Tree Biomass & Carbon

Price & Cost Information

FOR 1001
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Today's Objectives

- ❑ **Meaning and measurement of biomass and carbon**

- ❑ **Meaning and calculation of "stumpage"**

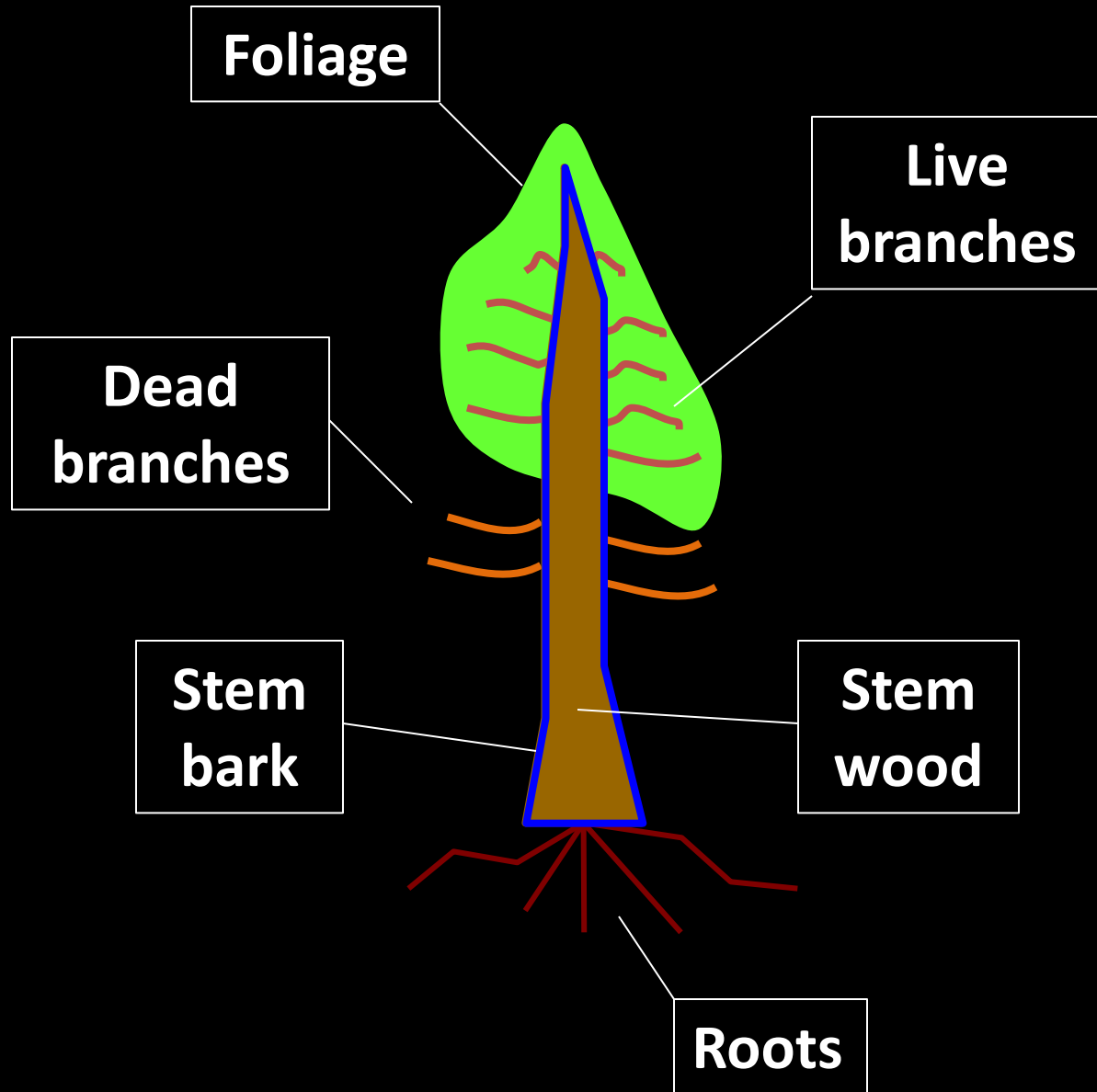- ❑ **Familiarity with pricing cost**

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

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)

  $1m^3$ *of wood* = 0.45 * 1000kg = *450 kg bone dry*

- **Specific gravity varies by species**

Trembling Aspen	=	0.35	Balsam Fir	=	0.34
Sugar Maple	=	0.56	Eastern Cedar	=	0.31
Red Oak	=	0.57	Spruce	=	0.36
Black Locust	=	0.66	Red Pine	=	0.41

Tree Biomass

How?

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

  > *1m³ of wood* = 0.45 * 1000kg = *450 kg bone dry*

- ❑ Specific gravity varies by species

  > Calculate stem volume

  > Multiply by specific gravity to get biomass

  > E.g. *1.5 m³ X 0.45 T/m³ = 0.675 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*

Carbon

How? ❑ **Commonly used approximation**
(biomass is 50% carbon)

> *Carbon* (t) = 0.5 * *tree biomass* (t)

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

Stem Volume = pi x $(DBH^2)/40000$)* 17 * 0.42

Stem Volume = 0.32 m^3

Specific Gravity = 0.56 tonnes/m^3

Biomass = 0.32 m^3 * 0.56 tonnes/m^3 = 0.18 tonnes

Carbon = 0.18 tonnes * 0.50 = 0.09 tonnes

Carbon

Note

❑ **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*

Millyard

Where is the wood in the production chain?

Product

Forest

Where would you likely pay the most for it?

Roadside

Millyard

What are the processes (& costs) to get it there?

Handling & Hauling

Forest

Roading & Logging

Roadside

Millyard

Stumpage

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

Handling & Hauling

Roading & Logging

Forest

Roadside

Millyard

Mill Price

- price paid for wood delivered to a mill or wharf destination

- many owners sell at millgate or at export port

Handling & Hauling

Forest

Roading & Logging

Roadside

Prices & Costs

How?

Millyard $$

Handling & Hauling $$

Mill $$ – Shipping&Handling = Roadside $$

Roadside $$

Roadside $$ – Logging&Roading = Stumpage $$

Roading & Logging $$

Costs include profit, overhead & mgmt

Forest $$

Prices & Costs

Be Alert

❑ **Reported *products***

    - logs by grade (e.g. S1 or S2 or S3)

    - pulp

    - chips

❑ **Reporting *units***

    - m^3

    - 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

- ❑ **Standing Merch Volume = *400 m³/ha***

- ❑ **Stand Area = *10ha***

- ❑ **Overall Volume = 10ha * 200 m³/ha = *2000 m³***

- ❑ **Expected volume breakdown at harvest:**
  25% *Grade 1 logs* = *500 m³*
  50% *Grade 2 logs* = *900 m³*
  25% *pulp* = *600m³*

- ❑ **How much *stumpage* we should receive?**

Prices & Costs

Example – Stumpage Sale

❑ **How much stumpage we should receive?**

Mill $$ – Shipping&Handling = **Roadside $$**

Roadside $$ – Logging&Roading = **Stumpage $$**

Stumpage $$ =
Mill $$ – Shipping&Handling – Logging&Roading

❑ **Where to find prices?**

Dept Natl 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 1. NB Crown land royalty rates by timber class and species.		
Class of Timber	Species or Groups of Species of Timber in a Class	Fair Market Value of Standing Timber by Class
SW veneer logs	white pine	$25.15/m³
	spruce, fir, jack pine	$21.82/m³
	other softwoods	$17.47/m³
HW veneer logs	sugar maple	$36.78/m³
	yellow birch	$44.87/m³
	poplar	$15.00/m³
	other hardwoods	$30.70/m³
select sawlogs	sugar maple	$27.59/m³
	yellow birch	$33.66/m³
	other hardwoods	$23.02/m³

Table 1. NB Crown land royalty rates by timber class and species.

Class of Timber	Species or Groups of Species of Timber in a Class	Fair Market Value of Standing Timber by Class
pulpwood	spruce, fir, jack pine other softwoods	$10.55/m³ $6.99/m³
	any hardwood species	$8.15/m³
OSB	any hardwood species	$8.15/m³
fuelwood	any hardwood species	$8.15/m³
fencing	cedar	$17.54/m³
poles and pilings	red pine	$33.54/m³
	jack pine	$26.04/m³
	cedar	$17.54/m³
posts, rails and shinglewood	cedar	$6.60/m³
OSB	any hardwood species	$8.15/m³
fuelwood	any hardwood species	$8.15/m³
weir stakes	any softwood species	$30.95/m³
	any hardwood species	$38.53/m³

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