Mojave Applied Ecology Notes Winter 2009

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Progress in Strategic Research Areas

Scott Abella, Program Manager

Three years ago through conversations with resource managers, assessing the status of knowledge of the scientific literature, and our own interests, we set forth several strategic research areas that we believed would be timely for advancing Mojave Desert conservation and management. Below is a partial list of these initiatives with a summary of progress made and thoughts on future directions:

**Fire Ecology and Management.** We sought and are seeking to understand natural recovery patterns after desert wildfires and how burns may be actively managed to accelerate revegetation. To date, we have published a literature synthesis of natural post-fire recovery patterns in the Mojave and Sonoran Deserts [1], a case study of recovery on the Loop Fire in southern Nevada’s Red Rock Canyon [2], and a monitoring assessment of post-fire seeding effectiveness in the Sonoran Desert [3]. Further, we have completed fieldwork for a Clark County-wide (southern Nevada) assessment of recovery on a temporal chronosequence of 32 fires differing in age, are continuing monitoring with the BLM-Las Vegas on fire effects and post-fire seeding, and brought a nationally competitive Joint Fire Science grant to the Mojave Desert in 2007 to examine species traits for identifying candidate revegetation species. These efforts help provide a foundation of knowledge, but have only scratched the surface on this important topic; we are interested in a variety of future studies.

**Revegetation and Ecological Restoration.** Our first step in this initiative was to quantitatively synthesize the scattered literature on revegetation methods and effectiveness in the Mojave Desert, which illuminated examples of both successful and failed projects [4]. Simultaneously, we sought to identify a concept of reference conditions (e.g., ecosystem conditions before burro and livestock grazing) for the Mojave Desert to assist in setting management goals by reconstructing the species composition of past desert ecosystems. This effort has been slow to gain momentum, although we have published a status of knowledge on how burros may have affected current vegetation [5]. We also have ongoing projects with Joshua Tree National Park and Lake Mead NRA to assess techniques for revegetating disturbed roadides. The purpose of the next generation of revegetation experiments should be to compare a variety of candidate prescriptions and species while controlling for as many external factors as possible.

**Invasibility/Exotic Species.** We adopted a two-faceted approach involving understanding what makes communities invasible by exotic plants (and how invasibility could be manipulated positively) and developing specific treatment prescriptions for killing targeted species. We have completed and are working on a variety of projects to meet these objectives, such as evaluating invasion patterns of exotic annuals in the eastern Mojave [6], comparing community condition among springs in the Sheep Mountains, examining the exotic Sahara mustard’s seed banks and establish-

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ment requirements, a graduate project by Adria DeCorte on soil effects on invasibility, and a graduate project by Sara McPherson on invasibility and an overall project on the status of exotic species threats in Mojave Desert parks. We are not satisfied with progress on habitat requirements and control prescriptions for exotic annual grasses, and look forward to future projects to advance this critical area of research.

Climate Change Management. We have been working with Stan Smith to assist efforts in understanding effects of elevated CO$_2$ on desert ecosystems. We also have an ongoing graduate student project by Chris Roberts to assess 30-year dynamics of desert vegetation in southern Nevada by remeasuring a landscape network of plots established in 1979. We believe that a serious shortcoming in current research and management on the ground is that there are few examples of specific management plans and implementation of prescriptions for conserving resources in a changing climate. We are hopeful that some of the several funding proposals we have written to try to provide science support for specific climate change management are funded, because we believe that some specific examples could help stimulate progress in this emerging area of conservation and land management. The Mojave Desert could be at the forefront of some of these efforts.

We have worked to advance these initiatives through literature syntheses and new monitoring and research field studies. We appreciate the financial support we have received from the National Park Service, Bureau of Land Management, Joint Fire Science Program, and the Ecological Restoration Institute at Northern Arizona University. We welcome feedback on opportunities to advance these objectives and possibilities for future attention.

References

Soil-Tech and Native Resources Balance Construction with Nature

Soil-Tech has a special passion for mitigating construction impacts on native communities and preserving natural resources. Company President and Founder, Jerry Stanley said, “With the use of our environmentally friendly products, we have the ability to blend natural elements as well as artificial structures into their surroundings. We make it our commitment to meet and exceed all expectations through uncompromised quality, specialized products and the Team that has the knowledge and skills to adapt to all challenges. By protecting and restoring the native environment, we are balancing construction with nature.” His enthusiasm for preserving natural settings is shared by the people he has added to the team over the last two decades. This passion is also reflected in plans to revise the company website to add more informational and awareness content. You can follow developments at www.soil-tech.com.

Soil-Tech has been solving problems for some of the largest construction projects in the Southwest over the past 20 years. We provide important and specialized solutions that cannot be provided by traditional landscaping firms or construction companies. The problems we solve require specialized training and experience in desert habitat restoration, natural desert revegetation services, air quality compliance with specialized eco-friendly products and techniques for all dust control applications while saving water.

Soil-Tech has an impressive range of services that fulfill our mission. We started with hydroseeding of native species into disturbed areas to blend the edges of construction projects with natural surroundings. Our work expanded naturally to include stabilizing soils for erosion control, reclaiming mine sites, plant salvage and re-planting, weed eradication and fuel reduction. The needs of clients drove us to develop skills in restoring desert varnish, installing desert tortoise fencing, road decommissioning and construction of post and cable fences and trail construction. Our patented product, Permeon™ provides color mitigation for visual pollution without dangerous chemicals.

Some of Soil-Tech’s’s best work is on display near Northshore Road at Lake Mead NRA, at Anthem in Henderson, Pulte’s Anthem at Mesquite and Howard Hughes’ Summerlin. We are performing color mitigation at the Hoover Dam Bypass site. Our large-scale utility projects include the Transwestern Gasline Expansion in Arizona, the R4 Detention Basin for Army Corps of Engineers, the Level 3 Fiberoptic Cable project for Time-Warner, as well as the Kern River Phase II, which spanned Utah, Nevada and California. This was the largest pipeline in the west at the time.

If you have a project that might require one of Soil-Tech’s services, let us know and we will provide a complimentary mock up.

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Saving Water. As water conservation became a critical issue in the Southwest, Soil-Tech worked to develop innovative products that save water and control dust. We pioneered new, environmentally friendly products and application techniques. These innovations have saved millions of gallons of water on projects. The need to save water also drove our effort to promote native plant salvage and replanting. We maintain a nursery of salvaged shrubs, cacti and yucca plants for conservation purposes. The cost of native vegetation is one third that of traditional landscaping and uses natural rainfall after establishment. The savings of water and labor are huge.

Road Decommissioning. As the Las Vegas population continues to grow and the city limits continue to expand, access to our once hidden treasures are more frequently visited by off-highway vehicles (OHV). Although it’s positive that more people are visiting our public lands, it’s also concerning that disturbance to sensitive areas is increasing rapidly. In more recent years, Soil-Tech have taken it upon ourselves to meet this issue head on. Our strategy is to sit down with the customer and understand the specific concern of each individual disturbance. In some instances, access to the sensitive areas needs to be fenced off, while other sites may only need the tire tracks raked out and broadcast seeding. In one recent project, we were asked to close a road that led to petroglyphs. To prevent further damage by OHV enthusiasts, we decommissioned 400 linear feet of the visible portion of the road that led to the petroglyph site. In addition, we created a turn-around that was located just prior to the decommissioned road. This helped confirm to the OHV user that the road had ended and they should turn back. The remainder of the road (approximately 2 miles) was not visible from the turn-around and so did not need decommissioning. This was a very cost-effective way of protecting a large area. Soil-Tech achieved the goal by using vertical mulch, planting boulders, spreading and raking rock mulch and planting native vegetation. We knocked down the berms on both sides of the road and used small hand tools to contour new swales and drainages into the surrounding natural features. To date, this road is a success and has deterred OHV users from unintentional and malicious disturbance.

Noxious Weed Control. Most people recognize that noxious and invasive species have become a major threat to natural resources and native communities. Soil-Tech has been active for more than ten years and treated more than one thousand acres of land in both upland and aquatic/riparian habitats.
“Our crews are highly trained and experienced in precision application and compliance with EPA regulations. This helps to guard against damages to desirable plants and against liabilities and possible citations,” said Jeff Deason of Soil-Tech. Soil-Tech’s habitat restoration biologist, Jim Marble, Ph.D., has years of experience in planning and conducting noxious weed eradication programs and integrated pest management programs throughout central and southern Nevada.

Our certified pesticide applicator directs the work of experienced and trained crews. Crews have worked on numerous projects, including many within the Las Vegas Wash. They have helped conserve and restore environmental resources in the Las Vegas Wash in keeping with the Clark County Wetlands Park Master Plan. Elements of this work area have been tamarisk and noxious weed removal, hydroseeding, broadcast seeding, revegetation plantings, erosion control and aquatic plant seed collection.

Permeon™. Construction, notably in desert regions, often exposes large, unsightly areas of scarred rock, visible for miles. Construction of roads, drainage facilities, housing developments, and utility lines all create this problem. Given that nature’s timetable in restoring the desert varnish to the scarred areas is estimated at hundreds of years, the challenge for Soil-Tech was to develop an artificial desert varnish that would produce natural colors in days or weeks rather than centuries. We understood that the development of a product must be environmentally friendly and pose no threat to plants, animals or the applicators. Older products have harsh chemicals that can damage plants and soil organisms. In 1974, our original simulated desert varnish was developed in the laboratories of Arizona State University under the guidance of Dr. Carleton Moore. This product, Permeon™, was perfected in 1994 and exclusive rights were awarded to Soil-Tech, Inc. We have been restoring natural beauty to the desert ever since. Typical applications include highway cuts, mining scars, haul roads, rip-rap, landscape boulders, reservoirs and decommissioned roads. We also use it on concrete retaining walls, man-made lake shorelines, cart paths, sidewalks, drainage structures and water tanks. Permeon™ is a one step application with permanent results. It is non-toxic to plants and animals and has a neutral pH. Skilled applicators adjust the formula to blend with the natural desert varnish. The Permeon™ colors can range from the lightest tan to the darkest black and any earth tone in between.
Cryptogamic Crusts. Recent decades have shown the importance of biotic crusts in holding down soils and providing nutrients and water to native plant communities. These crusts are widespread in deserts and are composed of soil lichens, cyanobacteria, mosses and fungi. As in the past, Soil-Tech is looking ahead to find solutions to new problems. We are working to develop an agreement with University of Nevada, Las Vegas and other partners to develop and test new approaches to restoring biotic crusts.

These efforts show a long history and continuing commitment to balance construction with nature. “We have made it our mission to be a solution provider to help restore the environment. We use our vast experience and knowledge of the local soil and climate conditions to provide highly successful methods. Our years of experience have helped us to select and train field crew members with a special understanding and respect for resources that is rare in typical construction crews,” said Jerry Stanley. Soil-Tech and Native Resources is not a typical landscaping company, but rather, an innovative specialist in desert habitat restoration.

Upcoming Events

Natural Resource Needs Related to Climate Change in the Great Basin & Mojave Desert: Research, Adaptation, Mitigation

A Decade of Discovery Science Symposium
Part of the BLM’s National Landscape Conservation System (NLCS) 10th Anniversary Celebration
Albuquerque, New Mexico on May 24 - 28, 2010; http://www.blm.gov/nlcs
Spring Mountain Forest Structure Research

Lindsay Chiquoine, Research Assistant

The Spring Mountain National Recreation Area (SMNRA), located west of Las Vegas, NV, is a part of Humboldt-Toiyabe National Forest. The Spring Mountains have played an important role in the history of the Las Vegas area. About 10,000 years ago the Spring Mountains and surrounding Mojave Desert transitioned into a dryer environment, isolating the mountains. The harsh desert conditions biologically isolated the Spring Mountains by preventing most plant and animal migrations. Over the past two centuries, the mountains and many small springs have attracted explorers and settlers searching for relief from the desert. Trapping, mining, ranching, and timber harvest communities began to spring up in the mountains and surrounding valley areas. At the turn of the 20th century, recreation also began to play a larger role in the Spring Mountains, and recreational facilities were built, such as campgrounds, roads, trails and waterlines.

Modern human impacts, such as trapping, hunting, introduction of non-native species, timber harvesting and the establishment of settlements in the mountains have altered overall forest ecology by affecting the density and diversity of wildlife and herbivory influence on vegetation, fire regimes, avalanche influence on valleys, and overstory and understory species density and diversity. With funding support from the Ecological Restoration Institute (<www.eri.nau.edu>) at Northern Arizona University, in summer 2009 we were able to conduct overstory vegetation sampling and obtain tree core samples that will assist in developing a current view of forest structure.

We concentrated on ponderosa pine systems, which are a well-researched system in other regions of the southwest. Older ponderosa pine develops thick fire-resistant bark that allows it to survive low intensity fires while younger trees are eliminated. In some instances of fire, the fire may not kill a pine but leave a fire scar, providing evidence of fire history. Fires assist with decreasing tree density and reducing competition, while potentially supporting a greater biodiversity. Fire appears to have played a role in the Spring Mountain ponderosa pine systems; however, we are unsure of the extent. Ponderosa pine and other tree species also take a long time to degrade after they have died, providing evidence of historic forest structure.

Our initial goal is to develop a chronology of the forest structure and use. Information acquired from overstory vegetation surveys in addition to historical data on tree harvest, precipitation data, and fire evidence will assist us in developing a chronology of forest structure and changes through time. Preliminary observations of the forest structure show at some sites, forest structure has changed (or is in the process of changing) and is influenced by human activities and possibly changes in climatic conditions.
Chapter 2. A systematic review of species performance and treatment effectiveness for revegetation in the Mojave Desert, USA
Scott R. Abella and Alice C. Newton

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. For example, *Baileya multiradiata*, *Phacelia parishii*, *Atriplex polycarpa*, *Penstemon palmeri*, and *Penstemon bicolor* became established at densities ranging from 3-9 plants/m² in individual seeding studies. Based on published data, seeding should not be discounted and warrants additional research as a revegetation option. Our review focused on the Mojave Desert, but our method of systematic, evidence-based synthesis may be useful for assessing revegetation options in other arid lands.

A pdf of this chapter is available at <http://faculty.unlv.edu/abellas2/> under the “Publications” tab.