Sustainable Forest Residues and Mill Wastes

Northeast Sun Grant Regional Feedstock Summit Working Group

Working Group Participants

- Jingxin Wang, West Virginia University
- Amy Welch, Penn State University
- Jude Liu, Penn State University
- Tony Nekut, Forest Owner Biomass Coop

Current best feedstocks in this category in the northeast

- Three major categories:
  - Primary
    - Logging residues
    - Fuel treatments
    - Tree trimming
  - Secondary
    - Mill residues
    - Pulping liquors
  - Tertiary
    - Urban wood residues

Best source(s) of information for determining quantities

- State agencies, Energy, Forestry
- Universities, forestry or natural resources related departments
- For example,
  - In West Virginia, WVU produces a detailed state wide report on biomass availability, uses, and opportunities – www.wdsc.caf.wvu.edu/BioMatCtr
  - We believe other states like PA, NJ have the similar reports

Inventories, databases and information available for existing feedstocks

- NE FIA
- Are there databases that are available but not well known?
  - State-level DB existing but not well known
  - Compatibility and boundary adjacency constraints need to be considered
  - Suggestion (NESGI coordination)

Top 3 most significant challenges that must be addressed to bring the feedstock (or the technology) to the energy market?

- Cost, cost, and cost
- Handling and collection techniques and equipment
- Market demand

What would be the cost (dollars, equipment, full time equivalent positions, time, etc.,) to adequately address the identified roadblocks?

- First, typical forest harvesting systems used in the region
  - Chainsaw and cable skidder
  - Feller-buncher and grapple skidder
- Others exist but not commonly used in this region

What would be the cost (dollars, equipment, full time equivalent positions, time, etc.,) to adequately address the identified roadblocks?

- $2-3/ ton for land once you have it
- $25/ ton delivered price to mill
- Must be lower than $30 per ton for pulp wood to meet labor cost—very bottom
- $15-20/hr labor to operate machine (for regions—NE)
- (Depends on purchase price) $80-100/ hour for harvesting prior to transport to mill
- Still pretty high**—Where can we reduce these costs?** Increase efficiency of residue collection, new machines
- Develop new technology
- Government policy subsidies can lower cost
- Now higher than $100/ton

Working Group Session Notes
Sustainable Forest Residues and Mill Wastes

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Current best feedstocks in this category in the northeast
Best source(s) of information for determining quantities

Best feedstock sources in the NE:
WV - state wide inventory on logging and mill residue available at county level
Spatial analysis tools available, and detailed
Biomass uses and opportunities in WV summarized: www.wdsc.caf.wvu.edu/biomatctr

- Analysis began as a DOE initiative, money to State level Dept of Energy and have a working relationship with biomass center at WVU, first few years was seed money
- NJ-new database presented and available at www.njeas.rutgers.edu/bioenergy
- Dr Wang does not have information on rest of NE, not sure how close the level of data is between the various sources

How do other states compare to WV's residue assessment?—WV used detailed info from state, did not rely exclusively on FIA data, used state, NASS, WV state level info not via FIA for logging residue assessment
FIA the primary source for non-residue (challenge of FIA data use at the fine scale recognized, also no new data since 2001, limited point source data at the sub-county level

Dr Wang suggests that the typical hauling distance is at least 90 miles, that 10-15 miles is not adequate to capture enough resource
50 miles is most economical distance because of scalability of production, but might not capture enough resource for mid-sized projects (~100 million g/yr)

Smaller scale, distributed ethanol production? Forestry is not able to scale down as readily as food grease or even farm level residues because of distribution of resource

T. Nekut interested in 100+ member coop to aggregate resource: direct heat for several hundred local homes—efficiencies of distributed head generation that displace petrol use for transportation sector

~5 million green tons(?) of residue across state of WV (smaller area that other NE States though 80% forested—300 miles n/south, 200 miles East West (less 2.4 million dry tons at 15% moisture content) Maine has highest % forested land, VT #2, WV #3

Current best feedstocks:
3 categories:

- primary: logging residue;
- secondary: sawmills, and
- tertiary: pulp and paper as well as utility line maintenance (120 tons/year), urban tree trimming—urban tree trimming is not a big factor in WV as well as MSW (C&D)

C&D is bigger in WV than general MSW, (used population data—waste per capita from national study to characterize MSW production) but don't have any other info source for that part of the inventory

Managing for NPP? Stand structure?
Not a lot of activity in NE to increase yield in forests—most yield work related to genomics--Hybrid poplar-much activity to increase yield, research into applications for strip mining reclamation, among other species being tested

What is productivity of hybrid poplar without any field nutrient treatments?—not known in this group. What is the harvesting technology for hybrid poplar?

WV engaged in study of 7 regions terrain species for harvesting equipment by species—NE two major types: feller-buncher, grapple scale

Harvester forward (?) not used in WV and NE in general due to species and terrain limitations—more popular in MI and lake states. Mr. Nekut has seen it used in in NY and looks like lower impact—feller-buncher and grapple is ½ of capital cost of this equipment

On -site chipping? Many years of whole three chipping—specific activity depends on what you want to do with resource. Cost is a big driver of how resource is handled--nobody brings whole three to mill. Dr. Wang believes whole tree chipping will be used with biofuels—chipping could provide greater density if thechnology to compact on site is produced or could keep trans cost lower as a function of density

Nutrient cycling? How much do you have to leave? 80% of nutrients in tops. Harvest time can influcen—collect after leaves fall though controversial issue-- Reapplication of ash occurs in some Euro systems

Other technologies:
Forest slash bundler
Timberjack / bundler from John Deere: tops branches everything—works well but very expensive

Inventories, databases and information available for existing feedstocks

Databases: (some discussion above)

NE forest data (non-industry residue) = FIA
Statewide inventories, WV no state wide level inventory aside from FIA for non-residue but do have some smaller scale inventories on a company by company databases—believed to be similar across the NE region: State level, residue database yes, and interactive maps available though not necessarily in compatible format or with uniform data

Residue: no region-wide database, but do believe there is comprehensive data at some level at state level in most states in NE region—coordination is important and they should be compatible

i.e. 20 fields in WV database vs 30 fields in PA—needs to be coordinated by NE regional efforts
The regions should set up a guideline for the states

Have all the potential parts, but need to have a project to coordinate feedstock availability between each state (not a lot of $$--$10,000 to give particular format of data from NE sun grant office)—need coordination

Even more important to have coordinated reporting versus universal database

Nekut: Need to learn from Europe on BMP for harvesting

Many assessments do not consider BMPs (for nutrition cycling, water quality have them but not used in inventories)

Top 3 most significant challenges that must be addressed to bring the feedstock (or the technology) to the energy market?

The cost—logging residue, MSW, whatever the resource—colleting and processing in a cost effective way is the biggest issue

We have a lot of resource, but it is too expensive to get it to market
Even if already working there, still comes at a cost, (though certainly less)

From a land owner perspective $2-3 dollar per ton is good but the equipment for colleting and transporting low value reside to market is prohibitive

Nationwide current research at WV indicating about $35 dollars per dry ton breakeven, many scenarios could be lower than this and still be profitable—what makes this possible? Delivery form (Chipping/not chipping, bundled) Harvesting and bringing it to landing while in the forest already—easily recovered is biggest issue.

Minimum of $30/ton for residue might encourage harvesting

For other applications (heat, electricity), might be able to charge higher ($70/ton would be great)

Machinery, availability of equipment and cost—need a machine to compact material and maximize transportation efficiency.

Forest—may be have it or for some parts (bundling) but not necessarily collecting, availability of equipment should be considered, residue collection technology and processing equipment is not widely available or is too expensive Forest resources are not as accessible for second round collection, must do it in one round.

Whole system--no

Pre-process—collecting is in need of real progress research wise.

Too much material in field with hemp, $1 per bale , but $2 to transport

Demand

We have the resource, we don't have exact number but we know we have a lot, we just cant get to it cost effectively.

Other concerns that are stil uncertain:
Environmental impacts unknown (i.e. nutrient removal impacts. Exp of Canada must leave 30% on soil)

What would be the cost (dollars, equipment, full time equivalent positions, time, etc.,) to adequately address the identified roadblocks?

What would be the cost to adequately address the three roadblocks?

Pre-costs assessments from research at WVU:
$2-3/ ton for land once you have it (?)
$25/ ton delivered price to mill
Must be at least $30 per ton for pulp wood to meet labor cost—very bottom
$15-20/hr labor to operate machine (for regions—NE) But we are now higher than $100/ton in most forest areas

(Depends on purchase price of equip) $80-100/ hour for harvesting prior to transport to mill
Still pretty high—where can we reduce these costs?
Increase efficiency of residue collection, new machines

New technology
Government policy subsidies can lower cost

Feller-buncher
Southern tier thinning/stand improvement, for mixed forest management profitable at $30 ton to move. Fairly close to pulp mill , fairly high density (1 –yr for ~1000 acres)

A lot of factors affect cost:

- Size of residue (low size—higher cost)—density—harvesting and transportation
- Labor cost
- Machine
- Environmental cost—site conditions

How to bring these down:

- New machines or modify existing equipment
- Density of delivered product
- Govt subsidies
- Drive down cost of production equipment somehow

Benefits and consequences of feedstock development (many work in both directions):

- Nutrition cycling
- Pest control
- Invasive species
- Stand structure:
- Water quality wildlife
- Sustainable forest management is always major concern

Technology drivers for feedstock development (genomics) covered in other groups.