Summer 2008

Mojave Applied Ecology Notes Summer 2008

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Soil Climate Project Underway in Southern Nevada

Land management agencies lack sufficient information to understand the relationships between vegetation distribution and productivity, local climate, and soils within ecologic zones. Improved understanding of these factors will enhance efforts to protect sensitive-status plant species, maintain wildlife habitat, reduce soil erosion and sediment transport, maintain sustainable wild horse and burro populations, restore after fire and subsequent processes that contribute to the evolution of landscape mosaics, and refine estimates of ground-water recharge, consumptive water use, and surface-water runoff.

View of the Kyle Canyon climate data-collection site. This site is part of the Soil Climate Analysis Network (SCAN).

Through the Southern Nevada Public Lands Management Act, a project is being conducted to characterize the local climate and soils within ecological zones of the Spring and Sheep Mountains. This is a cooperative effort led by Jim Huria of the U.S. Forest Service. Other cooperators include U.S. Fish and Wildlife Service, U.S. Geological Survey (USGS), Natural Resource Conservation Service (NRCS), and Bureau of Land Management. NRCS and USGS have been contracted to implement the collection of quality data for the project.

The Spring Mountains and Sheep Mountains of southern Nevada are documented as two of the most biologically diverse mountain ecosystems in The Nature Conservancy's Mojave Desert Ecoregion biodiversity assessment report. Adding specific support to the Conservancy's recognition, two Spring Mountain floras and a Desert National Wildlife Refuge plant checklist document more than 750 known plant species in each mountain range, including 15 endemic plant species in the Spring Mountains and 3 endemic plant species in the Sheep Range. Considering the relatively small 551,508 acres in the Spring Mountains and 377,028 acres in the Sheep Range within the nearly 33 million acres of the Mojave Desert Ecoregion, the total number of plants and number of endemic plant species concentrated in these two mountain ecosystems are remarkable.

Vegetation zones occur in mountains along elevation gradients that are characterized by unique combinations of plant species and soil types. In the Spring and Sheep mountains, zones range from creosote bush and desert shrub communities at low elevations on valley floor areas to an alpine community at the highest elevations of the Spring Mountains and a bristlecone pine community at the highest elevations of the Sheep Mountains; additional zones at intermediate elevations include blackbrush, sagebrush, Pinyon-Juniper, Ponderosa pine, White fir-Limber pine, and Limber pine-Bristlecone pine communities. Yet, little is known about the microclimatology of these mountains.

*See **Soil Climate** on page 3*

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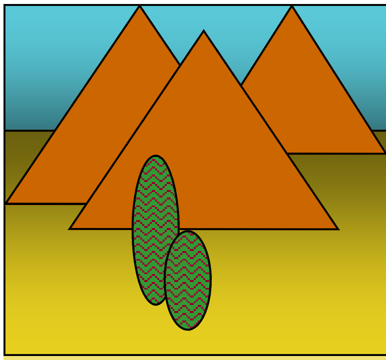

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Mojave Applied Ecology Notes is a newsletter published quarterly by the UNLV Desert and Dryland Forest Research Group. We specialize in working with resource managers to address key information needs for management through applied research. Submissions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

We're Moving into UNLV's New Science and Engineering Building

Scott Abella, PI

View looking southeast of UNLV's new research facility.

Our research group is one of the few select groups that is moving into the new, $113-million UNLV Science and Engineering Building. The building is exclusively dedicated to research, and its four stories contain 200,000 square feet of research laboratories, faculty offices, and auditorium space for research symposia. Located on North Campus just northeast of the Biology Building, the building is anticipated to obtain LEED (Leadership in Energy and Environmental Design) certification.

Designed to promote interdisciplinary research on the UNLV campus, the facility will house an exciting breadth of research clusters including materials science, entertainment engineering, nanotechnology, alternate energy, chemical sciences, physiology, genetics, soil and water science, and ecology. More than a dozen core labs will be housed in the facility, such as the Nanotechnology Center, Imaging and Electron Microscopy Center, National Supercomputing Center for Energy and the Environment, and the Geographic Information Systems Laboratory. Occupation is expected this summer, and the move-in process has already started.

What does this mean for us? We will be joining Dale Devitt (Professor of Life Sciences, Director of the Center for Urban Horticulture and Water Conservation), Jeff Shen (Associate Professor of Life Sciences, plant genetics), Lloyd Stark (Associate Professor of Life Sciences, bryophyte and stress biology), and David Costa (Professor of Mathematics, differential equations) in a 2,500-square foot lab to form a water-plant sciences-ecology research group. We will be located on the fourth floor, which also houses soil and geological analytical laboratories and a four-bay research greenhouse.

We are grateful for the opportunity to conduct research in this state-of-the-art facility and commend UNLV administrations and building planners for their vision in navigating through the difficult processes of securing funding and making a facility of this magnitude a reality. We also thank our group's current funding partners – the National Park Service (Lake Mead National Recreation Area) through the Clark County Multiple Species Habitat Conservation Plan, the Joint Fire Science Program, and the Bureau of Land Management, Las Vegas Field Office – for supporting our work. This support allowed applied ecology to be recognized as an asset to UNLV's research mission and a productive component of the research consortium allocated space in the new building.

View of the first floor.

Rare Plant Monitoring

Dianne Bangle, Research Assistant—Botany

Maintaining ecosystem health and stability by protecting habitat that supports high biodiversity areas including rare plant sites is a prime concern to land managers. In cooperation with the National Park Service (Lake Mead National Recreation Area) and Clark County (Multiple Species Conservation Plan), we designed and implemented monitoring protocols for four rare plant species to evaluate changes within and across each species' populations. Specifically our monitoring objectives are to 1) maintain the current density of each target species within 30% of the first measurement (annual species evaluated in high rainfall years); 2) determine the abiotic factors that influence the density of each target species; 3) maintain native plant community biodiversity and density at monitored rare plant populations within 30% of the first measurement. By comparing biotic and abiotic variables we will be able to determine specific habitat use requirements for each species in order to provide the tools necessary for land managers to meet their conservation goals.

We are monitoring two perennial gypsum species, *Arctomecon californica* (10 sites) and *Anulocaulis leiosolenus* var. *leiosolenus* (8 sites), and two annual sand species *Eriogonum viscidulum* (2 sites), and *Astragalus geyeri* var. *triquetrus* (2 sites). Monitoring methodology was designed specifically for each species in order to minimize the impact to the habitat and to achieve powerful data.

Soil climate *Continued from page 1*

Micrometeorological data are being collected from representative benchmark soils and typical ecologic zones of the Spring and Sheep Mountains. Data will include parameters such as air temperature, soil moisture and temperature, humidity, wind speed and direction, precipitation, and net (direct solar and diffuse atmospheric) radiation. Instrumentation will be installed within a network of sites along a general transect ranging from the western slopes of the Spring Mountains to the crest of the Sheep Mountains to collect near-continuous measurements of climate data. The network will include several existing sites where climate data are monitored as part of a state-wide cooperative program such as the NRCS Snow Survey program or as part of ongoing USGS studies to quantify evapotranspiration rates.

One of the key elements of the project is to place the sites on benchmarked soil series with known geographic distributions… helping to establish edaphic relationships.

NRCS has collected manual snowfall-measurement data along several courses in the Spring Mountains for many years. The Spring Mountains are an important ground-water recharge area for southern Nevada and the NRCS snow-course measurements provide water managers with information used to estimate water budgets and understand ground-water flow. Although snow-course data provide useful water-budget and hydrologic information, the frequency of data collection (every few weeks) is not sufficient for understanding local climate relationships. Instrumentation used by the NRCS SNOTEL (SNOwpack TELemetry) program will be installed along several snow courses in the Spring Mountains to automate data collection and provide near-continuous climate-data measurements. The SNOTEL sites will be equipped with a pressure-sensing snow pillow; storage-precipitation gage; additional sensors to record air temperature, soil moisture and temperature, wind speed and direction, and net radiation; and electrical power and radio telemetry equipment. NRCS maintains a network of over 600 sites in 11 western states as part of its SNOTEL program. Recorded data are posted to the Internet and available through a public-accessible website.

Information is available on the web at http://www.wcc.nrcs.usda.gov/scan/Nevada/nevada.html.

For more information on this project contact Doug Merkler, (doug.merkler@nv.usda.gov).

Joint Fire Science Grant Update

Donovan Craig, Research Assistant

This past spring, two field experiments were initiated on a burned area near Goodsprings, Nevada to test different revegetation techniques and to identify plant species that are most capable of establishing in burned areas. The first experiment examines seeding with questions pertaining to granivory and additions of water. We set up four replicate blocks with 20 plots per block. Each plot had one square meter seeded with one of the following community mixes: late-successional shrubs, early-successional shrubs, forbs, or a mix containing a grass species. Plant species being examined in this seeding trial include: *Larrea tridentata*, *Ambrosia dumosa*, *Eriogonum fasciculatum*, *Hymenoclea salsola*, *Bebbia juncea*, *Encelia farinosa*, *Sphaeralcea ambigua*, *Baileya multiradiata*, *Penstemon bicolor*, and *Aristida purpurea*. Further tests involving seed fates will be added to this study. No plant establishment as a result of seeding has been observed to date.

Wire mesh exclosures were installed to investigate effects of granivory on seeding (top). Effects of shelters and slow release irrigation on outplanting mortality are also being tested (bottom).

The second experiment involved outplanting nursery-grown plant species to the same burned area. We outplanted 320 plants comprising eight species: *Larrea tridentata*, *Ambrosia dumosa*, *Eriogonum fasciculatum*, *Encelia farinosa*, *Sphaeralcea ambigua*, *Penstemon bicolor*, *Muhlenbergia porteri*, and *Sporobolus airoides*. Shelters and slow-release irrigation (Rain Bird ®) treatments are being tested for their abilities to enhance plant survival. Thus far, many plants have perished, yet plants under shelters and shelters with slow-release irrigation have exhibited fewer mortalities overall.

Preliminary data and observations for these revegetation efforts further attest to the difficulties with plant establishment in burned desert areas, especially creosote-scrub communities. Many factors play a role in a plant's ability to survive outplanting or establish from seed. In the desert, as in most environments, adequate water is crucial. However, shelter from herbivory and intense solar conditions also seem to play a vital role in revegetation success.

The Utah State University Weed Mapping Workshop

Weed Sentry—Jessica Spencer, Research Assistant

A couple weeks ago, I attended a Weed Mapping Workshop put on by Steve Dewey and Kim Edvarchuk of Utah State University. It was a valuable course for people mapping any kind of vegetation, not just weeds. The most important lesson was that the way that you collect information must be determined by clientele's objectives. It is essential to define objectives so proper methods can be employed to produce a map with enough detail to address the client's questions. There are thousands of ways to produce a vegetation map. Do you use points, lines or polygons? How do you account for varying densities? How much detail is required? Most of these questions can be answered by ironing out objectives before rushing into the field to map.

The course provided several examples of methods that could be used to provide various levels of detail. It also covered how to effectively search based on your search criteria and the type of terrain. We practiced these methods in different field settings. There was a "final exam" that required us to go into the field and map weed populations with a GPS unit. We were responsible for defining objectives, determining search patterns and mapping populations of three different weeds. The course was very informative; I would recommend it to anyone who is either developing or refining a vegetation mapping project.

The Impact of Native Granivorous Rodents on the Spatial Distribution of Sahara Mustard (*Brassica tournefortii)*, an Invasive Exotic Species

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Heteromyid rodents (e.g., *Dipodomys* sp., kangaroo rats, Fig 1) are abundant in desert habitats. These small nocturnal rodents are effective seed eaters, and can affect native plant distribution and species composition by consuming and caching large quantities of seeds. Heteromyid rodents are also known to preferentially select foraging microhabitats; kangaroo rats forage in open areas while pocket mice (*Perognathus* sp.) forage under shrubs. These microhabitat preferences can affect soil seed bank dynamics. Interactions between native rodents and native plants/seeds have been well studied. Our knowledge of the interactions between native rodents and invasive plants in desert habitats is minimal, even though invasive exotic species are colonizing desert habitats at an alarming rate. To discern granivory patterns by native rodents on Sahara mustard (*Brassica tournefortii)*, an invasive annual plant, I designed a study to document the effects of burial depth on seed removal. Predators may be less likely to detect and remove seeds beyond a certain burial depth. My specific objectives were to document 1) the depth at which seed of *Brassica tournefortii* escape rodent granivory; 2) the differences in seed removal from open and under shrub microhabitat types.


Fig. 1. Kangaroo rat (*Dipodomys* sp.), a granivorous rodent in North American deserts. Rodents are important seed consumers and strongly affect plant community structure and dynamics.

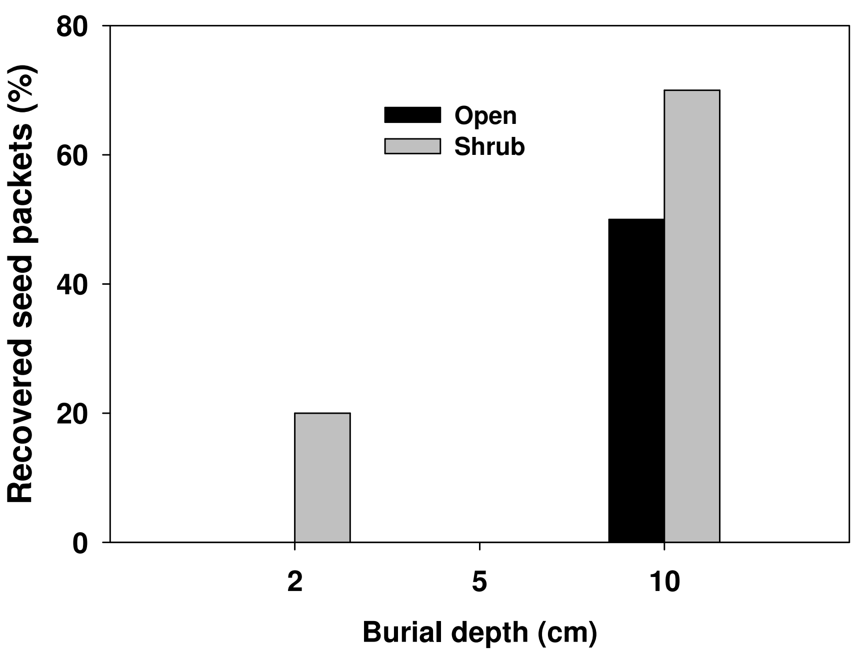

Fig. 2. Percentage of *Brassica tournefortii* seed packets recovered after four days of being buried at 2, 5, and 10 cm depths. Predation below shrubs did not occur on seeds buried at 10 cm depth. Longer term studies are needed to confirm the observed patterns.

I conducted the study at Lake Mead National Recreation Area located in the southern portion of the Mojave Desert. The study site is a large wash, and creosote (*Larrea tridentata*) is the dominant shrub, while bursage (*Ambrosia dumosa*) and other smaller shrubs are present in low numbers. To monitor rodent granivory, I offered 1 g packets of Sahara mustard seeds buried at 2, 5, and 10 cm depths in open and under shrub microhabitats. Four days after burial, I documented the presence or absence of seed packets. Rodents removed 100 % (10 out of 10) of seed packets buried at 2 cm from open and 80 % (8 out of 10) from under shrub microhabitats. Seed removal decreased at 10 cm depths (Fig 2). These preliminary patterns of seed removal suggest that the vertical position of *Brassica tournefortii* seeds may influence its removal and detection by native rodents in desert ecosystems. Longer term studies are being conducted to confirm the observed patterns.

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Recent Publications

We're on the web!
http://faculty.unlv.edu/abellas2/

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