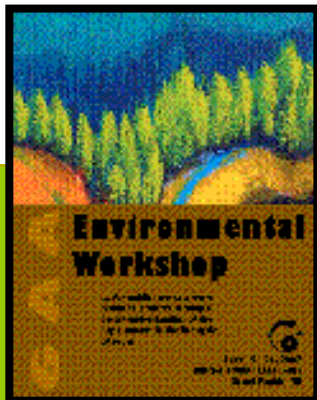


What's Hot in the Industry

Competing Interests for Wood: Fiber, Biomass, Biofuel

Jim Marshall

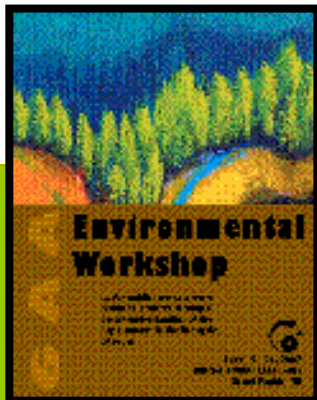
UPM Blandin Paper Mill



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UPM - Blandin Paper Mill

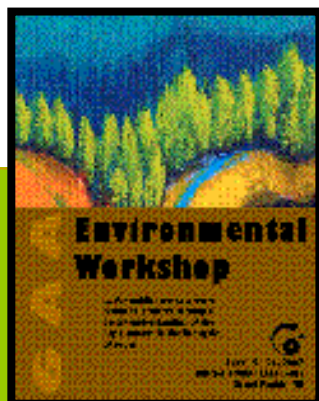
- Purchased by UPM October 1997
- Certified since 1999 under ISO 14001 environmental standard and SFI
- 197,000 acres forest land
- Mill uses 195,000 cords per year aspen, balsam and spruce



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Energy Policy Drivers

- Broad consensus to reduce US dependency on imported oil
- Minnesota, a leading producer of corn ethanol, passes "25 x 25" in February '07 (25% renewable energy by 2025—wind, solar, biofuels, hydrogen, etc.)



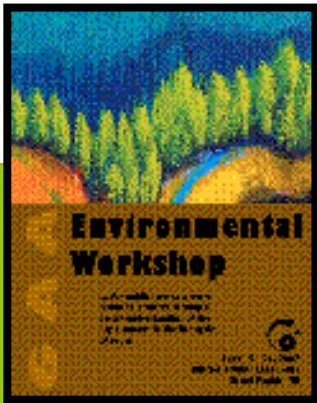
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Energy prices will drive use of biomass

Current Energy Prices

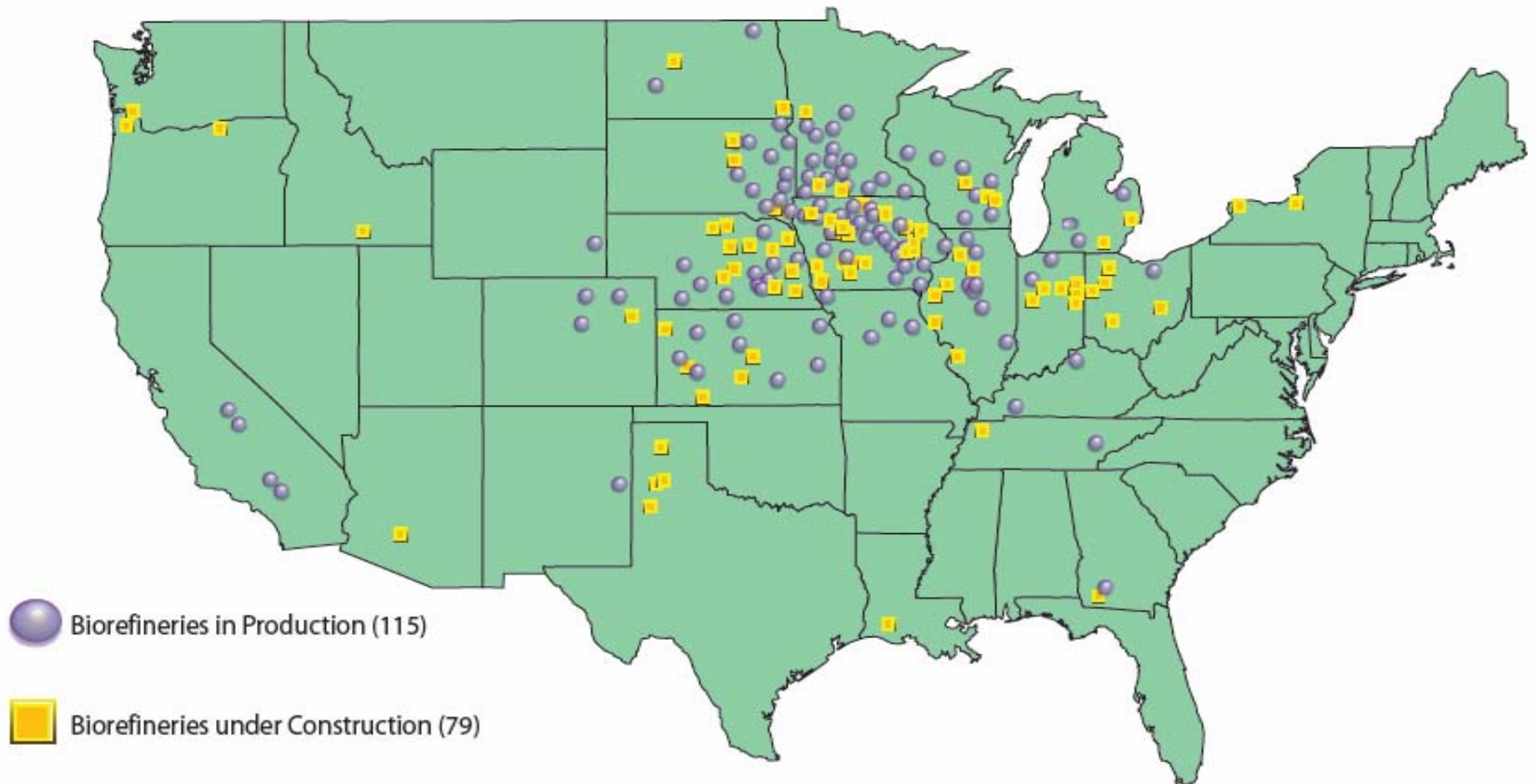
		unit	\$/mmbtu	efficiency	net cost
Natural Gas	\$7.80	mmbtu	\$7.80	0.9	\$8.66
Heating Oil	\$1.71	gallon	\$12.30	0.85	\$14.47
Propane	\$0.92	gallon	\$10.11	0.9	\$11.23
Round Wood	\$75.00	cord	\$3.83	0.6	\$7.35
Wood Chips	\$25.00	gr. ton	\$2.94	0.6	\$4.90
PRB Coal	\$10.00	ton	\$0.57	0.6	\$0.94

Slide data courtesy of Bill Berguson, NRRI



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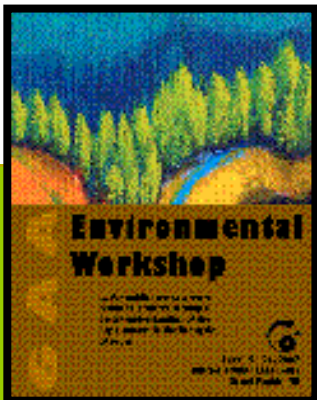
U.S. Ethanol Biorefinery Locations



Source: Renewable Fuels Association
4.3.07

Can Corn Ethanol replace Gasoline?

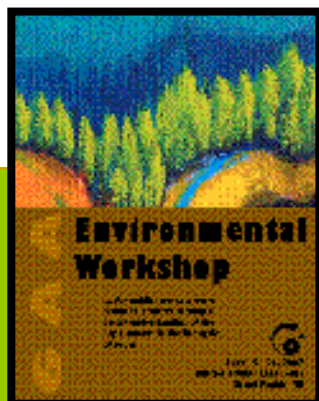
- Renewable? Not really...
 - to produce a gallon with its 80,000 Btu of energy, requires 36,000 Btu of natural gas (for distilling, vaporizing, etc.) **plus** fuels for tractors, combines, fertilizer production, diesel fuel to haul to market.
- Net energy balance calculations vary from negative to slightly positive, e.g. ca. 10% more energy than was used to produce it.
 - » 100% of nation's corn crop would only supply 7% of fuel consumed by our vehicles



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Better—Ethanol from Cellulose

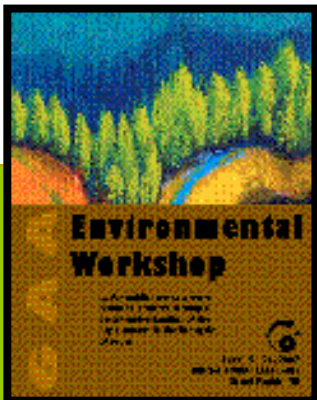
- Iogen Corp. (Ottawa) working on technology using bacteria or fungi-produced enzymes from termite gut, "jungle rot", etc.) Scale up needed.
- Much more cellulose is available than corn—USDA estimates it could replace up to 1/3 the gasoline the US consumes.
- Lignin byproduct can be burned to heat water, produce electricity; displacing coal or natural gas at the turbines, so that net CO₂ emissions per mile driven with cellulosic ethanol are near zero or below zero.



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Laurentian Energy Authority

- Hibbing and Virginia Public Utilities re-power district heating boilers to burn wood instead of coal to produce 35 megawatts
 - Fuel was to be supplied by independent loggers harvesting biomass and by closed loop hybrid poplar—up to 50 tons/hour

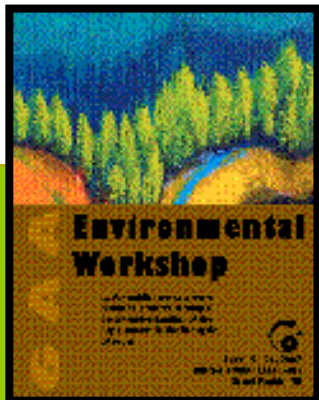


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Laurentian Energy Authority



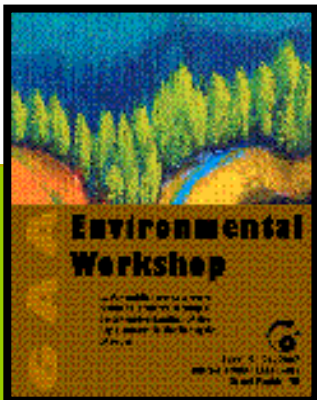
Shutdown of Ainsworth Engineered plants in autumn 2006 created piles of unmarketable roundwood; some went to LEA



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Minnesota Power

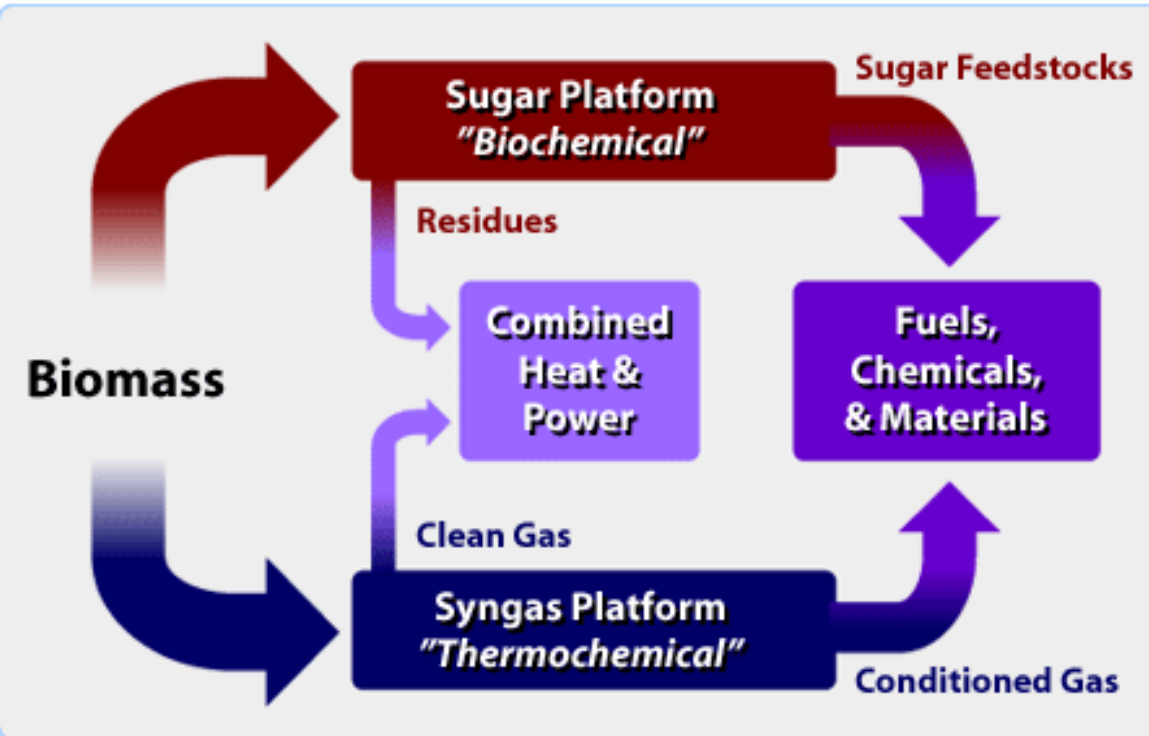
- \$50 million Taconite Ridge facility will produce a constant flow of 25 megawatts of electricity from 10 2.5-megawatt wind turbines
- MP now uses wood waste to produce a million megawatt hours and plans to add another 1 1/2 million from renewable biomass sources



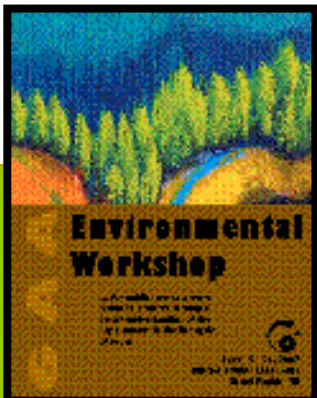
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Biorefineries—>Next growth area?

Biorefinery Concept



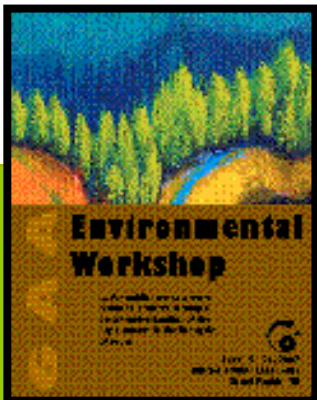
From biomass, produce fuels, power, and chemicals like ethanol, 1,3 propanediol, polylactic acid, isosorbide, etc.



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Cautions

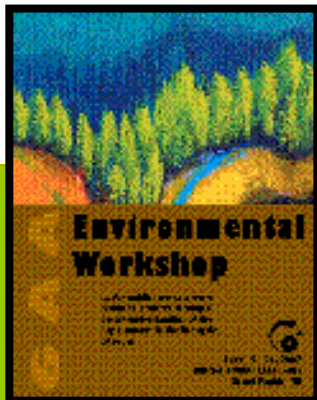
- UPM Deadwood Study, with UofM, et al., summarizes ecological values:
 - Wildlife habitat, water quality, soil productivity
 - MN forests have ca. 8 cords/acre of Course Woody Debris (CWD); Federal is at 10 cd/ac
 - Landowners follow MN guidelines 75% of time



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Draft MN Forest Biomass Harvest Guidelines—May 2007

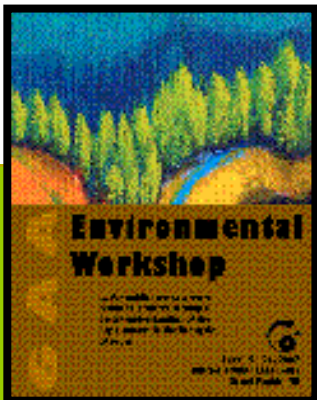
- Protect sensitive sites, soil productivity
- Avoid damage to new growth
- Leave tops and branches from every fifth tree, etc.



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Carbon Sequestration

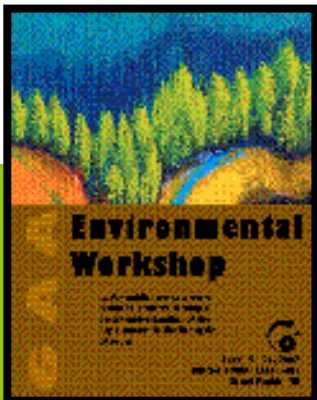
- Harvard Forest study—showed 1 acre 70 yr old hdwd removes 3/4 ton CO₂ per year
- Managed forests—newly established plantations, second growth forests, etc., take up 1/2 Billion tons CO₂ a year.
- Mature forests are in "steady state"
 - So—how do we have perpetually young forests that are hungry for CO₂?



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Foresters can keep forests "young" indefinitely by:

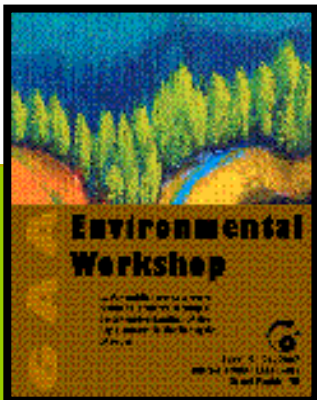
- Regular thinning--removals every 10-12 years (with appropriate species that can grow in shade)
- Removal of trees to make products like lumber and paper locks up Carbon
- Trees inhale CO₂, putting carbon into leaves and wood



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Unanswered Questions

- What is the realistic forest-based supply of energy wood?
- How to manage the market to build energy independence without displacing existing wood-using industries?
- How can agricultural residues be used in concert with forest biomass?



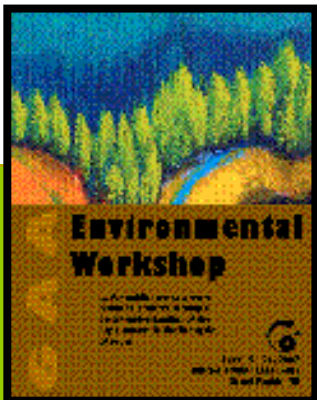
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Summary: main issues

- Appropriate level of forest biomass removal
- Appropriate "share" of the tree for energy
- Long term Forest Health and sustained ability to produce more fiber



Photo courtesy of David Anderson



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