Pando Study Sheds Light on Genetic Diversity of Aspen Stands

On Fishlake National Forest in south-central Utah, an enormous aspen stand named Pando is thought by many to be the largest and oldest organism on the planet. Pando, which is Latin for “I spread,” covers 100 acres, weighs more than 14 million pounds, contains 47,000 trees, and is perhaps Utah’s most famous forest feature. It was first identified in 1976 from aerial photographs and has increased in notoriety since. However, until now, the boundaries of the Pando clone have only been described by using visual characteristics of the stand such as branching patterns, leaf colors in the fall, and the emergence of leaves in the spring. Recently, geneticists have begun to wonder whether Pando is actually a single aspen clone or a cluster of related clones with similar physical characteristics.

Since the 1950s we have known that stands of genetically identical aspen trees (called clones) grow from interconnected root systems. This process, called “suckering” is thought to be the primary means of reproduction among aspen stands in the Intermountain West. Although aspen have seeds and are capable of sexual reproduction, most scientists and managers believe that aspen reproduction by seed is extremely rare in the Intermountain West. Aspen stands in this region are thought to consist of enormous, genetically identical clones that have been regenerating for centuries. Pando is often cited as the most extreme example of this trend among aspen in the Intermountain West, and its status as the world’s largest living organism is based on
the assumption that it consists of just one, genetically identical clone.

So is Pando really just one clone? Dr. Karen Mock, a conservation geneticist with USU’s Department of Wildland Resources, has been examining the genetic makeup of aspen stands for the past several years (see UFN Summer 2006). Recently, she collaborated with colleagues from the US Forest Service’s Forest Genetics Lab in Placerville, California to examine whether Pando was indeed a single living organism. The results of their research were recently published in two journals: *Molecular Ecology* (November 2008) and *Western North American Naturalist* (December 2008).

In order to analyze the genetics of Pando, the researchers drew out a 50 m grid over the entire stand and gathered samples from 561 aspen trees within the grid. Both overstory and understory trees were sampled. Some creativity was required to obtain leaves from high canopy trees – one technique was to cast a fishing pole with a bit of twisted wire at the end into the canopy to “catch” a leaf sample. In some cases, it was not possible to obtain a leaf sample from a very tall tree, and a small square of the sample tree’s cambium was taken instead. After collection, samples were dried and sent to the USU and California labs for analysis. A similar, but larger, study was conducted in Logan Canyon in northern Utah during the same time and these results were also sent to the USU lab.

The genetic analysis of Pando and several stands of aspen in Logan Canyon yielded some interesting and unexpected results. In keeping with previous hypotheses, the existence of Pando as a single clone was confirmed, and its boundaries were found to be almost identical to those described previously by using visual characteristics of the stands. Dr. Mock and the other researchers concluded that Pando covered 108 acres, an only slightly different area than the 107 acres estimated by the first aerial photograph study of the clone.

The more surprising finding of the study, however, was the discovery of 59 additional small clones around the perimeter of Pando and in an adjacent stand. These clones are so genetically dissimilar from adjacent clones as to suggest that they were created by sexual reproduction, not as the result of accumulated mutations. Many of these small clones were clustered on the north and northeast edges of Pando, on an uphill slope, and the researchers believe that they may have established from seed at some point after the emergence of the larger Pando clone. It is possible that a disturbance or some other environmental condition spurred this seeding event.
In Logan Canyon, the study area was approximately 2100 hectares, and included 30 distinct stands of varying sizes. In this location, a total of 812 trees were sampled, and a whopping 191 genetically distinct clones were discovered. None of them were as large as Pando. Again, genetic relationships and clone positions in this study area suggested that most of the landscape is covered by different clones from seeding events, instead of just a few ancient, fragmented clones.

So, it appears that while sexual reproduction within Intermountain West aspen is still rare, it must be a more frequent occurrence than was previously thought. Seeding also appears to be an important contributor to genetic diversity in aspen stands.

The genetic analysis of the stand also revealed very few genetic mutations within the Pando clone. The low number of these mutations suggest that Pando might actually be far younger than we have previously thought. If Pando was an ancient clone, as is commonly believed, researchers would expect to find evidence of larger genetic changes that have accumulated over hundreds of thousands of years. However, a molecular “clock” has yet to be discovered that can be used to age Pando accurately to within a thousand years or so.

The genetic confirmation of the existence of Pando seems to bear out the theory that careful examination of the visual characteristics of an aspen stand is a useful way to identify aspen clones. However, Dr. Mock cautions that despite the proven existence of large clones, the genetic diversity of aspen stands appears to be much greater than we previously thought. Seeding, though rare, must also be acknowledged as an important contributor to this diversity, and more research is needed to understand seeding events and seedling survival. Also, foresters and landowners should now be considering the genetic diversity of their aspen stands when making management decisions. We can no longer assume that a given stand of aspen contains only one clone that will respond uniformly to management. Instead we now need to acknowledge that many unique clones exist within most aspen stands, each with particular genetic strengths and weaknesses. Taking this diversity into account should lead to a more sophisticated ability to manage this important tree species in Utah and across the West.

by Olivia Salmon and Darren McAvoy
USU Forestry Extension has released a new online tree browser, available at [www.treebrowser.org](http://www.treebrowser.org). This browser replaces the Utah Tree Browser CD available from USU since 2002. Though the Tree Browser CD was quite popular, the software it was based on was becoming outdated and it never worked on Mac computers. Also, it could only be updated occasionally by producing a new version of the CD.

The new interactive USU Tree Browser is available on the Web for free and is always up-to-date. It has 12 new species (241 total) and hundreds of new color photos (1,073 total). Users can browse through a complete list of trees or narrow their choices by selecting from 21 general, growth-related, cultural, and ornamental characteristics, including whether a tree is native or introduced. For each species there is a fact sheet, usually including descriptions of the leaves, twigs/buds, flowers/fruit, bark, wood, general comments about the tree’s native habitat, and a description of its uses in cultivated landscapes, including its USDA Plant Hardiness Zone designation.

The new online Utah Tree Browser allows users to select from 21 general, growth related, cultural, and ornamental characteristics.
First USU Forestry Extension Webcast a Success

In January 2009, USU Forestry Extension launched its first interactive webcast. Forestry Extension Associate Darren McAvoy gave a live presentation: “An Introduction to Utah Trees and Forests.” Fifty-five webcast participants logged into the presentation and were able to communicate with each other and Darren by typing questions and comments into a chat box on their screen.

An evaluation survey at the end of the webcast indicated that the majority of the participants found the webcast format to be convenient. While many participants thought in-person classes were valuable when they could get to them, they commented that webcasts allowed them to learn about forestry topics without needing to travel. Because interest in the webcast was high, USU Forestry Extension has decided to proceed with regular webcasts in the future. If you would like to receive updates about when these webcasts will take place and information on how to access them, please visit http://extension.usu.edu/forestry/Presentations/webcasts.html to be added to our email list.

Sagebrush Rangeland Management Practices DVD Available

The SageSTEP Outreach Program has released a DVD entitled Restoring Sagebrush Rangelands in the Great Basin: An Introduction to Alternative Land Management Practices. The DVD was funded by Western Sustainable Agriculture Research and Education (SARE).

This DVD provides information about current threats to sagebrush rangelands in the Great Basin and discusses land management practices that can restore healthier systems. Because juniper encroachment is discussed in some detail in the DVD, the information should be of interest to woodland owners. The disc also includes bonus tracks with extra information about sagebrush restoration provided by scientists, private landowners, and public land managers.

To view a low resolution version of the DVD online, visit: www.sagestep.org/pubs/DVD.html.

If you are interested in obtaining a copy of the DVD, send an email to summer.c.olsen@usu.edu.
The American Recovery and Reinvestment Bill of 2009 (also known as the Economic Stimulus Bill) was signed by President Barack Obama on February 17, 2009. The Bill will provide $787 billion for energy, science, and transportation projects, tax cuts, health care costs, and more. The Administration hopes the bill will create or retain 3.5 million jobs. Foresters and forest landowners stand likely to benefit from provisions in the Bill that encourage forest health management, fire hazard reduction measures, and wood-to-energy projects.

The US Forest Service will receive $1.5 billion from the stimulus bill. Of this, $650 million will be used to fund the construction, maintenance, and decommissioning of roads, trails, and facilities on federal lands. The remaining $500 million is to be spent on reducing the threats of wildfire throughout the country. Half of the $500 million will be used for federal lands, and the other $250 million will be given to the State and Private Forestry arm of the Forest Service to perform fuels reduction projects, ecosystem improvements, and forest health activities on state and private lands. Additionally, $50 million of the $250 million set aside for state and private forest land can be used to fund wood-to-energy projects (see UFN Spring 2008 and Fall 2007). Thanks to the lobbying efforts of the Council of Western State Foresters and the National Association of State Foresters, state forestry agencies will not have to provide matching funds for these projects to move forward, a significant issue considering the budget issues that many states are facing this year.

The American Recovery and Reinvestment Bill is giving priority to “shovel-ready” projects that can begin immediately. In order to gain access to this funding, Utah’s Division of Forestry, Fire and State Lands (DFFSL) has been acting quickly to submit projects that are eligible for money from the Economic Stimulus Bill. According to Geoff McNaughton, Forestry Programs Supervisor with the DFFSL, the Division has sent a proposal to Washington that applied for several million dollars worth of projects that could begin within 7 days, and several million dollars worth of projects that could begin within 30-60 days. They are still waiting to hear whether this funding has been approved. Look for updated information about the status of these projects in future Utah Forest News issues.

by Olivia Salmon
New Publications Available at Timber Tax Web site

The National Timber Tax Web site was created as a resource for landowners needing information about tax treatment of various timber-related activities. The Web site recently added two new publications to help forest landowners with their 2008 taxes. “Tax Tips for Forest Landowners for the 2008 Tax Year” by Linda Wang and John L. Greene summarizes key federal income tax provisions for forestland owners filing their 2008 taxes. The Timber Tax Web site also has information on how to order Timber Tax Management for Family Forest Owners by William L. Hoover and Mark Koontz. This 2009 manual includes filled-out tax forms and detailed instructions on how to complete the IRS Form T: Forest Activities Schedule.

To visit the National Timber Tax Web site, go to: www.timbertax.org.

USU Forestry Extension Associate Darren McAvoy Wins SAF Communications Award

USU Forestry Extension Associate Darren McAvoy is the recipient of the Communications Award, given by the Intermountain Chapter of the Society of American Foresters. The award was presented to him at the Society of American Foresters National Convention held in November 2008 in Reno, NV. The award recognizes McAvoy’s “work with private landowners, contributions to the USU Extension Forestry Website, and publication of the Utah Forest News.” Darren has been with USU Forestry Extension since 1999.

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.
COMING EVENTS

Small Log Conference 2009: March 26-27, 2009. Coeur d'Alene, ID. For more information, email Jan Raulin at tenaj@telus.net.

Forest Products Society 63rd International Convention:

7th North American Forestry Ecology Workshop:
June 22-26, 2009. Logan, UT. This workshop will bring together forest ecologists from around the world to share ideas about forest ecosystems in North America. For more information, visit: www.nafew2009.org.

This 1905 carving was found in an aspen tree at the top of Card Canyon in northern Utah. Historic carvings in trees are called arborglyphs. Today, carving in aspen trees is discouraged because it can introduce disease.