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Mojave Applied Ecology Notes Winter 2011

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A NEWSLETTER OF THE UNLV
APPLIED ECOLOGY RESEARCH GROUP

Mojave Applied Ecology Notes

Science for natural resource conservation and management

2011
Volume 4, Issue 4

UNIVERSITY OF NEVADA LAS VEGAS

INSIDE THIS ISSUE:

"Their foresight in this series of projects has facilitated great advancements in the science of our understanding of LMNRA's diverse ecosystems…."

Lake Mead's Applied Science Program

By Scott Abella

In late 2006, Lake Mead National Recreation Area (LMNRA) Resource Chief Kent Turner (presently LMNRA Water Resources Program Manager) and Vegetation Program Manager Alice Newton initiated several inventory, monitoring, and research projects through cooperative agreements with the University of Nevada Las Vegas (UNLV). These, and new projects, were re-supported in 2010-11 by Alice Newton and present Resource Chief Gordon Olson through new agreements. Their foresight in this series of projects has facilitated great advancements in the science of our understanding of LMNRA's diverse ecosystems and more broadly of the ecology and management of Mojave Desert ecosystems. Moreover, this has established a good foundation to build upon to meet contemporary resource management challenges in the face of increasing wildfire, exotic species invasions, and a changing climate.

Significantly, LMNRA has supported publishing this work so that the information is not buried in infamous office-drawer reports and instead is freely available to all. It also is citeable in NEPA documents and can provide strong support/justification for agency management decisions, as well as support for drawing project funding. Examples of projects and corresponding advancements that have been made through the LMNRA-UNLV partnership include, but are not limited to:

- Inventory and distribution assessment of exotic plants in Clark County[1]
- Assessment of vegetation and threats at springs of Desert National Wildlife Refuge[2]
- Soil seed banks of gypsum soils, including method advancements for characterizing Mojave Desert seed banks in general[3]
- State-of-the-science syntheses on post-fire recovery and disturbance/succession influences in the Mojave and Sonoran Deserts[4]
- Synthesis of effectiveness and use of Mojave Desert revegetation techniques[5]

See Applied Science cont. on next page

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Mojave Applied Ecology Notes is a newsletter published quarterly by the UNLV Applied Ecology Research Group. We specialize in working with resource managers to address key information needs for management through applied research.

Federal Agencies can Easily Contract with UNLV Using GSA or CESU

http://gsa.unlv.edu/

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- Synthesis of influences of wild burros on Mojave Desert vegetation[6]
- Distributional relationships and environmental correlates of red brome in LMNRA and surrounding BLM lands[7]
- Relationships of native species with habitat invasibility by red brome to help guide native species selection for post-burn revegetation[8]
- Identifying native species competitive with red brome[9]
- Plant community classification and soil-plant relationships for LMNRA[10]
- Evaluating candidate restoration treatments for severe Mojave Desert disturbances[11]
- Soil disturbance and altered rainfall effects on native and exotic Mojave Desert annuals[12]
- Roadside distributions of native and exotic annuals[13]
- Encyclopedia article on principles of exotic species ecology and management[14]

Some other past and ongoing efforts are nearing completion, such as: evaluations of irrigation and other treatments for establishing a range of native desert plant species, techniques for the rehabilitation of biological soil crust, treatment effectiveness for the exotics Sahara mustard and African mustard, influences of elevated CO_2 on Mojave Desert vegetation (in collaboration with Stan Smith), shifts over 30 years in species distributions within LMNRA, comparing planting and seeding effectiveness, developing measures of restoration success using invertebrate indicators, drawdown succession and management needs of the Lake Mead shoreline, and characteristics and management needs of mesquite/acacia riparian communities.

See Applied Science cont. on next page

Applied Science cont. from page 2

All of these are applied science projects that are rigorous scientifically and also have clear implications for resource conservation and management. Many of these topics in the Mojave Desert have been little studied (or not at all) since the biological programs of the 1970s. Clearly ecosystems have changed, along with management challenges, and they continue to change. This highlights the utility of management-science partnerships and how valuable the body of knowledge highlighted above can be for informing present land management and building upon in future work.

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[2]Manuscript in review on spring vegetation.

[3]Manuscript in review on Mojave Desert seed bank characterization methods.

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[14]Abella, S.R. 2010.Exotic species. Pp. 1048-1050 *in* Warf, B. (ed.). Encyclopedia of geography, volume 2. SAGE Publications, Inc., Thousand Oaks, CA.

These and other publications not cited here freely available from: http://faculty.unlv.edu/abellas2/

The following three pages are examples of some of our publications:

In: Arid Environments and Wind Erosion
Eds: A. Fernandez-Bernal and M. A. De La Rosa
ISBN: 978-1-60692-411-2

This was an earlier synthesis of revegetation technologies that is still timely. Research was funded by a cooperative agreement between Lake Mead National Recreation Area and the University of Nevada, Las Vegas.

Chapter 2

A Systematic Review of Species Performance and Treatment Effectiveness for Revegetation in the Mojave Desert, USA

Scott R. Abella**[*1] and Alice C. Newton[2]

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[2] National Park Service, Lake Mead National Recreation Area, 601 Nevada Way, Boulder City, NV 89005, U.S.A.

Abstract

Land managers need ecologically and cost-effective strategies for revegetating arid lands, such as the Mojave Desert in the southwestern United States. Many disturbances – failed agricultural attempts, grazing by exotic herbivores (e.g., burros, cattle), creating roads, land clearing for military or mining activities, off-road vehicle use, and wildfires fueled by exotic grasses – have modified or eradicated native vegetation. Natural revegetation often is slow, or consists of exotic species that do not meet management objectives. As a result, active revegetation using native species may be required to accomplish ecological and utilitarian objectives, such as enhancing native plant communities, curtailing fugitive dust that poses a human health hazard, or establishing non-flammable vegetation for reducing wildfires. We evaluated the following questions by systematically reviewing published revegetation studies in the Mojave Desert: (1) Which species have been most commonly and effectively planted or seeded? (2) Which treatments have increased plant establishment? (3) What are the relative performances of planting and seeding, and are these species specific? Fifteen planting studies assessed a total of 41 species, 33 of them shrubs. None of the nine species planted in ≥ 3 studies avoided a complete failure (0% survival) in one or more treatments in one or more studies, but several species (e.g., *Larrea tridentata*, *Atriplex* spp.) consistently exhibited high (> 50%) survival. Fencing, shelters, and irrigation increased survival of some species, but these treatments require cost/benefit analyses. Though seeding frequently has been discouraged relative to planting, seeding success is species and situational specific.

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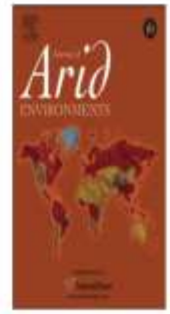

A hierarchical analysis of vegetation on a Mojave Desert landscape, USA

S.R. Abella[a,*], K.A. Prengaman[a], T.M. Embrey[a], S.M. Schmid[a], A.C. Newton[b], D.J. Merkler[c]

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This study was supported by a cooperative agreement between Lake Mead National Recreation Area and the University of Nevada, Las Vegas.

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A B S T R A C T

To examine four elements of the hierarchical structure of desert communities, we analyzed plant species composition and 13 environmental variables at 126 sites within a 755 000-ha Mojave Desert landscape, southwestern USA. By a coarse, six-group level (out of 17 groups) in cluster analysis, four generalized community types emerged: widespread, low-elevation communities with *Larrea tridentata* or *Ambrosia dumosa*; communities on unique soils (e.g., gypsum) indicated by *Atriplex* spp.; higher elevation/rugged terrain communities including *Coleogyne ramosissima*; and disturbance-associated communities such as *Bebbia juncea-Hymenoclea salsola*. Based on indicator species analysis (ISA), there was no clear level of the community classification that optimized discriminating among communities, because each of four measures of ISA peaked at different hierarchical levels. Three general types of indicator species were identified based on whether their value for discriminating among communities peaked at coarse (e.g., *L. tridentata*), intermediate (*Atriplex hymenelytra*), or fine (*Krameria grayi*) levels of the community hierarchy. Environmental variables differed in their relationships to the hierarchy, with some (e.g., pH) not differing among communities at any level and others, such as rooting depth, differing among communities at multiple levels. Hierarchical analytical techniques can help identify structural patterns within arid land plant communities, species distributions, and vegetation–environment relationships.

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION INTERNATIONAL

RESEARCH ARTICLE

Identifying Native Vegetation for Reducing Exotic Species during the Restoration of Desert Ecosystems

Scott R. Abella,[1,2] Donovan J. Craig,[1] Stanley D. Smith,[3] and Alice C. Newton[4]

Abstract

There is currently much interest in restoration ecology in identifying native vegetation that can decrease the invasibility by exotic species of environments undergoing restoration. However, uncertainty remains about restoration's ability to limit exotic species, particularly in deserts where facilitative interactions between plants are prevalent. Using candidate native species for restoration in the Mojave Desert of the southwestern U.S.A., we experimentally assembled a range of plant communities from early successional forbs to late-successional shrubs and assessed which vegetation types reduced the establishment of the priority invasive annuals *Bromus rubens* (red brome) and *Schismus* spp. (Mediterranean grass) in control and N-enriched soils. Compared to early successional grass and shrub and late-successional shrub communities, an early forb community best resisted invasion, reducing exotic species biomass by 88% (N added) and 97% (no N added) relative to controls (no native plants). In native species monocultures, *Sphaeralcea ambigua* (desert globemallow), an early successional forb, was the least invasible, reducing exotic biomass by 91%. However, the least-invaded vegetation types did not reduce soil N or P relative to other vegetation types nor was native plant cover linked to invasibility, suggesting that other traits influenced native-exotic species interactions. This study provides experimental field evidence that native vegetation types exist that may reduce exotic grass establishment in the Mojave Desert, and that these candidates for restoration are not necessarily late-successional communities. More generally, results indicate the importance of careful native species selection when exotic species invasions must be constrained for restoration to be successful.

Key words: *Bromus rubens*, competition, invasion-reducing communities, native-exotic species relationships, nitrogen, restoring resistance, *Schismus*, soil.

Funded by the Joint Fire Science Program through a cooperative agreement between Lake Mead National Recreation Area and the University of Nevada, Las Vegas.

Interest in New Project Opportunities

We are actively interested in continuing existing partnerships and building new partnerships by working with agencies and others in developing new funded projects. We are interested in identifying projects of mutual interest and writing funding proposals, including for sources such as year-end money and other opportunities.

Thank you…….

We thank our current funding partners for their support:

Lake Mead National Recreation Area – Alice Newton

Bureau of Land Management Ely District

Mojave Network of the National Park Service - Nita Tallent-Halsell

Parashant National Monument – Kathleen Harcksen

Saguaro National Park - Dana Backer

U.S Geological Survey / Clark County, Nevada – Lesley DeFalco

We look forward to continuing these partnerships and working with future new partners for mutual benefit.

Annoying the Elephant

By Alice C. Newton, Lake Mead Vegetation Manager

Public land managers must often determine management objectives and implement actions to achieve those objectives, without a clear understanding of environmental conditions or processes, either past or present. We wonder if we have defined the proper goals, and we wonder if our actions will achieve them. We know these decisions can have both short- and long-term consequences that we cannot imagine today, and hope that even if we don't get it exactly right, at least we don't get it horribly wrong. Researchers help us with these decisions by investigating processes and conditions, and exploring the possible implications of one action or another. But often this science delivers conflicting or inconclusive results and provides confusing information.

Sometimes I feel like a participant in the old story about three blind men describing an elephant. One feels the trunk and declares, "An elephant is like a strong and flexible hose!" Another wraps his arms around a leg and states "No, an elephant is tall and robust like a tree!" The third grabs the tail and shouts, "You're both wrong, an elephant is like a thin, furry rope!" Then all three throw down their canes, declare each others' methods invalid and data suspect, and get into a fist fight. The land manager wonders how all this is supposed to help her achieve her elephant management objectives, and if all this fuss is doing nothing but simply annoying the elephant.

I feel fortunate that I work for a federal agency with a relatively clear and well-defined mission, fairly unaltered for almost 100 years by congressional meddling or presidential ambition. In fact, most congressional action has only served to strengthen the mission, not diminish or weaken it. There have been attempts over those 100 years, but that's another story.)

The essence of the National Park Service mission was stated this way: "[The National Park Service] shall promote and regulate the use of the Federal areas known as national parks, monuments and reservations… which purpose is to conserve the scenery and natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as to leave them unimpaired for the enjoyment of future generations."

This mouthful of a sentence is a pretty tall order. We must provide for the enjoyment of our parks, *and* leave them "unimpaired" for a very, very long time. Early park management concepts focused primarily on making sure they were not despoiled, plundered or pillaged by logging, mining, and other economic interests. Park landscapes were viewed as majestic and unchanging as long as the human element was removed or carefully controlled. To this end, native peoples were removed from designated park lands. Our collective American ideals of "pristine nature" and "wilderness" were being formed around this time, and these ideals considered mankind, native or otherwise, as having no role in nature's creation. For most places, and with some exceptions, management actions sought to keep the parks as we found them, believed to be their natural, steady state.

The practice of ecological restoration began to emerge as a management tool in response to human disturbance in the "static" and "pristine" landscapes in our parks. Wildfires (then wildfire suppression), predator control efforts, invasive plants and animals, off-road vehicle disturbances and more, were considered disruptions that must be mitigated so that the park can be returned to its "natural" state. To do this, the manager had to establish the reference or baseline to determine specific goals to be achieved by restoration activities. Sounds simple enough, and for a small discrete disturbance, say a logging road, it is relatively easy to find an intact reference site to work towards. But when one is dealing with larger ecosystems with many components and processes degraded or missing, that reference determination becomes much more difficult.

For many years the reference or baseline for ecosystem-wide restoration has been considered the "pre-Columbian" or "pre-settlement" state, i.e., before the white man came and messed everything up. However, with passing time we realized that our landscapes are not unchanging or static; not only in the long-term (Pleistocene to Holocene for example), but in the short term as well. Natural (not human-

See Elephant cont. on next page

Elephant cont. from page 7

caused) climate change is so common across centuries that choosing a particular point in time as a baseline may be an arbitrary decision at best. We are also beginning to recognize that early Americans managed and changed their landscapes to a very high degree. In fact, many of the landscapes that National Park Service manages as "pristine" and "natural" were shaped and maintained over millennia by the very people we drove from the land!

In just a few years, the National Park Service will enter its second century of managing "America's Great Places." Climate change is throwing park managers a curve-ball not even imagined when the parks were created so long ago. We have many challenges ahead of us; we know that maintaining the ecological landscape *status quo* will not be practical, but we don't have a clear idea of what the "new normal" will be either. Will we plant Joshua trees and redwoods so those parks will retain their name-sakes? If we do, won't we be then just flat-hatted gardeners? Do we stand back and let nature (or evolution) take its course? Or do we become the agents of evolution, and guide the future development of these areas? Ironically, we may eventually come full circle and begin intensive human management of "natural" landscapes, once again, in order to achieve a particular set of objectives.

One thing is certain: we cannot even begin to make intelligent management decisions without understanding the elephant. We cannot rely on a limited and/or short-term set of observations to make choices with long-term impacts. We must continue to study the elephant; how it moves, why it moves, what it eats, what kind of creatures live on its skin and dung. We can then answer the question, "Shall we move the elephant, or build a barn over it, or leave the elephant alone?" But whatever we do, we must stop annoying it.

Alice C. Newton has been the vegetation manager at Lake Mead NRA for seven years. She grew up in Southern Nevada and ditched high school at Lake Mead. She likes metaphors with elephants.

Save the Date

The Desert Tortoise Council
Thirty-Seventh Annual Meeting and Symposium Spring 2012

Desert Tortoise Council 37th Annual Symposium
February 17 to February 19, 2012
Sam's Town, Las Vegas, Nevada

Scott Abella will be presenting "Potential shifts in Mojave Desert plant communities in a changing climate." Last year, Scott Abella was presented with the Desert Tortoise Council's Robert C. Stebbins Research Award, at the 36th Annual Desert Tortoise Council Symposium.

More Save the Dates

Southwest Fire Ecology Conference

Fire Landscapes, Wildfire, and People: Building Alliances for Restoring Ecosystem Resilience

Feb. 27-March 1, 2012 - Santa Fe, New Mexico

The **Association for Fire Ecology (AFE),** in association with **Humboldt State University** and the **Southwest Fire Science Consortium** announce the **Southwest Fire Ecology Conference** in Santa Fe, New Mexico.

This conference will engage researchers, decision makers, and practitioners across disciplines in friendly roundtable discussions on key issues, informed by scientific and practitioner talks and panel debates. For more information please visit: http://www.humboldt.edu/swfire/

NWRA 2012 Lake Mead Symposium

March 5-8, 2012 - Las Vegas, Nevada

The 2012 NWRA Annual Conference Week has been scheduled for March 5 - 8, 2012, at the Tuscany Hotel in Las Vegas, Nevada. This week will also be the **Lake Mead Symposium**! This year, the opening Keynote Address on March 7th will be presented by **Nevada Governor Brian Sandoval**; Wednesday's Luncheon Keynote Speaker will be **Patricia Mulroy**, General Manager of the Southern Nevada Water Authority.

2012 Lake Mead Symposium Program: for additional information please visit their website, www.nvwra.org or feel free to contact Tina Triplett at 775-473-5473 or creativerno@charter.net for more information.

Kenneth Chittick (UNLV student), E. Cayenne Engel and Scott Abella will have a Poster presentation:

Plant succession and dynamics of soil properties along the Lake Mead shoreline

Kenneth Chittick, E. Cayenne Engel and Scott Abella will present an Oral presentation during the Riparian and Shoreline Resources session:

Plant succession and native plant species reestablishment along the newly exposed shoreline of Lake Mead

Scott Abella will present an oral presentation during the Riparian and Shoreline Resources session:

A landscape-scale assessment of mesquite and acacia woodlands of springs, washes, and shoreline along Lake Mead

Abstracts of the presentations follow on the next 2 pages - - -

Plant succession and dynamics of soil properties along the Lake Mead shoreline

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Abstract

The receding water level at Lake Mead has exposed large areas of land that were formerly submerged, resulting in new soil surfaces potentially available for plant colonization. It is unclear, however, how these soils may have changed during the period of inundation or to what extent the soils may be able to support vegetation. Moreover, plant colonization in this case would be primary succession, which is not well understood in desert ecosystems. We studied how soil properties, native plant community establishment, and invasive species dynamics vary with time since soil exposure. At Stewarts Point, Overton Beach, and Boulder Beach along Lake Mead, we established 150 sampling plots. The plots were established on 10 linear transects at each location, with five plots on each transect established at different elevations coinciding with a known time since exposure, with undisturbed (never submerged) control sites. Soil properties and plant communities were compared among different elevations and with the control plots to estimate soil differences and plant succession as a function of time since exposure. Results can help inform theory of primary succession in arid lands and have important practical implications for evaluating if soil properties might limit plant colonization of the exposed shoreline and whether natural plant colonization meets National Park Service management goals.

Plant succession and native plant species reestablishment along the newly exposed shoreline of Lake Mead

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Abstract

Water levels have been decreasing overall in Lake Mead since the peak water level in 1998. This receding water level has exposed large areas of soil surfaces that now may have unique management needs. The prior submersion may alter soil characteristics such as through siltation and salinization. The objective of this study was to assess how soil conditions might influence primary succession around

Lake Mead. This study was conducted by establishing 150 plots around Lake Mead at Stewart's Point, Overton Beach, and Boulder Beach. The plots were established on 10 linear transects at each location, with five plots on each transect at different elevations coinciding with a known year the plot was submerged. A control plot, which was never submerged, also was included. We have collected data on plant species composition along the different aged surfaces, the establishment of invasive species, the relationship between vegetation and soil properties, and tamarisk (*Tamarix* spp.) density and cover. Field data suggest that some native plants are slowly reestablishing, but composition still strongly differs from that of control sites after 12 years since exposure. Tamarisk density and cover decrease with time since submersion. We also are conducting a restoration experiment by planting perennial plant species dominant in adjacent never-submerged sites to evaluate which native species are best at reestablishing on the newly exposed shoreline.

A landscape-scale assessment of mesquite and acacia woodlands of springs, washes, and shoreline along Lake Mead

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Abstract

Woodlands dominated by mesquite and acacia trees in arid lands represent critical habitat for many wildfire species and provide important services to humans such as providing recreational opportunities and plant cover along watercourses. However, the extent of these important communities is believed to have declined in southern Nevada together with the health of the woodlands within protected areas. The objective of our study was to identify relationships of mesquite/acacia woodlands with environmental factors (e.g., soils), evaluate community types, and assess measures of woodland health (e.g., tree regeneration) and wildlife habitat quality (e.g., mistletoe infections as avian food sources). We sampled 50 plots within mesquite and acacia communities of springs, washes, and the Lake Mead shoreline within Lake Mead National Recreation Area of southern Nevada. Within each plot, we measured plant communities, assessed soils, and inventoried tree characteristics. Analyses are designed to help the National Park Service formulate management strategies for conserving woodlands around Lake Mead.

Get to Know Some of Our UNLV Students

Lindsay Chiquoine, Research Assistant/Graduate Assistant

Since 2009 I have been a full-time research assistant at UNLV and in fall 2010 I entered into the Environmental Science graduate program at UNLV. Currently, I am working on an assessment of the influence of the non-native invasive buffelgrass on the soil and vegetation ecology in Saguaro National Park, an outplanting project in Lake Mead National Recreation Area (LMNRA) to assess use of native plants for restoration, the potential for stimulating population growth of the rare plant, Las Vegas bearpoppy (*Arctomecon californica*), and assessing the seed ecology of the non-native *Malcolmia africana* for LMNRA. My thesis work concentrates on the assisted rehabilitation of disturbed biological soil crusts in gypsum soils. I have a BA in Environmental Humanities and a minor in chemistry from Northern Arizona University (NAU). Over the past twelve years I have worked for a private consulting firm on petrochemical contamination assessment, the Ecological Restoration Institute and the Watershed Research and Education Program out of NAU, Grand Canyon Trust as a field botanist and research assistant, and the USGS in Olympic National Park as a wildlife technician.

Ben Jurand, Graduate Student/Research Assistant

I'm a second year graduate student in the UNLV Environmental Science program, pursuing my love of ecology and the dynamics of the natural world. The focus of my master's thesis explores characteristics of the invasive annual grass red brome. I am conducting several seed bank studies (both field and lab) exploring questions regarding seed longevity and seed bank composition over time. I am hoping to continue working in the lab and the field on ecological surveys and studies after graduation.

Miki Horiai, Undergraduate Student/Research Volunteer

I am a senior at UNLV studying for a degree in Bachelor of Science in Environmental Studies, with a minor in Solar Renewable Energy. My first passion is dance and I have been privileged to be a part of the UNLV dance team Rebel Girls in my second and third year in college. My goal is to have a meaningful career that is not a typical desk job, maybe out in the field researching or helping communicate the importance of our environment to the public, and I feel this degree should help me get there. Right now I am just a full-time student trying to finish up school and volunteer on the side to get more experience. I am currently interning for the Small Business Development Center at UNLV, learning the business aspect of sustainability. I do not have any specific projects started right now but I am open to learning any hands on work from volunteering for things such as restoration projects for Dr. Abella.

Pam Sinanian, Undergraduate Student/Research Assistant

I have a BS in Computer Science and will be graduating in the spring with a BS in Environmental Studies and a minor in Biology. I am interested in working in restoration or conservation ecology after graduating. I have been helping on several projects including the Saguaro National Park seedbank study and the effects of herbicides on *Malcolmia*. I also received the EPSCOR scholarship to work on the Spring Mountain forest structure project.

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Sylvia Tran, Undergraduate Student/Research Assistant

This is my second year studying environmental science. I am working on the shoreline project with Cayenne Engel at Lake Mead, and also the mesquite project at Lake Mead with Ken Chittick. I enjoy backpacking, hiking all day in the Sierras and reading a great adventure book. I am currently working on seeing 24 more states, as being ‘on the road' is my favorite thing to do.

UNLV Student Wins NSF EPSCoR Award

Pam Sinanian, UNLV Undergraduate Student and Research Assistant, has been awarded a scholarship from the 2011-2012 National Science Foundation’s *Experimental Program to Stimulate Competitive Research (NSF EPSCoR) Research Infrastructure Improvement (RII) Award:*
“Nevada Infrastructure for Climate Change Science, Education and Outreach”
The award comes with a $3900 scholarship to help cover research expenses. **Congratulations Pam!**

Using Dendrochronology in the Spring Mountains to Assess Forest Change

By Pam Sinanian, UNLV Undergraduate Student

The Spring Mountains are an isolated, unique mountain range in southern Nevada. They are topographically dynamic with steep slopes and narrow canyons having rapid ecosystem transitions and multiple ecosystems over short distances. Since the Euro-American influence of the past 120 to 160 years, it is hypothesized that the ecosystems of the Spring Mountains have changed due to land management practices (e.g., fire suppression and timber harvests), climate change, and an increase in pests and disease (e.g. dwarf mistletoe and bark beetles) (Entrix 2008). This project focuses on understanding the dynamics of the current and past forest structure using dendrochronology.

In May to September 2009, 30 0.25-ha permanent overstory monitoring plots were established in the Spring Mountains using standard forest measurement methods. All live and dead trees were mapped, diameters were measured for all trees taller than 1.37 m, and seedlings, trees shorter than 1.37 m, were tallied per species. Cores were taken at 40 cm from the ground in each plot from 10% to 15% of all live trees per species per plot.

Dendrochronological methods are being applied to dating the tree cores. Each core has been mounted on a core mount and initially sanded. When the core is being read it is sanded with very fine sand paper to help the rings become more visible. The core is then examined under a dissecting scope. The core is read from the most current year, the bark end, to the pith. During the reading of a core decade (single dot), half century (two dots), and century years (three dots) are marked on the core. Utilizing an understanding of tree growth and ring formation, a pattern of marker years, years with smaller rings, is documented for each core. A marker year is a year with less growth than surrounding years and is due to either drought or an unknown cause, such as a disturbance. If the drought was extreme there may be no visible ring for that year and is referred to as missing. Figure 1 is a white fir (*Abies concolor*) core from the nloop1 plot near the North Loop Trail. A marker year exists where the seven (2007) is written on the core and a missing ring is indicated where the circle is drawn (2002).

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The pattern of marker years from other cores is useful in determining when missing rings occur. Figure 2 shows an example of the differences between three cores, the white fir from figure 1 and two ponderosa pine (*Pinus ponderosa)* cores. False rings also occur. This is when a line of darker cells occurred within a ring, giving the appearance of a ring, without the change in cells of late wood.

The process of reading a tree core establishes the year of germination. Once the years of germination has been determined from the cores of a species in a plot, a correlation between the age and diameter can be used to extrapolate the ages of the other trees of that species in that plot. Ultimately a density map for each plot will be created for 2009, 1900, 1850, and other years of interest.

Another aspect of analyzing the tree cores is to establish a chronology for the Spring Mountains. By tracking the emerging patterns of marker years together with weather data obtained from NOAA a chronology is being developed. The patterns can be used to determine when drought years occurred before the recording of weather data, thus providing a climate history. The results will help provide current and historical views of the forest system and may be useful for helping to formulate ecologically based forest management in the Spring Mountains.

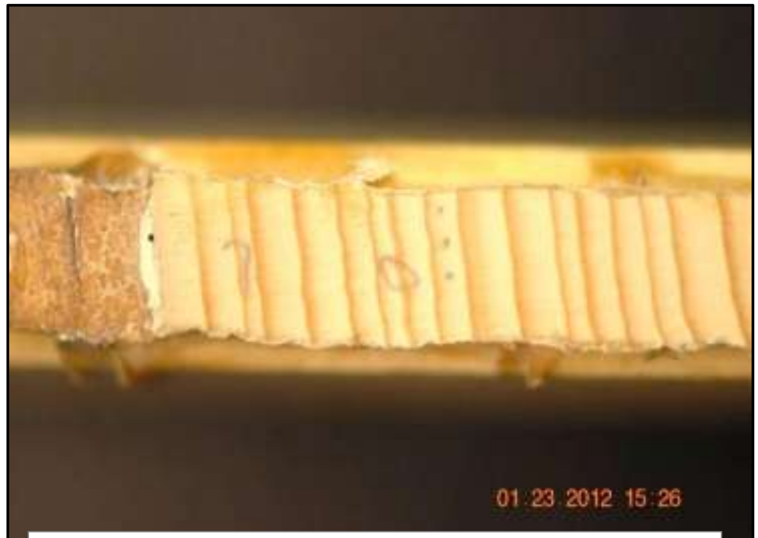

Fig. 1. White fir core from the nloop1 plot near the North Loop Trail off of Deer Creek Road.

Fig. 2. Examples of three mounted tree cores from the Spring Mountains. The bottom core is a white fir core from nloop1 plot, center core is ponderosa pine from nloop1 plot, and the top core is a ponderosa pine from w2 plot near Whispering Springs.

White fir and ponderosa pine trees, both mature and immature, in the Spring Mountains National Recreation Area of southern Nevada

Review of 2011 - 2012 Publications and In Press Articles

***bold denotes agency co-authors**

In press:

Abella, S.R., D.J. Craig, S.D. Smith, and **A.C. Newton**. 2012. Identifying native vegetation for reducing exotic species during the restoration of desert ecosystems. Restoration Ecology (in press).

Abella, S.R., T.M. Embrey, S.M. Schmid, and K.A. Prengaman. 2012. Biophysical correlates with the distribution of the invasive annual red brome (*Bromus rubens*) on a Mojave Desert landscape. Invasive Plant Science and Management (in press).

Abella, S.R., **J.C. Hurja, D.J. Merkler**, C.W. Denton, and D.G. Brewer. 2012. Overstory-understory relationships along forest type and environmental gradients in the Spring Mountains of southern Nevada, USA. Folia Geobotanica (in press).

Abella, S.R. Great Basin montane forests. Biomes and ecosystems (upcoming).

Abella, S.R., and E.C. Engel. Riparian vegetation. Lake Mead science synthesis. USGS Circular. (upcoming).

Engel, E.C., and S.R. Abella. Littoral vegetation. Lake Mead science synthesis. USGS Circular. (upcoming).

Published:

Abella, S.R., K.A. Prengaman, T.M. Embrey, S.M. Schmid, **A.C. Newton,** and **D.J. Merkler**. 2012. A hierarchical analysis of vegetation on a Mojave Desert landscape, USA. Journal of Arid Environments 78:135-143.

Suazo, A.A., J.E. Spencer, E.C. Engel, and S.R. Abella. 2012. Responses of native and non-native Mojave Desert winter annuals to soil disturbance and water additions. Biological Invasions 14:215-227.

Abella, S.R. 2011. How well do U.S. Forest Service terrestrial ecosystem surveys correspond with measured vegetation properties? Silva Fennica 45:611-632.

Engel, E.C., and S.R. Abella. 2011. Vegetation recovery in a desert landscape after wildfires: influences of community type, time since fire and contingency effects. Journal of Applied Ecology 48:1401-1410.

Abella, S.R., A.C. Lee, and A.A. Suazo. 2011. Effects of burial depth and substrate on the emergence of *Bromus rubens* and *Brassica tournefortii*. Bulletin of the Southern California Academy of Sciences 110:17-24.

Abella, S.R., D.J. Craig, L.P. Chiquoine, K.A. Prengaman, S.M. Schmid, and T.M. Embrey. 2011. Relationships of native desert plants with red brome (*Bromus rubens*): toward identifying invasion-reducing species. Invasive Plant Science and Management 4:115-124.

Springer, J.D., S.R. Abella, and T.R. DeKoker. 2011. A survey of monitoring and management activities for conserving rare plants in national parks and protected areas, Arizona and Nevada, USA. Pp. 307-317 i*n* Daniels, J.A. (ed.). Advances in environmental research, volume 8. Nova Science Publishers, Inc., Hauppauge, NY.

PDFs available from http://faculty.unlv.edu/abellas2/

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