

Pinyon Juniper Harvest Study: Matching the Harvesting System to Conditions

By Bob Rummer and Darren McAvoy

Pinyon-juniper (PJ) woodlands provide significant resource management challenges in the western United States. Lacking disturbances such as fires, pinyon and juniper trees grow closer together over time, expanding into surrounding grasslands and sagebrush habitats, occupying ever more acres. This expansion is a concern to land managers for a variety of reasons. When pinyon-juniper stands in Utah become dense, they become more prone to crown fires. This extreme fire type leaves little behind but charred stems and a ripe seedbed for cheat grass and other noxious weeds. By removing a portion of the PJ in these stands, the resistance of the remaining trees to disturbances is improved. The loss of sagebrush habitat is another concern, especially in light of the possible listing of the greater sage grouse as an endangered species.

In an effort to slow this tide of ecological change, the Bureau of Land Management and many other organizations, such as Utah's Watershed Restoration Initiative

well-developed systems for cutting and handling the material. Traditional logging equipment, which was developed for more traditional forests, can be utilized, but it is oversized and, therefore, overpriced to be able to operate in a cost-efficient manner in PJ woodlands. Harvesting systems using conventional logging machines are estimated to cost at least \$75 per ton. This cost can be covered by selling larger, high-value material such as sawlogs, but prices paid for biomass, based on informal surveys and observation, tend to run more in the range of \$15 to \$30 per ton. Therefore, a study conducted by the US Forest Service, Bureau of Land Management (BLM), Bloomin Ranch Services LLC, and the Utah Biomass Resources Group attempted to identify alternative harvesting and processing methods that are more cost-effective.

The study site is plainly visible along the west side of I-15 just south of Beaver, Utah. Passersby will notice areas where practically all of the PJ has been chipped or removed, and other areas where it has



The BioBaler, made by the Anderson Group Co. (grpanderson.com), combines a rotary drum shredding head with a heavy-duty round baler to fell, shred, and bale a wide range of woody biomass.

shred, and bale a wide range of woody biomass. The baler was towed by a four-wheel-drive tractor, pulling the baling device over the tree. The baler shredded and then baled the biomass into a standardized agricultural bale (4 feet by 4 feet). The machine consistently handled material up to six inches in diameter, creating a swath that was seven feet wide. Within the baled area, three different treatment plots were evaluated, ranging in density from 35 to 170 trees per acre. Baled material included pinyon, juniper, and any sagebrush in the swath. This system was able to treat almost four acres per hour in the light-density areas and about 1.5 acres per hour in the medium- and high-density plots. Treatment costs were about \$41 per acre in the light-density areas and between \$95 and \$110 per acre in the medium- and high-density areas. Because of the relatively low volume per acre, however, the recovered biomass still costs more than \$80 per ton.

The second system tested was a chip-and-forward system, sometimes called a "chip at the stump" system. Just like it sounds, this system involves a machine that cuts the tree, chips it and blows the chips into a trailer, and then dumps the chips into a roadside bin. This system used a conventional skid-steer shear feller-buncher, a machine that cuts and piles the selected stems. The shear was followed by a mobile chipper that towed a chip trailer.

At each pile, the chipper would stop, collect, and chip the stems. When the trailer was full, the mobile chipper would drive to the roadside to dump the chipped material. During testing, this system experienced a range of performance problems, including low chipping productivity, knife wear, mechanical failures in the trailer, and power-train limitations. There is value in knowing the limitations of such equipment. Furthermore, results from the study can be used by machine manufacturers to estimate productivity and cost if the mechanical issues can be addressed in an improved machine.

The third system tested was a shear-and-forward system that used a conventional tree shear followed by a large forwarder. The forwarder is a machine with a grapple arm and bunks that collects the piled stems and carries them to roadside piles. A large eight-wheeled forwarder was used in three different treatment units. This system could treat about 0.5 acres per hour at a cost of about \$300 per acre. With the higher per-acre removal volume and no chipping, this system had the lowest cost per ton to get the material to the roadside.

This study highlights the importance of matching the right harvesting system to the specific conditions of the PJ treat-

(Sci-Tech continues on page 15)



A Fecon Bio-Harvester (www.fecon.com) system cuts and chips trees. When full, the chips in the trailer are transferred to a roadside bin.

(wildlife.utah.gov/watersheds/), are spending millions of dollars each year to treat PJ stands so they are less fire prone and to improve wildlife habitat. The costs can typically start around \$300 per acre, and there are far more acres that need treatment than there are dollars and workforce to do the treatments. Since there is little market value for pinyon and juniper wood, the wood is simply chipped and left on the ground.

Development of markets for PJ woody biomass is necessary. An option is harvesting and selling the biomass during restoration treatments to help offset costs and support rural communities. There are limited traditional markets for firewood and posts made of PJ, but new markets are required to make utilization of this material more universal. Most of the effort along the utilization front is focused on using the biomass material for energy production. Several surrounding states have biomass energy facilities in operation, and there are several efforts underway to utilize this clean and renewable fuel source in Utah.

A second stumbling block to economical utilization of this material is the lack of

been thinned, leaving a few of the best trees widely spaced across the hillsides. Which trees were removed and which were left was carefully planned by BLM foresters in advance of the treatments. The goal was a mix of fire-hazard reduction along the highway and habitat restoration in the upper reaches of the treatment.

Evaluating Harvesting Systems

Three different PJ harvesting systems were evaluated in a thinning treatment near Beaver. The systems represented dramatically different approaches to treatment and biomass utilization: a cut-and-bale operation, a chip-and-forward operation, and a shear-and-forward operation. Each is explained in detail here. Directly comparing these systems to one another based on these results, however, is not a fair treatment of their capabilities, as each machine encountered considerably different terrain challenges and different sizes and density of PJ woodland.

The cut-and-bale operation was done by a biomass harvesting machine that combines a rotary drum shredding head with a heavy-duty round baler to fell,



Below: A Ponsse (www.ponsse.com) forwarder collects felled trees and carries them to roadside piles for chipping.

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ment. The baler had the lowest per-acre treatment cost, but could only operate in more open stands with smaller material. The chip-at-the-stump system was unable to effectively operate in the conditions it encountered, particularly due to rough terrain and difficulty in chipping the material. The shear-and-forward system handled larger material, long-distance extraction, and steeper terrain. On one hand, the higher volume per acre and more expensive equipment resulted in the highest cost per acre for treatment; on the other hand, this resulted in the lowest cost per ton of biomass delivered to the roadside. The failure of some of the equipment to perform satisfacto-

rily points out the need to make improvements in these equipment configurations before PJ harvesting can be done in an economical manner.

Materials harvested during this operation are being tested at various facilities for utilization for energy feedstock. Several bales were shipped to the Idaho National Laboratory in Idaho Falls, Idaho, where they are being processed into wood pellets for use in pellet stoves. Additionally, 1,000 pounds of chips were shipped to the University of Utah's Institute for Clean and Secure Energy, where they have undergone a series of tests on co-firing this material with coal in traditional coal fired power plants.

This study was conducted by Dr. Bob Rummel of the USDA Forest Service Forest Operations Research Center in Auburn,

Ala., in cooperation with USDA Forest Service Regions 1 and 4 State and Private Forestry, Bloomin Ranch Services LLC, the Bureau of Land Management, and the Utah Biomass Resources Group. The study includes follow-up monitoring of soil and vegetation characteristics that is being completed by faculty of the Wildland Resources Department in the College of Natural Resources at Utah State University. Darren McAvoy, CF, is a forester with the Utah State University Cooperative Extension, darren.mcavoy@usu.edu.

This article was originally published in Utah Forest News, a publication of the Utah State University Cooperative Extension (forestry.usu.edu) and is used here with the kind permission of editor Darren McAvoy.

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(Field Tech continued from previous page)

would add environmentalists to the list and, if I could, make it required reading for them. Mendell and Lang review and examine the history of wood energy and electricity production in the United States, the sources of feedstocks, and bioenergy markets and public policy. One chapter is devoted to wood pellets, another to cellulosic ethanol. A sidebar of just six paragraphs provides an excellent overview of why wood bioenergy is (or isn't) considered carbon neutral. The concluding chapter, "Looking Forward," lists some of the challenges of wood bioenergy production, such as raw material pricing and procure-

ment, as well as fears that bioenergy demand will encourage landowners to "vacuum" their forests of every particle of biomass, but the book ends with a note of optimism: "Smart use of available wood raw materials can support long-term forest health and energy objectives in the United States."

This 70-page booklet costs just \$9.95, plus \$4 for shipping (www.foresthistory.org); discounts are available for orders of 10 or more copies. At that price, any forester can afford to buy at least one copy to donate to a library or school. I've donated one copy to my local public library and will provide another as a reference for forestry students at Mt. Hood Community College.

What neat new toys (or books) have you been using? Let me know. wilents@safnet.org.

Trimbale's Juno T41 comes with either the Windows Embedded Handheld or Android operating system.



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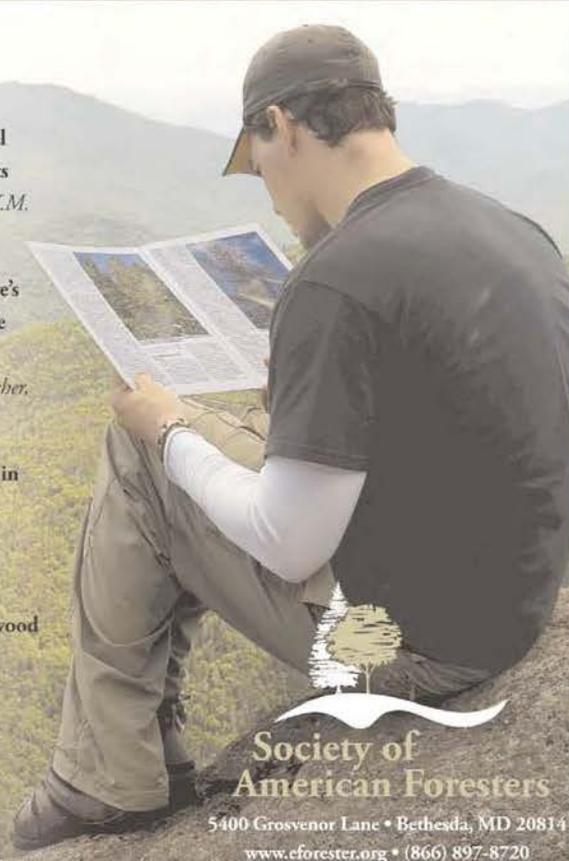
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Forest Carbon Marketplace: The business case for California forest carbon offsets

A decade of experimentation in voluntary carbon markets yielded important lessons for the development of a domestic compliance market. However, these early experiences also generated fatigue among many landowners, foresters, and service providers who invested their time and talent as the first compliance market for domestic forest offsets materialized. **Page 7.**

Society Affairs: Lopez, Hayes, and Hoss elected to SAF Council

Three SAF members were elected last year to fill three-year positions on SAF Council: J. Lopez, District 3; Andrew J. Hayes, CF, District 6; and Gregory A. Hoss, District 9. Their terms began January 1. **Page 9.**

SAF core language: Evolving forest management since 1900

SAF embarked on a nine-month process to reinvigorate the organization through understanding its core purpose and by examining our aspirations for the future. **Page 10.**

GIS for Foresters: OruxMaps: Mapping with Android devices

This article describes the reviewer's experience using Android tablet computers in conjunction with OruxMaps software to assist with this land cover mapping activity in cocoa landscapes in Ghana and Indonesia. **Page 13.**

Field Tech: An iPhone paired with a laser rangefinder?

The presentations on forest resilience and the many scientific and technical sessions on various topics at SAF's National Convention in October were as good as or better than those at any other national convention. Here's a brief look at a few of the products on display. **Page 14.**

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The Agony of Engine 57: Documenting the Esperanza Fire Book Details Arsonist's Conviction for the Murder of Five Firefighters

By Steve Wilent

John N. Maclean's *The Esperanza Fire: Arson, Murder, and the Agony of Engine 57* is not a book about a wildfire. It is much more than that. With a keen eye and ear for detail and raw emotion, Maclean dissects the tragic circumstances surrounding the deaths of five firefighters in 2006 after a wind-driven fire burned over their position on a ridge amidst a sea of chaparral and a few trees. Whether or not you've ever been on the front line of a wildfire, this book is a gut-wrenching, compelling narrative. It reads like a taut murder mystery, a whodunit novel you can't put down, with a cast of fascinating characters that includes shady suspects, a dogged detective, DNA evidence, a divided jury, and the victims' grieving family, friends, and colleagues.

The fire, started by an arsonist on October 26, 2006, burned about 42,000 acres and destroyed 34 houses. The arsonist was caught, tried, convicted, and sentenced to death. Maclean, a seasoned journalist with storytelling in his blood, spent six years piecing together the story of the crime. As for the deaths, he also answers the question, "Why?" as well it can be answered—Why did the crew of Engine 57 hold its position on that hilltop, with a fire driven by Santa Ana winds below them? And was anyone, other than Raymond Lee Oyler, the arsonist, ultimately responsible for the deaths?



A firefighter visits the remains of US Forest Service Engine 57, where five of his colleagues died in 2006 during the Esperanza Fire in Southern California.

Maclean worked as a writer, editor, and reporter for the *Chicago Tribune* for 30 years. During that time he helped his father, Norman, edit *Young Men and Fire*, the elder Maclean's account of the 1949 Mann Gulch Fire in Montana and the 13 men who died there. (Norman Maclean, who died in 1990, may be best known for his book, *A River Runs Through It and Other Stories*, and the 1992 film based on

the title story, directed by Robert Redford.) In 1995, John Maclean left his job with the *Tribune* to write *Fire on the Mountain: The True Story of the South Canyon Fire*, an account of the deaths of 14 firefighters in Colorado in 1994. Since then he has written *Fire and Ashes: On the Front Lines of American Wildfire* and *The*

(See "Maclean" page 3)

EPA Issues New Rule as Supreme Court Hears Forest Roads Case

The US Supreme Court heard oral arguments on Monday, December 3, in *Decker v. Northwest Environmental Defense Center (NEDC)*, an appeal of a controversial decision by the US Court of Appeals for the Ninth Circuit that



Does storm-water runoff via ditches, culverts, and channels require an Environmental Protection Agency permit? In December, the US Supreme Court held a hearing in a case that may decide the issue.

involves Clean Water Act permits for runoff from forest roads. However, the last-minute issuance of a rule by US Environmental Protection Agency clarifying that such permits are not required was greeted with surprise and irritation by Supreme Court justices and complicates what might have been a relatively straightforward appeal.

The Ninth Circuit ruled in 2011 that "stormwater runoff from logging roads that is collected by and then discharged from a system of ditches, culverts, and channels" is industrial activity and therefore "a point source discharge" that requires a permit from the EPA. Many forest managers and landowners were concerned that the new requirement would result in high compliance costs and delays in conducting timber sales and other forestry activities. In 2012, SAF submitted a brief to the court stating that existing state best-management practices (BMPs) are effective approaches to managing storm-water runoff and that EPA permits are not needed (see "SAF Briefs Supreme Court: With BMPs, EPA Road Permits Not Needed," October).

On November 30, the Friday before the Supreme Court hearing, the EPA published a "prepublication" copy of its new rule. On

(See "EPA" page 5)

Walters Elected SAF Vice-President; Cox Steps Up to President



The results of SAF's national elections are in: William D. Walters (left) was chosen as SAF's vice-president and three SAF members were elected to three-year positions on the SAF Council: J. Lopez, District 3; Andrew J. Hayes, CF, District 6; and Gregory A. Hoss, District 9 (see page 9 for more about the new Council members).

Joann Meyer Cox (right), who served as vice-president in 2012, became SAF's president for 2013. She succeeds William Rockwell Jr. A message from Cox to SAF members appears on Page 6. Walters will serve as president in 2014.

Walters has been an SAF member since 1981. He has held several SAF leadership positions, most recently as a Council member representing District 9 from

(See "Elections" page 11)