The Importance of Big Trees

In 2008, *Utah Forest News* published a story about the big trees of Utah and Darren McAvoy’s experience nominating the current state champion Engelmann Spruce. These woody wonders provide many benefits. Besides being fun to find and majestic to behold, they provide vital information for the scientific community and can have historic importance to their surrounding areas.

**Watershed Management**
Snowpack and watershed quality play a vital role in the daily lives of Utahns and anyone who calls the Intermountain West home. With the future of our climate uncertain, concerns over our future water supply have been raised by both scientists and citizens. In order to understand what the future may hold, researchers are using big trees in Utah to help understand the past.

The research is a joint effort between scientists at USU and BYU, along with the USDA Forest Service Rocky Mountain Research Station in Ogden, Utah. They are looking at the streamflow history of the Logan River, which originates in the Bear River Mountain Range. The Logan River is the largest tributary of the Bear River, which ultimately empties into the Great Salt Lake.

By measuring the average streamflow of a river, researchers construct a view of the previous winter’s snowpack and runoff. Records of snowpack via streamflow measurements have been kept in Utah since 1922, and one recently published study has extended that record all the way back to 1605. The measurement and analysis of tree rings, or dendrochronology, is the science that is making this all possible.

Typically, trees used for streamflow reconstruction include two-needled pinyon pine and Douglas-fir. Due to a lack of pinyon in the area, the research team had to rely on Douglas-fir and the seldom utilized Rocky Mountain juniper. Interestingly enough, the juniper proved to be a more...
accurate recorder of past streamflow compared to Douglas-fir.

This discovery is one of many coming from the dendrochronology lab at Utah State University. The dendro lab is part of a larger research group called the Wasatch Dendroclimatology Group (WADR). Eric Allen, the lead author of the paper, works with sites across the west to compile tree-ring research. Allen and Justin DeRose run the lab that measures and analyzes tree ring samples from across the country. The lab started work in 2005 and is currently working on many projects in a variety of fields.

Heritage Trees
Even the earliest Utahns planted trees in order to beautify their communities. The story goes that pioneer, botanist and horticulturist Joseph E. Johnson walked across the plains with his family and a wagon full of trees, cuttings and other plants. Each evening, Johnson’s wife would ensure the valuable cargo was well cared for and watered. Many early orchards are said to have originated from the nursery that Johnson started in St. George.

Of the many trees planted by the pioneers, one cottonwood made headlines nationwide. Pioneer Tree No. 1 was said to have been the first planted by the Mormon pioneers after their arrival in the Salt Lake valley in 1847. A plaque installed by the Daughters of Utah Pioneers organization commemorated the historic nature of the Salt Lake City tree.

In January of 1970, articles about the tree started surfacing in newspapers across the country. From the Gettysburg Times in Pennsylvania to the Eugene Register in Oregon, newspapers were reporting how the tree, once an impressive landmark, had been reduced to a 10-foot stump.

George B. Catmull, the Salt Lake City streets commissioner, wanted the tree removed in order to “allow for drainage improvements.” The Salt Lake Shade Tree Commission had recommended against the tree’s removal, threatening to resign if the tree were cut saying, “If that tree goes, so do we.” Catmull persisted, and the tree was removed. Hazel Bullough, head of the commission at the time, told reporters that the organization served no purpose “if one city commissioner can rudely ignore the unanimous decision of the tree commission.”

Upon the tree’s removal, all six members of the commission resigned. Bullough received letters of support from readers across the United States. Later, in 1975, the Utah Legislature passed the Heritage Tree Act to protect and preserve rare and threatened trees that contribute to the beauty and history of the state. Today, Utah state code includes a provision saying, “Any person who intentionally or knowingly alters, injures, damages, or causes death of a heritage tree is guilty of a class B misdemeanor.”

Shortly after the Heritage Tree Act was passed, the Utah State Shade Tree Association met with the intention of gathering and publishing stories and pictures of heritage trees across the state. The Shade Tree Association started in the 1950s and continued through 1985. Today, the Utah Community Forest Council is responsible for compiling information about heritage trees in Utah.
Sagebrush-steppe ecosystems, including pinyon-juniper woodlands, are some of the most extensive in North America, but they are also amongst one of the most threatened. Intensive land use, invasive species, climate change and the increasing occurrence of wildfires are causing significant ecosystem degradation and vegetation changes in the interior West. Pinyon-juniper expansion and exotic annual grass (cheatgrass) invasion is changing the character of the sagebrush-steppe.

Sagebrush ecosystems evolved with fire, and fire in these systems is not considered a net source of CO₂ to the atmosphere as long as a healthy sagebrush ecosystem returns over time. However, sagebrush and woodland ecosystems in the Great Basin have become susceptible to annual grass conversion in part due to increasing tree density and fire severity. Degraded sagebrush ecosystems and high density woodlands that burn under wildfire conditions are unlikely to recover and likely to become cheatgrass-dominated. Wildfires and subsequent land cover conversion to cheatgrass release several million metric tons (1 metric ton = 2,204 lbs) of CO₂ every year.

Pinyon-juniper woodlands in the Great Basin contain 21-60 metric tons of carbon per hectare (2.47 acres) in aboveground biomass depending on tree density. Each year, wildfires burn more than 1,350 square miles (350,000 ha) of pinyon-juniper woodlands.

Direct combustion of aboveground biomass and near surface soil organic carbon releases 9-39 metric tons of carbon per hectare and additional carbon is lost during the years that follow due to decomposition of residual aboveground biomass, roots and soil organic carbon. One hectare of cheatgrass-dominated rangelands contains < 1 metric ton of carbon in aboveground biomass. Based on the historical rate of conversion from sagebrush ecosystems to cheatgrass dominance, this means 2-10 million metric tons of CO₂ are released to the atmosphere each year from fires in pinyon-juniper woodlands.

Managing sagebrush-steppe and pinyon-juniper woodlands to reduce woody fuels and restore healthy native perennial herbaceous vegetation is the most effective way to mitigate the spread of cheatgrass and slow large scale land cover conversion. Ecosystems with healthy native perennial herbaceous vegetation and low tree density are less likely to experience severe wildfire and more likely to recover to a desirable state following fire. Reducing the number of acres burned under high severity wildfire and converted to cheatgrass each year has potential to reduce CO₂ emissions. If managers could reduce high severity fire by only 10 percent in high-density stands of pinyon-juniper woodlands, then 0.27 – 1.0 million metric tons of CO₂ emission could be offset annually. At a minimum, this represents the equivalent of CO₂ emissions from the entire USDA motor vehicle fleet and at best more than one third of the entire annual U.S. government motor vehicle fleet emissions.

Reducing Carbon Emissions from Sagebrush-Steppe
Bark Beetles and Crown Fire Hazard

If you have recently visited Utah’s high elevation forests, you have probably noticed large areas of dead trees, with either red or gray needles. The tree mortality you saw is probably the result of successful attack by small, tree-killing insects called bark beetles. This widespread tree mortality has raised a variety of concerns among both public and private forest managers, particularly in regard to the impacts of the dead trees on wildland fire hazard.

Anyone who has built a campfire knows the importance of the low moisture content of dead fuel and its arrangement for igniting and sustaining a fire. Based on that simple premise, many people expect the bark beetle-killed trees to create a fire hazard due to their low moisture content. However, the implications of recent tree mortality on wildland fire hazard are more complicated than simple intuition suggests and are dependent upon a host of site specific factors and definitions of the term “hazard.”

Previous and ongoing research conducted in the Department of Wildland Resources at Utah State University (USU) has attempted to gain a better understanding of the implications of bark beetle-caused tree mortality on potential fire behavior, firefighter safety, and fire suppression operations by using extensive field and lab work combined with discussions with wildland firefighters who have experience fighting wildfires in these forests.

The most recent research on bark beetles and fire from the USU Disturbance Ecology Lab has focused on the changes to crown fire potential in recently attacked forests during the red stage, the period when the “red and dead” needles are retained in the crowns of attacked trees. Although this period of time is relatively short, it does have significant implications for suppression operations and firefighter safety because crown fires hinder the ability of firefighters to conduct safe and effective fire suppression operations.

Based on our results, we have confirmed the presumed changes to moisture content, chemistry, and flammability of foliage on recently killed trees, noting a significant increase in the ignitability of the needle foliage. The consequences of the increase in ignitability are particularly relevant to wildland firefighters due to a lowering of the canopy ignition threshold and an increase in the probability of crown fire initiation in forests containing high proportions of bark beetle-altered needle foliage. Additionally, contrary to initial expectations, we found that the moisture content of the foliage on these dead trees does not change over hourly time frames the same way that other fine dead fuels, such as needle litter and small twigs on the ground, do in response to increases in relative humidity during the overnight and early morning hours. This finding also has significant implications for wildland fire personnel because it suggests a potential widening
of the window of crown fire activity outside the traditional daylight burning period.

While these changes are important in terms of fire behavior, they do not fully convey all of the relevant consequences of widespread bark beetle-caused tree mortality. In light of this fact, we also have recently investigated the influence of the extensive tree mortality on additional factors important to wildland firefighters, including fire suppression operations and firefighter safety within the context of resistance to wildfire control.

Based on that analysis, we believe that a holistic examination of the impacts of bark beetle-caused tree mortality is needed to fully appreciate the range of consequences associated with tree mortality on fire behavior, fire suppression operations, and firefighter safety. Such an approach allows firefighters to better understand how bark beetle-induced tree mortality can ultimately impact a wildfire’s resistance to control and allow for better decision making. For example, it is important to know that due to the increased resistance to control, the duration and cost of fires in these bark beetle-attacked forests may be greater than anticipated. Detailed discussion of the results from this work is beyond the scope of this brief article.

In Utah’s high elevation forests, both large scale bark beetle outbreaks and high-intensity forest fires have historically been a common feature. The main drivers of such events are known to be combinations of long-term drought and other important biotic factors associated with the life histories of the relatively fire-sensitive spruce and pine found at these high elevations. Despite the “naturalness” of these disturbances, they do have significant consequences in today’s world that may have not been relevant in the past. For example, because people, including their values, desires, and priorities, are either directly (e.g., firefighters) or indirectly (e.g., buildings or desires for multiple-use) a part of the environment, the forest conditions created by these outbreaks may conflict with a particular set of forest management goals and objectives. Forest managers who are dealing with bark beetle-caused tree mortality at a landscape scale are faced with an important decision as to how to deal with such situations. As with other forest management decisions, this choice should be based on the stated goals and objectives for the particular forest and an understanding of how tree mortality can impact the values and resources of concern.

Interested readers can go to http://www.usu.edu/forestry/disturbance/bark-beetles-fuels-fire/index.cfm where they can find more research from the USU Disturbance Ecology Lab.

by Wesley Page, Graduate Research Associate, USU
Utah’s New Director of Forestry, Fire and State Lands

After 40 years of service to the state, Director of Forestry, Fire and State Lands Dick Buehler has retired. His successor, Brian Cottam, started working with the Division in early 2013 as Deputy Director. Since beginning his work as Director, his schedule has been full, spending a great deal of time at the capitol working with legislators. He even met with a group of fourth grade students from Monroe Elementary School who are hoping to change Utah’s state tree. Currently, the Colorado blue spruce is the official state tree, but the young students from Sevier County have been actively lobbying the governor and others to pass legislation changing it to quaking aspen. The legislation has passed both the state house and senate, and needs only the signature of Governor Herbert to be enacted. Despite his busy schedule, Cottam was able to momentarily sneak away and talk with me about his new position.

I asked Cottam about the path that led him to become director of the Division. He told me how while working on a self-directed bachelor’s at Westminster College, he began to personally take more interest in natural resource issues. After graduating from Westminster, Cottam earned an M.S. in Forestry at Utah State University. His master’s work led him to his first job directing the Southern Utah Forest Products Association. “That experience served me well,” Cottam said of his work with SUFPA. He said that the opportunity gave him useful experience in the industry side of forestry.

From there, Cottam worked in a variety of positions, most recently for SUU’s Office of Government Relations and Regional Services. His work there helped build up rural communities, and he was responsible for working with the Division to create the state’s first demonstration forest. The demonstration forest is located on the University’s Mountain Ranch, about 10 miles up Cedar Canyon. The forest offers hands-on learning of forest management principles to both the Division and the University.

With a broad administrative background, Cottam hopes to empower his staff. He said his leadership approach is “to allow my people to do the job they were hired to do.” His high expectations of his staff are clear: his goal is to have a Division with the best natural resource managers in the country. “I expect we will get there because we have some of the best people. With them knowing they have the support they need to become the best, it’s going to happen,” he said.
Our conversation quickly turned to fire, as conversations concerning western forests often do. “Fire in particular is where the Division will more immediately see a different approach,” said Cottam. “It’s the simple idea that an ounce of prevention is worth a pound of cure.” Governor Herbert’s recent call for a Catastrophic Fire Reduction Strategy Committee is something that makes Cottam believe this shift in policy will happen sooner rather than later.

The project created by Governor Herbert aims to reduce the size, intensity and frequency of wildfires in Utah. According to a report recently published by the committee, “every dollar spent in prevention saves $17 in suppression.”(The report can be found in full at ag.utah.gov). Cottam told me of the importance of this change, but let me know that the safety of wildland firefighters is paramount. “We will not minimize the focus on suppression, but we will elevate the focus on the other elements,” he said.

Brian Cottam’s experience leading up to his appointment as State Forester differs greatly from past directors, but his ability and desire to create an environment that enables and empowers his staff is something that can help protect the future of Utah’s forests.

A view of Dixie National Forest from SUU’s demonstration forest in Cedar City, Utah.

by Sam Nielsen, USU Forestry Extension Intern

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.

To get on our list for email delivery of this newsletter, go to http://forestry.usu.edu and click on Join Our Mailing Lists. For back issues, visit http://forestry.usu.edu and click on Publications and Utah Forest News.

The Utah State University Forestry Extension website, found at http://forestry.usu.edu, is an excellent source of technical forestry information for woodland owners.

State of Utah Division of Forestry, Fire & State Lands 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.
This plaque commemorates Salt Lake City’s Lone Cedar tree, whose story is similar to that of Pioneer Tree No. 1. The plaque and structure were constructed by the Daughters of Utah Pioneers near 300 South and 600 East as a reminder after the tree was removed by vandals in September of 1958.