



HYBRID POPLAR AND THE PULP AND PAPER INDUSTRY IN NORTH AMERICA: IMPLICATIONS FOR A SECURED SUPPLY OF QUALITY FIBER FOR PAPERMAKERS WORLDWIDE

NATIVE POPLAR RESOURCES FOR THE GLOBAL PULP AND PAPER INDUSTRY

Poplar (*Populus* spp.) is an important fiber resource for the global pulp and paper industry. Large natural reserves of *Populus tremuloides* and *Populus tremula* in Canada and the Russian Federation produce an annual cut totaling 116 million cubic meters that accounts for a significant tonnage of the worldwide production of hardwood pulp and paper.¹ Poplar wood is relatively high in cellulose and low in lignin. It is amenable to a range of pulping processes, fiber blends, and papermaking applications. A premium application has been to blend poplar with long-fibered softwood pulps to develop wet-web strength in the manufacture of higher value fine paper grades with good sheet formation, opacity, bulk, and printability.²

HISTORY OF HYBRID POPLAR PLANTATION DEVELOPMENT

Hybrid varieties formed by crossing the poplars, cottonwoods, and aspens - all members of the genus *Populus* - were among the first trees domesticated in North America by the pulp and paper industry. One of the earliest hybridization programs was undertaken in 1925-1927 by the Oxford Paper Company to develop high-yield varieties to ensure the success of its pulpwood-growing operations.

¹ FAO. 2004. Synthesis of Country Progress Reports, 22nd Session, International Poplar Commission, Santiago, Chile, November 28 – December 9, 2004. Working Paper IPC/3, Forest Resources Division, FAO (Rome).

² Balatinez, J. J., Kretschmann, D. E., and Leclercq, A. 2001. Achievements in the utilization of poplar wood – guideposts for the future. *Forestry Chronicle*. 77: 265 – 269.



One-Year-Old Poplar Stand

Significant commercial development first occurred in the Mississippi River Valley with plantings of eastern cottonwood (*Populus deltoides*) during the 1960s and 1970s. Plantation development was expanded to the Pacific Northwest in the 1980s with *Populus x generosa*, and to the North Central Region in the 1990s with *Populus x canadensis*. Today, hybrid poplars remain the best choice for hardwood plantation management throughout all of North America for the manufacture of premium grades of communication papers.³ More recently their management has been expanded to biomass feedstock for the emerging bio-fuels and composite-products industries.

³ Kellison, R. C. 2000. A global forestry perspective. In *Hybrid Poplars in the Pacific Northwest: Culture, Commerce, and Capability*. K. A. Blatner, J. D. Johnson, and D. M. Baumgartner (eds.) p 9-13 Symposium Proceedings, Washington State University.

PLANTATION MANAGEMENT SPECIFICS

Poplar plantations are tended throughout North America using an intensive, agronomic-style of cultivation that includes mechanical and chemical methods of weed control, integrated pest management techniques, fertilization and, in some cases, irrigation.⁴ Under competent management, hybrid poplar is the fastest growing tree in the temperate zone with plantation growth rates of up to 35 cubic meters per hectare per year after eight to 12 year rotations. Management strategies incorporate clonal varieties that have undergone intensive selection for growth rate, ease of propagation, pest resistance, wood specific gravity, and site adaptability.



Indoor Poplar Breeding Orchard

More recently, both traditional breeding approaches as well as novel biotechnological ones have addressed improvements in fiber morphology and chemical pulp yield to improve processing efficiencies and product quality.⁵

⁴ Stanton, B., Eaton, J., Johnson, J., Rice, D., Schuette, B., and Moser, B. 2002. Hybrid poplar in the Pacific Northwest: The effects of market-driven management. *Journal of Forestry* 100: 28-33.

⁵ Tuskan, G., West, D., Bradshaw, H.D., Neale, D., Sewell, M., Wheeler, N., Megraw, R., Jech, K., Wislogel, A., Evans, R., Elam, C., Davis, M., and Dinus, R. 1999. Two high-throughput techniques for determining wood properties as part of a molecular genetics analysis of hybrid poplar and loblolly pine. *Appl. Biochem. Biotech.* 77-79:55-65.

THE PULPING OF HYBRID POPLAR

North American papermakers have successfully pulped poplar wood using both mechanical and chemical means. In mechanical processes, hybrid poplar's comparatively low wood density (e.g. 300 to 375 kg cu m⁻¹) could be an advantage as lower energy may be required during chip refining and bolt grinding. Moreover, poplar's characteristic bright wood is preserved in mechanical pulps with minimal bleach requirements.

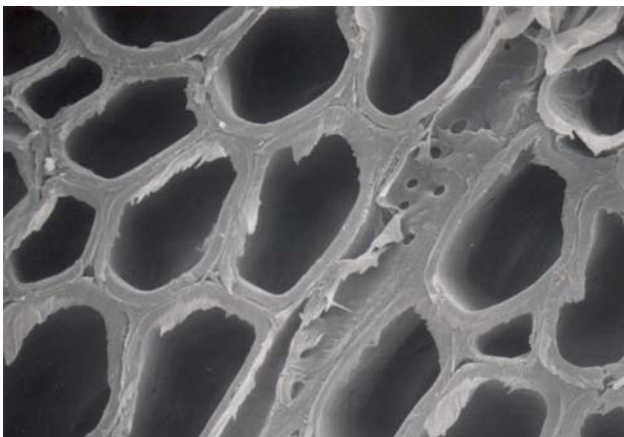


Trucking Poplar Logs to Asian Pulp Mill

In chemical pulping processes, poplar's low specific gravity results in less efficient utilization of digester volume. The low specific gravity is also problematic in continuous digesters that rely on a settling of the wood throughout the pulping process. Batch digesters that do not require a settling of the chips may be better suited to poplar in this regard. Conversely, poplar's low wood specific gravity may provide for superior digester efficiency as measured in terms of the weight of pulp produced per unit of energy and chemical required to complete digestion. However, to the extent this is true, the realization of any cost savings may be offset by the high rate with which today's recovery boilers typically reclaim pulping chemicals. In a similar vein, cost savings owing to a decrease in digestion time may not be actualized if recovery boilers are not appropriately sized to expeditiously process residual organic matter so as to maintain pace with, and thereby not impede, the digestion stage.

NORTH AMERICAN COMPANIES INVOLVED WITH HYBRID POPLAR PAPERMAKING AND THE ROLE OF FIBER MORPHOLOGY

Poplar plantations have been managed by several prominent paper companies in North America for the manufacture of a range of paper grades including coated and uncoated fine papers (Boise Cascade, Crown Zellerbach and Westvaco), specialty newsprint (James River), paperboard and tissue (Potlatch), and coated super-calendared papers (International Paper). Poplar's short (1.0 millimeters) and relatively wide (25 micrometers), thin-walled (3.5 micrometers) fibers are well suited to the manufacture of high quality bond paper grades.



Poplar Fibers

Although the freeness of poplar pulp and fines are limitations, their fibers have low coarseness values (e.g. 0.085 milligrams per meter) and collapse easily during sheet formation resulting in a smooth, dense formation with few surface voids and moderately good opacity.

HYBRID POPLAR AS THE PREFERRED COSMOPOLITAN HARDWOOD SPECIES FOR THE GLOBAL PAPER INDUSTRY

Internationally, the poplar plantation industry commands great commercial importance with over 3,600,000 hectares under worldwide management for wood production. Countries supporting large poplar programs include Argentina, China, France, India, Italy, and Turkey. In China in particular, significant plantation expansion is foreseen in light of the growing demand for paper and paperboard products throughout Asia that is

expected to reach 80 million tons in 2010.⁶ This includes an enlargement of its high-yield forest estate to 13 million hectares by 2015. A significant portion of the planned pulp and paper expansion will occur in China's temperate region where hybrid poplar cultivation is favored over tropical and sub tropical species such as eucalyptus.



Mature Poplar Stand

As a result, two million hectares of this forest base will be established with high-yield poplar plantations specifically for pulp and paper production. The success with which China expands its poplar plantation industry will, to a large extent, be highly dependent upon the development of higher-yielding, pest-resistant, and site-adaptable varieties of improved wood and fiber qualities.

⁶ National Poplar Committee of People's Republic of China. 2004. 22nd Session, International Poplar Commission, Santiago, Chile, November 28 – December 9, 2004. Working Paper IPC/3, Forest Resources Division, FAO (Rome).



FUTURE OUTLOOK: THE POPLAR ADVANTAGE

Poplar's competitive advantage will be increasingly defined by a world in which carbon-neutral operations will become a higher priority. Global papermakers will find it essential, therefore, to more closely situate their fiber procurement and pulp and paper facilities near the world's principal paper markets located throughout the temperate zone. Poplar is the fastest growing tree species within this region. Thus, highly productive plantations will be strategically located within proximity of papermaking facilities, thereby reducing the increasingly prohibitive transportation costs associated with fiber procured from tropical hardwood plantations.



Harvesting Poplar for Pulp Fiber

GREENWOOD RESOURCES

GreenWood Resources is the global leader in the development and management of short-rotation, high yield poplar plantations for a range of products and end uses. GreenWood manages 15,000 hectares of intensively managed poplar farms throughout the Pacific Northwest and the lower Mississippi River Valley. GreenWood's sustainable management of its poplar farms has been certified under the Forest Stewardship Council (FSC). GreenWood Resources also manages poplar nurseries and conducts poplar varietal testing in support of its international operations in Asia and South America. Today, GreenWood maintains offices in Beijing with nursery operations in Shijiazhuang, Beijing, Zhengzhou, Dailian, and Hefei where over 1,000 clonal poplar varieties are being evaluated for commercial operations. GreenWood also manages a poplar clonal nursery in

Los Angeles Chile with replicated field trials in Colicheu, Yumbel, Valdivia, and Los Angeles. GreenWood has developed formal collaboration agreements with the Chinese Academy of Forestry and the University of Talca, Chile.



GreenWood Poplar Nursery in China

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