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Generating Biochar from Russian Olive Trees

In April 2015, USDA Forest Service Soil Scientist Dave Marr met with USU Extension Assistant Professor, Darren McAvoy, to explore opportunities for making biochar from Russian olive (*Elaeagnus angustifolia*) trees for use on a streambank restoration project along Stone Creek just north of Snowville, Utah, on the Curlew National Grassland.

Russian olive is a non-native species that was historically planted across the United States as a shelterbelt, windbreak and ornamental tree. On the Curlew National Grassland, Russian olive was historically planted in shelterbelts but it has since become an unwelcome invader on parts of the reserve. Russian olive grows in very dense stands and crowds out native vegetation and other desirable species. This growth habit damages habitat for wildlife and other important species such as the monarch butterfly which has a surprising dependence on the Curlew. Additionally, these stands of trees have altered the natural flooding regime and reduced the availability of soil nutrients and moisture for more desirable species.

The Curlew National Grassland comprises approximately 47,000 acres of public land located west of Malad, Idaho. Historically, the grassland was inhabited by the Bannock and Shoshone Tribes before the pioneers settled there. In the *(continued on page 4)*

The use of Russian olive derived biochar is being explored to not only alleviate the large amount of debris generated from the cutting of the trees, but to also provide an alternative to pile-burning which is shown to damage soils.

Extent of Russian olive presence along Stone Creek on the Curlew National Grassland
Photo credit: Darren McAvoy.

In This Issue

- Will woody biomass 'bricks' replace coal?
- USU welcomes new Forestry Research Professor, Dr. Julia Burton
- Farm bill provisions facilitate forest restoration in Idaho
- Does Utah have a new Aspen champion?

AEG CoalSwitch Blowing up Woody Biomass for Energy in Utah

Brick of coalswitch material.

AEG CoalSwitch is a relatively new company to Utah with an innovative method for treating woody biomass to create a coal substitute…they blow it up. Their uniquely patented system mixes wood chips with water to create a slurry. They inject the slurry into a high-pressure cylinder and administer a combination of heat and pressure to the reactor. After a specific residence time in the reactor, the pressure is suddenly released and the cell walls of the material explode – this reaction makes the material readily available for energy production and use. The rapid change in pressure could be compared to the decompression syndrome experienced when a deep sea diver ascends from the depths of the ocean too quickly – The Benz. Two of the founders, Russ Taylor and Phil Scalzo, have plans to install a 5 ton per hour reactor in their west-side Salt Lake City facility and a second reactor in Mona, Utah, adjacent to the essential oil operation at Young Living Farms (see UFN Spring 2016).

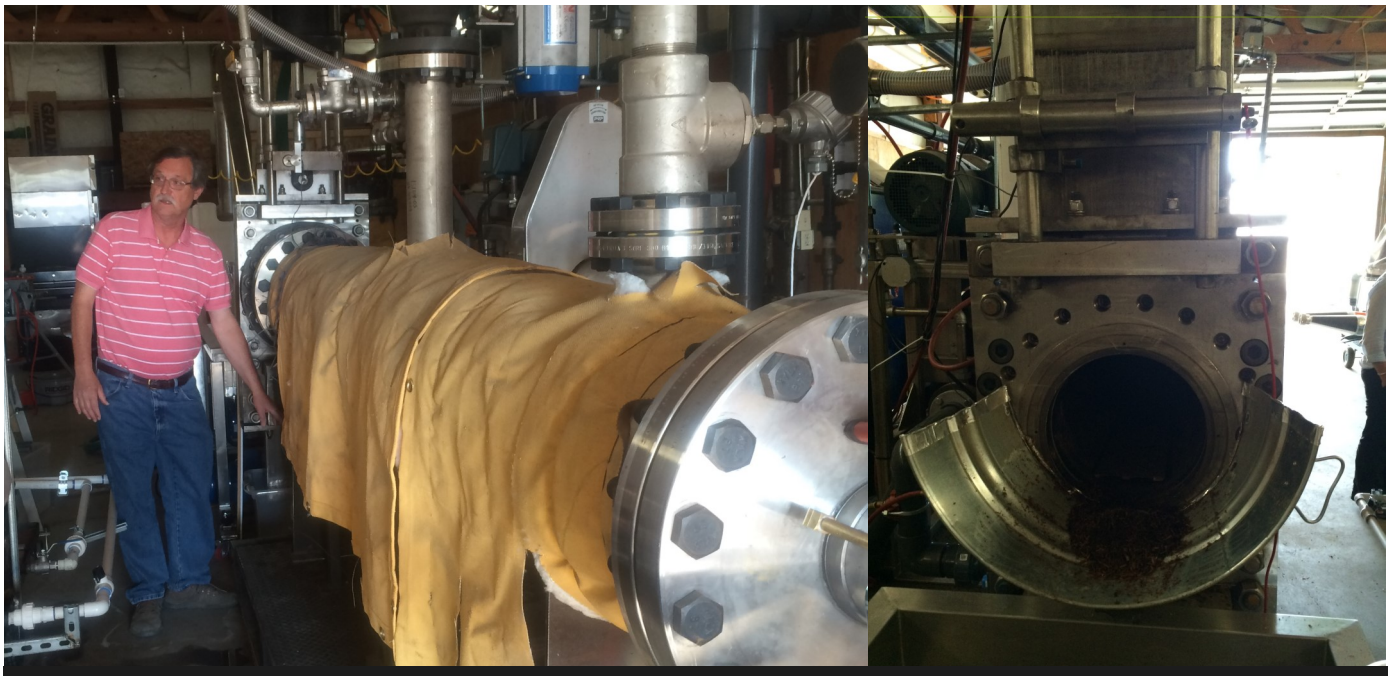
AEG CoalSwitch is currently undergoing 3rd party laboratory testing to validate the use of this coalswitch product as an ultra clean replacement for coal. This innovative use of low-value woody biomass waste could be a game changer for the nearby Manti-LaSal National Forest and private forest lands faced with a need to remove and utilize low-value biomass on their land.

The Utah Forest News will be closely monitoring these developments, so stay tuned for updates.

By: Darren McAvoy, USU Extension Assistant Professor

"If successful, this would be a tremendous opportunity to utilize the massive amounts of waste wood on the nearby Manti-LaSal National Forest, not to mention the potential benefit for private forest landowners interested in disposing of the excess woody debris on their land."

-Darren McAvoy



Left: Phil Scalzo explaining the reactor. Right: Looking into the reactor. | Photo Credit: Darren McAvoy.

Can silvicultural practices be leveraged to maintain forest diversity?

By: Megan Dettenmaier, USU Forestry Extension Educator

Newly hired Utah State University Research Assistant Professor Julia Burton, PhD is making the case for an increased awareness on the importance of preserving the forest understory species (i.e. shrubs, forbs, grasses) in managed forests. Burton argues that the undervalued understory plays an important part in forest ecosystems. For example, the understory provides important habitat for wildlife, regulates nutrient cycling, and can affect tree regeneration processes. In temperate forests the understory can contain up to 20 times the number of species than the overstory. As a result, maintaining diversity in the understory has become an important management objective. In Wisconsin, Burton has investigated the impacts of canopy openings that mimic the natural disturbance regime on understory productivity, species richness and biodiversity in northern hardwood forests. Her findings indicate that larger gaps in the forest canopy result in more light transmittance (big gaps = more sun reaching forest floor) which also resulted in higher soil moisture within the gaps (gaps = less rain intercepted by and taken up by trees). These two results facilitate greater species diversity and high resource availability in the forest understory. Burton concludes that creating a range of gap sizes in managed forests, similar to what is observed in old-growth forests, may maintain the greatest diversity of plant species overall.

The types of plants growing in the forest understory follow a predictable series of occupation over time known as succession. Early-successional species are good at colonizing disturbed areas (after thinning for example) and require greater levels of sunlight to grow, while late-successional species tend to be limited by seed dispersal yet are tolerant of low light levels in the understory. In the temperate rainforests of Oregon, Burton's team examined the relationship between carbon storage and the diversity of early-successional compared to late-successional plant species following variable density thinning (VDT). This thinning technique created large forest gaps in addition to retaining dense, unthinned "leave islands" (green-tree retention clusters), and in turn, substantial variability in the amount of sunlight reaching the forest floor. Increases in sunlight allowed a high diversity of early-successional understory plants to colonize VDT forests, but reduced carbon storage. This is because trees, which are removed during thinning, naturally store more carbon than smaller understory shrubs, grasses and forbs that colonize thinned areas. In comparison, the diversity of late-successional understory plants increased, but only weakly, with carbon storage.

Dr. Burton arrived at Utah State University during the Summer of 2016 and she is already launching two new studies in the Intermountain West. First, she will examine linkages between overstory and understory vegetation at the regional scale using forest inventory data. The second project will investigate the relationship between climate change and beetle disturbance(s), primarily at higher elevations. These studies will provide useful information for managing forest ecosystem responses to climate change.

Utah has acquired an ambitious and thoughtful forest scientist in Burton. We welcome her to the faculty at Utah State University and are excited about her future contributions.

Variable density thinning

Variable density thinning means varying the density and spatial pattern of residual trees; in contrast, more traditional thinning approaches retain high densities of trees that are evenly spaced in order to maximize rates of timber production.

Early-successional species

Late-successional species

(continued from page 1)

late 1800s and early 1900s the Curlew Valley was settled by homesteaders for the purpose of ranching and farming; however, many of these farms eventually failed after severe drought in the late 1920s & 1930s left much of the land unusable as a result of severe erosion and unsustainable land management practices. The federal government purchased several of these failing farms between 1934 and 1942, and for a time, the Natural Resource Conservation Service managed the land. Today, the Curlew National Grassland is managed by USDA Forest Service, Caribou-Targhee National Forest. The area is managed for multiple sustained uses such as grazing, recreation, water resources, and it also serves as important Greater sage-grouse habitat and distinctive monarch butterfly breeding ground.

Personnel from the Westside Ranger District and the Supervisor's Office of the Caribou-Targhee National Forest began cutting the Russian olive this spring to start to address this problem. Typically the wood is piled and burned on site, but in this case it was intentionally chipped into enormous bags with handles called super sacks. Marr delivered the filled super sacks to Amaron Energy in Salt Lake City for pyrolysis, or thermochemical conversion, into biochar. To expand the investigation of using Russian olive sourced biochar as a soil amendment on the Curlew National Grassland, the chips were pyrolyzed at two different temperatures; 500^0 C and 600^0 C. The 500^0 C char was sent to the lab for analysis as is typical to meet the International BioChar Initiative Laboratory Tests for Certification. (Click here for lab results).

The goal is to perhaps convert this no-value material from the Russian olive tree into a valuable soil amendment that could be reapplied on the Curlew. Biochar may help increase the water holding capacity of the soils, increase microbial activity, and persist for decades.

Russian olive tree derived biochar

Several projects are in the planning phase to address the continued spread of Russian olive on the Curlew National Grassland. The use of Russian olive derived biochar is being explored to not only alleviate the large amount of debris generated from the cutting of the trees, but to also provide an alternative to pile-burning which is shown to damage soils. Russian olive biochar could potentially be used as a soil amendment following various phases of vegetation removal. This investigation has been put on hold until time and funding allow it to continue, but it is perhaps a foreshadowing of a new way of doing business on the Curlew and other National Grasslands and Forests that may improve soil and landscape health. In the near-term, however, the standard operating procedure of burning the slash piles where they lay is far more economical.

By: David Marr, Forest Soil Scientist, USFS, Caribou-Targhee National Forest & Curlew National Grassland; davidmarr@fs.fed.us

Darren McAvoy, USU Extension Assistant Professor; darren.mcavoy@usu.edu

Personnel from the Caribou-Targhee National Forest chip Russian olive into a supersac to pyrolyze | Photo Credit: David Marr.

Williams Creek, Idaho: Applying Silvicultural Practices on Federal and State Lands

Treatment objectives:

1) Create an uneven-aged stand structure comprised of groups and clumps.

2) Manage species composition to favor early seral species.

3) Improve residual tree growth, health, and vigor-with reduced density stocking levels.

4) Move stand toward old forest structure and composition requirements.

Williams Creek, Idaho following treatment. | Photo credit: Kasy Kliewer.

In October 2016, The Intermountain Society of American Foresters (IMSAF) invited Utah State University Society of American Foresters chapter members to the Boise National Forest to learn about silviculture practices for forest management. John Riling, Silviculturist on the Emmett Ranger District in Idaho, teamed up with Clint VanZile, Forester on the Emmett Ranger District, to tell us about NEPA (National Environmental Protection Act) processes necessary to bring a project to fruition. They also discussed the Farm Bill Categorical Exclusion authority, which President Obama signed into law on February 7, 2014. There are provisions in the Farm Bill that will assist the Forest (*continued on page 6*)

(Left) Motorized drop line carriage in action. (Middle) Skyline yarder. (Right) Off road jammer. All are used in timber extraction.

(*continued from page 5*)
Service with accomplishing the agency mission while focusing on high priority work: ecological restoration, providing support to communities, and reducing the risk of wildfires.

We specifically learned about the Williams Creek Project while in Idaho. The goal of this project is to: 1) manage forest structure and species composition to improve forest landscape resilience, and 2) facilitate a smooth recovery from disturbance (i.e., fire). Projected outcomes from this project include larger tree size class dominated by early-successional species such as ponderosa pine and western larch. If the project is successful, the Forest Plan's mission (which outlines the preferred vegetation and wildlife habitat characteristics) will be accomplished.

Left to right: Chuck Slaughter, John Harrington, John Roberts, John Riling, Justin Short, Jim Long, Kasy Kliewer, Erika Eidson, Raychel Skay and Dan McKenna

How will they accomplish the project goals? The project administrators will treat for the hazard (i.e. insects and disease) through the manipulation of forest structure (density, horizontal and vertical distribution). Primary insects and disease of concern are western pine beetle, Douglas-fir beetle, Ipps pine engraver, western spruce budworm, Douglas-fir and ponderosa pine mistletoe. Targeted removal of infested trees can reduce the hazard, but this is less effective than managing for structure and composition.

This was a successful field trip filled with networking, equipment demonstrations, and a shared interest in forest health and regeneration. The Utah State University SAF chapter members benefitted immensely from their time in Idaho and wish to heartily thank our hosts, John Riling and Clint VanZile.

By: Kasy Kliewer, USU Forestry Extension Intern

Ever wondered what these rings are?

United States Forest Service Forest Pathologist, John Guyon (Ogden, Utah) notes that the black rings sometimes found on aspen bark are commonly caused by the fungus, *Diplodia tumefaciens*, or if found in a confined oval trunk infection, as *Curcurbitaria staphula.* Some refer to this condition as 'rough bark' due to the grayish-black, corky bark that results from the galls on the tree. Despite its unsightly appearance, these fungi have a mostly superficial impact to the tree, as the cambium is usually found to be healthy, upon further investigation.

New Aspen Champion in Utah?

Does Utah have a new ‘champion’ aspen? Alex Howe (M.S. student at Utah State University) and Sylvia Kinosian (Ph.D. student at Utah State University, pictured here) spotted this ~4ft DBH aspen on the Markagunt Plateau in the Dixie National Forest. Formal ‘champion’ status determination is forthcoming. The current record holder for tallest aspen in Utah is one that measured 85 feet tall in 2000.

Photo Credit | Alexander Howe

Forestry Program Administrator, Geoff McNaughton, is pictured presenting Dr. Ralph Coates with the Forest Stewardship Achievement Award in 2016. Dr. Coates has worked tirelessly on advancing technology for the utilization of woody biomass in Utah. His dedication to improving the efficient pyrolization of low-value biomass into high-value products such as biochar, are helping advance forest restoration efforts throughout the Intermountain Wst. Congratulations Ralph!

Contact Us

Do you have a story idea for the next edition of Utah Forest News? Have feedback about any story in this issue? Get in touch with us.

Megan Dettenmaier USU Forestry Extension Educator:
megan.dettenmaier@usu.edu
435-797-8424

Darren McAvoy USU Extension Assistant Professor:
darren.mcavoy@usu.edu
435-797-0560

USU Forestry Extension, 5230 Old Main Hill Logan, UT 84322-5230

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