

Utah Forest News

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Aspen Research Sheds Light on Management and Diversity

Editor's note: Richie Gardner is a forestry master's student in the department of Wildland Resources at Utah State University.

What we know about western aspen reproduction is undergoing a fundamental change that could result in management techniques that may create more resilient forests and woodlands. The accepted knowledge in the field tells us that aspen reproduce almost entirely by suckering, meaning that the roots send up new shoots that become trees, and that groups of trees are joined together by common root systems. These genetically identical groups of trees are called clones. An important facet of this theory is that aspen do not reproduce by seeds, an assumption which has huge implications for how we manage aspen. Recent advances in the science of genetics, however, have uncovered evidence that seedling establishment is more common than previously recognized. This is good news for our ability to conserve and restore aspen in the Intermountain West.



This stand of aspen in Big Cottonwood Canyon demonstrates clonal boundaries where green leaves meet autumn color and bare branches.

We are finding that stands of aspen have far more clones than traditional views would suggest, even in areas thought to have very few especially large clones, such as around the Pando Clone (See *UFN Winter 09*) on the Fishlake National Forest. Pando is generally regarded as the largest known aspen clone

in the world. Thanks to genetic fingerprinting techniques, researchers have found that Pando is in fact a very large, genetically identical clone. However, many smaller clones have also been discovered adjacent to and near Pando. This pattern has been seen in other areas with large clones. Even more interesting is that the patterns of the clonal diversity strongly suggest

successful seedling establishment is occurring over relatively recent time.

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If you are anything like me, you try to pick out clonal boundaries of aspen as the leaves change color in the fall or during leaf out in the spring when neighboring stands have yet to break bud. This visual evidence can be striking, and we are good at recognizing these patterns. What we often miss when admiring these large clones are the many smaller clones around them. This is precisely the pattern we are picking up using genetic tools to identify clones. These clonally diverse stands are good news for land managers because each clone can respond to its environment quite differently than the one right next to it, as evidenced by early leaf out or late leaf color patterns. In short, more clones means more adaptive potential to cope with future environmental challenges. The likely result is more hardy and resilient aspen forests.



Clonal diversity in aspen stands can signal hardiness and the ability to resist environmental change.

The discovery of more diverse stands raises the question: when did they establish and can we do anything to promote more seedling establishment? As a forestry graduate student in the department of Wildland Resources at USU I wanted to explore aspen clonal diversity on Cedar Mountain, east of Cedar City. Under the guidance of Dr. Karen Mock and others, we asked: 1) What types of conditions may have led to successful aspen seedling establishment, and 2) in more clonally diverse aspen stands, are clonal boundaries stationary or are they advancing or retreating into neighboring clones? Answering these questions could help inform land managers on how to create conditions for seedling establishment,

and in stands that contain multiple clones, how the individual clones may interact over time.

Fire can create ideal seedbed conditions for aspen seeds to germinate, and although fire has been relatively rare on Cedar Mountain, there are locations (primarily on the eastern and northern edges) where fire has been more frequent over the last 20 years. Our study found that aspen stands in areas with a more

frequent fire history had higher clonal diversity, or more individual clones per stand. Fire alone is not likely leading to successful seedling establishment. We are not suggesting that on Cedar Mountain, more fire equals more aspen clones. Other factors likely played a role in the successful establishment of clones, such as abnormally frequent precipitation events following fires, and

also some sort of relief from grazing animals for a number of years following germination.

To detect whether clones are expanding and/or retreating at clonal boundaries, we first determined the clonal identification of each stem (tree) using DNA fingerprinting techniques. We did this for understory, mid-story and canopy stems in research plots across Cedar Mountain and looked for patterns where a specific clone may occur more frequently in the understory or overstory. The repeated presence of a particular clone in the understory of an adjacent clone would suggest clonal expansion over relatively recent time. It would also suggest the likely retreat

of the overstory clone at those locations. We found that about a fourth of the clones showed evidence of advancement into neighboring clones. We interpret this to mean that three fourths of the aspen on Cedar Mountain seem to be relatively static in regard to clones spreading across the landscape, or at least they seem to be spreading very slowly. This information gives us some idea of how clones interact within stands and what percent of clones may replace others as they succumb to environmental hardships, such as prolonged drought.

Regenerating wild aspen seedlings will never replace the profuse suckering of aspen in the short term, but promoting seedling establishment could be part of a long-term strategy to promote aspen resilience in Utah. Fire is often hard to implement as a management tool, but there are other ways to mimic the effects of fire. Using tractor discs, for example, to remove competitor plants and to allow naturally produced aspen seeds to come into contact with the soil is a viable option, keeping in mind that aspen seedlings are highly susceptible to grazing pressure and drought conditions. Creative management can at least partially offset the negative effects of drought

and grazing animals. Preparing seed beds around or within existing stands of aspen, or some other forest type, may ameliorate certain drought conditions.

Fencing these areas or leaving behind fallen trees or creating some matrix of jack-straw to protect seedlings from grazing could also enhance seedling survival rates.



Richie Gardner is completing his forestry master's degree at Utah State University. He continues to study aspen in the Great Basin as a U.S. Geological Survey Pathways Intern.

Short-term regeneration efforts in aspen forests and woodlands will almost certainly involve aspen's ability to sprout following coppicing or fire, as this method can rapidly initiate the next cohort. Promoting clonally diverse aspen stands through seedling will likely add future resilience. We have witnessed mass seeding events following large fires in the western U.S.,

such as the Yellowstone Fires of 1988. Although a majority of the seedlings succumbed to drought or browsing, some survived due to proper moisture conditions and protection from grazing animals. These new clones will likely add to the resiliency of these stands in the years to come and provide the genetic material for these stands to withstand future environmental hardships.

by Richie Gardner and Darren McAvoy

Learn at Lunch Webinar Series Continues in 2013

The Learn at Lunch webinar series will continue in the new year. These monthly webinars cover diverse forestry topics and provide an opportunity to hear from professionals in environmental education, horticulture and other fields. One ISA Continuing Education Unit (CEU) is available for each hour-long webinar.

Upcoming Webinars:

Tuesday, April 23, noon until 1 p.m.

Tree Planting Primer Speakers: TreeUtah Staff

Tuesday, May 21, noon until 1 p.m.

Intro to Woody Biomass & Biochar in Utah

Speaker: Darren McAvoy, Forestry Extension Associate

Massive Wood Walls Utilize Beetle-Killed Timber

Kip Apostol, owner and operator of Euclid Timber Frames, LC, in the Heber Valley, has developed a use for the massive amount of standing dead timber that currently exists in many western forests. Bark beetle infestations have resulted in what is likely the highest inventory of standing dead trees western forests have seen since Euro-American settlement. As a lifelong “wood guy,” Apostol is driven by the desire to utilize this resource that is otherwise rotting away. This commitment has led to his adoption and development of massive wood wall technology.

Massive wood walls focus on this underutilized resource to make sustainable wood-based structures. Some call it 21st century log home construction. By joining together three-inch-thick boards, Euclid manufactures completed walls that are nine to 15 inches thick. These wall sections are manufactured in Euclid’s shop, complete with cut-outs for windows, doors, electrical outlets and heating ducts. All of the specs and measurements for each wall section are entered into a computer and a machine makes the wall with appropriate cut outs and dimensions. Apostol uses what looks like a sawmill on steroids, called a Hundegger Whole House Saw. The machine is from Germany and is about the size of a two-car garage. Apostol is the exclusive dealer of this equipment in the U.S.

Euclid is currently working on a home east of Heber City at Wolf Creek Ranch, making use of beetle-killed wood harvested from the same parcel. Logs were harvested and shipped 20 miles to Euclid’s shop for milling. The completed walls were then hauled

back up the mountain to the building site. Harvesting wood from your own backyard uses far less energy than importing wood from another state or country. In addition to the sustainability benefits of using locally harvested wood, this type of construction allows for the utilization of less desirable lumber that is not merchantable in a traditional sawmill. Even though Apostol guessed that this construction approach



Euclid Timber Frames owner Kip Apostol, right, explains how the massive wood walls are joined during a tour Euclid hosted for wood utilization personnel from Utah and Idaho last November. A portion of the Hundegger sawmill can be seen in the background.

uses 50 times the amount of wood as traditional stick home construction, it uses locally sourced beetle kill that would otherwise rot in the woods. Construction that uses beetle-killed wood stores carbon in the wood for hundreds of years, further enhancing sustainability. This construction method has also been shown to be very resistant to damage from earthquakes and fire.

The comfort of living in a structure of massive wood walls is another significant consideration. R value is a construction insulation term that refers to thermal resistance, which is the ability of a material to resist the flow of heat, or coldness in this case. Apostol says that although the insulation rating for the thicker

wall panels is a R28, it performs like R54 because of the thermal mass provided by the thick wood walls. Thermal mass as applied to home construction is the ability of the structure to protect the inhabitants from the outdoor temperature swings, which are especially drastic in Utah's mountains and deserts.

For an example of wood's thermal mass attributes, think of a tree well. This is the area around the trunk where the snow has melted to form a void around the tree below the level of the snowpack. The snow is melted back from the heat captured by the tree during warm periods and released during cold periods. The thermal mass is the stored energy.

Apostol cited a study from the University of Austria in Graz where researchers built three homes in a cold climate, one of typical insulated stick construction, one of insulated masonry and one of massive wood walls. The outside temperature was held below freezing at a consistent 14 degrees. Each home was heated up to 70 degrees, then the heat source was turned off. Then, how long it took for the inside of each structure to fall back to freezing inside was measured. The stick home was at 32 degrees in 25 hours, the insulated masonry home lasted 75 hours before it fell to freezing inside and the massive wood wall home took 225 hours, or nine days and nine hours, to fall back to a freezing temperature.

The Hundegger machine Euclid uses is able to create interlocking grooves in the boards, so when fastened

together they act like a single piece of wood. Apostol has experimented with using glues and metal fasteners but prefers to use wood joinery instead. He found that the cost of using metal fasteners soon outpaced the raw material cost of the wood. This motivated him to develop a system to join the wood together with small

interlocking pieces. He also prefers making structures without toxic glues typically used in laminated beam construction.

Apostol points to the other health benefits of this construction type, compared to traditional stick construction; using 2 x 2 studs, plywood and petroleum based insulation, which comprise 88 percent of homes in the U.S. He points out that modern homes are sealed like a Ziploc baggie, nothing

gets in or out, without the additional purchase of expensive mechanical equipment. A wood based structure offers more breathability with the outside environment. The use of wood also replaces the use of more energy intensive materials such as concrete, aluminum, steel and plastic. The insulation value and thermal mass properties of wood make buildings that are efficient to heat and cool.

After testing a seven story solid wood structure on the earthquake shake table in Japan, an engineer exclaimed, "It turns out that the best building material for the future was the best building material from the past, wood!"

by Darren McAvoy



This cross section of a massive wood wall was taken during a tour of the Euclid Timber Frame operation in the Heber Valley. It displays the thickness of the wall with a pen shown for scale. Each of the interlocked boards is approximately three inches thick.

Looking Back in Time at Utah's Climate

A decade of collecting thousands of tree ring samples from throughout the western United States is resulting in new data and producing a new way of reconstructing Utah's past climate change patterns.

Utah State University climatologist Simon Wang and U.S. Forest Service Rocky Mountain Research Station researcher Justin DeRose recently published the results of their study in the *Journal of Hydrometeorology*.

Wang believes the large number of samples and close spacing between sites provides a much finer resolution than any known conventional tree ring records. "The new tree ring dataset essentially provides a telescope for us to look into Utah's past climate with great detail," said Wang.

This information helps climatologists and policy makers make more informed decisions regarding Utah's changing climate.

"For example, we know that 150 years ago the phenomenon of El Niño affected the entire state of Utah, rather than the weak opposite effect divided between northern and southern Utah we see today," said Wang.

DeRose explained that tree rings give important climate signals to be discovered by scientists.

"As a tree grows, it produces a ring for each year that it ages," said DeRose. "The thickness of each ring normally reflects fluctuations [of] climate conditions

with a harsh climate resulting in narrower rings and a favorable climate producing wider rings as a tree grows faster."

DeRose believes that the information gathered from the data can aid dendrochronologists (tree ring scientists) in future site selection.

"One important finding of the current study is that forest-grown trees record the same signals that are found on highly-sensitive sites, meaning that climate signals can be found almost everywhere," said DeRose.

The team hopes that by extending the dataset to the rest of the Interior West and eventually to the West Coast, it will be possible to map climate drivers such as El Niño over progressively larger areas and longer time scales. The data is far from finished; many thousands of samples from across the Interior West still need to be processed and analyzed. Upon completion, a high-resolution climate data set will be reported and made available.

This piece originally appeared in the February 28 edition of Utah State Today.

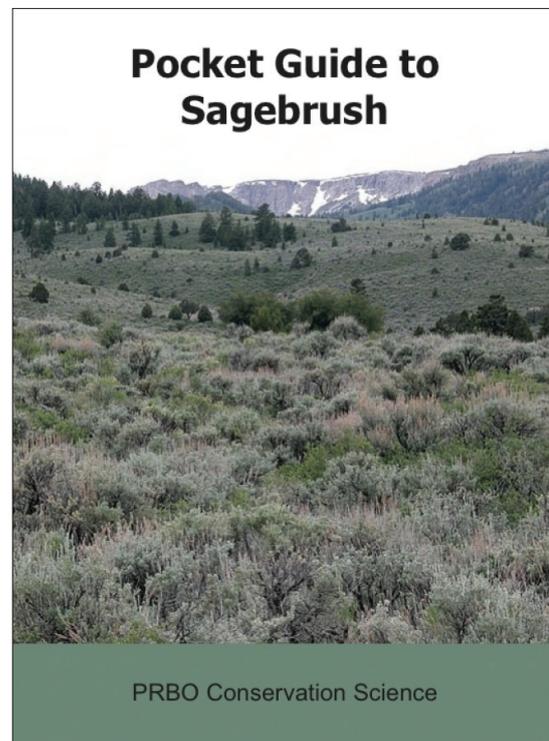
by Paige Pagnucco, Tiffany Adams & Rick Fletcher,



Pocket Guide to Sagebrush Now Available

The *Pocket Guide to Sagebrush*, a publication of the Point Reyes Bird Observatory (PRBO), is now available. Written by Leila Shultz and produced in partnership with the Natural Resources Conservation Service, USDA Forest Service, the Bureau of Land Management and PRBO Conservation Science, the guide highlights identification characteristics and range maps of 18 species of sagebrush found in the Intermountain West. The guide features high quality color photographs and detailed botanical illustrations for reference.

Contact your state's Natural Resources Conservation Service office to inquire about receiving a copy. You can also view a pdf of the guide at this address: <http://sagegrouseinitiative.com/content/brand-new-pocket-guide-sagebrush>.



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.

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COMING EVENTS

Intermountain SAF Annual Meeting: April 12-13, Logan, UT. Details at <http://www.usu.edu/saf/> under the "Meeting" tab.

Spring Arborist Series, Class 3: April 13, 9 a.m. to 3 p.m., at the Provo City Library, Provo, UT. For more information see <http://utahurbanforest.org/events/calendar/icalrepeat.detail/2013/04/13/601/-/2013-spring-arborist-series-class-3>.

St. George Arborist Training: April 18, May 16, June 20, 7 a.m. to 8 a.m., St. George Parks Department, St. George, UT. See <http://www.utahurbanforest.org/events/calendar/cat.listevents/2013/03/11/-> for more details.

2013 Utah Tree Climbing Championship: May 16-18, Pioneer Park, Salt Lake City, UT. See <http://www.itcc-isa.com/events/calendar/calendar.aspx?ID=1222> for details.



The heat of the sun was absorbed by this snag, melting out a tree well in the snow at the base. The heat was captured during warm periods and released during colder periods. Tree wells are an example of the principle of thermal mass.