Today’s Objectives

- Meaning and measurement of biomass and carbon
- Meaning and calculation of “stumpage”
- Familiarity with pricing cost
Tree Biomass

What?

- Weight of tree or tree components
- Usually dry weight (excludes water content)
- "Green tonnes" = weight including water
  "Bone dry tonnes" = weight excluding water
- Often subdivided by tree component
Tree Biomass

- Foliage
- Dead branches
- Live branches
- Stem bark
- Stem wood
- Roots
Tree Biomass

Why?

- **Pulp** (paper) is produced governed by *weight* of fibre in tree stem (not volume)
- Biomass represents a *bioenergy* source (if burned)
- Biomass is a measure of *primary productivity* of an ecosystem
- Relates directly to *carbon* content (50% of biomass is carbon)
Today’s Objectives

- Biomass as fuel
Tree Biomass

How?

- **Stem mass** approximated using *specific gravity* of wood (e.g. 0.45)

  \[1m^3 \text{ of wood} = 0.45 \times 1000\text{kg} = 450\text{ kg bone dry}\]

- Specific gravity varies by species

  
<table>
<thead>
<tr>
<th>Species</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trembling Aspen</td>
<td>0.35</td>
</tr>
<tr>
<td>Sugar Maple</td>
<td>0.56</td>
</tr>
<tr>
<td>Red Oak</td>
<td>0.57</td>
</tr>
<tr>
<td>Black Locust</td>
<td>0.66</td>
</tr>
<tr>
<td>Balsam Fir</td>
<td>0.34</td>
</tr>
<tr>
<td>Eastern Cedar</td>
<td>0.31</td>
</tr>
<tr>
<td>Spruce</td>
<td>0.36</td>
</tr>
<tr>
<td>Red Pine</td>
<td>0.41</td>
</tr>
</tbody>
</table>
Tree Biomass

How?

- **Stem mass** approximated using specific gravity of wood (e.g. 0.45)

  \[1 \text{m}^3 \text{ of wood} = 0.45 \times 1000 \text{kg} = 450 \text{ kg bone dry}\]

- Specific gravity varies by species

  Calculate stem volume
  
  Multiply by specific gravity to get biomass
  
  E.g. \[1.5 \text{ m}^3 \times 0.45 \text{ T/m}^3 = 0.675 \text{ T biomass}\]
Carbon

What?

- Weight of *carbon* (C) stored in forest trees
- Overall forest carbon includes *soil carbon and other components*

Why?

- Key in *regulating atmospheric* carbon (and related to climate change)
- Important in carbon *credit trading* & *international treaties*
How?

- Commonly used approximation
  \((\text{biomass is } 50\% \text{ carbon})\)
  \[
  \text{Carbon (t)} = 0.5 \times \text{tree biomass (t)}
  \]

- Example:
  how much carbon in sugar maple tree stem with diameter = 24cm and height = 17m?

  Stem Volume = \(\pi \times (\text{DBH}^2)/40000 \times 17 \times 0.42\)

  Stem Volume = 0.32 m\(^3\)

  Specific Gravity = 0.56 tonnes/m\(^3\)

  Biomass = 0.32 m\(^3\) \times 0.56 tonnes/m\(^3\) = 0.18 tonnes

  Carbon = 0.18 tonnes \times 0.50 = 0.09 tonnes
Example: how much carbon in tree stem with diameter = 24cm and height = 17m?

Tree Stem $C = 0.09$ t

Annual Carbon emissions per capita

Canada = approx 5.5 tonnes C per person

How many trees of this size needed to store the C equivalent annual output of one Canadian?
Prices & Costs

What?

Prices

- The *money received* for timber (or other form of wood) at a particular *location* in a particular *form*

Costs

- The *expenses incurred* in steps required to get wood to that *place* in that *form*
Prices & Costs

Why?

- **Profitability** of forest management is governed by relationship between *prices* and *costs*

- **Management decisions** are heavily influenced by profitability

- **Valuation** of forests and their profitability is critical to making sound *management decisions*
Where is the wood in the production chain?

Where would you likely pay the most for it?
What are the processes (& costs) to get it there?

Forest

Millyard

Roading & Logging

Handling & Hauling

Roadside
Stumpage

- price paid landowner for standing timber (“on the stump”)
- buyer harvests & removes timber
- equals market price minus cost of getting logs to market

Millyard

Forest

Roadside

Handling & Hauling

Roading & Logging

• price paid landowner for standing timber (“on the stump”)
• buyer harvests & removes timber
• equals market price minus cost of getting logs to market
Mill Price

- price paid for wood delivered to a mill or wharf destination
- many owners sell at millgate or at export port

Millyard

Forest

Roading & Logging

Handling & Hauling

Roadside
Prices & Costs

How?

Mill $$ – Shipping & Handling = Roadside $$

Roadside $$ – Logging & Roading = Stumpage $$

Costs include profit, overhead & mgmt
Prices & Costs

Be Alert

- **Reported products**
  - logs by grade (e.g. S1 or S2 or S3)
  - pulp
  - chips

- **Reporting units**
  - m³
  - tonnes (green)
  - tonnes (dry)
  - board feet

- **Reporting locations**
  - at wharf or mill
  - loaded on export ship

Prices are reported in different units and for different locations

Know what are being used for prices quoted
Prices & Costs

Example – Stumpage Sale for a Stand

- Standing Merch Volume = \(400 \text{ m}^3/\text{ha}\)
- Stand Area = 10ha
- Overall Volume = 10ha \(\times\) 200 m\(^3\)/ha = 2000 m\(^3\)
- Expected volume breakdown at harvest:
  - 25% Grade 1 logs = 500 m\(^3\)
  - 50% Grade 2 logs = 900 m\(^3\)
  - 25% pulp = 600 m\(^3\)
- How much stumpage we should receive?
Prices & Costs

Example – Stumpage Sale

- How much stumpage we should receive?
  
  \[ \text{Mill } \$\$ - \text{Shipping} \& \text{Handling} = \text{Roadside } \$\$ \]
  
  \[ \text{Roadside } \$\$ - \text{Logging} \& \text{Roading} = \text{Stumpage } \$\$ \]
  
  \[ \text{Stumpage } \$\$ = \text{Mill } \$\$ - \text{Shipping} \& \text{Handling} - \text{Logging} \& \text{Roading} \]

- Where to find prices?
  
  Dept. Nat'l Resources,
  Forest Products Marketing Boards
NEW BRUNSWICK REGULATION 86-160
under the Crown Lands and Forests Act
(O.C. 86-918)

SCHEDULE A

The Royalty to be paid on the following species of the following classes of timber based on the fair market value of the standing timber of that class is that amount prescribed by the following table:

<table>
<thead>
<tr>
<th>Class of Timber</th>
<th>Species or Groups of Species of Timber in a Class</th>
<th>Fair Market Value of Standing Timber by Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW veneer logs</td>
<td>white pine</td>
<td>$25.15/m³</td>
</tr>
<tr>
<td></td>
<td>spruce, fir, jack pine</td>
<td>$21.82/m³</td>
</tr>
<tr>
<td></td>
<td>other softwoods</td>
<td>$17.47/m³</td>
</tr>
<tr>
<td>HW veneer logs</td>
<td>sugar maple</td>
<td>$36.78/m³</td>
</tr>
<tr>
<td></td>
<td>yellow birch</td>
<td>$44.87/m³</td>
</tr>
<tr>
<td></td>
<td>poplar</td>
<td>$15.00/m³</td>
</tr>
<tr>
<td></td>
<td>other hardwoods</td>
<td>$30.70/m³</td>
</tr>
<tr>
<td>select sawlogs</td>
<td>sugar maple</td>
<td>$27.59/m³</td>
</tr>
<tr>
<td></td>
<td>yellow birch</td>
<td>$33.66/m³</td>
</tr>
<tr>
<td></td>
<td>other hardwoods</td>
<td>$23.02/m³</td>
</tr>
<tr>
<td>Class of Timber</td>
<td>Species or Groups of Species of Timber in a Class</td>
<td>Fair Market Value of Standing Timber by Class</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>pulpwood</td>
<td>spruce, fir, jack pine, other softwoods</td>
<td>$10.55/m³</td>
</tr>
<tr>
<td></td>
<td>any hardwood species</td>
<td>$6.99/m³</td>
</tr>
<tr>
<td>OSB</td>
<td>any hardwood species</td>
<td>$8.15/m³</td>
</tr>
<tr>
<td>fuelwood</td>
<td>any hardwood species</td>
<td>$8.15/m³</td>
</tr>
<tr>
<td>fencing</td>
<td>cedar</td>
<td>$17.54/m³</td>
</tr>
<tr>
<td>poles and pilings</td>
<td>red pine</td>
<td>$33.54/m³</td>
</tr>
<tr>
<td></td>
<td>jack pine</td>
<td>$26.04/m³</td>
</tr>
<tr>
<td></td>
<td>cedar</td>
<td>$17.54/m³</td>
</tr>
<tr>
<td>posts, rails and shinglewood</td>
<td>cedar</td>
<td>$6.60/m³</td>
</tr>
<tr>
<td>OSB</td>
<td>any hardwood species</td>
<td>$8.15/m³</td>
</tr>
<tr>
<td>fuelwood</td>
<td>any hardwood species</td>
<td>$8.15/m³</td>
</tr>
<tr>
<td>weir stakes</td>
<td>any softwood species</td>
<td>$30.95/m³</td>
</tr>
<tr>
<td></td>
<td>any hardwood species</td>
<td>$38.53/m³</td>
</tr>
</tbody>
</table>
Summary

- **Biomass** and **carbon** are increasingly important measures of forest content (for **economic** & **environmental** reasons).
- **Biomass** can be calculated from **DBH & height** using **appropriate** relationships (produced by forest researchers).
- Know how to **use** them.
- Carbon content is roughly **50%** of biomass.
Summary

- **Stumpage** = value of *standing timber*
  - = market price – cost of bringing logs to market

- Market *prices vary* by:
  - quality of material (e.g. log grade)
  - location of market (mill, on-ship)

- Market prices are *regularly reported* (DNR & others)

- **Be alert** to units in which prices are quoted and convert to appropriate base in each case