



Dave Lanning, Jim Dooley and Mike Perry, left to right, stand next to the "muncher," a machine that makes Forest Concepts LLC's patented WoodStraw erosion control material.

Northwestern Ingenuity Takes SHAPE

Backed by a solid vision and a wealth of ingenuity and experience in the wood products industry, Forest Concepts LLC is poised to revolutionize the way wood products are manufactured and distributed within the wood-based biomass industry.

By Bryan Sims

A young, innovative company in the Evergreen State has become a valuable player in the biomass industry using a machine it calls the “muncher” to produce its patented WoodStraw. Forest Concepts LLC, a small research forest products company with headquarters in Auburn, Wash., develops, manufactures and markets wood products for environmental restoration, watershed protection, habitat enhancement and sustainable landscapes. Formed in 1998 by forest and natural resource industry professionals, the company’s mission is to use technology to increase the value of nonvalued wood-based materials.

The muncher is a compact sawmill that can rapidly shred industrial waste material—off-spec veneer strips called “fishtails” because of their unique shape—from plywood mills and turn it into a product called WoodStraw. Dave Lanning, a mechanical engineer, led the design and development of the machine. The company’s first production-scale model was developed in 2005 and it built three production-scale models in 2006.

“[The muncher] is like a heavy-duty paper shredder of sorts,” says Lanning, a 2003 graduate of the University of Washington where he developed the first benchmark prototype as an undergraduate, before eventually being hired by Forest Concepts. “We basically used concepts that have been around since the 1800s with a little bit of finesse and massaged it to make it work with our material. We ended up with a real efficient system.”



PHOTO: FOREST CONCEPTS LLC

Dooley Selected ASABE President-Elect, Forest Concepts Receives Award

Jim Dooley, chief technology officer and cofounder of Forest Concepts LLC, has been chosen as president-elect of the American Society of Agricultural and Biological Engineers for 2008-2009. Dooley, who will serve as president beginning this year, previously served as president of the Institute of Biological Engineering. "Through leadership in ASABE society, it has allowed me to go to forums with people who are trying to figure out how to apply engineering to meet the national goals of reducing our dependence on foreign oil," Dooley says. "The office of president-elect, shortly president and then consequentially the year as former president provides me lots of communications opportunities both to influence the direction of the profession but, more importantly, to be in meetings with really bright people who can influence what we do and how we do it."

Dooley, who holds agricultural engineering degrees from California Polytechnic State University in San Luis Obispo and the University of California, Davis, has held a number of engineering, technical management and business development positions with major corporations, including Weyerhaeuser and Amfac Inc. Dooley has been awarded five U.S. patents. He has published more than 60 conference papers, journal manuscripts and book chapters. Commercial products resulting from his development programs have won recognition from ASABE, the International Erosion Control Association, the U.S. Forest Service and the Renewing the Countryside Foundation.

Additionally, Forest Concepts' patented WoodStraw technology has been selected as the Rain Bird Engineering Concept of the Year by ASABE. One of ASABE's major awards, it will be given at their 2008 International Meeting, to be held June 29-July 2 in Providence, R.I. The company will also present a related technical paper at the meeting.

Jim Dooley, chief technology officer and cofounder of Forest Concepts, views the machine as a result of what can be achieved when science and disciplined engineering come together. "The concept is really 120 years old," says Dooley, who spent 18 years at Weyerhaeuser, one of the world's largest pulp and paper companies.

How the Muncher Works

The muncher produces 1 to 2 wet tons of WoodStraw per hour (roughly 1 dry ton per hour in the biofuels arena), and expends one-third the amount of energy of conventional manufacturing processes. The company uses a pragmatic approach to energy efficiency in its research platforms, Dooley says. "When we formed Forest Concepts, we chose to form under a different paradigm," he says. "That paradigm was that energy was precious and that producing waste is to be avoided."

Forest Concepts employees manually unload the veneer from pallets and then slide the wood-based material onto the muncher's tabletop where it's transformed into WoodStraw, a wood-strand erosion control material the company developed in 2002 in response to the increasing number of wildfires, man-made and other natural disasters in the United States. Invented by Dooley, WoodStraw was supported in part by a USDA Small Business Innovation Research grant in addition to collaborative research and feasibility studies by the USDA Forest Service Rocky Mountain Research Station in Moscow, Idaho, Washington State University, the USDA Agricultural Research Service and the Washington Technology Center in Seattle.

In addition to energy efficiency, mitigating dust was another priority that was considered when the muncher was being invented, Dooley says. Out of 100 tons of WoodStraw produced, about 10 pounds of dust is emitted. With minimal dust



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emissions, Forest Concepts isn't required to file for an air permit because it doesn't produce enough dust to measure at its small industrial complex. The company also painstakingly studied the biology of the material itself before developing the muncher and WoodStraw technologies, which is a reflection of its research and development roots. "We've spent a lot of time

figuring out the first principles of how the material behaves in the physical properties and the anatomical structure of the materials before we decide how we make big pieces become small pieces," Dooley says.

According to Dooley, the development of WoodStraw prompted the creation of the muncher, which is a rather unorthodox business strategy in today's climate, but effective nonetheless. "That's backwards to what a lot of people do today," he says. "Most people that make erosion control material start with the process or waste products and then they try to make their adjustments. Fortunately, the muncher technology not only makes [WoodStraw] very well but we believe that it applies to other stuff pretty well too."

Attracting Attention

With a positive track record backed by its WoodStraw erosion control technology and the muncher, Forest Concepts is rapidly increasing its market presence and is garnering attention from a variety of markets.

Some of the most notable accomplishments involving WoodStraw include its application in fire rehabilitation projects such as after the California wildfires last year. Another was a reclamation project in Utah's Crandel Canyon Mine where it was used to stabilize holes in the ground after six miners were trapped. WoodStraw is currently approved by the Washington Department of Transportation and the Oregon Department of Transportation, and accepted by the Washington Department of Ecology as erosion control mulch. Public agencies, non-profit environmental groups, hunting and fishing organizations, contractors and private landowners are the primary WoodStraw customers. In its first two years of commercial production, Forest Concepts delivered more than 2,700 tons to



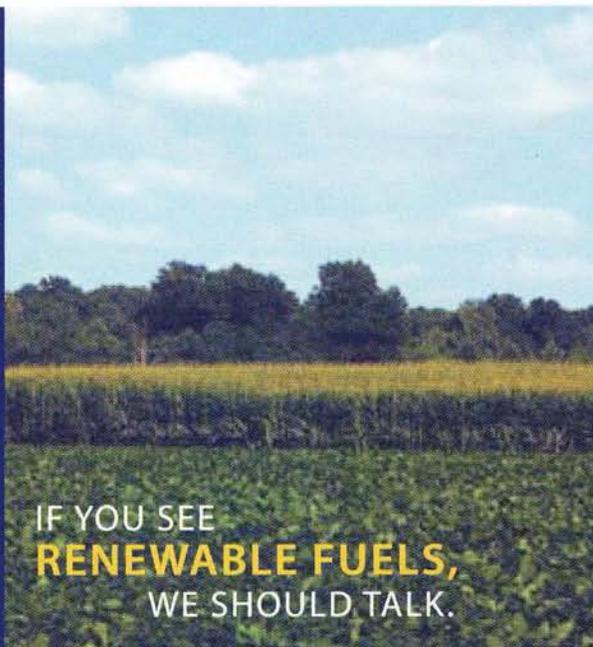
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Employees of Forest Concepts hand-feed wood veneer into the muncher for conversion into WoodStraw.

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the USDA's Forest Service. In 2007, the company produced approximately 87 truckloads from its Auburn facility for erosion control projects in the western United States. "When they need something that works in a really sensitive area, they call us," says Forest Concepts Chief Executive Officer Mike Perry.

WoodStraw is unique because it handles like hay and can be baled in common sizes for easy transport. It can be applied by hand, blower or helicopter, which is referred to as "helimulch." According to Perry, the USDA Forest Service and the Bureau of Land Management represent about 85 percent of Forest Concepts' business. One of the most prevailing advantages of using WoodStraw is that it prevents weed growth and promotes revegetation, Perry says. "It just costs an enormous amount of money to get rid of [weeds] and most of the time [customers] can't get rid of them," he says. "Because we manufacture it from wood, there's definitely no weeds or seeds involved. It gives [customers] a lot of comfort in knowing it's not going to introduce invasive weeds."

Forest Concepts' proprietary muncher technology is also gaining ground, developing distribution partnerships and licensees for its proprietary wood-munching process. Demand for the machine could be even greater as cellulosic ethanol plants start to look for efficient feedstock procurement methods. Additionally, Forest Concepts is keeping its options open and would be willing to sell its entire WoodStraw brand to a third party who could take it national or international. "For the

underlying [wood-munching] technology, we're continuing to develop the patent process that enables us to invest intellectual property protection on it," Dooley says. "If there were a biofuels plant today that wanted to install this technology we would work with them to adapt it to their specific needs under a license. If there were an equipment manufacturer that wanted to compete based on our technology, it would be available."

Improving Logistics

In an industry where wood collection, removal and recycling is a necessity, finding the most cost-effective and efficient means of handling and transporting wood can be a challenge. However, Forest Concepts has discovered a practical method that could relieve short-term impediments.

As part of the USDA Small Business Innovation Research contract initiated in 2005, Forest Concepts has developed a biomass baling system that can be installed at the end of its wood-munching process. After two years of characterizing the woody biomass resources in three western states, the company determined that the project reduces the cost of transportation and distribution. Forest Concepts began design work on the baler last year and has since completed the second phase of the project. At press time, the baler was 90 percent complete. Once it's finished it will undergo rigorous field trials. "It's not just a normal baler that you would see in an industrial plant or you pull behind a tractor," Lanning says. "It's actually a pretty smart

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machine that uses a third of the energy that you would normally use for [producing bales of] this size. A lot of engineering went into making this highly efficient and effective baler.”

Baling and collecting wood-based materials isn't new for Forest Concepts. The company has been baling WoodStraw since 2002. The company intends to introduce its proprietary baling technology to the biofuels sector where it could easily be used to bale cellulosic feedstocks such as corn stover, switchgrass, woody biomass and other cellulosic material.

While it was conducting problem analysis on the baler, Forest Concepts discovered that tree service companies and landscapers use chippers because the chipped material is easier to haul than loose brush, and to avoid costly tipping fees, Dooley says. Forest Concepts' baling technology would not only enhance biomass handling activities but also improve transportation methods at a reasonable cost. “What you want to do is expand on existing capabilities and so what we're doing is leveraging the existing systems for recycling,” Dooley says. “We can add value to them either by consulting, partnering or forming joint ventures on the logistics side.”

The muncher is also being repurposed to convert urban woodwaste into bundles that can be more efficiently transported than wood chips. “For us, as we go forward, we think there are lots of ways for integrating urban woody materials as feedstocks into the traditional wood products industry, and as feedstocks for the solid/liquid biofuels markets,” Dooley says. “We

probably won't operate collection centers because there are people who already do that for other materials. But, we will continue to develop the logistics and the management systems for that because we understand both the source and the market.”

Although the widespread consensus in the industry is that cellulosic biomass cannot be cost effectively shipped more than 50 miles, Forest Concepts' baling and transportation project is designed to endure a 150- to 300-mile-transport radius. To make sure it was feasible, Forest Concepts conducted 350-mile test shipments from Seattle to Medford, Ore., last summer with positive results.

As for drying the woody biomass, Forest Concepts has recognized the need for creating cost-effective drying methods. However, the company doesn't anticipate it will tackle that issue in the immediate future. “Today, huge amounts of energy go into drying the wood material,” Dooley says. “There are definitely big opportunities in drying for us or somebody else. We just haven't gotten to it yet.” **BIO**

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