Summer 2011

Mojave Applied Ecology Notes Summer 2011

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Mojave Applied Ecology Notes

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INSIDE THIS ISSUE:

"The direction of change….is the opposite of what would be expected for forest adaptation to the warmer, drier, more fire-prone conditions projected for the next century in the southwestern USA."

Article in press on overstory-understory changes in the Spring Mountains of southern Nevada

By Scott Abella

Working with soil scientist Jim Hurja of the Humboldt-Toiyabe National Forest, Doug Merkler of the NRCS, and collaborators with Northern Arizona University's Ecological Restoration Institute, we analyzed a data set supplied by the U.S. Forest Service on the dominance of overstory and understory trees across a network of plots in the Spring Mountains of southern Nevada.

The data revealed valuable insights about the long-term shifts in overstory-understory relationships that already have occurred in the Spring Mountains during a period of fire exclusion and that may occur in the face of climate change with or without fire. An article from this work is in press with the international journal *Folia Geobotanica*:

Abella, S.R., J.C. Hurja, D.J. Merkler, C.W. Denton, and D.G. Brewer. 2011. **Overstory-understory relationships along forest type and environmental gradients in the Spring Mountains of southern Nevada, USA. Folia Geobotanica (in press).**

Abstract: Isolated forested mountains in deserts have numerous ecological and societal values, but land management practices (e.g., fire-regime alteration) and climate change can affect forest composition. We analyzed tree overstory-understory relationships on 123 sites in the Spring Mountains within the Mojave Desert near Las Vegas, Nevada, USA to assess three hypotheses. We hypothesized that: the tree species comprising understories are less tolerant of fire than species in overstories, reflecting land management practices of fire exclusion; mid-elevation forests have the lowest overstory:understory similarity since this zone could have maximum species mixing; and overstory:understory similarity is correlated with environmental gradients (consisting of 14 topographic and soil variables). We found that *Pinus monophylla* comprised greater relative canopy cover in understories of juniper

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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.

Catastrophic fire possible on Mount Charleston

A feature on Mt. Charleston (southern Nevada) fire ecology and management aired on KLAS channel 8 Las Vegas on Monday, June 13, 2011. Scott Abella and UNLV students Sylvia Tran and Ken Chittick were interviewed on site. A link to this feature is available from:

http://www.8newsnow.com/story/14900025/fire

Excerpt from the newscast:

The scars from last summer's Cathedral fire can still be seen at Mount Charleston. UNLV scientists believe each year brings higher chances for a catastrophic fire in that community.

UNLV students measure the diameter of trees at a research plot. Overseeing them is ecologist Scott Abella.

Stumps show where two large trees grew 100 years ago. The woods are now filled with trees which may be too much of a good thing.

"[We are seeing a] Major increase in the density of the forest, so a lot more trees today than a hundred years ago, so a lot more fuel. When we do have a fire today, it can pretty much take everything out," said Dr. Scott Abella, UNLV ecologist.

Abella's team hikes to the starting point of last year's Cathedral fire. Only the underbrush should have burned, instead, tall, dead trees remain.

"Because we've been so good at actually stopping these fires, we've had this tremendous fuel buildup," he said.

UNLV's scientific data show wildfire once burned frequently in the understory. Without that, Abella says it's time to cut down some of these smaller trees to establish a clumped tree pattern mimicking natural forest patterns that also is resistant to catastrophic fire.

Using a terrestrial ecosystem survey to estimate the historical density of ponderosa pine trees

By Scott Abella, Charles Denton, David Brewer, Wayne Robbie, Rory Steinke, and W. Wallace Covington

A U.S. Forest Service, Rocky Mountain Research Station research note was recently published which may be of interest to some of you. This note reports a novel use of the Forest Service's region 3 ecosystem survey for estimating tree densities across the landscape. The effort was a collaboration among UNLV, the Forest Service, and the Northern Arizona University Ecological Restoration Institute.

Abstract: Maps of historical tree densities for project areas and landscapes may be useful for a variety of management purposes such as determining site capabilities and planning forest thinning treatments. We used the U.S. Forest Service Region 3 terrestrial ecosystem survey in a novel way to determine if the ecosystem classification is a useful a guide for estimating historical (1880) ponderosa pine (Pinus ponderosa) tree densities on a northern Arizona landscape. Based on sampling 53 sites spanning 9 ecosystem types, we grouped the types into low and high density categories. Tree density was less than 24/ acre on 91 percent (21 of 23) of sites in cinder, dry limestone, and clay basalt ecosystems. In contrast, 70 percent (21 of 30) of sites that contained densities exceeding 24 trees/acre were in basalt, mixed igneous, and moist limestone ecosystems.

A link to this publication is online:
http://www.treesearch.fs.fed.us/pubs/37962

Examples of stumps (foreground, and to the left of the large tree), indicative of historical tree locations, and a live tree of pre-settlement origin (left-center). Photo by S.R. Abella in 2009, Forest Road 3E, Coconino National Forest, northern Arizona (UTM:440,918 m E, 3,885,850 m N, North American Datum 1983).

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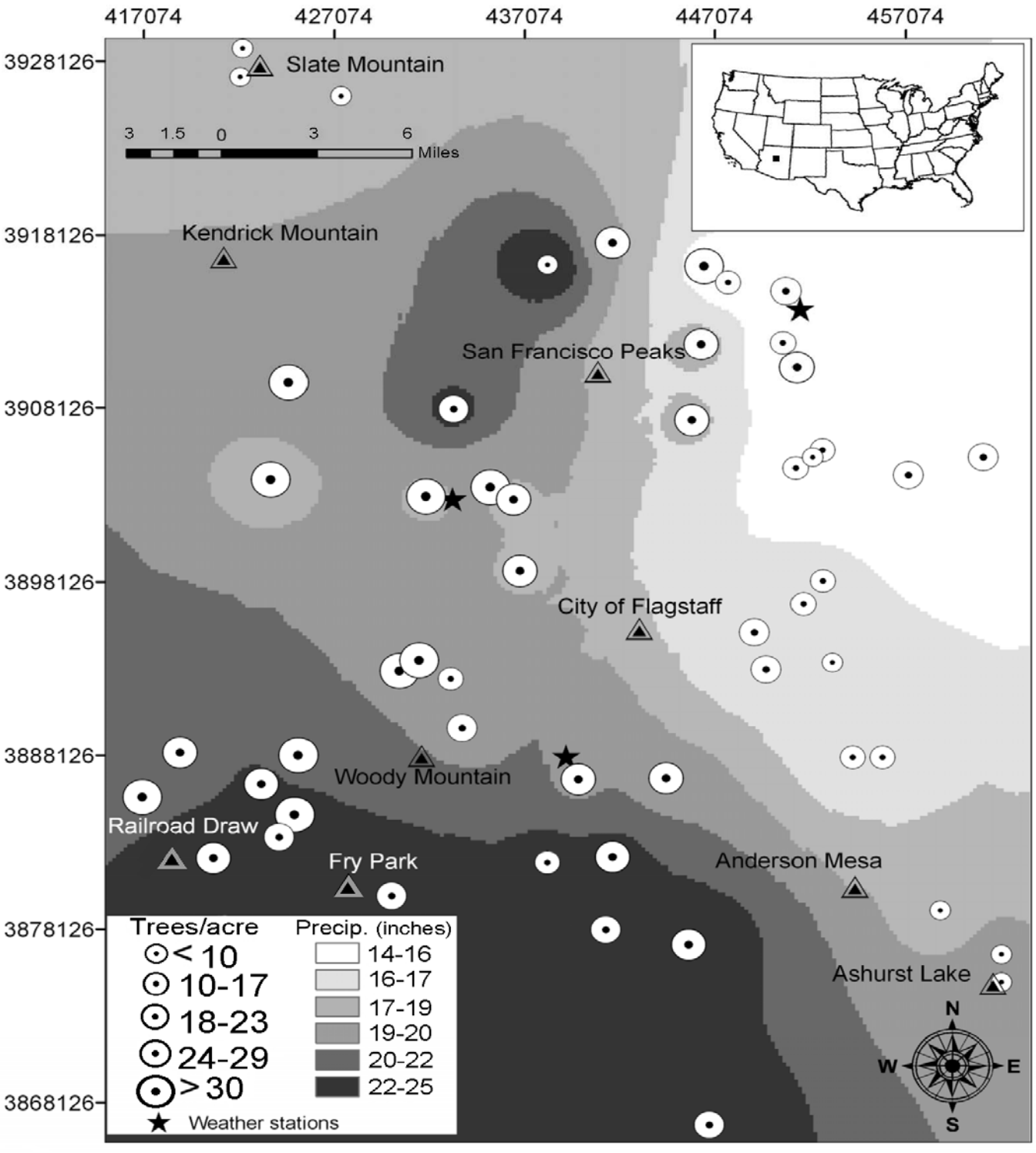
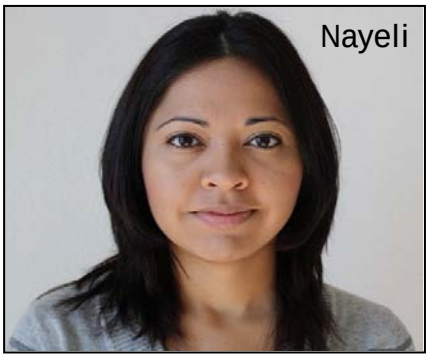


Location of 53 sample sites on a northern Arizona landscape. Sizes of Points for sites are scaled to reflect ponderosa pine tree density reconstructed for 1880 forests. Shading depicts gradients in annual precipitation estimated from sample site values using the PRISM model (Daly and others 2008). Coordinates are UTM, North American Datum 1983.

Student research with the AERG Lab

Our lab actively has engaging research opportunities for undergraduate and graduate students who are motivated to build project experience and resumes and make positive contributions to advancing environmental management in Las Vegas and the Southwest. This summer, to advance those goals as well as to provide course credit (to help students graduate) given the budget-related uncertainty of the Environmental Science program, we have been offering a variety of undergraduate and graduate research course credits. Two of the students, undergraduates Sylvia Tran and Ken Chittick, were introduced in our last issue, and are continuing their work on a mesquite habitat restoration project and other projects. Several other students and volunteers are working on an array of other projects. Nayeli Carvajal, a graduate student, supplied a bio for this issue. Nayeli is working on a project in the Spring Mountains of southern Nevada seeking to understand the effects of chips and slash on rare plant dynamics (which are important variables for several endangered butterfly species) during forest thinning.

Nayeli Carvajal completed a Bachelor's degree in International Business from CESUES University in Sonora, Mexico and she will be obtaining her M.S in Environmental Policy and Management from UNLV this Fall semester. After completion of her Master's degree, she plans to pursue a Ph.D. in Ecology. Nayeli is currently working on a butterfly habitat assessment project in the Spring Mountains. She enjoys spending her free time outdoors and traveling.


Nayeli

Save the dates:

2011 Desert Restoration Workshop

July 13-14, 2011 Hampton Inn - 2710 Lenwood Road - Barstow, CA 92311

Scott Abella, Cayenne Engel, and Lindsay Chiquoine will be speakers at the workshop.

Workshop Goals:

- Provide new information from recent studies relevant to successful restoration projects.
- Challenge participants to carefully plan projects for a changing climate.
- Share knowledge, experience and lessons learned.
- Identify opportunities for future collaboration and knowledge sharing.

Please check www.dmg.gov for updates.

2011 Clark County Multiple Species Habitat Conservation Plan Annual Progress Report Symposium

Wednesday, August 17, 2011 - 8:30 AM – 4:45 PM
Rogers' Auditorium, Desert Research Institute - In the Atomic Test Museum Building
755 East Flamingo Road - Las Vegas, NV 89119

Scott Abella will be speaking at the workshop on desert restoration.

Detailed agenda and presentation times will be placed on their website once available:
http://www.clarkcountynv.gov/Depts/dcp/Pages/Symposium.aspx

Evaluating seeding effectiveness on two fires in Red Rock Canyon National Conservation Area

By E. Cayenne Engel

UNLV researchers have been collaborating with the USGS on a Clark County funded project with the goal of evaluating whether seeding native species after fires can increase the abundance of those target native species. Over the last two years we monitored seedling establishment and community composition within two fires in Red Rock Canyon National Conservation Area, the Goodsprings Fire (burned 2005; 32,000 acres; seeding applied in 2006) and the Bonnie Springs Fire (burned 2007; 400 acres; seeding applied in 2008). Seeds of native species were applied aerially to approximately 2700 acres of the Goodsprings Fire (across six sites on the north end of the fire) and applied by hand to approximately 100 acres of the Bonnie Springs Fire. Monitoring was designed to provide BLM with an overall assessment of the effectiveness of the revegetation seeding treatments on these two fires in terms of whether any of the seeded species became established in greater abundances than natural sources, and if so, which species performed best.

Seeds applied consisted solely of native species. All seeded species in the Goodsprings Fire were perennial. Seeded species included desert needlegrass (*Achnatherum speciosum*), fourwing saltbush (*Atriplex canescens*), blackbrush (*Coleogyne ramosissima*), mormon tea (*Ephedra nevadensis*), California buckwheat (*Eriogonum fasciulatum*), *winterfat (Krascheninnikovia lanata), Antelopebush (Purshia tridentata), and desert globemallow (Sphaeralcea ambigua).* The Bonnie Springs seeding included purple threeawn grass (*Aristida purpurea*), desert marigold (*Baileya multiradiata*), globemallow (*Sphaeralcea ambigua*), cheesebush (*Hymenoclea salsola*), and one annual species, chia (*Salvia columbridae*).

Desert desert globemallow was the only species within the Goodsprings Fire that increased in abundance in seeded plots averaging 26 ± 5 (± SD) individuals per 100 m^2 plot in seeded plots in contrast with 17 ± 4 seedlings per plot in control sites. However, at the Bonnie Springs sites desert marigold was the only species to show an increase with seeding (however, the increase is marginally significant) with 33 ± 16 seedlings per plot in seeded plots and 10 ± 4 in unseeded sites. Fourwing saltbush and California buckwheat showed trends of increased abundance within seeded plots in the Goodsprings Fire. However, seedlings of these species were much less evenly distributed across the study sites than the seemingly ubiquitous desert globemallow and desert marigold. As noted in other seeding studies in desert ecosystems, the efficacy of the treatments is strongly determined by environmental conditions after the seeds are distributed, and successful germination and survival of all species used is unlikely. However, if diverse species mixes are applied, there may be some "winners" within the system. We hope to continue monitoring and conducting experimental treatments to find out which species have the best chances of success across systems and under varying environmental conditions.

Burned hillside with abundant desert globemallow in the Goodsprings Fire, spring 2011

An act of kindness that saved my data!

By Sylvia Tran, UNLV student

Last month, after a particularly rough, yet productive day of climbing up and down hills, setting up plots to identify plants, and most importantly collecting data for the Goodsprings Fire project, UNLV Research Associate Cayenne Engel and I were both hot, tired and sweaty. I guess I was a lot more tired than I realized, because I left my clipboard, with valuable plant data attached, on the side of a dirt road behind some bushes on Cottonwood pass about 7 miles from the nearest road.

I was completely oblivious to what I had done until two weeks later when Cayenne handed me my clipboard and told me how my data had found its way back to me.

Someone had come through that area and found my clipboard full of chewed up papers, and that someone traveled all the way to the Las Vegas Interagency Facility (which is at least 30 miles away) and gave it to the fire crew guys. They then gave it to the BLM ecologist Lauren Brown, who then called Dr. Abella, because she knew he was attached to the Goodsprings Fire seeding project. Dr. Abella contacted Cayenne and she drove all the way to the Interagency Facility to retrieve the data. Now I have all my chewed up notes to remind me to always look up, down and around before leaving an area, for anything I may have left behind, especially in an area that is it not easily accessible! I am so happy that whatever it was that was snacking on my papers did not find it too tasty to finish them all off. And I want to say a BIG Thank You to whoever found my clipboard, and was so kind and responsible, as to start the journey of my clipboard of papers back to me.

Fig. 1 (above) and Fig. 2 (below) show several of the clipboard pages with teeth marks.

Graduate Thesis Defense on 30 Years of Change in Desert Vegetation

Ross J. Guida, a UNLV master's student in Environmental Science mentored by Bill Smith and Scott Abella, on July 6, 2011, successfully defended his thesis on modeling changes in the distribution of vegetation in the Newberry Mountains of southern Nevada titled:

Climate and Vegetation Change in the Newberry Mountains, Southern Clark County, Nevada

Ross is using a unique data set collected in 1979 by then UNLV graduate student Jim Holland under the direction of Wes Niles on plots that were remeasured in 2008 by Chris Roberts, another UNLV student. Full plant community data were collected on over 100 sites spanning an elevation gradient from the Colorado River to over 5,000 feet at the top of Spirit Mountain, enabling a unique assessment of 30 years of change with implications for managing vegetation in a changing climate.

Abstract: Few studies have mapped changes in Mojave Desert species' geographic distributions in relation to the most recent period of climate change. I address this gap in the literature by mapping how perennial species distributions have changed in the Newberry Mountains, which are partially located within Lake Mead National Recreation Area, using vegetation surveys from 1979 and 2008. I use the Maxent ecological nichemodel to map species in 1979 and 2008. I analyze changes over the 30-year period using geographic information systems (GIS). Additionally, I use existing climate data to determine how climate has changed in the study area. I find that high elevation species in the Newberries show a general decline in predicted occurrence and a trend of migrating to even higher elevations based mainly on decreasing precipitation between the 1970's and 2000's. Species widely distributed across the study area show little to no change. Since the only model variables that changed are species presence locations, 1970's climate variables, and 2000's climate variables, I conclude that the high elevation species in the Newberry Mountains that are most reliant on precipitation are migrating to even higher elevations in order to adapt to the current climate change.

*Research funded by the National Science Foundation project, *Nevada Infrastructure for Climate Change Science, Education, and Outreach, Policy, Decision Making and Outreach Component*.

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:

Bureau of Land Management, Southern Nevada – Nora Caplette and Kevin Oliver, and Ely District – Karen Prentice

Lake Mead National Recreational Area – Alice Newton

Mojave Network of the National Park Service - Nita Tallent-Halsell and Jeanne Taylor

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.

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(32% relative cover) and pinyon-juniper (78%) forests than it did in overstories of these forests (0% and 53%). Similarly, fire-intolerant *Abies concolor* had 6-fold greater understory than overstory cover in forests with overstories dominated by the fire-tolerant *Pinus ponderosa*. Overstory:understory Sørensen similarity averaged 43-77% among six forest types, and there was little support for the supposition that similarity was lowest in mid-elevation forests. Distributions of individual overstory and understory species more closely corresponded with environmental gradients than did overstory:understory similarity. Results suggest that there is high potential for change in at least two of the six dominant forest types of the Spring Mountains. The direction of change (species of moist, higher elevation sites establishing in understories of drier forests) is the opposite of what would be expected for forest adaptation to the warmer, drier, more fire-prone conditions projected for the next century in the southwestern USA.

Conservation Implications

After observing increases in *Abies* and other moist-affinity species in northern Arizona and southwestern Colorado ponderosa and mixed conifer forests, similar to what this study found in the Spring Mountains, Cocke et al. (2005) and Fulé et al. (2009) noted that the expansion of moist species into drier forests is the opposite of what would be expected for forest adaptability to future climate change scenarios. The Southwest is projected to become warmer, drier, and more susceptible to fire (e.g., due to earlier snow melts and longer fire seasons; Seager et al. 2007). Fulé et al. (2009) also noted that moist-affinity conifer forests such as those dominated by *Abies concolor* can accumulate more fuel, including ladder fuels, and are less fire-resistant than ponderosa forests. Thus, tradeoffs are anticipated if ponderosa forests are replaced by *A. concolor* forests, as overstory-understory relationships suggest.

Examples of sites in the Spring Mountains, southern Nevada, USA: (a) pinyon-juniper forest, (b) ponderosa forest (overstory trees) with an *Abies concolor* understory, (c) ponderosa forest with *Pinus ponderosa* in both the overstory and understory, and (d) bristlecone forest with a sparse understory.

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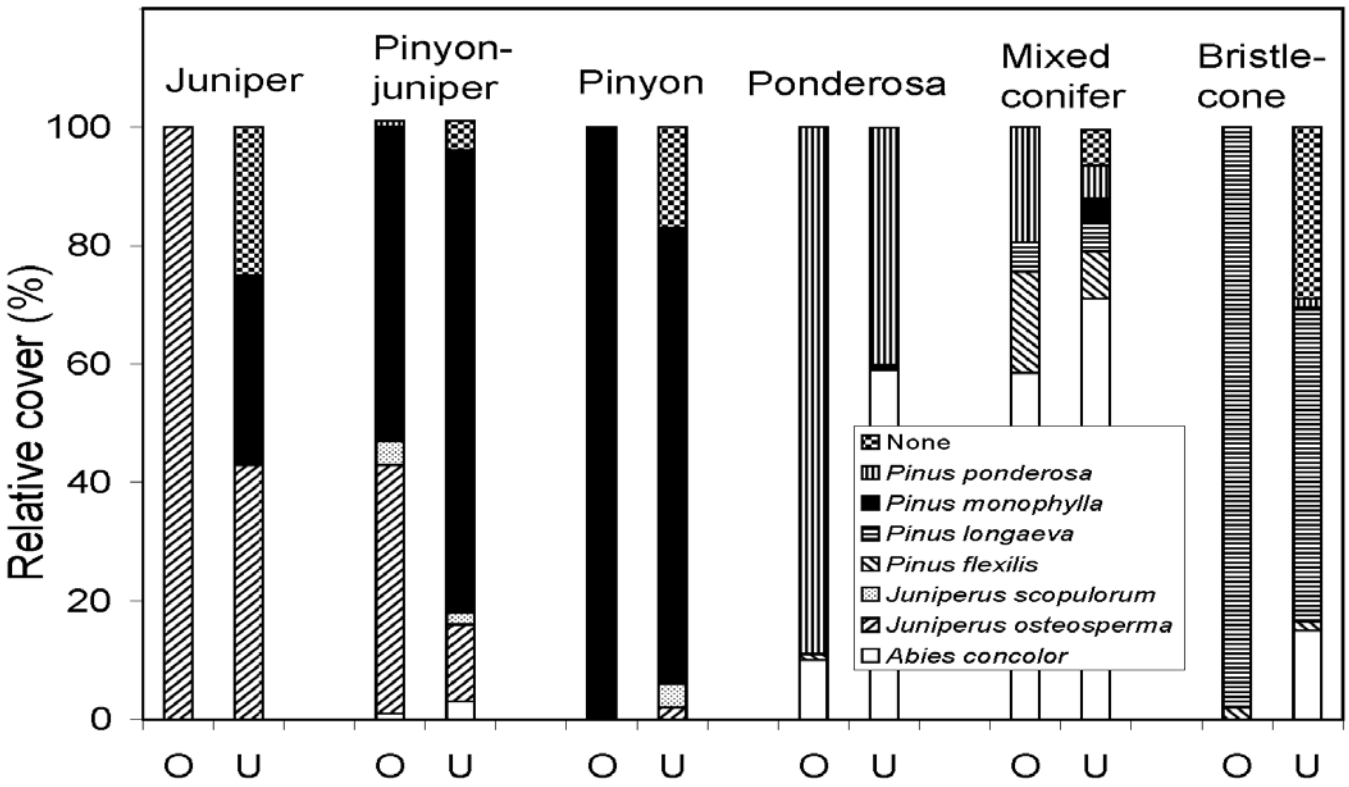
Several approaches could be available for forest management in the Spring Mountains. First, passive management (no action) could be employed. Under this scenario, future forest composition in juniper and ponderosa forests likely depends on the abilities of moist-affinity, fire-intolerant species (*Pinus monophylla* and *Abies concolor*) to attain overstory status in drier forests than their overstory trees presently occupy. Because current overstory species in these two forest types are sparse in understories, there would be a lag time before these trees could attain overstory status even if the species began regenerating now. Passive management may largely maintain the status quo of species composition in pinyon, mixed conifer, and bristlecone forests, assuming that current understories attain overstory status and continue regenerating. Second, active management could be attempted to maintain *Juniperus* spp. and *Pinus ponderosa* in their forest types. Selective thinning of other species, or prescribed or wildland fire use (Fulé and Laughlin 2007), could be attempted to adjust species composition based on overstory-understory relationships. Third, additional management approaches could be tested for their feasibility in helping forests cope with climate change. More drastic activities could include attempting to facilitate establishment of species with warmer and drier affinities on higher and currently moister sites in anticipation of climate change influences (Hulme 2005). The appropriateness and feasibility of these activities are generally considered debatable among ecologists (e.g., Seastedt et al. 2008). Ultimately, a useful framework for selecting management strategies could result from evaluating which possible forests provide the best functions for maintaining the numerous rare species of the Spring Mountains (Niles and Leary 2007), are the least susceptible to unnatural catastrophic fires, and are the most adaptable to climate change.



Relative canopy cover by forest type (top of bars) and overstory (O) and understory (U) strata in the Spring Mountains, southern Nevada, USA.

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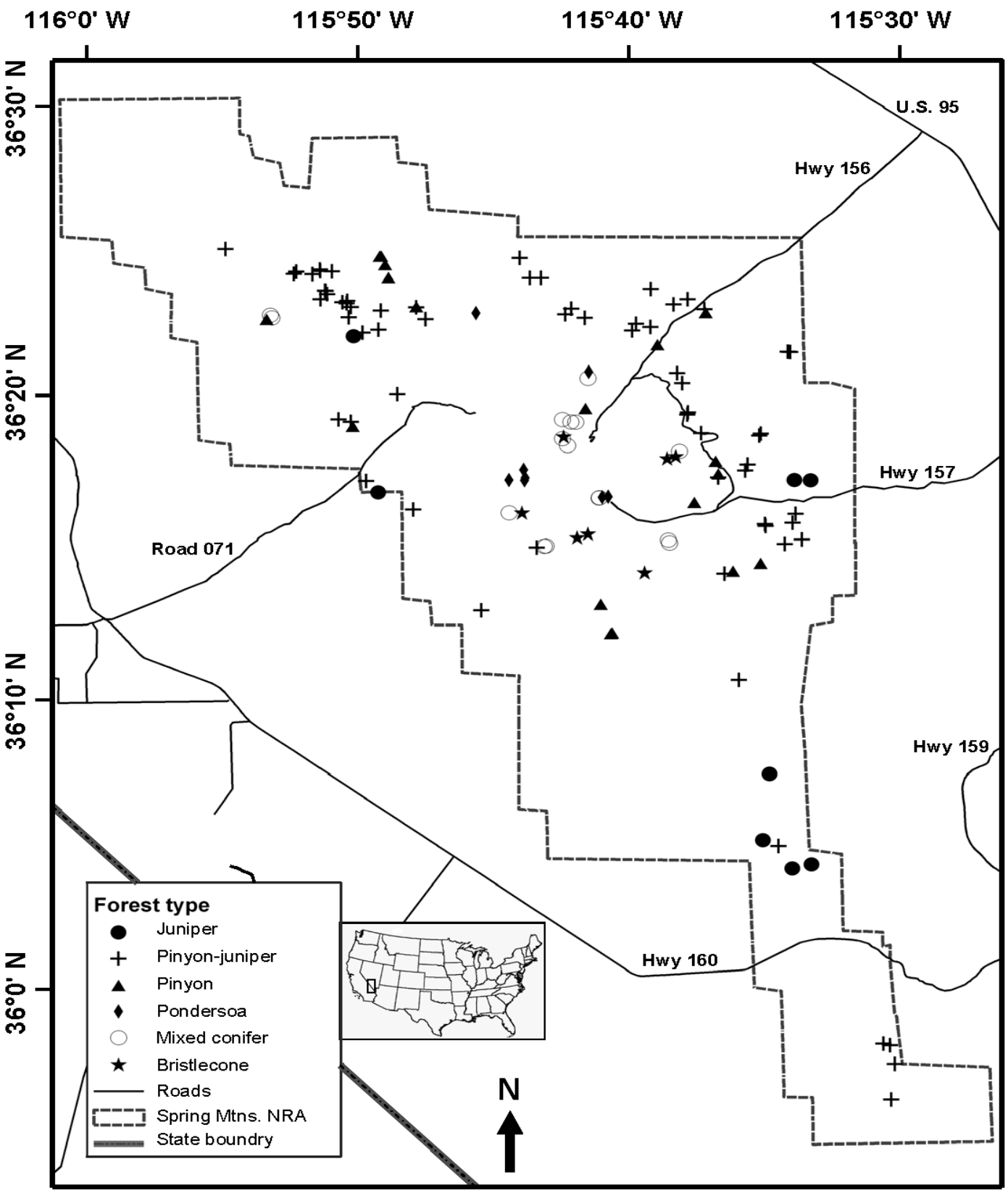

Location of 123 sample sites in the Spring Mountains, southern Nevada, USA.

Review of 2011 publications and in press articles

Recently published:

Abella, S.R., C.W. Denton, D.G. Brewer, W.A. Robbie, R.W. Steinke, and W.W. Covington. 2011. Using a terrestrial ecosystem survey to estimate the historical density of ponderosa pine trees. Res. Note. RMRS-RN-45. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 9 p.

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 in Daniels, J.A. (ed.). Advances in environmental research, volume 8. Nova Science Publishers, Inc., Hauppauge, NY.

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.

In Press:

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 (in press).

Suazo, A.A., J.E. Spencer, E.C. Engel, and S.R. Abella. 2011. Responses of native and non-native Mojave Desert winter annuals to soil disturbance and water additions. Biological Invasions (in press).

Abella, S.R., J.C. Hurja, D.J. Merkler, C.W. Denton, and D.G. Brewer. 2011. Overstory-understory relationships along forest type and environmental gradients in the Spring Mountains of southern Nevada, USA. Folia Geobotanica (in press).

Abella, S.R. 2011. How well do U.S. Forest Service terrestrial ecosystem surveys correspond with measured vegetation properties? Silva Fennica (in press).

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

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