



In this Issue:

New Fire-Climate Study Underway in Mexico

If Opportunity Doesn't Knock, Build a Door

Working Group Forms in Northern Arizona to Develop Native Seed Supply

ERI Collaborates in Creation of a Statewide Strategy for Restoring Arizona's Forests

ERI Art Gallery

**Diversity in a Dry Forest:
Place-based Ecological Restoration in the Wahoo Watershed**

ERI Graduate Students and Their Research

Alumni Corner

Does Coarse Woody Debris Play a Role in the Recovery of Pinyon-Juniper Woodlands After Severe Fire?

Daniel Laughlin Wins Another Award from Ecological Society of America

Staff News

New Fire-Climate Study Underway in Mexico by Larissa Yocom, NAU Forestry Graduate Student



Three of the sites sampled in 2007 were located on this mountain in Coahuila.

measurements of fuel dynamics. A set of unique relict sites, where fire regimes and forest structures were least perturbed by humans during the nineteenth and twentieth centuries, will also be incorporated.

The 2007 field season was very successful as the research team sampled seven sites for fire scars and one site for forest age/structure data in just two weeks. Twelve people participated, including researchers and students from NAU, the University of Arizona, Rocky Mountain Tree-Ring Research, Inc., Universidad Autónoma Agraria "Antonio Narro," and INIFAP CENID-RASPA--a government research agency in Mexico.

Sites sampled were located in the Sierra Madre Oriental mountain range in eastern Mexico, in the states of Coahuila and Nuevo León. The sites were all located at or above 10,000 feet in elevation. The research team collected 254 fire scar samples. Most samples were Mexican mountain pine (*Pinus hartwegii*), but there were some Mexican white pine (*Pinus ayacahuite*), Vejar fir (*Abies vejari*), and Douglas fir (*Pseudotsuga menziesii*) as well. Almost all samples were cut from stumps, logs, or standing dead trees. In addition, one or two samples from live trees were taken at each site.

I will be processing the fire scar samples and analyzing the data during the 2007-2008 academic year here at NAU. After the samples are prepared, the dates of past fires will be determined. Fire years will then be compared with climate reconstructions to determine what effect climate events have on fire occurrence.



Pictured at Ejido La Encantada, Peña Nevada (state of Nuevo León): Front (l to r): Vicenta Constante García, INIFAP CENID-RASPA; Julián Cerano Paredes, INIFAP CENID-RASPA. Back (l to r): Dr. Pete Fulé, NAU & ERI; Erica Bigio, student, U of A; Cameron Fulé, volunteer, Flagstaff, AZ; Gustavo Medellín Pérez, Ejido La Encantada; Armando Becvort, student, Universidad Autónoma Agraria "Antonio Narro"; Larissa Yocom, student, NAU

If Opportunity Doesn't Knock, Build a Door
by Susan Nyoka, ERI Research Technician



NAU Senior Forester Academy Challenge ropes course (team challenge; Ryan is on the left, partner Enzo is on the right)

This past summer, NAU School of Forestry faculty and NAU's Centennial Forest staff, along with ERI staff and graduate students, collaborated in "building a door" for NAU sophomore, Ryan Thomas. Ryan, who is legally blind, participated in a four-week internship that provided him with hands-on experience in laboratory, field, and educational settings in the field of forestry-his chosen major.

During the course of his internship, Ryan participated in various projects, including serving as a counselor-in-training with the Centennial Forest's Junior Forestry Academy where he mentored campers and presented some of the curriculum. Ryan also served on the crew assisting Ph.D. student Liz Kalies with her research project looking at small mammal responses to forest management, and he travelled to Mount Trumbull with the ERI to assist botanists in collecting data for a seeding study. During the final week of his internship, Ryan worked in Assistant Professor Andy Thode's forestry lab collecting biomass data for a greenhouse experiment along with various other lab-related tasks, including data entry.

I recently interviewed Ryan to discuss his internship and the lessons he learned from the experience. Ryan told me that his primary goal in participating in the internship was to gain work experience, although he also set out to alleviate doubts about his abilities and disprove some assumptions others may have about his limitations. Indeed, when I talked with people who interacted with Ryan, they said that he often exceeded their expectations in his ability to find solutions and modify methods of assigned tasks to suit his needs. When I asked Ryan about his best experience, he said that he especially appreciated Dr. Thode's approach because she allowed him to try a variety of tasks rather than assuming something was too difficult for him to take on. This vote of confidence was useful in helping Ryan discover ways to adapt field and lab methods so he will be

able to work more independently in the future. Ryan conceded that accommodating him in lab and field environments may require some preparation and creativity, which was not always possible for the projects he participated in for the internship due to their short duration. However, with just a few adjustments, Ryan can easily see himself working fully and independently on any of the research projects he participated in this past summer. He suggests that adaptations may be as simple as using puff paint on plot layout diagrams to make them accessible or installing JAWS software on a computer to enable him to perform data entry on a spreadsheet.

Junior Forester Academy group (Back, left to right: Ryan, Cheryl Miller, Enzo (counselor in training), Front: camp nurse and counselors)



In the end, the "door of opportunity" has proven to open in both directions, providing a win-win situation for all parties. Ryan obtained forestry-related work experience, while NAU faculty, staff, and students not only benefited from Ryan's hard work and enthusiasm, they also came away with an expanded view of what is possible for a blind student and how best to accommodate their abilities. As Ryan so eloquently stated, "The main things are to observe, keep an open mind, and occasionally wing it."



Working Group Forms in Northern Arizona to Develop Native Seed Supply
by Judy Springer, ERI Research Specialist, Sr.

The Northern Arizona Native Seed Alliance (NANSA) was formed in March, 2007 in order to increase the supply of locally grown native seeds and plants for northern Arizona revegetation and restoration projects. The NANSA is comprised of a large number of individuals, for-profit and non-profit organizations, government agencies, NAU elements (the ERI, NAU Ecological Monitoring and Assessment Program, NAU Research Greenhouse Complex), Arizona Game and Fish Department, U.S.

Working Group Forms in Northern Arizona to Develop Native Seed Supply, continued

Forest Service, Arboretum at Flagstaff, Coconino Natural Resource Conservation District, Museum of Northern Arizona, The Nature Conservancy, Bureau of Land Management, National Park Service, and numerous others. Janet Lynn, of NAU's Ecological Monitoring and Assessment Program, is the coordinator of the organization.

The mission statement of the NANSAs states that the alliance is "a task force comprised of individuals, government agencies, non-profit organizations, and commercial businesses who are interested in developing a source of native plant materials for revegetation following wildfires, restoration, and other revegetation projects in northern Arizona."

The NANSAs is working at developing a venue that will help members share information and collaborate on native plant research, education, and applied projects in our region. The alliance is also currently seeking funding to conduct research on such topics as 1) requirements and techniques for growing native plants--from seed collection to commercial production; 2) selection of the best species for use in revegetation and wildlife habitat projects on the Colorado Plateau; 3) ecology and life history of native plant species; and 4) economic feasibility of growing native plants in northern Arizona. The NANSAs is working in tandem with the Uncompahgre Plateau Project (<http://www.upproject.org/>), and others across the Colorado Plateau, to form a partnership known as the Colorado Plateau Native Plant Initiative. This organization also has native seed increase as one of its main goals.

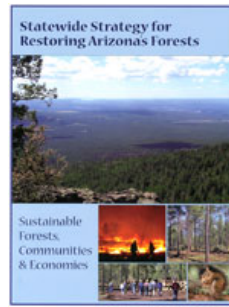
Meetings are held monthly, and a workshop on seed production and increase will be held on Oct. 31, 2007 in conjunction with the Ninth Biennial Conference of Research on the Colorado Plateau in Flagstaff:

http://sbosc.wr.usgs.gov/cprs/news_info/meetings/biennial/2007/index.asp

For further information, or to be added to the e-mail list, please contact Janet Lynn (NAU/ EMA) at janet.lynn@nau.edu or Judy Springer (NAU/ERI) at judy.springer@nau.edu.



ERI Collaborates in the Creation of a Statewide Strategy for Restoring Arizona's Forests by Dave Egan, ERI Editor/Writer






On July 25, 2007, Arizona Governor Janet Napolitano released a first-of-its-kind, 20-year plan to restore the state's forests. The plan calls for increased funding to implement landscape-scale ecological restoration of Arizona's now fire-prone forests, protect Arizona's citizens and infrastructure,

and promote wood products industries that can utilize small-diameter timber and biomass.

Several current and former members of the ERI played important roles in the creation of this important policy statement. They included Wally Covington, Diane Vosick, Jesse Abrams, Pete Fulé, Victoria Yazzie, and Dave Egan. Diane, in particular, was very engaged in this process and was instrumental in organizing people, writing various parts of the strategy, making presentations at public meetings, and strategizing ways to bring people with different perspectives together to reach consensus. Victoria helped the group make important connections with tribal leaders in the state, and Dave aided Jean Palumbo, the project coordinator, with the editing, layout, and final print publication of the 150-page document.

In this project, ERI staff worked as members of the Statewide Strategy Subcommittee of the Governor's Forest Health Oversight Council, which was co-chaired by Ethan Aumack (Grand Canyon Trust) and Thomas Sisk (NAU, ForestERA). The subcommittee was populated with Arizonans from the environmental community, wood products industry, and federal and state agencies.

The plan has five key strategies:

-  Increase the human and financial resources dedicated to restoring Arizona's forests and protecting communities
-  Coordinate and implement action at the landscape scale
-  Increase the efficiency of restoration, fire management, and community protection activities

ERI Collaborates in the Creation of a Statewide Strategy for Restoring Arizona's Forests, continued

- ✚ Encourage ecologically sustainable, forest-based economic activity
- ✚ Build public support for accomplishing restoration, community protection, and fire management across the state

These strategies are supported by 16 recommendations and 50 action items.

In addition to sections that discuss the current state of Arizona's forests, the policy context for restoration, economic considerations for restoring forest health and building a collaborative foundation for the strategy, the strategy includes detailed accounts of nine forested landscapes across the state.

Print copies of the strategy are available from Ethan Aumak, The Grand Canyon Trust, 2601 N. Fort Valley Road, Flagstaff, AZ 86001; (928) 774-7488 x 210, Fax: (928) 774-7570, eaumack@grandcanyontrust.org. The strategy can be viewed online at <http://www4.nau.edu/eri/DownloadFiles/12459-60Statewide-final.pdf>



ERI Art Gallery by Robin Long



The ERI is proud to feature original art by its students, staff, and alumni in our ERI Art Gallery, which is located in Room 35 of the NAU Forestry Building. Our current exhibit is a series of photographs by Kaitlin Tymrak,

who is a senior majoring in environmental engineering. Kaitlin's photographs are of landscapes and cityscapes she experienced during her travels earlier this year throughout Scandinavia, where she was part of the NAU Study Abroad Program.

Visitors are welcome to view the art gallery during normal business hours—8 a.m. to 5 p.m., Monday through Friday—except when the room is scheduled for other ERI activities. Call Linsey Baker at 928/523-7182 to make sure there are no conflicts. Arrangements can also be made to contact the artists, and items are often available for sale.

Past exhibits have included photographs, paintings and

quilts, usually with an environmental theme. We would like to acknowledge past exhibitors: Patty Kohany, Joe Trudeau, Erin Thurston, Joel Viers, Brandon Oberhardt, Megan Robertston, and Danielle Gift.



Diversity in a Dry Forest: Place-based Ecological Restoration in the Wahoo Watershed by Matt Tuten, ERI Research Technician



Dense pine stands within the first project site before treatment. This area was thinned during the Spring of 2005.

Heading west from the Black Range Ranger District office in Truth or Consequences, New Mexico on my first visit to the site of a proposed forest restoration project, it seemed unlikely that a montane ponderosa pine forest existed anywhere near the desert scene of bare rock, blue grama grass, and creosote scrub I saw from my car window. Aside from a few brief incursions into pinyon- and juniper-dotted hills, the scene remained similar for the nearly 60-mile journey. However, a dramatic change took place shortly after passing the dusty hamlet of Winston, New Mexico. I was soon in a familiar ponderosa pine landscape, one showing the signs of an ecosystem where fires had not occurred for decades: a landscape of dense pines with interlocking crowns, fire-scarred stumps, trees encroaching into grassy meadows, and a thick layer of pine needles and forest litter where one might expect an understory of bunchgrasses.

My purpose in this part of the world was to assist the Wahoo Watershed Workgroup, a local collaborative forestry group, with the planning and monitoring of a 70-acre forest restoration treatment. The group, founded in 2003, exists to involve community members in the work of forest restoration. It is funded by the Collaborative Forest Restoration Program, a federally funded program that exists in New Mexico, but not other western states. This program prods collaborative forestry groups to complete restoration activities within the national forests of the state. It encourages loggers, ranchers, rangers, birders, and bikers to come together to develop restoration projects capable of sustaining ecosystem and community values. The Sierra County Water Conservation

Diversity in a Dry Forest: Place-based Ecological Restoration in the Wahoo Watershed, continued:

District had obtained a grant from this program to initiate forest restoration activities, and a group of us from the ERI were on-board to assist the planning and monitoring of three forest restoration projects during the course of three years.

Initially, the task seemed fairly straight forward. We were working in a relatively pure ponderosa pine stand near the Continental Divide. Evidence of historical forest conditions abounded in the form of fire-scarred tree stumps, old yellow-barked pines, and the occasional ancient juniper or oak. We collected a few fire-scarred tree cross-sections and developed a monitoring and assessment framework for the initial 40-acre area. After analysis of the stand and fire scar data, we found that a massive influx of pine establishment occurred in the last 70 to 80 years, and that there were no fires during the same time period. This was not exactly surprising--a similar story is told in many western national forests. Our recommendations for the restoration of this area were: Replace the old stumps and old dead pines with young trees and retain all of the old, yellow-barked trees in the area; then remove the remainder of the many small, suppressed trees.



Ancient pinyon, juniper and oak woodlands within the highest reaches of the second project area

After this trip and other later trips to this site, I was confident the pinelands of the Gila National Forest operated under the same principles as the well-researched pinelands near Flagstaff, Arizona. That is, remove fire from the ecological equation and pine regeneration, once kept in check by frequent surface fires, will grow up, dominate the landscape, and crowd out understory plant species. This story holds true for much of northern Arizona, but the Black Range of the Gila National Forest is a long way from Flagstaff.

Our second project within the surrounding area drove this point home. This 120-acre parcel of land was less than a mile

away from our first project, but it was a far from homogenous pine stand. A network of intermittent dry creeks dissected this landscape, draining uplands rising 400 feet above their cobbled beds. Several cottonwood groves dotted the eroded stream banks. Pine regeneration crowded old meadows. Following our assessment, more forest complexity emerged. The ponderosa pine-dominated bottomlands and meadows blend seamlessly into a rocky pine, oak, and juniper savanna on the midslope. Eventually the pine-dominated forest transitions into a dense and ancient pinyon, alligator juniper, and gray oak forest at the highest extents of the project area. Little historical evidence of these species in the form of old trees, stumps or downed logs was present in the bottomlands, although many small-diameter pinyon and junipers were seen growing beneath the canopy of large noble pines.

Each of these tree species, including the cottonwoods growing along the streambank, has a different response to the management activity and natural processes they experienced during the last century. There is little evidence that the current condition of the dense pinyon, juniper, and oak forests of the uplands is outside the natural range of conditions expected in this forest type. Logging did not take place in these inaccessible areas and fires have difficulty burning in these stands. It is very likely that these same past management activities were an important disturbance factor in the ponderosa pine lowlands. Here the lack of fires during the last century has resulted in unnaturally high tree densities and uncharacteristic species compositions. Needless to say, the prescription we developed for this site differed dramatically from that of the first.

As we begin the third project with the Wahoo Watershed Workgroup, I look back on the lessons we've learned during our first attempts at ecological restoration within this watershed. I've learned about the give-and-take that is necessary for meaningful collaboration to occur within a group of diverse stakeholders. I've learned forest restoration thinning in the Southwest is expensive, especially when it takes place almost two hours away from the nearest economic center. Most importantly I've learned to avoid painting the landscape with a broad brush. In much the same way an artist paints or draws from life, recreating what he or she sees, we forest practitioners must attempt to restore places, not idealized landscapes. Our task is to restore complex mosaics of different ecological parts. To do this, we must see the places where we work for what they really are, and we can only do this through an unbiased assessment of the parts before we attempt to improve or restore the whole. Call it the basis of good forest stewardship, I like to consider it job security. 🌲

ERI Graduate Students and Their Research
by Mark Daniels, ERI Research Specialist



Corinne (Cordie) Diggins received her bachelor's degree in wildlife conservation from the University of Delaware in 2006, and worked on various research projects in Delaware, Kentucky, Maryland, and Maine before coming to NAU. Her research

with the ERI is centered on the landscape-scale restoration projects at Mount Trumbull, on the Arizona Strip. Using data collected on monitoring plots before and after treatment, and FVS and FIRESUM computer models, Cordie will attempt to forecast changes in tree structure, biomass, potential forest products, carbon and nutrients under alternative scenarios of restoration treatments and scheduling. Another aspect of her research will look at bird communities in the treated and control units at Mount Trumbull to analyze the effects of the treatments. The goal of both of these research projects is to provide guidance to land managers for effective long-term management of the ecosystem. At present, Cordie has begun analyzing the FVS data, and has collected field data on bird populations at the site.



Liz Kalies received a bachelor's degree in environmental science from Cornell University in 1998, and a master's in environmental science with a focus on wildlife ecology from Yale University in 2004. She worked on research projects in Connecticut and Massachusetts before coming to

NAU. Her current research involves a series of projects looking at small mammal communities in the context of the forest restoration and thinning projects being conducted around Flagstaff. For her first study, Liz collected field data (trapping small mammals) at about 100 sites southwest of Flagstaff. To analyze this data, she will use a technique called occupancy modeling to track changes in small mammal biodiversity over time and in response to various management practices. The second portion of her research will address changes in the composition of fungal communities in response to forest management practices. Analyzing hair and fecal samples of

several mammal species, Liz will attempt to determine which species are primarily responsible for the dispersion of fungal spores, and put this in the context of how forest treatments affect forest mammal communities. The third major component of her research will be to assess the effects of the changing mammal communities on one of their primary predators, the northern goshawk, which has been in decline across the Southwest. Liz hopes that outcomes of these three studies will help to effectively incorporate wildlife conservation issues into large-scale forest management in the Southwest.



Valerie Kurth received her bachelor's degree in biology from Macalester College in St. Paul, Minnesota in 1999, and a master's degree in forestry from the University of Montana in Missoula in 2004. During

and between her time in school, she worked on a variety of research projects in Montana, Wyoming, Colorado, and North Dakota. Valerie's research at NAU centers around the effects of wildfire on soil and forest floor properties, using sampling across a chronosequence of fires (a series of fires that burned at different times in the past, in this case from 2 to 35 years ago) to assess changes over time. The first part of her study examines rates of nitrogen mineralization after wildfire, in an attempt to understand the dynamics of this important ecosystem process after stand-replacing wildfire in ponderosa pine forests. Valerie is also growing native species in burned forest soils to measure above- and belowground biomass and nutrient uptake, to get a more realistic idea of what soil nutrients are actually available for plant use. A third component of her project, presently in its earliest phases, is to attempt to characterize the fungal species that participate in decay of woody debris after wildfires. Results from these studies may help researchers understand the ecosystem processes that operate after wildfires, and help future rehabilitation efforts.



Daniel Laughlin received his bachelor's degree in biology from Calvin College in Grand Rapids, Michigan in 1999, and his master's degree in ecology from Penn State University in 2002. Daniel worked as a

researcher and teacher in Pennsylvania, Missouri, Oregon, and Belize before coming to Flagstaff to accept a botanist position with the ERI. His Ph.D. research concerns the long-term effects of climate variability and forest structural changes on herbaceous plant communities. Using data from a series of recently relocated historic monitoring plots, Daniel will attempt to answer three broad questions: 1) What are the relationships between inter-annual climatic variability and herbaceous productivity and diversity in ponderosa pine forests?, 2) To what extent has the herbaceous understory changed since the beginning of the 1900s?, and 3) What types of functional consequences have followed in the wake of the observed changes in herbaceous communities? With several seasons of data already collected, including re-mapping the vegetation on almost 100 1-m² plots, as well as information from soil cores and biomass samples from around the plots, Daniel will analyze his data using a variety of techniques, including structural equation modeling--a cutting-edge method for characterizing relationships between the many interrelated variables in complex ecological systems.



Chris McGlone received both his bachelor's and master's degrees in biology from New Mexico State University in 1995 and 2001, respectively. After working in a variety of botanical and ecological positions in New Mexico, Chris came to the ERI in 2001 as a research specialist. During the

course of his botanical work with ERI, Chris noticed a major invasion of cheatgrass (an invasive annual grass species) across the Mount Trumbull ecological restoration site, and decided to study the invasion and possible ways to counter it for his Ph.D. research. In the first aspect of his project, Chris examined the ecological factors that influenced why certain

patches on the landscape remain dominated by native species and resist invasion by cheatgrass. He then went on to study ways land managers might be able to fight cheatgrass invasions, including physical removal of cheatgrass biomass and seeding with native species. Finally, Chris is also conducting a greenhouse study on the abilities of three native plant species to compete with cheatgrass under a variety of nutrient and water conditions. Chris has completed field work for the first two parts of the project, and is planning to begin the greenhouse study next summer.



Donna Peppin received a bachelor's degree in environmental conservation from Northern Michigan University in Marquette in 2003, and has worked as a researcher and native plant specialist around Michigan and southwestern Colorado.

She also co-owned a native plant nursery in Durango, Colorado for two years—an experience that will serve her well in her master's program at NAU. For her project, Donna will develop a feasibility study on the production and use of native seeds for large-scale revegetation projects, such as seeding after forest fires, restoration projects, or highway construction. Seed sources for large-scale projects like these have been difficult to come by, which often results in land management agencies seeding with non-native species. There are currently efforts underway to initiate native seed production on a larger scale (see Judy Springer's article on the Northern Arizona Native Seed Alliance in this issue), and Donna's work will help inform such efforts so that they have the best chance of success.



Ken Stella received his bachelor's degree in natural resources from Humboldt State University in Arcata, California in 2002. Since then he has worked as a consultant and researcher in various locations around California and Colorado. Ken's research focuses on the response of plant

treatments after wildfires in northern Arizona ponderosa pine forests. Using three treatments (seeding with two widely used non-native grass species, a mix of common native grasses

and forbs, and an unseeded control) Ken will attempt to quantify and analyze the effects of each treatment on the regeneration of plant communities after fire, and determine which treatment was most effective at producing high rates of plant cover. Ken collected data from three recent wildfires in the 2006 and 2007 field seasons, and will return to all three sites for one more season of data collection in 2008.



Matt Tuten received his bachelor's degree in biology, geography, and environmental studies from Gustavus Adolphus College in Saint Peter, Minnesota in 2001. He then worked on research projects in Colorado and New York before joining the ERI in 2002 as a

research technician. Matt's research project will attempt to statistically compare two forest improvement treatments (evidence-based ecological restoration thinning and thinning based on requirements for northern goshawk habitat) in a replicated experiment on the Kaibab National Forest, north of the Grand Canyon. On-the-ground application of the goshawk guidelines across the Southwest (which are mandated by U.S. Forest Service policy) has been difficult and inconsistent, and land managers have recently proposed using evidence-based ecological restoration thinning as a way to satisfy the requirements for goshawk habitat in a more standardized fashion. Matt's research involves marking both treatments on replicated 1-hectare study plots with colored flagging, and then measuring and mapping all trees and historical forest evidences on the plots. This will allow him to model differences in forest structure and composition following the two treatments and compare them to the historical forest structure, so that land managers may scientifically determine if evidence-based ecological restoration treatments are actually compatible with the goshawk guidelines.



Larissa Yocom received a bachelor's degree in public policy analysis and biology from Pomona College in Claremont, California in 1999, and a master's degree in environmental science from Yale University in 2006. Larissa has worked in a variety of research and coordination positions in

Connecticut, Washington, D.C., Montana, Idaho, Australia, and Panama. Her research at NAU involves examining the factors that influence fire regimes in the Sierra Madre Oriental and Occidental mountains in Mexico. Larissa and a group of researchers from the United States and Mexico, led by ERI's Dr. Pete Fulé, travelled to several sites in the Sierra Madre Oriental this past summer to collect more than 250 fire scar samples, and measure various site and stand characteristics. Larissa's work now involves dating all the fire scars and reconstructing the fire history of the sites, after which she will try to match up the historical fire patterns with a variety of climatic cycles, such as El Niño-Southern Oscillation and the Pacific Decadal Oscillation. She will then attempt to determine if these large-scale climate patterns or more local site characteristics, such as topography, elevation and fuel load, are more important in influencing the fire regimes. (See Larissa's report on this project in this newsletter, on page 1).



Alumni Corner by Robin Long, ERI Student Services Coordinator



Allison Snyder and her husband, Derek

After almost four years assisting with data management in the National Park Service Inventory and Monitoring Program's Pacific Island Network, **Allison (Cocke) Snyder** (M.S. Forestry '04) has returned to Flagstaff. Allison now works at the NPS office on campus where she manages natural resource data for the NPS Southern Colorado Plateau Network, which includes 19 national parks and monuments throughout Arizona, New Mexico, Colorado, and Utah. Allison and her husband, Derek, have bought a home in Kachina Village. She is happy to be back in the Southwest and is looking forward to her first winter in four years. Rumor has it that she still wears her trademark flip-flops even though the temperatures are already dropping below freezing at night here in Flagstaff!



Jeff Muehlbauer (B.S. Chemistry & Biology '07) and his new wife, Jacque, are settling in comfortably in Chapel Hill, North Carolina. Congratulations are in order for these two high school sweethearts. Jeff is pursuing a Ph.D. in riparian ecology at the University of North Carolina.

He already "dove in" to his research project this past summer in the Adirondacks Mountains of New York, where he was spotted riding a duckie about a mile north of the headwaters of the Hudson River. The project goal was to take water velocity measurements at different depths, but Jeff writes, "We spent most of our time getting swept away by the flood currents!"



Wedding bells continue! **Megan Van Horne** (M.S. Forestry '05) married Sam Date in June at Old Orchard Beach, Maine at what looks like a lovely beach wedding. Megan works with the Arizona State Lands Department as a natural

resources manager II in Flagstaff. She finds herself busy educating others on the fact that she is now Megan Date. Cool last name, Megan!



Jon Lamb (B.S. Forestry '07) checked in from northern California where he is enjoying his job as a fuels specialist on the Beckworth Ranger District on the Plumas National Forest. In Jon's own words

"This is a super sweet position." Not only is he working as a resource advisor on prescribed burns, but he also is involved with Burned Area Emergency Recovery teams and on post-fire salvage operations. Newlyweds Jon and Ali were married in January and are enjoying living close to swimming holes in the woods and doing some daily fishing on the way home from work.



And we have a new member of the ERI family! **Ruby Joy Ball** was born September 20th, 2007 in Flagstaff to Randall and Laura Ball (B.S. Nursing '07). Ruby was 6 lbs. 14 oz. and 19.5 inches long when she arrived. She seems to be already living up to her middle name as you can tell by taking

one look at her proud parents.

Have alumni news to share? Please send your news to Robin Long at robin.long@nau.edu or call (928) 523-7187.



Does Coarse Woody Debris Play a Role in the Recovery of Pinyon-juniper Woodlands After Severe Fire?
by Dave Huffman, ERI Research Associate, and Joe Crouse, NAU Forestry Applications Systems Analyst

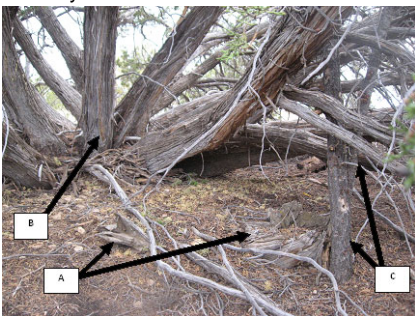


Juniper trees establishing near the logs and branches of trees killed in a severe fire 30 years ago.

Ecosystems characterized by the presence of pinyon pine (*Pinus edulis*, *P. monophylla*) and juniper (*Juniperus* spp.) trees occur on millions of acres across the American Southwest. These ecosystems are commonly referred to as the "pinyon-juniper", or "PJ" forest type. Pinyon-juniper ecosystems are typically found in semi-arid environments and their structure ranges from open savanna to closed woodland formations. Presently, there is keen interest in identifying management approaches that restore ecological integrity, conserve biological diversity, and sustain the resource values of these ecosystems. Developing such approaches requires fundamental understanding of natural processes and dynamics. Fire and patterns of recovery after disturbance are two key processes we are researching at the Ecological Restoration Institute.

Severe fires that kill most or all of the trees are common in pinyon-juniper woodlands of the Southwest. These fires are often small in size but in hot, droughty summers when winds are strong, dense woodlands of hundreds to thousands of acres may burn in a single blaze. Several researchers have described the sequence of vegetative recovery after such fires. Recovery is typically slow and may require up to 300 years before dense woodlands reoccupy the burned site. Generally, it is thought that annual plants disseminated by the wind establish on the site immediately after fire; then shrubs, perennial grasses, and herbs gain ground and mainly replace the annuals; next there is a period when shrubs and small trees are most abundant; and finally shrubs and perennials lose their hold and trees again form a woodland structure. The rate of the recovery process appears to depend on several factors, including density of the woodland before fire, past management (e.g., woodcutting, livestock grazing), fire severity, availability of propagules (i.e., seeds, and sprouts), and presence of "nurse" structures.

It has been shown that seedlings of pinyon, and to some extent juniper, establish well beneath shrubs and other trees as well as near large rocks. Seeds are often deposited close to these structures by animals. Some birds may use shrubs as perches, while other animals intentionally cache seeds in these specific types of locations. Shrubs and rocks function as "nurses" by providing young seedlings with protection from harsh environmental conditions. Since shrubs and rocks can function as nurse structures, it seems plausible that standing dead trees, logs, and even stumps may play a similar role. However, little research has been done to describe the role of coarse woody debris in affecting patterns of ecosystem recovery after severe fire.



Over time, coarse woody debris may function as a "nucleus" around which woodlands develop after severe disturbance. This image shows (A) coarse wood left after a fire that probably occurred before 1900, (B) a juniper tree that has established and grown since the fire, and (C) younger pinyon pine trees that have established beneath the older juniper.

Coarse woody debris can be defined as dead trees or tree fragments (e.g., stumps, logs, large branches, or chunks of wood) greater than about 3 inches in diameter. The ecological roles, rates of input, and spatio-temporal patterns of coarse woody debris in pinyon-juniper ecosystems have not been thoroughly studied. Research done by Mike Stoddard with the ERI indicates that slash (i.e., boles, tops, and branches left over after tree thinning) reduces soil erosion and helps grasses establish. Other scientists have found similar results on a variety of sites. In addition to protecting seedlings from harsh environmental conditions and stabilizing soil, coarse wood may also trap wind-blown seeds, provide a source of carbon and stimulate nutrient cycling, and protect seedlings from herbivory. These effects may continue for a period of decades since wood decomposition can be very slow in the dry conditions of the Southwest. Once trees grow and provide shade, they may provide microsites suitable for yet more trees to regenerate. In this way, coarse woody debris may function as a sort of nucleus around which woodlands eventually develop after severe disturbance. The amount and type of coarse woody debris left after fire is influenced by several factors, including initial woodland conditions, fire intensity, and management actions. If coarse woody debris does play an important role in facilitating recovery of woodland conditions after such disturbances, management interventions may be planned that emphasize conservation of dead wood in order to accelerate tree establishment and sustain habitat.

In 2007, we began a project to address questions related to post-fire recovery patterns in pinyon-juniper ecosystems of northern Arizona. In particular, we are studying spatial arrangement of coarse woody debris, shrubs, and tree regeneration. We will evaluate associations among these components by mapping their exact point locations, as found on large sample plots, and analyzing these maps using spatial statistics. With these data we will be able to compare the relative importance of coarse woody debris and shrubs as nurse structures for both pinyon and juniper tree establishment. We will also be able to assess the relative benefit of standing dead trees, logs, or other types of coarse wood for tree regeneration. Finally, since sample plots were placed in fires of different ages, we will be able to ask additional questions related to the length of time, or the period in woodland development, during which coarse woody debris is an effective facilitator of tree regeneration. These studies are intended to increase our understanding of natural processes in southwestern pinyon-juniper woodlands and assist efforts to conserve and restore these valuable ecosystems. 🌲

Daniel Laughlin Wins Another Award from the Ecological Society of America

by Dave Egan, ERI Writer/Editor

Daniel Laughlin, an ERI research specialist and winner of the 2006 Ecological Society of America's E. Lucy Braun Award for Excellence in Ecology, recently won the 2007 E.C. Pielou Student Award in Statistical Ecology from the Statistical Ecology Section of ESA.

Daniel's award-winning work, which he co-authored with former ERI employee, Scott Abella, and presented at the ESA Conference this August in San Jose, California, is titled "Explaining gradients in plant community composition with a general multivariate model." When asked about his most recent award, Daniel said, "I was very excited about the results of our study, and I am honored that the Statistical Ecology Committee felt the same way." For his efforts, Daniel will receive a check for \$200 and a book written by the famed statistical ecologist and writer, Eveleyn C. Pielou, at next year's ESA meeting in Milwaukee, Wisconsin. Congratulations, Daniel!!

For those interested in learning more about Daniel's work you can read the abstract of his ESA talk (following), or contact him at Daniel.Laughlin@nau.edu

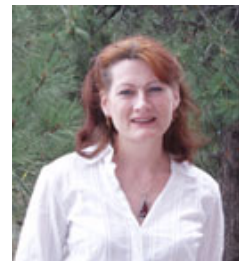
Abstract: Analysis and interpretation of community composition is difficult due to the high dimensionality of community datasets. Data reduction methods, such as ordination, can reduce a community matrix down to at least two orthogonal axes, suggesting that at least two major ecological processes generate gradients in species space. Based on assembly and response rule theory, we hypothesized that plant community composition is a function of the interactions among three general constructs: abiotic and biotic factors and disturbance history. We sampled vegetation and soils on 75 randomly located plots across a broad soil gradient within a 110,000-ha ponderosa pine forest in northern Arizona to evaluate this hypothesis. General multivariate models have appeal when analyzing ecological systems because they have the potential to shed light on the relative importance of multifaceted factors (e.g., abiotic gradients). We evaluated the relationships between ordination results and environmental conditions using structural equation modeling. The model employed composite variables, which specify the combined effects of multiple factors on a response in order to simplify the complex specific model, to address the general hypothesis, and to evaluate the relative importance

of the three theoretical constructs. We identified two independent compositional gradients in ponderosa pine forest understory plant communities, suggesting that there were at least two underlying ecological processes that generated these gradients. Interestingly, the general model suggested that abiotic factors explained one compositional gradient ($R^2=0.71$), and biotic factors and disturbance history explained the second compositional gradient ($R^2=0.61$) in this system.



Staff News:

Krista Coquia Joins ERI as Web Content Manager; Hagoónee' and See You Soon Wishes to Victoria Yazzie and Charlie Denton



Krista Coquia joined the ERI team in mid-July replacing Chuck Bullington as the ERI web content manager. She works with Yiqun Lin, who oversees programming the web site, and Dave Egan, ERI editor/writer, as a member of the web site team.

Krista has many varied interests and is constantly taking classes to satisfy her inquisitive nature. She has a degree in biology from San Francisco State University (1993), and a master's degree in art history from the University of California Riverside (1997), where her thesis was "Andrea del Sarto's Madonna of the Harpies" (Look it up and learn something about Italian Renaissance painting!!). Prior to accepting her new position with ERI, Krista was studying reptiles in the Mojave Desert and working on a second master's degree in biology at California State Polytechnic University.

In addition to her experiences in academia, Krista is very skilled with computers, developing databases, and, naturally, in creating and maintaining web sites. She has created web sites for [Scripps College's permanent art collection](#), [Cal Poly's Biology Department](#), [The Physiological Ecology of Reptiles Lab](#), and for [various artists](#) and [art studios](#). Krista has also taught digital photography and digital imaging classes while working at Scripps College.

Krista's husband, [James](#) is a ceramic artist. He is at NAU pursuing a degree in ceramics from the University's highly

respected ceramic arts program. When not at her computer, Krista enjoys woodworking, gardening, taking care of her chameleons, and tending her bonsai plants. She'll be busy next year with a new joy—a baby girl!!



Victoria Yazzie, former assistant to the director, left ERI in July to take a teaching position at the [College of Menominee Nation](#) in Keshena, Wisconsin. In her first semester at CMN, Victoria is teaching Intro to Environmental Science;

Intro to Forestry, Fisheries and Wildlife; and Internships in Natural Resources. Her longer-term goals include helping the college, which only became fully accredited in 1998, develop a forestry program. The Menominee Nation is known worldwide for their sustainable forestry practices, and Victoria interacts with personnel from [Menominee Tribal Enterprises](#) as part of her work with students. She writes of her experience, "Field work with the students has turned out to be rather rewarding for all. I have had MTE Forestry participate. There is great support here."



Charlie Denton has officially retired from ERI after six years as an integral member of the ERI Agency Outreach Team. During that time, Charlie has been a leader in terms of working with Forest Service personnel and community leaders who are interested in restoring frequent-fire forests in Arizona

and New Mexico. Fortunately for ERI and its clients, Charlie will be returning to ERI on a temporary, part-time basis in the near future. In the meantime, he has a new wood planer to play with and a "honey-do" list that's longer than his arm!! Happy retirement, Charlie! It's well deserved.



Agave, northern Mexico
Photo credit: Larissa Yocom

Northern Arizona University
Ecological Restoration Institute
P.O. Box 15017
Flagstaff, AZ 86011