Biomass Potential in Tompkins County

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Cornell University 2012
What is Biomass?

- Organic material that contains stored energy from the sun
- Wood, crops, manure, some garbage
- Focus on biomass available for heat production purposes
Land Use in Tompkins County

- 305,368 total acres (excluding lake)
- “other” includes residential, commercial, etc.
- Avoid competition with agriculture
- Emphasis on sustainability

“Tompkins County Land Use and Land Cover.” Department of Planning. 2007.
Land Area Available for Biomass Production by 2020

<table>
<thead>
<tr>
<th>Crop Land (acres)</th>
<th>Hay Land (acres)</th>
<th>Grass Land (acres)</th>
<th>Shrub Land (acres)</th>
<th>Total Area (acres)</th>
<th>Production (dry tons/Year)</th>
<th>Yield (tons/acre/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,719</td>
<td>2,084</td>
<td>7,243</td>
<td>4,911</td>
<td>25,958</td>
<td>115,682</td>
<td>4.5</td>
</tr>
</tbody>
</table>


- Assumes constant increase in agricultural productivity
- Excludes forested regions
- Most conservative estimate available
Land Area Currently Available for Biomass Production

- Data from 2009 Biomass Resource Mapping Workshop
- Matlab program quantifies region of interest
- Private, unused fields colored brown
- Data extrapolated to fit unmapped townships
- 90,500 acres available
### Biomass Yield Rates

<table>
<thead>
<tr>
<th>Wood Chips From Existing Forests (dry tons/year)</th>
<th>Dedicated Energy Crops (dry tons/year)</th>
<th>Corn Stover (dry tons/year)</th>
<th>Total Biomass (dry tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>87,006</td>
<td>115,682</td>
<td>4,288</td>
<td>206,976</td>
</tr>
</tbody>
</table>


- Emphasis on sustainable harvesting
- For comparison, AES Cayuga burns 860,000 tons of coal per year
- Substantial decrease in carbon emission
Heat Content of Wood in Local Forests

- Average heat content 6061 BTU/lb. or 14.1 MJ/Kg
- Applies to dried wood
- Study of 600 acres of County-owned forested land
- 25 tree species in actual list

<table>
<thead>
<tr>
<th>Wood Species</th>
<th>% in Forests</th>
<th>Heat Density (MMBTU/chord)</th>
<th>Mass Density (lb./chord)</th>
<th>Heat Content (BTU/lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red Maple</td>
<td>5.74</td>
<td>18.7</td>
<td>2290</td>
<td>8166</td>
</tr>
<tr>
<td>Sugar Maple</td>
<td>4.5</td>
<td>24</td>
<td>2120</td>
<td>11321</td>
</tr>
<tr>
<td>White Ash</td>
<td>3.03</td>
<td>23.6</td>
<td>2240</td>
<td>10536</td>
</tr>
<tr>
<td>Black Cherry</td>
<td>1.4</td>
<td>20</td>
<td>2670</td>
<td>7491</td>
</tr>
<tr>
<td>Northern Red Oak</td>
<td>1.26</td>
<td>24</td>
<td>3690</td>
<td>6504</td>
</tr>
<tr>
<td>Hemlock</td>
<td>8.94</td>
<td>15.9</td>
<td>3100</td>
<td>5129</td>
</tr>
<tr>
<td>Black Birch</td>
<td>0.703</td>
<td>21.7</td>
<td>3200</td>
<td>6781</td>
</tr>
<tr>
<td>Beech wood</td>
<td>2.36</td>
<td>24</td>
<td>3120</td>
<td>7692</td>
</tr>
<tr>
<td>Quaking Aspen</td>
<td>3.16</td>
<td>14.7</td>
<td>3480</td>
<td>4224</td>
</tr>
<tr>
<td>Basswood</td>
<td>0.866</td>
<td>13.5</td>
<td>2870</td>
<td>4704</td>
</tr>
<tr>
<td>White Pine</td>
<td>5.45</td>
<td>14.3</td>
<td>4330</td>
<td>3303</td>
</tr>
<tr>
<td>Pitch Pine</td>
<td>1.1</td>
<td>17.1</td>
<td>3300</td>
<td>5182</td>
</tr>
<tr>
<td>Black Locust</td>
<td>4.27</td>
<td>27.3</td>
<td>3240</td>
<td>8426</td>
</tr>
<tr>
<td>Scots Pine</td>
<td>1.73</td>
<td>18.1</td>
<td>3250</td>
<td>5569</td>
</tr>
</tbody>
</table>

“Tompkins County Forest Management Plan.” Department of Planning. October 2007

1 chord = 3.62 m

1 BTU = 1,055 Joules
Wood Pellets for Domestic Heating

- 79.2 million BTU/year to heat average home
- Enough wood pellets to heat 13,317 homes
- 41,674 homes in County
  - United States Census Bureau, 2010
- Monetary and environmental benefits
Perennial and Warm Season Grasses

- Switchgrass may yield 10-20 tons/acre
- Reduced to 5 tons/acre after drying
- Cool season grasses less labor intensive
- High sulfur content
- Unused fields may produce 1-2 tons of dry biomass

- Hilary Mayton, Cornell Plant Breeding and Genetics Department
Agricultural Byproducts

- “Most economically feasible option”
  - Hilary Mayton

- 12.5% of corn stover extracted after harvest

- 536 dry tons/year

- Good starting point for biomass utilization in County
Summary

- 26,000-91,000 acres available for biomass production
- 200,000 dry tons of biomass/year
- One third of homes in County could be heated using locally sourced wood
- Cool season grasses well suited for region
Recommendations

- Begin by utilizing locally produced corn stover
- Develop best management practices for forest utilization
- Harvest wood from local forests
- Promote use of wood stoves and pellet stoves
- Harvest cool season grasses, such as canary grass, in vacant fields
Special Thanks To:

- All of you!
- Zellman Warhaft
- Katie Borgella
- Hilary Mayton
- Peter Woodbury
- Perrine Pepiot
- Elizabeth Fisher