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A Forest in the Desert: Hybrid Poplar Plantation Feeds New Mill

Traveling east along the Columbia River from Portland, Oregon, reveals stark differences in plant communities, from the wet, perpetually green forests on the west side of the Cascades, through the ponderosa pine-dominated landscape of the east side, and on into sagebrush and grasslands, where trees are far fewer than wheat fields and wind farms. Morrow County, about 150 miles from Portland, receives less than nine inches of rain per year, on average—desert, by most definitions. Near the Columbia, however, river water has turned the desert green. A sign at a travelers' rest area welcoming visitors to the small town of Boardman touts the fruits of irrigation: alfalfa, corn, onions, garlic, potatoes, watermelons, and other crops. Last on the list, but not least, is Greenwood Resources's hybrid poplar tree farm.

GreenWood's history in the area began in 2007, when it purchased 17,000 acres of hybrid poplars and a chip mill from Potlatch. Subsequent acquisitions brought the total to 29,000 acres, including 3,200 acres across the river in Washington State. GreenWood also purchased another 6,000 acres of poplar on the lower Columbia River in western Oregon, bringing its total in the region to 35,000 acres.

In October, GreenWood opened a \$35 million sawmill on the Boardman site and turned over the management of the sawmill and a nearby planer mill to the Collins Companies, which owns other land and mills in California, Pennsylvania, and Oregon. The sawmill turns out lumber and cants for a variety of end products, ranging from pallets and landscape timbers to molding, paneling, and furniture.

The trees are crosses of three poplar species: black cottonwood (*Populus trichocarpa*), eastern cottonwood (*Populus deltoides*), and a European species, black poplar (*Populus nigra*). Although poplar has traditionally been used primarily for pulp, Collins says the wood, which it markets as Pacific albus, is a good alternative to many Western softwoods and to softer hardwoods such as alder, aspen, and basswood.

Pacific albus also may be a good alternative to corn and other feedstocks for producing ethanol. Last year, ZeaChem, a Colorado-based company, announced that it would build a 1.5-million-gallon demonstration biorefinery near Boardman, and GreenWood signed a letter of intent to provide it with a long-term supply of biomass. The two companies also agreed to study the possibility of operating a larger, commercial-scale refinery in the future. In February, ZeaChem announced that it has selected CH2M HILL as the engineering and construction contractor for the plant. Groundbreaking is scheduled for later this year.

Desert Plantation

Boardman is an ideal location for growing poplar: a long growing season, very deep and well-drained soils, and plenty of river water at hand. In this environment, hybrid poplar grow so fast that some people call them "Frankentrees," said



These cuttings of two-year-old hybrid poplar, harvested last fall and planted in four-foot-deep holes in April, were leafed out and growing in late May. According GreenWood Resources harvest manager Bruce Summers, using such large cuttings reduces damage from wind and deer and results in a higher-quality log with less tension wood than in trees grown from smaller cuttings.

Mike Berk, Greenwood's assistant eastside manager.

"I've had individual trees grow to 16 feet in their first year," Berk said. "Last July, I measured one particular tree every Tuesday. In one seven-day period it grew 19 inches in height."

Some of the farm's trees, he said, grow to 30 feet tall in two years. The oldest trees on the farm, some of which are 18 inches in diameter at breast-height (dbh) or larger and more than 100 feet tall at the ripe old age of 14, are called "old-growth."

Because the original plantations were intended to produce pulpwood, many of the original plots were planted with about 600 trees per acre. In one such 14-year-old stand, thinned once at age seven by taking every third tree, dbh averages 11 inches. Across the road, trees in an 11-year-old stand thinned to 290 trees per acre are the same size.

Now, with the focus on growing sawlogs, planting density is typ-

ically 200 trees per acre and may be even lower in the future, said Berk. Combined with judicious prunings, the result will be larger stems with clear, straight grain. According to Bruce Summers, Greenwood's harvest manager, 145 trees per acre is the ideal density.

The farm's trees are propagated via cuttings that are collected in January and February from Greenwood's lands or from contract nurseries and are held in cold storage until planting season in April and May. This year, Collins planted about 230 acres with "sticks"—two-year-old stems taken in thinnings of established plantation plots. Poplar roots easily, and with no rooting hormones or other treatment, and the cuttings readily take hold and grow soon after their butts are buried in the soil.

Summers said establishing trees in this manner results in a higher quality stem with less damage caused by wind. The stems of some trees, established by much smaller cuttings, show significant curvature, and the wood in the butt logs of these trees will have more tension wood than is desirable, making the lumber cut from them more prone to warping and splitting. Another advantage to planting two-year-old sticks is that the larger stems are above the browsing height of deer, which cause severe damage to smaller trees throughout the tree farm.

In this dry country, fine control over irrigation is critical to tree growth. Greenwood's plantations are watered via more than 20,000 miles of drip tube and 26 million emitters. Computer software, called the Supervisory Control and Data Acquisition system, controls and monitors all pumps, manifolds, flow meters, automatic valves, fertilizer pumps, and other elements of the irrigation network via radio signals. Human operators can monitor the system via an onsite computer terminal or via the Internet and receive alarms via the terminal, a pager, or e-mail.

Aside from weather, water, and soil, Summers said the tree farm has other advantages: a year-round field season, flat ground, no significant riparian zones, no threatened or endangered wildlife in the area—and no protests over harvests. Greenwood's neighbors are farmers, said Summers, and they have no objections to growing and harvesting what to them is just another crop.

Lumber and Biomass

The sawmill, literally a stone's throw from the Potlatch chip mill, is surrounded by poplar trees destined for both. Stems seven inches in diameter and larger will be cut into lumber, waste from the mill will be chipped for pulp, and the tops will be ground into hog fuel or energy chips.

Like most other forest products companies, the world's economic troubles have affected output at the Collins facility. In late May, the mill was processing 350–400 logs per hour, producing about 100,000 board feet per eight-hour shift—about one-third of its capacity.

"We're going for 8,000 logs per day. We want to triple our current production," said Kerry Hart, Collins' sawmill manager.

Before they enter the mill, a computer scans each log and determines, based on the curves in the log, how best to buck the log for maximum lumber volume. It then directs two circular cut-off saws—one of which is mobile—to cut the log into lengths up to 12 feet. The log segments are moved into the mill, where more computers control a series of curve saws that slice the logs into rough lumber. According to Hart, the green poplar lumber may

have quite a bit of curve to it, but it stays straight after stacking and drying.

The mill is highly automated; few humans are needed, except when individual pieces of lumber must be moved or sorted by hand. Rough lumber is transported a few miles to the company's planing mill and kiln at the Port of Morrow, on the Columbia River at Boardman, just eight miles away.

With the mill in the middle of its sole source of raw material, its planing mill and kiln a short haul away, and Columbia River barge shipping, a rail line, and an Interstate highway all nearby, Collins' transportation costs are relatively low. Low transportation costs also are a significant advantage for ZeaChem, which will build its biorefinery on five acres at the Port of Morrow. The company has an option to lease another 30 acres for a future commercial-scale biorefinery that will produce 15 million to 25 million gallons per year.

ZeaChem sees poplar as the feedstock of the future and, together with Greenwood, is looking at the possibility of establishing short-rotation energy-crop plantations.

"Poplar trees are of the most interest to us now on a bone dry ton, per acre, per year, per dollar basis," said Carrie Atiyeh, ZeaChem's director of public affairs. "Poplar [as a dedicated energy crop] is grown in very high densities, with a yield of about 15 bone dry tons per acre [every three years], a higher yield than other potential cellulosic feedstocks being grown right now. The efficient use of land resources is going to be very significant, both from an economic perspective as well as from an environmental perspective, so the more tons that we can get out of every acre, the better. Currently, poplar trees are that resource."

Although the demonstration refinery will primarily use poplar as its feedstock, ZeaChem plans to experiment with other feedstocks available in the area, such as wheat straw and woody debris harvested from the Umatilla National Forest in eastern Oregon.

"We are not tied to one feedstock or one market. That flexibility allows us to reduce the risk associated with changes in policies, markets, and the economic climate."

News that ZeaChem Inc. will soon begin construction of a cellulosic biorefinery isn't surprising to Hart.

"If someone is going to make a decision involving millions of dollars, they're going to look for a guaranteed supply, or at least a supply that is more certain than other sources of biomass," Hart said. "We've got that supply right here."

GreenWood is working to develop biomass supplies in Asia and South America, too; it has offices in Chile and China.

"In all regions of the world," reads a GreenWood biofuels position statement, "poplar will become a feedstock of choice for cellulosic ethanol production. Over the next three to five years it is our goal to lead the development of poplar energy plantations in South America, China, and the United States."

In February, Greenwood announced a \$200 million agreement with Phaunos Timber Fund Limited to invest in existing plantations and new tree-farm development in China.