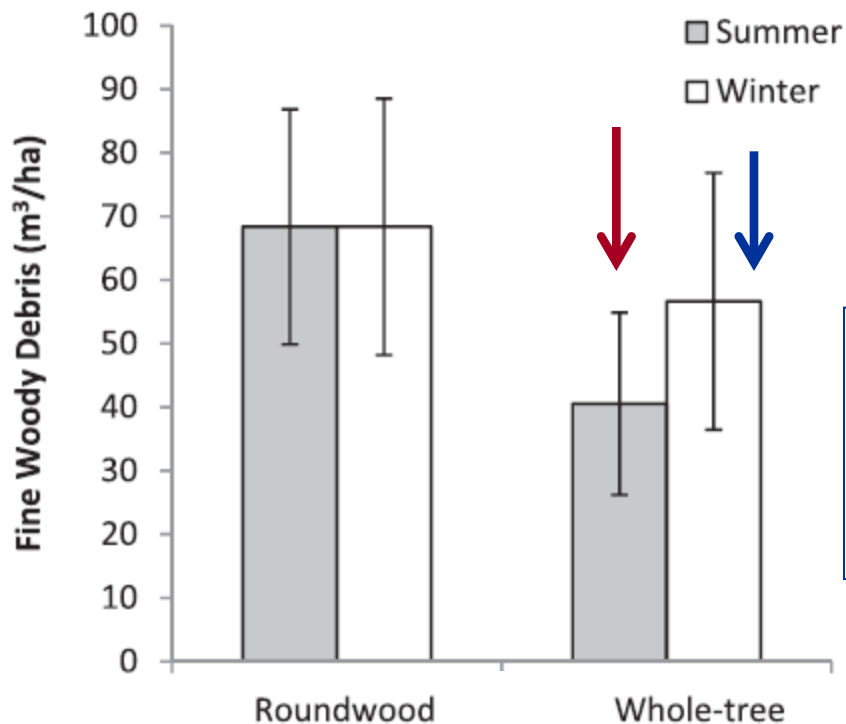


A. C



Down Woody Debris

- How much incidental DWD is left post-harvest?



Summer WTH

New FWD 3.57 tons per acre

Total FWD 7.15 tons per acre

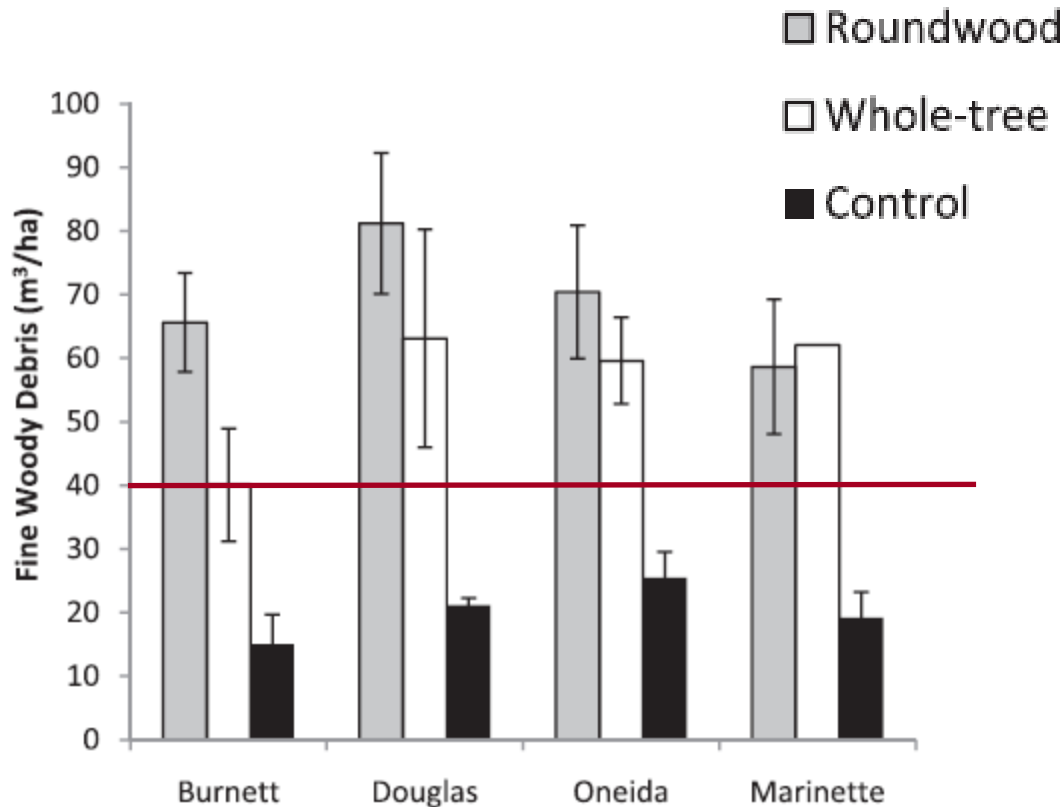
Winter WTH

New FWD 6.62 tons per acre

Total FWD 10.19 tons per acre

Down Woody Debris

- How much incidental FWD is left post-harvest?



FWD between counties is variable

Impacts of post-harvest slash and live-tree retention on biomass and nutrient stocks in *Populus tremuloides* Michx.-dominated forests, northern Minnesota, USA

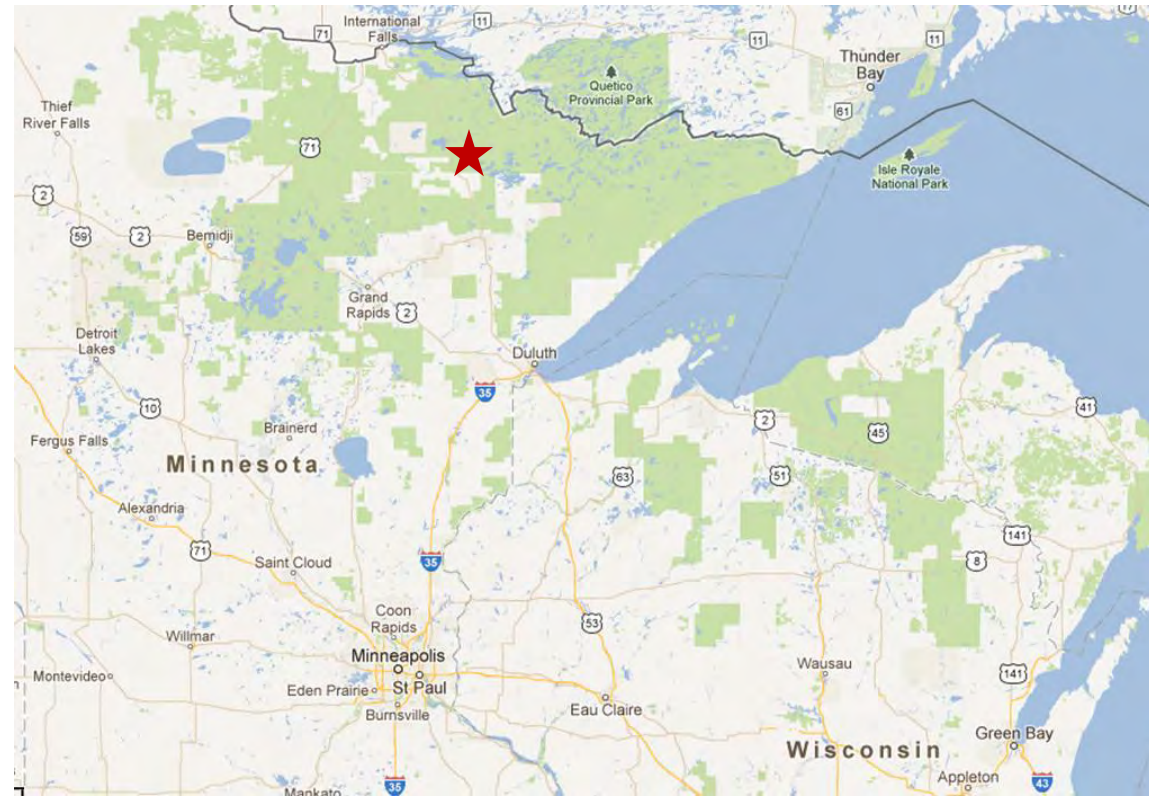
Paul A. Klockow^{a,*}, Anthony W. D'Amato^a, John B. Bradford^b

^a Department of Forest Resources, University of Minnesota, St. Paul, MN 55108, USA

^b US Geological Survey, Southwest Biological Science Center, Flagstaff, AZ 86001, USA

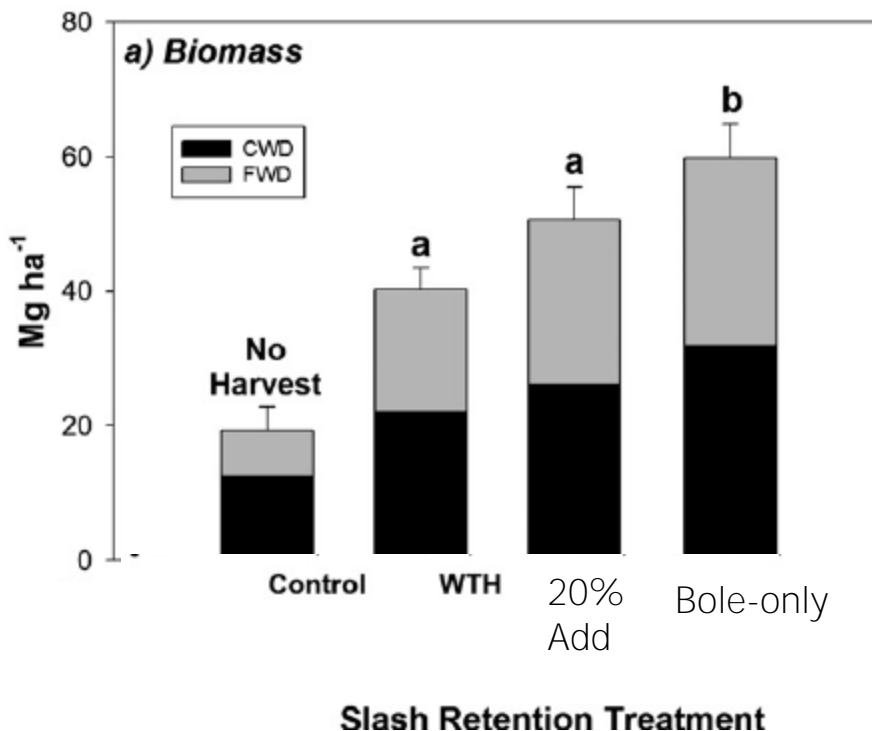
4 aspen dominated stands

Soils: Sandy Loam to Silt Loam



Down Woody Debris

- How much incidental DWD is left post-harvest?



Available slash left

Winter WTH

New ~ 5.05 tons per acre

Total ~ 8.11 tons per acre

Additional 20% Trt

New ~ 7.83 tons per acre

Total ~ 10.89 tons per acre

Research Questions

- **What are the short-term effects of WTH on soil nutrient pool?**

Reductions in soil nutrients after WTH

- **Does WTH affect growth of second rotation?**

In most cases, No

- **How much incidental Down Woody Debris is left post-harvest?**

Approximately 7.15 – 10.19 tons acre⁻¹



Questions