



WOOD RESIDUES FOR ENERGY IN ALASKA

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By

Dr. Allen M. Brackley, Team Leader, USDA, Forest
Service, Sitka Wood Utilization Center



Biomass/Renewable Energy/Residuals

In a sense coal and oil are renewable resources! The basic source material is subject to annual growth, but it takes millions of years to create the end product. The human animal just doesn't have the time to let nature do the job!



BIOMASS

The total mass (at any given time) of living organisms of one or more species per unit of space (species biomass) or of all the species in a biotic community (community biomass)

By: J & K Dunster, 1996, Dictionary of Natural Resource Management, UBC Press, Vancouver, BC.



Two Types of Biomass

- Fauna – Animal Communities
 - Exposed over time and subject to temperature and pressure = petroleum products.
- Flora – Plant Communities
 - Exposed over time and subject to temperature and pressure = coal products



RESIDUAL PRODUCTS/ RESIDUES

For the purposes of this presentation:

Residues

- From harvesting/thinning/salvage
 - Non merchantable sections of bole
 - Limbs/needles/leaves
 - Non-growing stock trees
 - Pucker brush (see: Young et al. 1964, 1967; Ribe 1973)
- From sawmill manufacturing
 - Bark
 - Slabs/edgings/chips
 - Sawdust/Shavings
- Others



For Harvesting Applications & Biomass Equations

- See:

Jenkins, J. C., Chojnacky, D. C., Heath and Birdsey, R. A. 2003. Comprehensive database of diameter-based biomass regressions for North American tree species, GTR NE-319, USDA Forest Service, Northeast Research Station, Delaware, OH.



RULES OF THUMB for WOOD MOISTURE RELATIONSHIPS

The 50/50 rules

Green wood is 50 percent water and 50 percent solid material

Thus: when fresh cut a bone dry unit (bdu) is 50 percent of the green unit

1 ton green = .5 ton bdu & 1 cord = .5 cord bd

1 cord = (4'x4'x8')128 cubic feet of wood/bark/air
(solid cubic content = 95 to 100 of wood and bark)

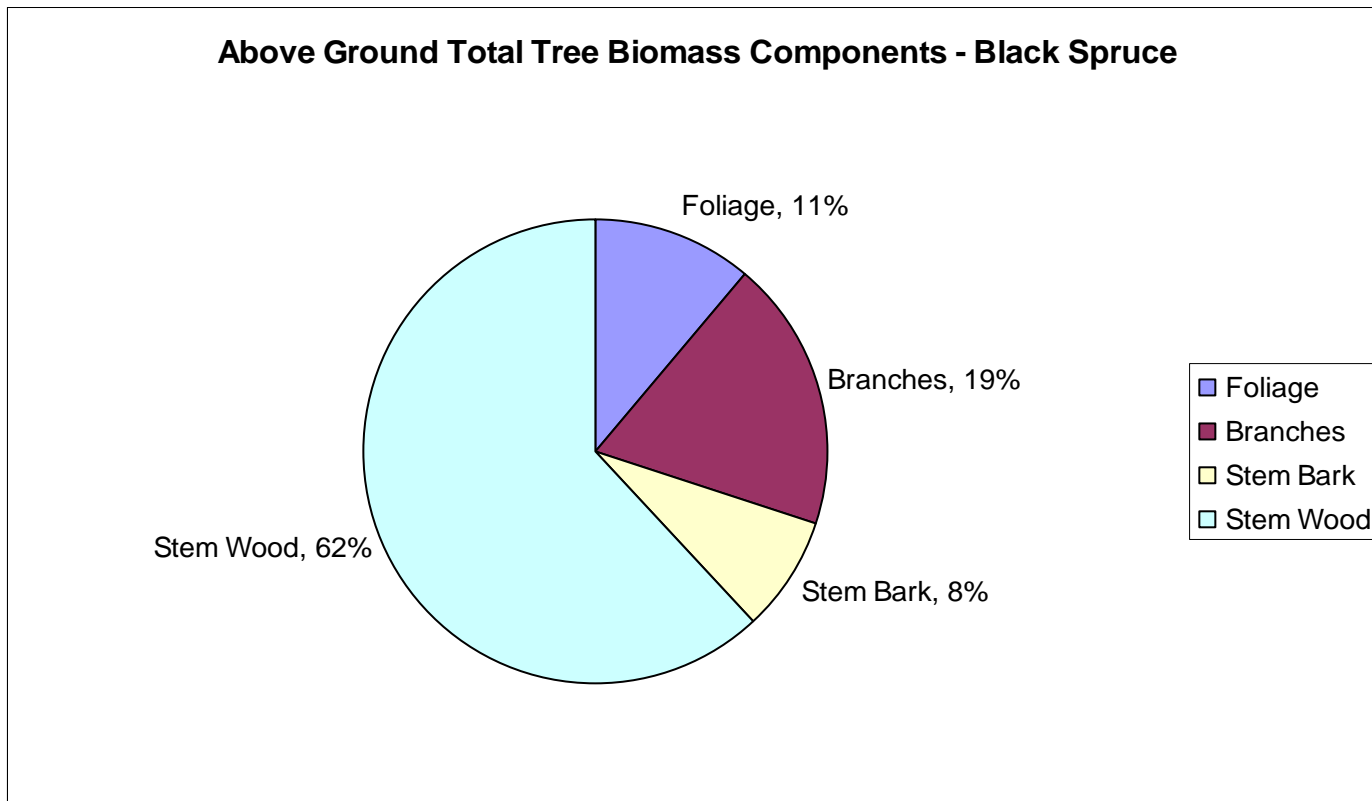


Source of complete tree values

Ker, M. F. 1980. Tree Biomass Equations for ten major species in Cumberland County, Nova Scotia, Information Report M-X-108, Maritimes Forest Research Center, Fredericton, NB, Canada pp. 26.



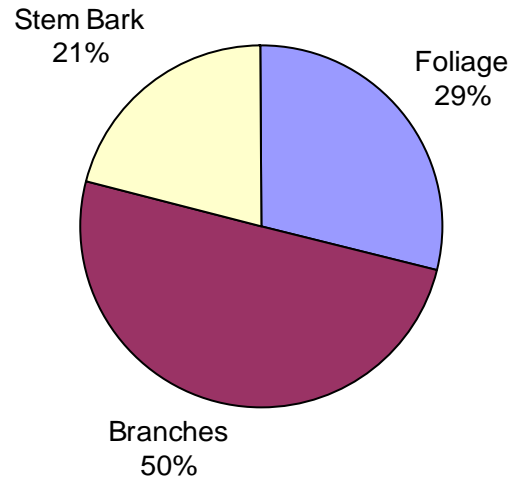
BLACK SPRUCE - TOTAL TREE COMPONENTS





GAIN IN VOLUME/UNIT OF VOLUME BLACK SPRUCE HARVESTED

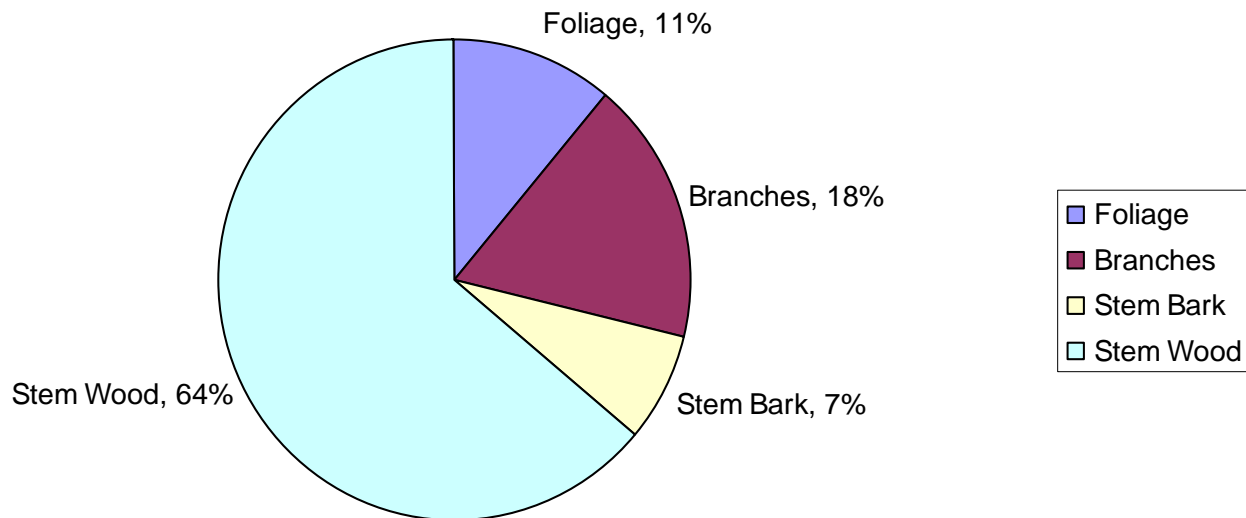
Increase in Volume from Harvesting of Above Ground Biomass
Components of Black Spruce (assuming merchantable stem 90% of
total stem = **.61 for every unit of merchantable stem
harvested**)





WHITE BIRCH - TOTAL TREE COMPONENTS

Above Ground Total Tree Biomass Components - White Birch



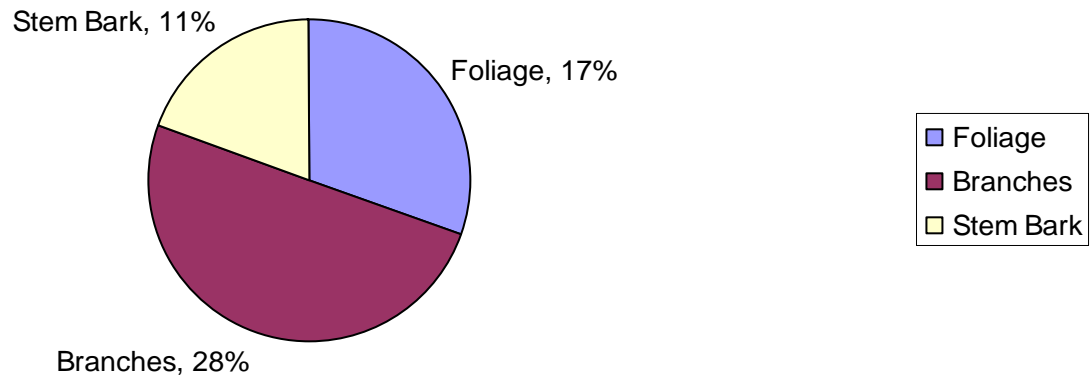


GAIN IN VOLUME/UNIT OF VOLUME WHITE BIRCH HARVESTED

Increase in Volume from Harvesting of Above Ground Biomass
Components of White Birch (Increase assuming merchantable stem is
harvested)

TOTAL INCREASE = 56% IN SUMMER

TOTAL INCREASE = 39% IN WINTER

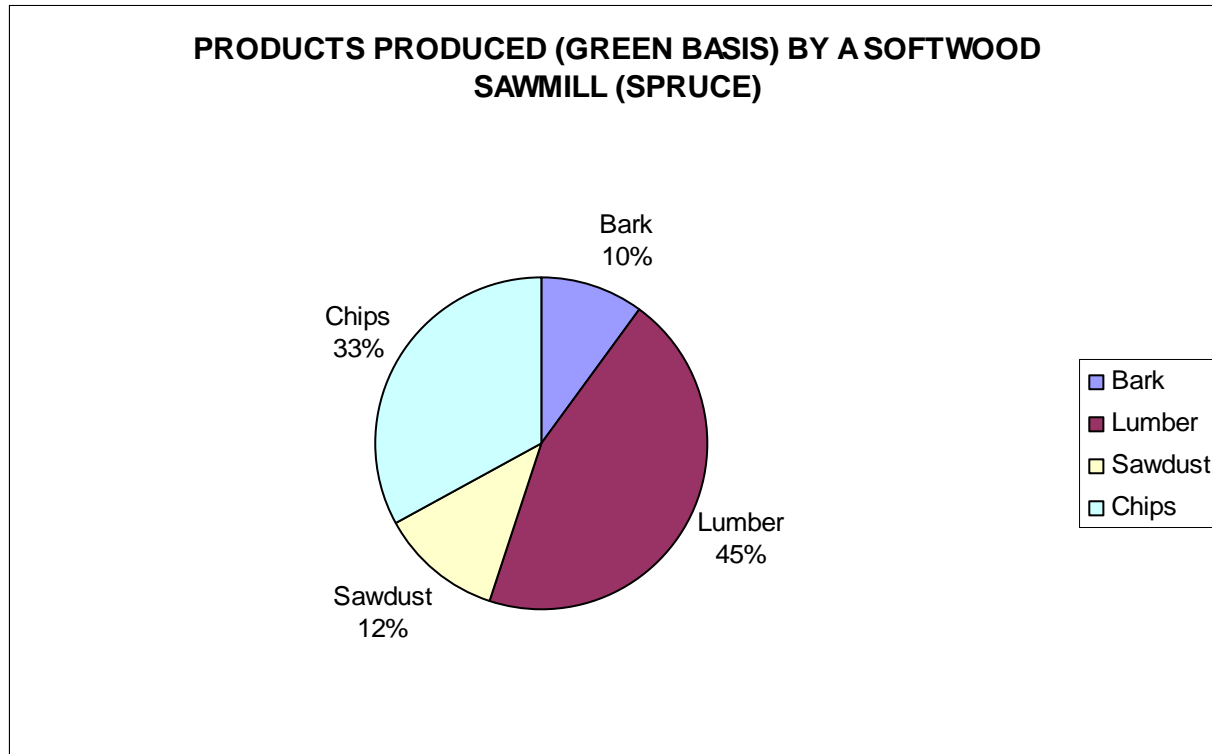




WHAT ABOUT RESIDUAL PRODUCTS (SLABS, EDGINGS, CHIPS, SAWDUST, SHAVINGS) FROM SAWMILLS?



PRODUCT AND RESIDUALS FROM A WHITE SPRUCE SAWMILL





RESIDUALS/UNIT OF LUMBER TALLY (OUTPUT)

Cubic Feet, Pounds and Tons of Material/MBF of Dry Lumber Production (AMBrackley/09/11/2007)							
		in Lumber	in Sawdust	in Chips	in Shavings	in Total	Bark
Cu ft of material / mbf of lumber production		60.0	16.0	44.0	2.9	122.9	12
Approx. Weight (lbs)		2,903	774	2,129	140	6,606	645
Approx. Weight (tons)		1.5	0.4	1.1	0.1	3.3	0.3
Lumber @ 19%Mc		1,742					
Bone Dry Weight (lbs)			387	1,064	70	3,303	323
Bone Dry Weight (tons)			0.19	0.53	0.04	1.65	0.16



IN SUMMARY FOR A SOFTWOOD SAWMILL

FOR **EVERY MBF OF DRY
LUMBER** YOU WILL GENERATE
.88 BD TONS RESIDUALS



A WORD OF CAUTION!

IN ALL PHYSICAL AND MECHANICAL SYSTEMS THE ULTIMATE EFFICIENCY (OUTPUT) OF THE SYSTEM MUST TAKE IN CONSIDERATION LOSS DUE TO FRICTION, HEAT AND DEGREE OF COMBUSTION.



BRACKLEY'S RULE FOR CALCULATING EFFICIENCY OF COMPLEX SYSTEMS

A GOOD SYSTEM ATTAINS 80%! *To calculate final estimates of biomass and residual recovery use 80% of calculated values.*



THE REALITY OF ALASKA

- Residual production is a function of existing activity (Existing Forest Product Industry)
- Alaska has an abundance of resource
- In comparison with other regions Alaska has a very, very small forest products industry (600,000 cords annually – includes exported logs – dispersed over an area that covers an area 1/4th the size of the lower 48 states).



In summary:

Limited volumes of residual products are available for use in energy applications.



In summary (continued)

1. Think in terms of small (4 bd tons) and medium (1,000 bd tons) size applications.
2. When investigating systems, the first consideration must be source and form of fuel



Recent Literature

- Benjamin, J. and Damery, D. [Editors] 2007. The northeast bioproducts puzzle. Proceedings of conference sponsored by the Forest Products Society and Forest Bioproducts Research Initiative, Bangor, ME, October 18 and 19, 2007. Available at:
<http://www.forest.umaine.edu/images/PDF%20files/FPS%20Forest%20Bioproducts%20Puzzle%20Proceedings.pdf>
- Forest Products Laboratory. 1999. Wood as an engineering material [The Wood Handbook]. Gen. Tech. Rpt. FPL-GTR-113. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory.
- Wynsma, B.; Aubuchon, R.; Len, D.; Daugherty, M. and Gee, E.; 2007. Woody biomass utilization desk guide. National Technology & Development Program, 2400-Forest Management. Washington, DC. Forest Management and Rangelands National Forest System.