Biomass Harvesting and Site Productivity: Is Policy ahead of Science?

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Why Harvest Residues?

- Renewable energy
  - Electrical, thermal (pellets)
  - Biofuels
- Particle board, composite materials
- Forest health (fire, insects, disease)
- Forest operations (site preparation)

Environmental Questions

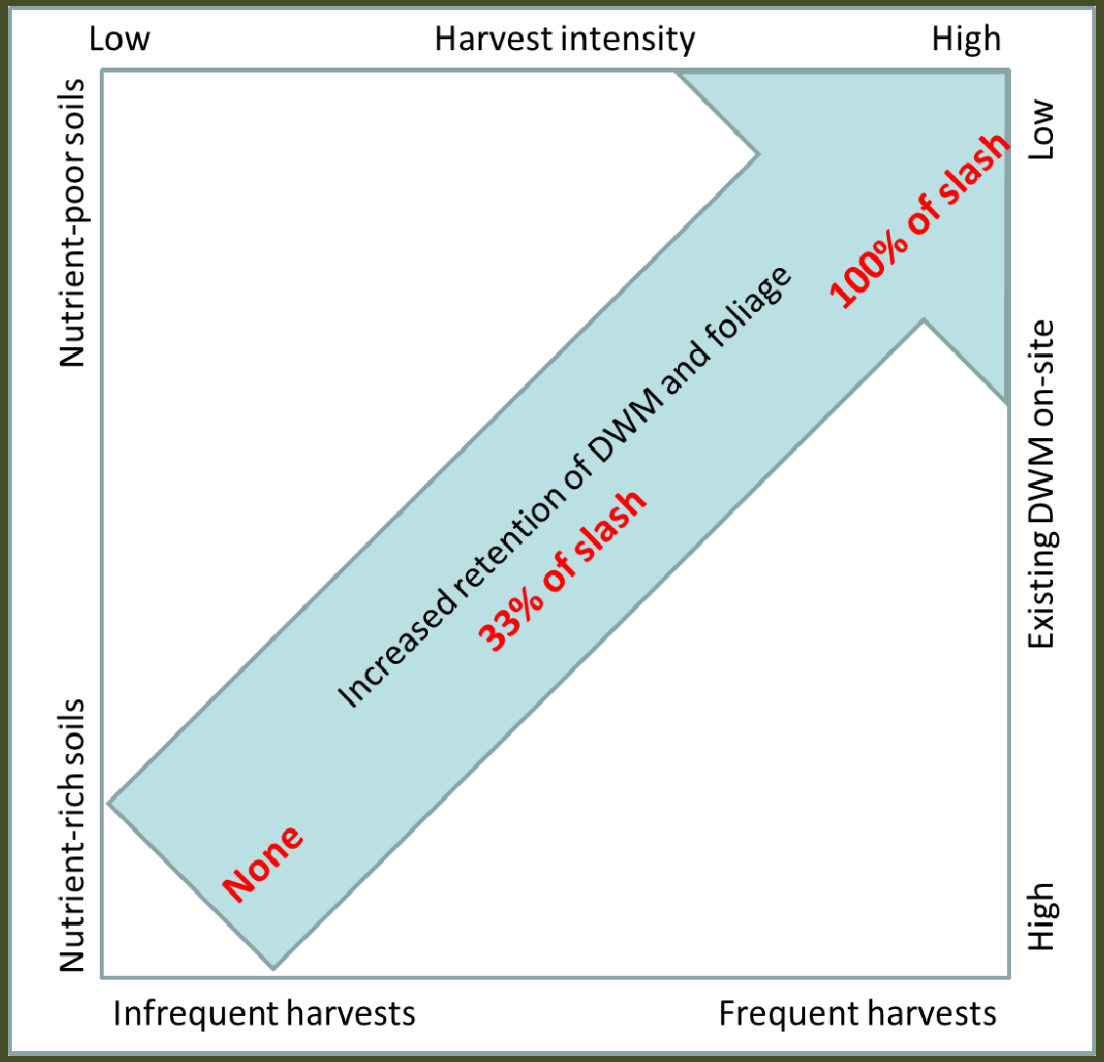
- Removal of biomass traditionally left on site
- Shorter rotations, more frequent site entries
- Site productivity
- Water
- Wildlife

Common U.S. Biomass Harvesting Guideline Provisions

- Retain 15-30% or “as much as possible”
- Restrictions on shallow, coarse-textured, nutrient-poor soils
- Minimize area in roads, landings, skid trails

Forest Guild Biomass Retention and Harvesting Guidelines

(February, 2012)



Forest Guild Biomass Retention and Harvesting Guidelines

- “Where science remains inconclusive, we relied on field observation and professional experience”

Frames of Reference

- “Natural” is optimal, more retention is better
- Conventional harvests retain residues
- Biomass harvesting removes all residues
- No beneficial practices
- Changes in State = Changes in Function

Perceived Benefits of Traditional Residue Management

25 to 80% of Non-Bole Residues Left after Operational Biomass Harvesting Due to Technical Limitations, Incidental Breakage

(Nurmi 2007, Ralevic et al. 2010, Klockow et al. 2013)

Sites in Minnesota following biomass harvesting

(The Forestry Forum)

Ecological Effects of Harvest Residue Management in Southern Pine Plantations

(USDA-AFRI, NC State Univ., Univ. of Georgia,
Weyerhaeuser, Plum Creek, Georgia Pacific, NCASI)

- 8 sites in NC and GA
- Residues retained
- Residues removed
- 15% or 30% retained
- Clumped or dispersed

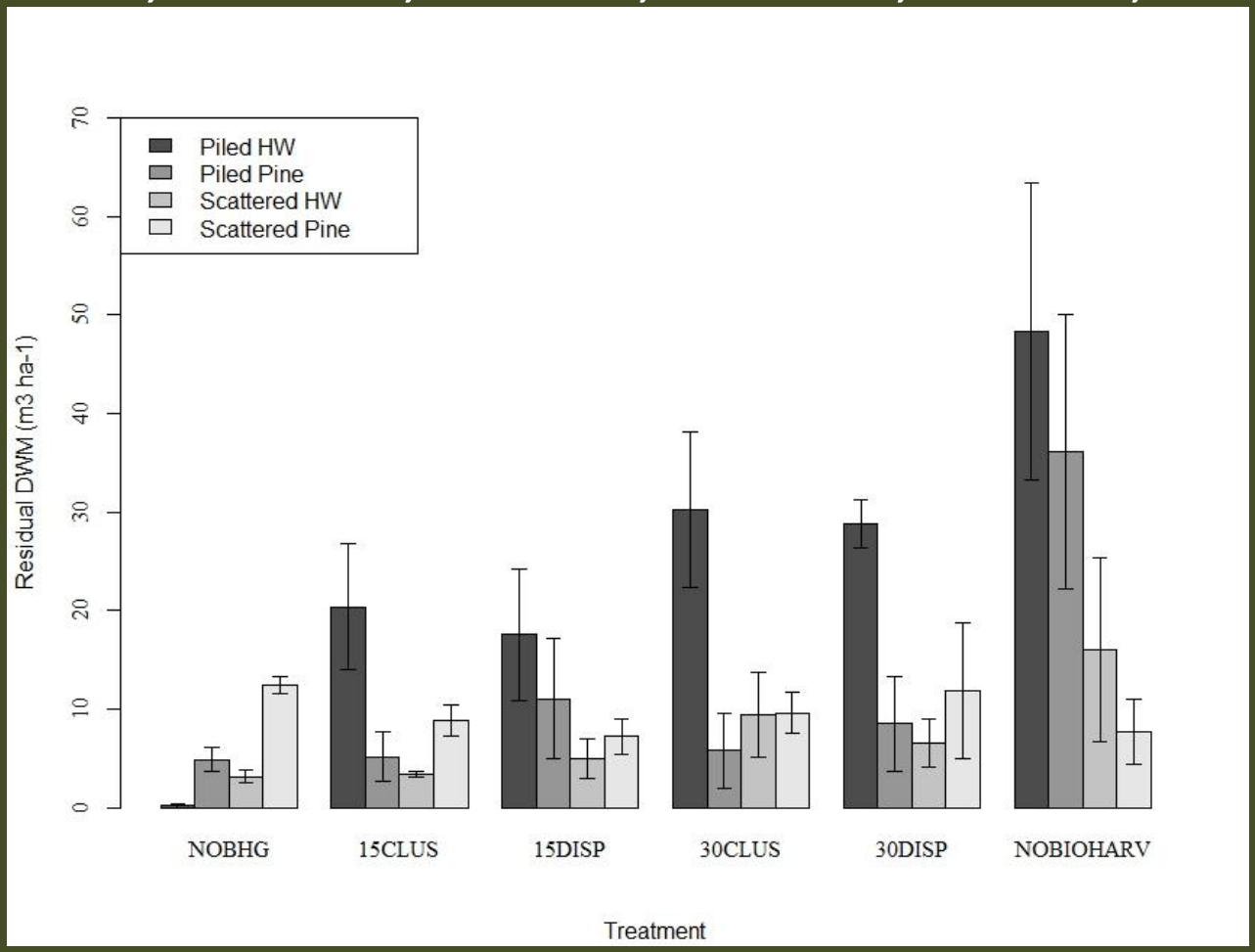
Harvest Residue Management in Southern Pine Plantations

- Small mammals, reptiles, amphibians, arthropods
- Plant community composition
- Soil properties, variability
- Technical input on BHGs
- Logger/manager survey

Residues Retained After Operational Biomass Harvesting in North Carolina, USA

S. Fritts, C. Moorman, D. Hazel, B. Jackson
NC State Univ., Univ. of Georgia

NO BHG, 15CLUS, 15DISP, 30CLUS, 30DISP, BOHarv



New Technologies will Increase Harvesting Efficiency

Analysis of 53 Temperate and Boreal Forest Studies

(Thiffault et al. 2011)

- Biomass harvesting can reduce soil nutrient pools, particularly in the forest floor
- “No clear impact of whole-tree harvest on soil C”
- “No consistent, unequivocal and universal effects of biomass harvesting on soil productivity”

Forest Service Long-Term Soil Productivity Project

(Ponder et al. 2012)

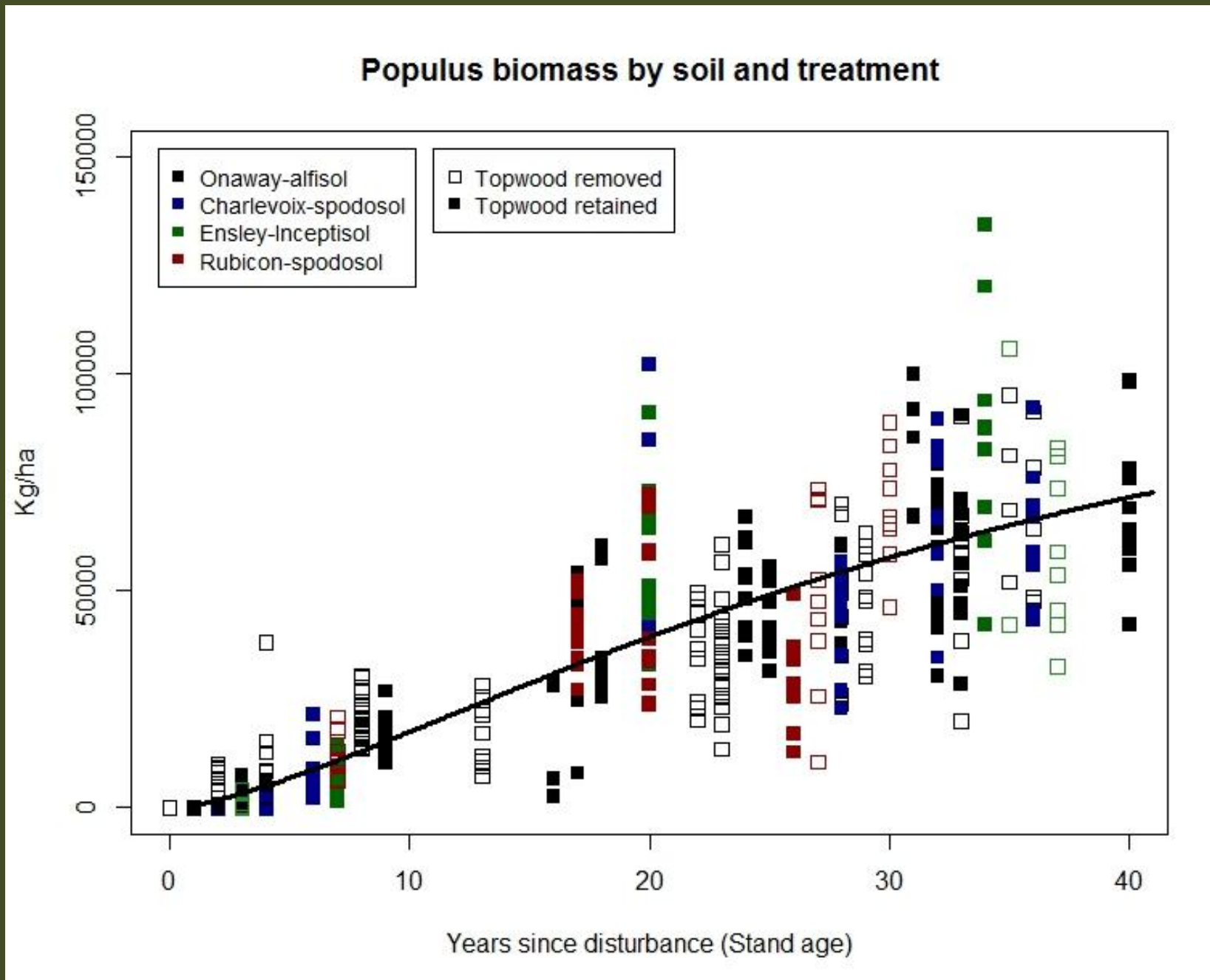
- 10 years, 45 installations across North America
- Whole-tree harvest: “little consistent effect on any response variable, including tree growth”
- Vegetation control consistently increased tree biomass
- Soil nutrient demands may increase

Ecological Effects of Logging Residue Harvest in Great Lakes Aspen Stands

(Michigan Tech, Plum Creek, NCASI)

("Residues removed" treatment; Michael Premer, Michigan Tech)

- 40 year chronosequence of harvested stands
- With or without residue removal

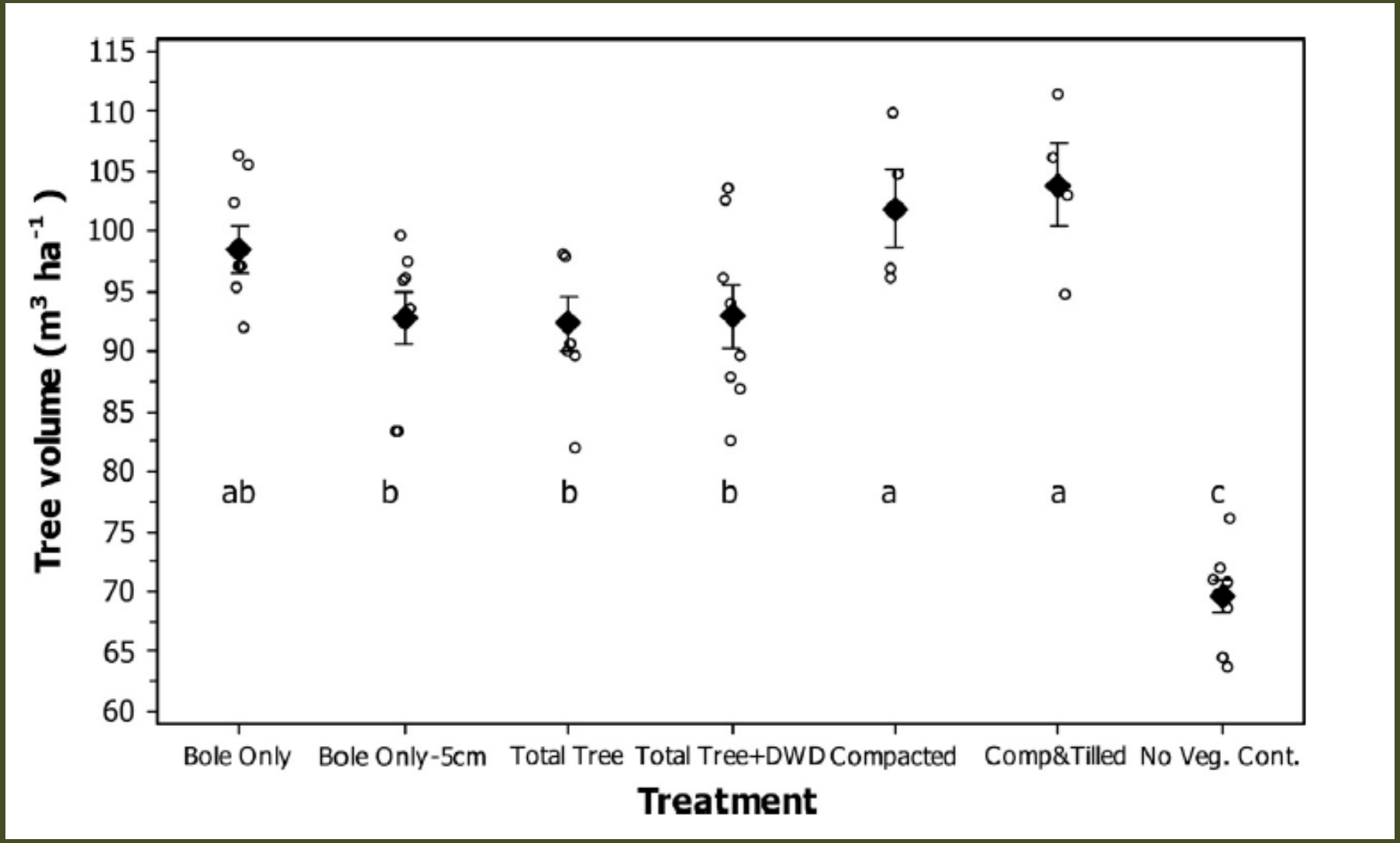

Populus biomass by soil and treatment
Onaway-alfisol
Charlevoix-spodosol
Ensley-Inceptisol
Rubicon-spodosol
Topwood removed
Topwood retained
Kg/ha
0
50000
100000
150000
0
10
20
30
40
Years since disturbance (Stand age)

Fall River Long-Term Soil Productivity Project

(Univ. of Washington, Weyerhaeuser, USFS, NCASI)

- Conventional bole-only removal
- Total stem (bole-only to a 5cm top)
- Total-tree removal
- Total-tree + legacy-wood removal

Fall River: Effects of Harvesting, Compaction and Vegetation Control on Age 10 Tree Volume (Holub et al. 2013)



Can Nutrient Deficiencies be Prevented or Corrected?

- Evidence suggests yes

  (e.g., Helmisaari et al. 2011, Jacobson et al. 2000, Smith et al. 2000)
- Lack of evidence for uncorrectable declines
- Many studies do not include fertilization
- Fertilization not an option on some lands
  - Management restrictions
  - Economics

Soil Erosion May Impact Soil Productivity and Water Quality

- Decades of Research: BMPs for water quality effective with 90% implementation
  - (Ice et al. 2011, Schilling et al. 2009)
- Biomass Harvesting Can Exacerbate Disturbance
  - (Curran and Howes 2011)
- Extra precautions
  - Minimize bare soil
  - Retain residues where needed
  - Monitor

Moving Forward in the Face of Uncertainty

- Default to operational expertise, best management practices
- Monitor Function rather than State
- Assess economic and bureaucratic deterrents
- Identify sensitive sites
- Mitigate, modify, or suspend practices if problems occur

Discussion