Utah Forest News

Utah Forest Landowner Education Program Newsletter

UtahState UNIVERSITY | COOPERATIVE extension

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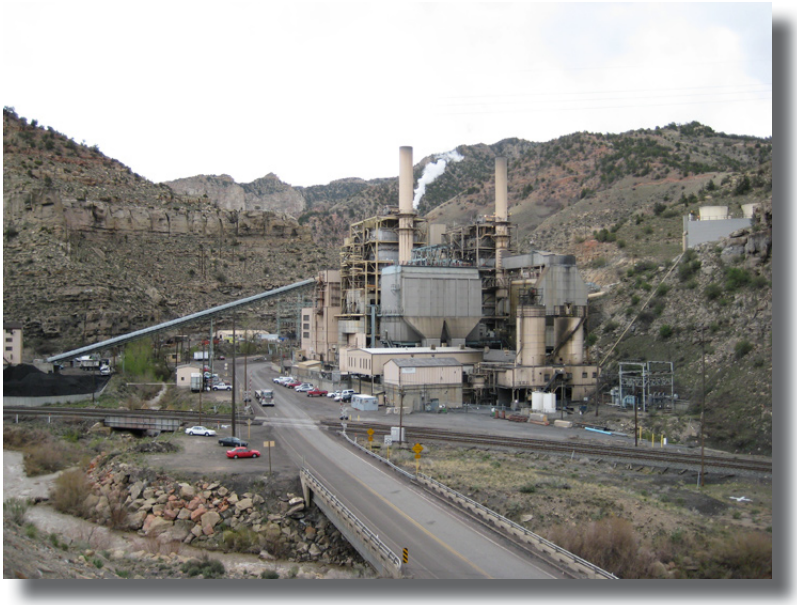
Utahns Attempting to Convert Power Plant from Coal to Wood

Robert Topping, director of the Western Energy Training Center of Helper, and Harrison Cooper, principal of Bountiful Applied Research, are attempting to prove that wood waste can be used to produce electricity in an economical and environmentally responsible fashion. Their goal is to turn the Carbon Power Plant, located on Highway 6 near the mouth of Price Canyon, from a coal facility into one that runs on wood. They face no shortage of challenges in this task.



The Carbon Power Plant, on Highway 6 near the mouth of Price Canyon, could transition from coal to wood power in the next five years.

The plant has been burning coal to produce electricity since 1954, and has been continuously operating longer than any other plant in the Rocky Mountain Power system. Burning around 1,800 tons of coal daily, the two-unit power plant produces steam to spin turbines and generate enough electricity to serve the needs of more than 300,000 people. But the age of the plant, and its associated technology, calls for its decommissioning in the coming years.

The project team wants to make this plant an example of what can be done with wood energy using the right process. At the same time, the team's efforts link two environmental concerns to a single solution: One, increased concern with using coal as an energy source and two, the call to thin forests around communities to control the threat of wildland fire.

One of many hurdles the project faced was cleared with successful completion of an experiment conducted this spring by Utah State University. Professor Conly Hansen and Research Scientist Reese Thompson at USU refined a process to treat wood

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waste process before it reaches the power plant in order to obtain the maximum energy from the material.

Instead of simply burning the woody waste, where much of the wood's available energy goew up in smoke, the new process separates the wood's lignin fraction from the cellulose and water, the main components of wood. The key is separating the lignin into a dry form so that it burns in the same manner using the same equipment and technology already used to fire coal in power plants. This allows use of existing facilities to generate electricity, as opposed to building new plants at considerable cost.

Harrison Cooper stands by a tank of black liquor at Utah State University.

Bountiful Applied Research uses the lignin separation technology developed by Professor Hassan El-Shall of the University of Florida Particle Engineering Research Center. Dr. El-Shall discovered the efficient lignin separation technology working in the pulp and paper industry to reduce paper mill water pollution. Bountiful Applied Research has rights to the lignin separation patents and has been working on practical applications including fuel for power plants from waste wood.

By treating the woody waste taken from forest fuel reduction using an alkali decomposition process (the digestion method from the pulp and paper industry), a product known as 'black liquor' is made. This is the first step in separating lignin and cellulose from the woody material, and is well proven in other industries.

Black liquor from flax, which behaves in ways similar to that derived from wood, was used in the USU experiment. The challenge was to separate the lignin into a dry form that would burn and to do it using low amounts of heat. This prevents the energy cost of the woody waste treatment from outweighing the energy benefits of the resulting power plant fuel. The research team demonstrated that by heating the black liquor and treating it with polymers and acid, it could be processed in an economical and efficient manner.

Woody waste digestion offers additional benefits. The project team is looking at ways to produce cellulosic ethanol, a biofuel, and to capture and use methane generated from biological treatment of residual organic matter during digestion. Professor Hansen and his development team, along with the Logan-based company Andigen, have plans to apply biotreatment technology developed and commercialized at USU to these applications. USU's acclaimed "Induced Blancket Reactor" for anaerobic digestion of dairy wastes, which has been successfully installed at numerous treatment plants to obtain methane energy, will be applied to woody waste.

One of the next steps is to prove the economics of the proposal and show the material can be used in the existing power plant. This will be addressed by the

project team with a demonstration proposed for this summer at the Western Energy Training Center.

Some projects like this one make a flawed assumption that with so much wildland fuel reduction going on, people would bring woody waste to the facility for free. However, the cutting, loading, and transportation of the material to the plant is increasingly more expensive, and people likely will not be able or willing to ship the material free of charge.

This project, however, assumes that there will be some payment for the material brought to the plant. The team is working with a projected estimate of six or seven dollars per ton for delivered woody waste. This is just an preliminary estimate, but it shows willingness and intention to pay something for the material. This amount will help pay for transportation of the material from the area immediately surrounding the facility. However, it won't pay for costs of forest treatment and removal of fuel materials from the forest.

An environmental advantage of the team's process is that this technology nearly eliminates particulate matter emitted from the burning of the material. Also, the process requires very little water input or output, as much of the water needed is recovered from the material itself. The project team also is confident they can treat waste products from the separation process as this technology is already well proven for dairy waste treatment.

The work at Utah State is supported by WETC, the Western Energy Training Center, a part of the College of Eastern Utah located in Price. MEP, the Manufacturing Extension Partnership also is cooperating. WETC is located in the buildings of the closed Willow Creek Coal Mine, about a mile north of the power plant.

The pilot plant planned for this summer at WETC will be a small-scale continuous-flow system designed as a demonstration project. The pilot plant will have acapacity of about one-half ton of dry biomass per day. Results from the pilot plant will enable design and construction of a next level scale-up "semi-works" facility, which will process about 20 tons of dry material daily. This unit will produce sufficient lignin fuel for proof-of-concept test firing at the power plant. A commercial facility to convert the power plant to woody biomass fuel may be four to five years away.

The commercial process plant will require treatment of approximately 50,000 acres of wildland fuels to annually to keep its hoppers full. Geoff McNaughton, Forestry Program Supervisor with the Utah Division of Forestry, Fire and State Lands, has been helping to estimate the amount of woody biomass available within a certain radius of the plant's location in Price.

The project team is seeking continued funding for this effort from the Governor's Centers of Excellence and from the USDA Rural Development Program. Collaboration with USDA's Forest Products Laboratory is also being pursued. Look for updates on this process in future issues of the Utah Forest News.

by Darren McAvoy

Douglas-fir Beetle Control with Pheromones

Private landowners at Sundance Resort are attempting to limit the mortality of Douglas-fir trees from Douglas-fir beetles in their forests with the use of a synthetic pheromone known as MCH (3-methyl-2-cyclohex-en-1-one). A pheromone is a chemical substance put out by one organism to send a message to another organism. When a stand of trees is colonized by beetles, they send out what is known as an antiaggregation pheromone. This chemical informs the other beetles of the same species that the trees are already full of beetles and that they should go elsewhere. Synthetic MCH has been in use since the 1970's.

Sundance Executive Assistant Mari Turner staples a pheromone blister pack to a tree just west of Sundance Resort.

The goal of the Sundance project is to create a chemical cloud of the synthetic pheromone in the forest that will last for the duration of the beetle's flight period, which peaks around June 14th for this particular beetle and forest. This is the third year of treating the stand with MCH, and thus far the project has been 99 percent effective. This means that very few trees have succumbed to beetle attack since the treatment began, according to Scott Zeidler, Wasatch Front Community Forester with the Utah Division of Forestry, Fire and State Lands.

Sundance landowners are taking advantage of the expertise available to all Utah forest landowners through their state forester's office. In this case, Zeidler is working with the Division's Forest Health Specialist Colleen Keyes. They also have the help from one of the Division's forestry interns and recent USU forestry graduate Sarah Sampson. In addition Zeidler alerted the landowners to the assistance available to them from the USDA Forest Service's Forest Health Protection office, which shares the cost of the materials with landowners.

"Using MCH is generally considered a short-term band-aid solution," Zeidler said. "It can help reduce tree mortality for a period of a few years, say during drought stress." The long-term solution to this problem, he said, involves removing some of the older trees so that there is less competition for water in the stand. This makes individual trees stronger and more resistant to beetle attacks."

"MCH offers landowners their best chance to obstruct the beetle's life cycle in an inexpensive and practical manner," Zeidler said.

Treating the target stands involves stapling porous, laminated plastic blister-packs of the chemical six feet up on the north side of trees in the target area. At Sundance crews spread out through the stand and attached the MCH blister packs to the trees in a grid that measures roughly 30 feet by 30 feet. This creates

even dispersal of the pheromone through the forest and emits a chemical cloud that will protect the trees from the beetles. Zeidler pointed out that it didn't matter what species of tree the blister packs were stapled to. What mattered is the spacing of the blister packs to get thorough coverage of the pheromone cloud throughout the stand.

Sarah Sampson, USU Forestry Graduate staples an MCH blister pack to a Douglas-fir at Sundance.

Sundance Resort is a good example of landowner participation in the program. The resort supplied most of the labor for the project by offering the opportunity for employees to get away from their normal responsibilities for the day and become woods workers hanging MCH packets on trees. Seven employees traded in their computers for a staple gun, including an executive assistant, a human resource specialist and a camp counselor. On other projects landowners and subdivision homeowners are hanging the blister packs themselves with the Division's oversight. Although the manufacturer recommends use of rubber gloves and eye protection for installing the packets, and avoiding ingesting or breathing the MCH, it is a fairly safe material to handle and requires no special training.

Three successive years of MCH blister-packs on an aspen at Sundance.

Sundance paid for about half of the materials costs for the day as well, while the remainder came from a grant from the USDA Forest Service. This project easily covered about 22 acres in a day with a 10-person crew. That same day the USDA Forest Service did a similar project on their land at the Aspen Grove trailhead. Two more such projects are planned for private land this spring in the canyon, including the Scapo subdivision and the Brigham Young University Aspen Grove Family Camp and Conference Center.

The MCH capsules cost approximately two dollars each, and about 35 are used per acre. This translates to a cost to a landowner of about $35 per acre with cost-share, although this number can vary greatly depending on the size of the project. If you are interested in pursuing such a project for your land or subdivision, contact the Utah Division of Forestry, Fire and State Lands or USU Forestry Extension (see the back page of this newsletter for contact information).

by Darren McAvoy

Cedar Mountain Aspen - Guest Editorial

There has been much speculation over the past several years on what is happening to the aspen stands on Cedar Mountain's private lands. As a forester who has specialized in silviculture (applied forest ecology) over the past 26 years, I would like to express a few (hopefully objective) thoughts formed by several relatively quick visits to the area.

The forests in this area are dominated by almost pure "stable" aspen. These are stands that have no conifer and thus no shade-tolerant tree species to replace the aspen. These are mostly old stands (averaging perhaps 150 years of age). Aspen stands reach maturity at 80-100 years of age, and thereafter begin to decline in health and vigor. Aspen stands have unquestionably occupied a large proportion of Cedar Mountain's landscape for thousands of years before Cedar City was settled. These stands perpetuated themselves without human intervention.

Aspen is often spoken of as a "disturbance" species – one that requires periodic broad scale ecosystem disturbance to stimulate a regeneration event. In "seral" aspen stands (stands where conifers will replace aspen over time if there is no disturbance event) fire is typically the primary disturbing agent. However, it appears that fire has played very little role in the perpetuation of the Cedar Mountain stable aspen stands. Most aspen stands have very little potential for carrying a wildfire unless there is another fuel present (such as conifers or a grass or shrub understory). Tall forb communities, such as those that once surrounded these aspen stands, generally do not carry fire due to the moisture content of the plant community.

Thus there must be another mechanism that would stimulate aspen stands to regenerate. This could be insects, disease, or simply senescence brought on by old age. I hypothesize that the primary regeneration agent on Cedar Mountain has been the natural aging process. Sucker (regeneration) growth will generally be minimal under young, healthy aspens. However, when aspen age, the hormonal balance in the tree changes to one that favors sucker growth over height growth on the main stem. It may be that a good "regeneration window" of opportunity for Cedar Mountain aspen has a typical span of 40-50 years (from age 80 to 130 years of age). Thereafter the decline of the overstory is such that the root system is also declining and the potential for regeneration success may be lessened.

Doug Page

As I stated earlier: *Aspen stands have unquestionably occupied a large proportion of Cedar Mountain's landscape for thousands of years before Cedar City was settled. These stands perpetuated themselves without human intervention.* Only one thing has changed – Cedar Mountain has been (once heavily) grazed for nearly a century by an introduced species (sheep) and it is now being impacted by a second species (elk). These are significant changes to the natural ecosystem under which these aspen stands survived for so many years before Cedar City was settled. To put it bluntly, the aspen ecosystems on Cedar Mountain have been significantly altered from the natural systems by the introduction of non-native animal species, which brought pressures and impacts to these systems that they are not adapted to.

While we recognize that livestock grazing has caused significant changes in the meadowlands surrounding these aspen stands (converting what were once tall forb communities to what are now grasslands), we are

still debating whether or not livestock are a significant cause of the decline of aspen in this area. There is no question in my mind that introduced animals are currently the key to the problem. They are not, however, the only factor. Age of the stands on the mountain is another large factor. Couple the fact that many of these stands have been in their regeneration window for well over half a century with the almost continuous grazing and I hypothesize that you have your answer as to why most of these stands are declining without significant regeneration to replace the old trees. The suckers are simply being eaten off and the stands are declining with no way to rejuvenate themselves. And this process has continued in some stands to a point of no return.

At any other time (outside of the regeneration window) sheep and elk browsing would not be so impactive to the aspen. However, the regeneration window is a critical time in the life cycle of these aspen stands. To regenerate these stands, livestock need to be excluded from the area for the trees to be regenerated for a minimum of 5-7 years (time enough to allow the new aspen suckers to get tall enough to be above the reach of browsing animals). This is best done before the aspen stands reach 120-130 years of age. Older stands may still be regenerated, but the density of the new stands cannot be expected to attain that of stands regenerated at a younger age when the above and below grown portions of the tree were both in a more healthy state.

It would not be difficult to test this hypothesis and it would only take a year or two to begin seeing the results. A case in point can be seen on the Heyborne property where the landowner fenced livestock out of an old aspen stand that was showing signs of decline with little to no regeneration. After four years of livestock-only exclusion, aspen suckers are almost head high and getting too thick to see through.

Dr. T. W. Daniel, my old silviculture professor at Utah State University once told me that a good silviculturist learns to read a forest as others read a book. I hope that my observations are helpful.

by Doug Page
Intermountain Society of American Foresters
Southwest Utah Zone Forester, Bureau of Land Management

For more information regarding any of the information presented in this newsletter, please call Darren McAvoy at Utah State University, 435-797-0560, write to him at 5230 Old Main Hill, Logan, UT 84322-5230, or email darren.mcavoy@usu.edu.

The Utah State University Forestry Extension Web site, found at http://extension.usu.edu/forestry, is an excellent source of technical forestry information for woodland owners. Check the “What’s New” section periodically for new postings.

State of Utah Division of Forestry, Fire and State Lands (DFF&SL) service foresters for your area can be contacted by calling 801-538-5555.

Ideas and written contributions to this newsletter are encouraged. Send your contributions or comments to the return address above or call 435-797-0560, or email darren.mcavoy@usu.edu.

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Utah Forest News

COMING EVENTS

Seventh Annual Timber Harvest Tour:

Join USU Forestry Extension, the Utah Division of Forestry, Fire and State Lands, and the Utah Chapter of the Society of American Foresters for the Sixth Annual Timber Harvest Tour in Richfield on Thursday, September 4, 2008. This is an opportunity to visit an active timber harvest and for landowners, loggers, and foresters to share their points of view on the harvest operation and its outcomes. Lunch will be provided. Look for an upcoming postcard in the mail with meeting times and location. For questions or to RSVP Contact Darren McAvoy at 435-797-0560 or darren.mcavoy@usu.edu.

Restoring the West Conference 2008
Frontiers in Aspen Restoration
September 16-18, 2008 at Utah State University, Logan, UT see restorethewest.org for details.

High school students study tree identification at the Utah Envirothon in Moab this spring.