Winter 2008

Mojave Applied Ecology Notes Winter 2008

Scott R. Abella
University of Nevada, Las Vegas, scott.abella@unlv.edu

E. Cayenne Engel
University of Nevada, Las Vegas

Jill E. Craig
University of Nevada, Las Vegas

A NEWSLETTER OF THE UNLV DESERT AND DRYLAND FOREST RESEARCH GROUP

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Opportunities for new collaborative projects

The Research Group is currently working in successful partnerships with Lake Mead National Recreation Area, BLM Las Vegas, Desert National Wildlife Refuge (U.S. Fish and Wildlife Service), Joshua Tree National Park, and in collaboration with the Ecological Restoration Institute, the U.S. Forest Service (Region 3). We are conducting a wide variety of collaborative projects with resource managers:

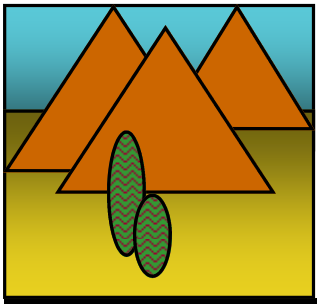
- Establishing a long-term network of monitoring plots along an elevation gradient in the Newberry Mountains at Lake Mead to assist the Park Service in understanding potential effects of climate change on unique park resources;
- Identifying candidate native species for burn revegetation through a nationally competitive Joint Fire Science grant;
- Assessing vegetation change and invasibility of low- and high-elevation springs at Desert National Wildlife Refuge;
- Synthesizing past revegetation data with Joshua Tree National Park to efficiently learn from earlier management trials; and
- Monitoring post-fire plant succession and exotic grass abundance on desert burns with BLM Las Vegas.

We seek to build on our track record of product-oriented collaborations with resource managers by developing new projects. Our work and approach distinctly differs from that of consulting companies and similar organizations. We produce publications in a variety of media (management-oriented outlets such as U.S. Forest Service serials and scientific journals), which provide permanent documentation of projects and lessons learned benefitting from high-quality scientific interpretation. We also deliver workshops and presentations to directly share research findings with managers, co-author publications with managers for special projects, and further disseminate scientific advances through conference presentations. Managers profit from this variety of scientific publicity by making their management areas better appreciated, leveraging political support for further project funding based on the documented successes, and having high-quality technical information at their fingertips. In addition to providing the benefit of accepted science for supporting management decisions, working with a university provides access to state-of-the-art libraries, lab facilities, and students who can become involved in the work at little or no cost to managers.

We seek new projects that both build ecological knowledge and are directly relevant to immediate or longer term information needs for supporting resource management decision-making. Projects in the areas of invasive species ecology and management, fire ecology and monitoring, restoration, data and literature synthesis, and landscape monitoring and management are well covered by our publication performance and record of successfully completed projects.

Please contact us if you have projects for which technical assistance and science support would be desirable. We enjoy making trips to meet face to face with managers and have a keen interest in management activities that are being undertaken and the issues that managers are grappling with.

Further information about our group is available from <www.unlv.edu/staff/cengel/DDFRGHome.htm>, with publications from <http://faculty.unlv.edu/abellas2/>, or through email (scott.abella@unlv.edu) or phone (702-895-5163).



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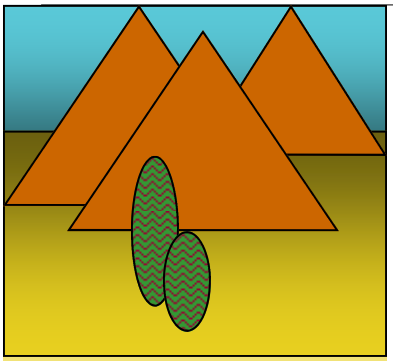

Desert and Dryland Forest Research Group

University of Nevada-Las Vegas
4505 Maryland Parkway
Las Vegas, Nevada 89154

RESEARCH STAFF

Dianne Bangle
Donovan Craig
Jill Craig
Adria DeCorte, Graduate Assistant
Teague Embry, Botanist
Cayenne Engel
Jon LaValley
Kate Prengaman, Botanist
Chris Roberts, Graduate Assistant
Alexis Suazo
Sarah Schmid, Botanist

COORDINATOR

Scott Abella, Ph.D.
scott.abella@unlv.edu

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Editor: Jill Craig, MS
jill.craig@unlv.edu

Mojave Applied Ecology Notes is a newsletter published quarterly by the UNLV Desert and Dryland Forest Research Group. We specialize in working with resource managers to address key information needs for management through applied research. Submissions to the editor are welcome. We reserve the right to edit all article submissions.

Fire history and forest structural change in the Spring Mountains

Scott Abella

Since early 2006 we have been working to develop a partnership with the Spring Mountains District of the Humboldt-Toiyabe National Forest to provide science support for understanding fire history and forest structural changes in support of ecologically based management strategies. We teamed up with the Ecological Restoration Institute (ERI) at Northern Arizona University and the University of Arizona Tree Ring Lab to deliver a workshop on March 6, 2008 at the interagency office in Las Vegas, Nevada. On September 16-18, we again teamed up with colleagues at ERI to conduct a preliminary field assessment of forest change at 10 sites in ponderosa pine and mixed conifer forests on the north side of the mountains. Our ERI colleagues on the field assessment included three retired U.S. Forest Service employees who collectively have over 103 years of experience with the Forest Service in the Southwest.

Our fieldwork was designed as a rapid assessment to illustrate the types of information that could be provided by our proposed project. Field observations suggested that some stands were historically dominated by ponderosa pine, but possibly through intense past pine cutting and fire suppression, are now dominated by fire-intolerant species. However, other sites showed less evidence of historically frequent fire and potentially less evidence of the dramatic forest structural and species compositional changes that have occurred over the past 100 years at some sites. Forests even within a given elevational belt in the Spring Mountains are a unique "jumble" of several different forest types, apparent fire regimes, and dynamic states of structure and composition.

On several sites, including ones very close to private holdings, we suspected that forest health is continuing to deteriorate (due to unnaturally high tree densities), with extreme hazardous fuels and potential fire behavior. Our observations only scratched the surface, and further work is required to understand the fire regimes and forest changes of the Spring Mountains. Such information would provide both educational resources and support for management activities.

Large ponderosa pine surrounded by fire-intolerant small trees. On this site, it is unclear whether pine replacement is due to suppression of frequent surface fire or is part of a natural cycle in between more intense fire in a mixed severity fire regime.

DDFRG: Establishing mutual partnerships

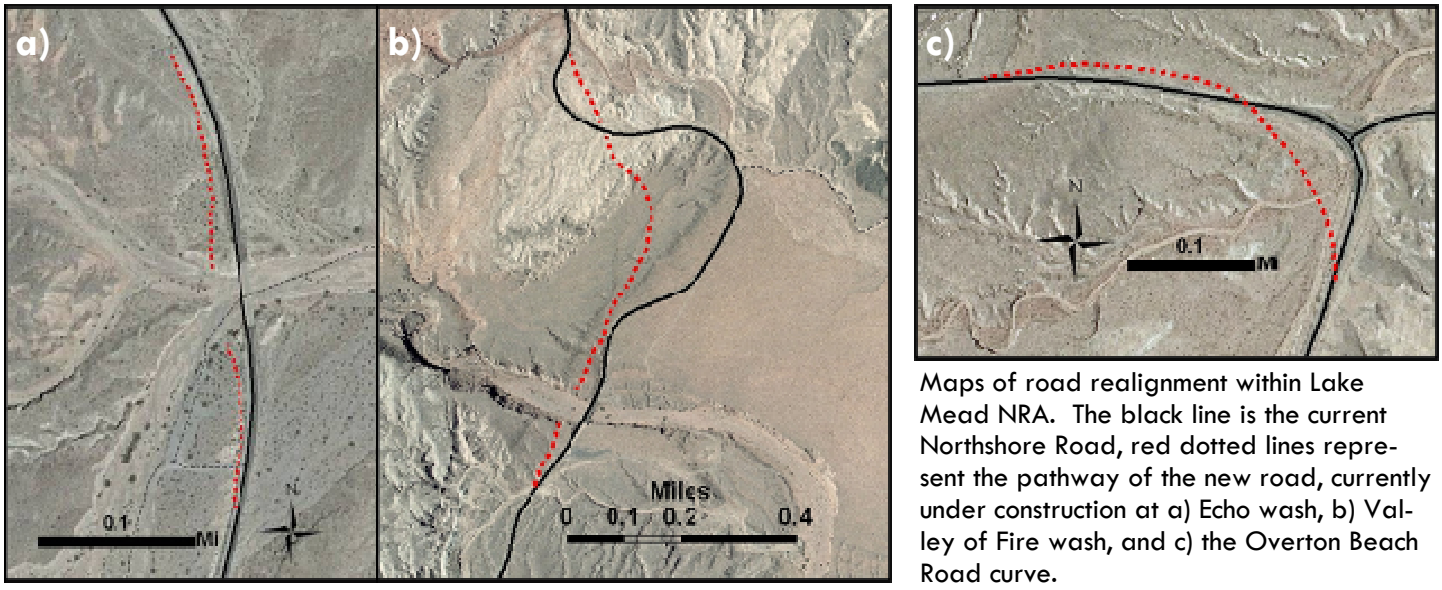
Northshore Road rehabilitation, working on FHA projects to make monitoring effective

Cayenne Engel

If you have taken a scenic drive up Northshore Road in Lake Mead NRA in the last couple of months then undoubtedly you have noticed the construction occurring at Echo Wash, Valley of Fire Wash, and the Overton Curve. The Federal Highways Administration (FHA) has implemented a plan to make the road safer by eliminating some of the curves in the road that don't conform to federal road safety standards and rebuilding some of the bridges. This means that several segments of the existing road, nearly two miles in total, will be eliminated and replaced with about a mile and a half of new road. Road construction started in October 2008, and will continue for at least one year.

This construction presents problems and opportunities for the resource management team at Lake Mead. Previously intact systems are disturbed in the process of construction leading to the destruction of sensitive desert soil surfaces and the plants on them. Additionally, some of the construction will be conducted in gypsum rich soils that support rare plant communities. However, with the construction of the new road comes the destruction of the existing road once the new road is finished. The old roadbed will ultimately serve as a large restoration project. Lake Mead vegetation and restoration teams will collaborate with members of the Public Lands Institute to design, conduct, and document restoration efforts. Documentation is particularly important, and strongly of interest to the restoration specialists from the Denver Service Center, the Park Service branch for sustainable planning, design, and construction. Often projects are conducted, but rarely are restoration efforts designed and documented in such a way that information about the success rate and causes of success or failure can be elucidated.

The focus of the restoration efforts will be re-establishing plants and soil biota on the old roadbed. Biological soil crusts and plants are extremely important for soil surface stabilization, and water and nutrient cycling and retention. Restoring these ecosystem functions to the exposed old roadbeds is necessary, and of equal importance to the National Park Service is the restoration of visual posterity and continuity. To date, we have conducted plant and biological soil crust salvage from the new roadbed, led by Janis Lee of the Lake Mead nursery. Crews salvaged over 2100 plants. The plants collected from the road site will be used in the post-construction revegetation efforts. We are collecting data examining survival rates of salvaged plants in the nursery based on plant size and addition of rooting hormone. Upon outplanting, plants will be monitored for up to five years for survival. Additionally, protocols are being developed to examine the best methods for effectively reintroducing soil crust to the restoration sites. The outplanting will be conducted in experimental blocks to examine the effectiveness of different techniques, like different watering regimes, soil crust placement, seeding, and plant protective structures on plant survival, soil crust survival and establishment, and native plant and weed seedling establishment.



Maps of road realignment within Lake Mead NRA. The black line is the current Northshore Road, red dotted lines represent the pathway of the new road, currently under construction at a) Echo wash, b) Valley of Fire wash, and c) the Overton Beach Road curve.

The Desert and Dryland Forest Research Group presents eight posters:

Wildfires and Invasive Plants in American Deserts

On December 9-11, 2008, the Society for Range Management hosted a special symposium: Wildfires and Invasive Plants in American Deserts. Four members of the Desert and Dryland Forest Research Group attended the symposium and workshops which were held in Reno, Nevada. The group presented eight posters during the Tuesday night poster session, highlighting a variety of relevant research projects the group has initiated. The following abstracts describe the research that was presented:

Early post-fire succession on a heavily visited Mojave Desert burn: Red Rock Canyon near Las Vegas, Nevada

Scott R. Abella[1], E. Cayenne Engel[2], Christina L. Lund[3], Jessica E. Spencer[4]

We examined plant recovery, soils, and soil seed banks on the 348-ha, 2005 Loop Fire in Red Rock Canyon National Conservation Area, 15 km west of metropolitan Las Vegas, Nevada. This burn is of special concern to resource managers because more than 900,000 people visit a scenic Loop Drive encompassed by the burn. We conducted sampling two years after the fire by measuring 10, 0.01-ha plots on the burn and on a paired unburned area. Perennial species composition shifted from dominance by late-successional native shrubs (e.g., blackbrush) on the unburned area to native perennial forbs (e.g., globemallow, desert marigold) on the burn. The burn was more species-rich, with richness of live plants averaging 26 (100 m^2 scale) and 239% (1 m^2 scale) greater. Fire and microsite (interspace, below creosote or yucca) interacted to affect 0-5 cm soil properties, with higher pH, conductivity, and total P and K on burned yucca microsites. Red brome density in 0-5 cm soil seed banks was four times lower on the burn, and its distribution among microsites reversed. Below-shrub microsites contained the most brome seeds on the unburned area but the least on the burned area. Intense fire below shrubs may have increased seed mortality, an idea supported by > 3-fold decreases we found in emergence density after experimentally heating seed bank samples to 100°C. Our study occurred after a post-fire period of below-average precipitation, underscoring a need for continued monitoring that characterizes moister years and evaluates aesthetic recovery on this heavily visited burn.

Management techniques for the control of Sahara Mustard (*Brassica tournefortii*) in the Mojave Desert

Dianne N. Bangle[5], Scott R. Abella[1]

In the southwestern United States, *Brassica tournefortii* (Sahara mustard) is a highly invasive plant that colonizes roadsides, beaches, sand dunes, and open desert threatening native annuals. Sahara mustard is believed to contribute to fuel loads in the Mojave Desert in areas where *Schismus* sp. and *Bromus* sp. occur. Sahara mustard may act as ladder fuel, thereby facilitating the spread of fire throughout the landscape. Manpower limitations and insufficient funding limits land managers ability to effectively control Sahara mustard. We tested seed germinability in Sahara mustard after fruiting plants were treated with either 2%, 5%, or 12% triclopyr. Sahara mustard seed pods were labeled based on three developmental stages prior to treatment. Application of herbicide decreased germination from control seeds, however effectiveness did not differ across concentrations of triclopyr (2, 5, and 12%). We also tested seed germinability in Sahara mustard after fruiting plants were separated from their resources and allowed to dry in the field. Seed pods were labeled by developmental stage before treatment. The three treatments consisted of; 1) pulling plants with roots intact; 2) pulling the plant and breaking the roots and leaf rosette from the inflorescence; 3) pulling off individual fruits. All treatments resulted in a decrease in germination from control seeds.

Post-fire plant recovery in the Mojave and Sonoran Deserts of Western North America

Scott R. Abella[1]

I systematically reviewed published literature that reported data on plant community recovery after fire in the Mojave or Sonoran Deserts. Re-sprouting by desert perennial species is generally limited but varies among species. For example, two studies found that an average of 75% of burned *Yucca schidigera* re-sprouted, whereas *Larrea tridentata* re-sprouting ranged from 3-37% among five studies. In chronosequence and permanent plot studies of community recovery, only weak trends were evident that species composition on burns was converging with unburned areas. For instance, time since fire explained only 9-19% of the variance in the Sørensen similarity of burned and unburned composition in studies with measurements up to 47 years after fire. In contrast, perennial plant cover and time since fire were closely related (r^2 = 0.39-0.99), suggesting that perennial cover recovers more rapidly than composition. Based on ordinating data from 13

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studies, overall perennial composition after fire differs between the Mojave and Sonoran Deserts. Dominant post-burn species variously included *Ambrosia deltoidea*, *Ephedra nevadensis*, *Gutierrezia sarothrae*, *Encelia virginensis*, *Sphaeralcea ambigua*, and grasses like *Achnatherum speciosum*. Some species exhibited versatility by being dominants in both burned and unburned habitat (e.g., *A. deltoidea*, *E. nevadensis*), at least in terms of their relative importance within communities even if their raw abundance declined after fire. While some general principles are suggested by analyzing the available literature as a whole, results suggest that more work is required for improving specific knowledge about plant recovery among fires, sites, species, and climates.

Burned and unburned desert near Goodsprings, NV.

Seeding effectiveness for eight Mojave Desert perennial species after a 2005 wildfire

E. Cayenne Engel[2], Scott R. Abella[1], Christina L. Lund[3]

In the Mojave Desert, where germination is largely dependant on the timing and amount of precipitation, seeding is a risky endeavor, but it is one of a limited number of restoration techniques available to managers attempting emergency revegetation on large desert burns. We monitored the seeding success of eight perennial shrub species in the 33,500-acre 2005 Goodsprings Fire within the Red Rock Canyon National Conservation Area two seasons after the aerial application of seeds. Seeded species consist of a mix of native perennial forbs, grasses, and shrubs. The seeding was divided into six plots totaling over 2700 acres that span different topographical features, soil types, and unburned plant communities. To date, seeding has not statistically affected the abundance of seeded species, although there are trends indicating that *Atriplex canescens* and *Sphaeralcea ambigua* may increase in abundance with seeding. Greenhouse seed bank trials produced no seedlings of seeded species in seeded or unseeded plots. The extraction method for seed isolation from the soil detected the presence of some of the seeded species, but in low abundance, and with no difference between seeded and unseeded plots. Many factors could affect seeding success including soil moisture availability, granivory, and use of species appropriate for existing site conditions and successional stage. We looked at the seeded species and associated plant communities coupled with the natural environmental variation across seeded plots to interpret the observed responses.

Abstracts continued on page 6

CONTRIBUTORS

[1] **Scott R. Abella**, Public Lands Institute and Department of Environmental Studies, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154, E-mail: scott.abella@unlv.edu

[2] **E. Cayenne Engel**, Public Lands Institute, University of Nevada, Las Vegas, 4505 S. Maryland Pkwy, Las Vegas, NV 89154, E-mail: cayenne.engel@unlv.edu

[3] **Christina L. Lund**, California State Office, Bureau of Land Management, 2800 Cottage Way, Sacramento, CA 95825

[4] **Jessica E. Spencer**, [3]U.S. Army Corps of Engineers, 701 San Marco Boulevard, Jacksonville, Florida 32207

[5]**Dianne N. Bangle**, Public Lands Institute, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154, E-mail: dianne.bangle@unlv.edu.

[6]**Alexis A. Suazo**, Public Lands Institute, University of Nevada, Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154, E-mail: alex.suazo@unlv.edu

[7] **Donovan J. Craig**, Public Lands Institute, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154, E-mail: donovan.craig@unlv.edu

[8] **John L. Gunn**, Maricopa County Parks and Recreation Department, 234 N. Central Ave., Suite 6400, Phoenix, AZ 85004

[9] **Mark L. Daniels**, Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ 86011

[10] **Judith D. Springer**, Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ 86011

[11] **Susan E. Nyoka**, Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ 86011

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Seed removal by granivores in burned Mojave Desert habitat: implications for revegetation

Alexis A. Suazo[6], Donovan J. Craig[7], Scott R. Abella[1]

Increased abundance of exotic annual grasses provide fuel for wildfires in North American desert habitats where fires were once uncommon events. Direct seeding techniques are used in an attempt to re-establish plant species important to desert ecosystem functions and processes. Granivorous ants and rodents are important components of North American deserts, and their seed-eating behavior can influence plant composition and establishment. Granivores can potentially consume large amounts of the seed used in revegetation, possibly slowing restoration efforts. To elucidate seed predation patterns by ants and rodents, we performed a seed removal experiment in burned and unburned creosote (*Larrea tridentata*) scrub desert habitats on the 2005 Goodsprings Fire in southern Nevada. We studied seed removal using wire cages that either excluded or included ant or rodent access to seeds. We offered 20 seeds of eight native species, and quantified seed removal by subtracting the number of seeds that remained in a Petri dish after a four day trial. Our results indicate that seed removal was three times higher in cages that allowed ant access in burned habitat, and seeds of *Penstemon bicolor*, *Encelia farinosa*, and *Sphaeralcea ambigua* suffered greater seed losses. Our results suggest that granivorous ants may play a significant role in the establishment of plant communities in burned areas by preferentially removing seeds of small seeded plant species. Therefore, managers may choose to sow species that are less susceptible to predation by ants in burned areas.

Vegetation reestablishment of Mojave Desert plant communities after 2005-2006 wildland fires

E. Cayenne Engel[2] and Scott R. Abella[1]

During 2005 above average precipitation from the previous winter and spring led to increased vegetative production, particularly for annual species including exotic invasive grasses. This biomass readily carried wildland fires. The result was over 125 fires greater than 5 acres in size in Clark Co., NV alone in 2005 and 2006. During winter 2007 and spring 2008 we sampled plant community composition in 15 burns and adjacent unburned sites from 2005-2006 burns in Mojave desert shrubland. We quantified the cover of perennial species and related their presence and abundance to abiotic site characteristics, soil chemistry, and unburned plant community composition to examine factors affecting vegetative recovery. After two growing seasons burned plots were dominated by the early successional perennial species *Dasyochloa pulchella, Encelia virgensis, Pleuraphis rigida,* and *Sphaeralcea ambigua,* in contrast to the unburned communities dominated by *Larrea tridentata, Ambrosia dumosa,* and *Coleogyne ramosissima.* The density of exotic *Bromus rubens* remained strongly reduced by the burn (1.9 ± 0.6 percent cover in burned plots, 14.0 ± 1.9 in unburned communities.) Elevation and latitude were correlated with burned community composition. Additionally, unburned plant community composition did not determine the recovery rate on burned plots and the similarity between burned and unburned plots was not associated with initial plant community or soil type. Burned plant community composition was associated with soil texture and total soil nitrogen; unburned plant communities were more closely associated with specific soil micronutrients. Understanding the process of post-fire recovery in an increasingly fire-rich landscape will help managers design effective restoration strategies.

Using a diverse seed mix to establish native plants on a Sonoran Desert burn

Scott R. Abella[1], John L. Gunn[8], Mark L. Daniels[9], Judith D. Springer[10], and Susan E. Nyoka[11]

Revegetating burns is a major challenge facing resource managers in the low- and unpredictable-precipitation deserts of the southwestern United States. We monitored the effectiveness of using a diverse, 28-species seed mix for establishing native plants on a 1.5-ha burn in the northern Sonoran Desert. Our objective was to compare species performances, which we assessed by measuring species frequencies and cover on five sampling dates to capture variation during a 32-month period following seeding. By 15 months after seeding, desert senna (*Senna covesii*) established best, with a frequency of 91% (based on 22, 10-m^2 plots) and a relative cover of 19%. Four other seeded species also became established in ≥ 50% of plots by 32 months after seeding. Several seeded species, including desert senna (which flowered only 7 weeks after seeding) and purple threeawn (*Aristida purpurea*), were observed with seed heads during one or more sampling periods. Although precipitation was only 67% of normal for 21 months following seeding and 71% of species established in < 10% of plots, we consider the seeding to have met short-term management objectives because of the subset of highly successful species. Our results also illustrate that caution should be used when evaluating seeding success: conclusions would have differed if the diversity of the seed mix had not included the successful species, and longer term monitoring was needed to detect some species in the seed mix that did not establish until 32 months after seeding.

FY2009 Weed Sentry surveying

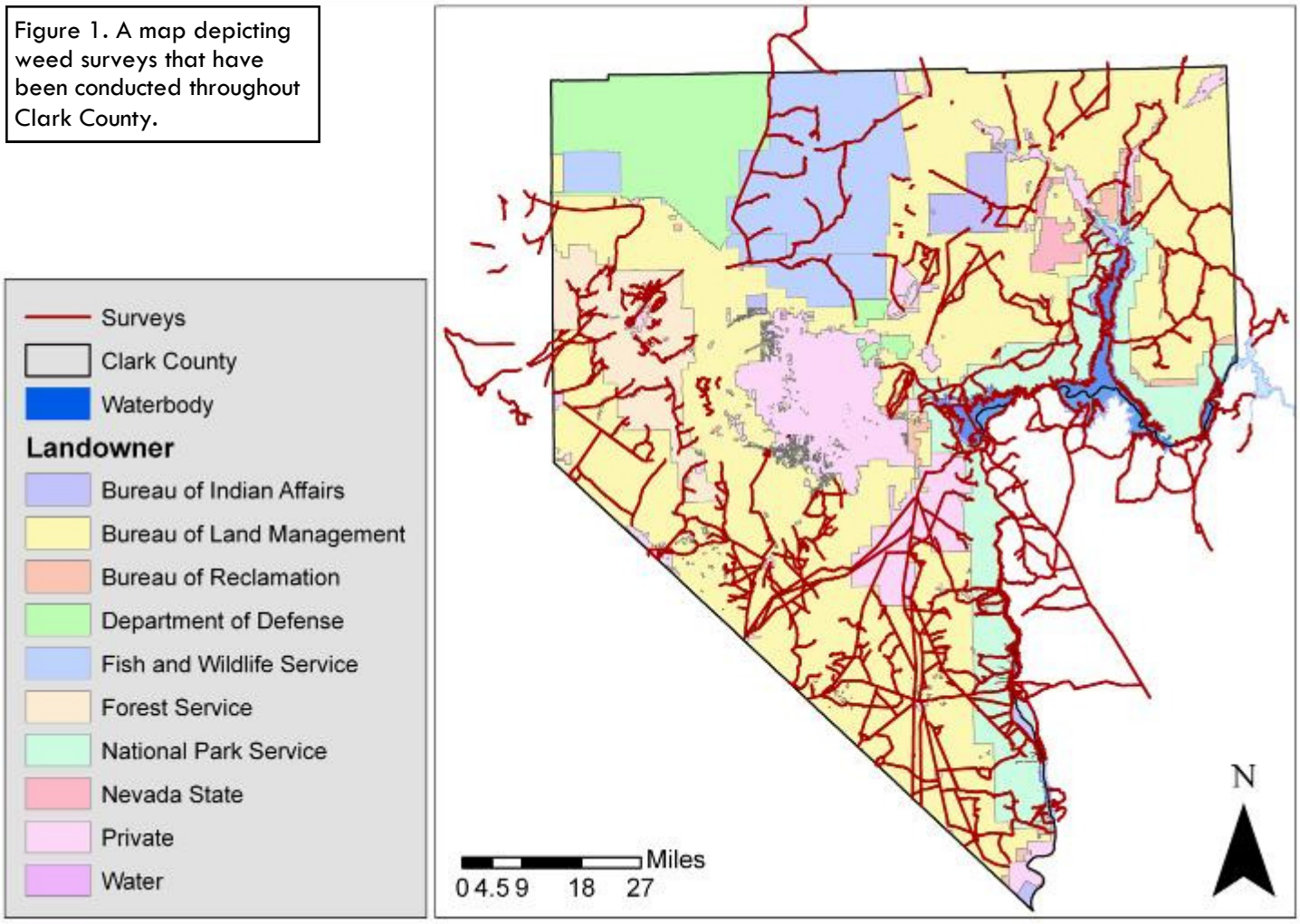
Weed Sentry—Jill Craig

The Weed Sentry Program surveys for and maps exotic invasive plant species on public lands throughout Clark County; providing weed management information to land managers of the U.S. Fish and Wildlife Service, Forest Service, Bureau of Land Management (BLM) and National Park Service (NPS).

In the past three months, Weed Sentry crews have surveyed thirteen trails at Red Rock Canyon NCA. Later in the season, lower elevation trails at Red Rock and trails through Sloan Canyon NCA will also be surveyed for populations of exotic invasives.

At Lake Mead NRA, Weed Sentry crews have focused survey efforts on road and trail corridors and shorelines. This year surveys will shift their focus to the undeveloped landscape of Lake Mead, such as along washes. There are two main reasons for planning this shift. First, most of the roads on NPS lands have already been surveyed multiple times. Additionally, a study conducted last field-season indicated that the cover of invasive species was not necessarily correlated with the distance from a roadway. We would like to detect weed populations that are becoming established off of the beaten path. During the last quarter, surveys for the NPS centered on determining the current growth stage of exotic plants to assist Carrie Norman, Lake Mead NRA Weed Manager, with determining where to allocate resources to control weed populations. As the season progresses and exotic annuals grow, surveying will intensify as we work to detect incipient populations in yet un-surveyed territory.

Figure 1. A map depicting weed surveys that have been conducted throughout Clark County.



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University of Nevada - Las Vegas
4505 Maryland Parkway
Las Vegas, Nevada 89154

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Recent Publications

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