Survey of resource managers completed on monitoring and management actions for rare plants in Arizona and Nevada

Scott Abella

In a collaborative project with Northern Arizona University and more than 35 resource managers in Arizona and Nevada, we completed a survey of monitoring and management activities that are ongoing in these states for conserving populations of rare plants. We sent questionnaires consisting of 16 questions to as many resource managers as possible in these states and had follow-up conversations with several managers willing to share their perspective on ongoing conservation actions. The findings may be interesting for managers to see what issues and management strategies other managers in the same or different regions are grappling with. Results will be published as a chapter in a book titled “Advances in Environmental Research” slated for printing in the fourth quarter of 2010. We thank Lake Mead National Recreation Area for partial support of the project and the many resource managers who provided their valuable help with this synthesis. The abstract is shown below:

Conserving rare species is one of the major objectives for protected areas such as U.S. national parks. Arizona and Nevada are in the center of an arid region rich in biodiversity and contain a variety of national parks, wilderness areas, and other conservation areas. We surveyed resource managers of 35 protected areas in these two states by posing 16 questions about threats, monitoring, and conservation management of rare plant species. Half of the managers (51%) cited herbivory by livestock (including feral animals) or native herbivores as threatening the sustainability of rare native plant populations that are protected from wholesale habitat destruction, and 49% also cited exotic plants as problematic threats. Fifteen additional threats were identified by one or more land managers. Some type of monitoring (e.g., presence/absence, demographic) of the status of rare plants is being conducted in 69% of the protected areas, although only 34% of the managers believed that the monitoring and associated conservation measures are adequate for protecting all rare plants. Monitoring was cited as a trigger for policy, management, or additional information-gathering activities in the vast majority of cases in which it was conducted, suggesting that monitoring data were used in conservation decision-making. However, it should be noted that monitoring does not necessarily result in an understanding of the causes of any observed population change, unless experimental treatments or quasi-natural experiments are performed. A wide variety of management activities were reported for rare plants, with avoidance of habitat disturbance and fencing being the two most common activities performed (each cited by 31% of managers), followed by exotic plant treatment (20%). However, 34% of managers reported that passive management is the primary strategy used. Habitat conservation has focused on occupied habitat, as only 11% of managers reported attempts to establish spe-

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Survey of resource managers (continued from page 1).

cies on unoccupied but seemingly suitable habitat. With 43% of managers believing that current strategies are insufficient for protecting rare plants and over 17 threats identified, we believe the data suggest that active management (e.g., curtailing tree encroachment, artificial pollination) of rare plant populations could be practiced more widely than it is at present, were it not limited by personnel, funding availability, and

Table 1. Measures that land managers in Arizona and Nevada implemented to protect rare plant populations from threats. Data are the percent of survey respondents that listed each action.

<table>
<thead>
<tr>
<th>Management action</th>
<th>%</th>
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<tbody>
<tr>
<td>Avoidance during construction</td>
<td>31</td>
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<tr>
<td>Constructing fences</td>
<td>31</td>
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<tr>
<td>Invasive plant treatment</td>
<td>20</td>
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<tr>
<td>Reintroduction and transplant measures</td>
<td>14</td>
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<tr>
<td>Closure to off-road vehicles</td>
<td>9</td>
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<tr>
<td>Closing area to public</td>
<td>6</td>
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<tr>
<td>Road closure</td>
<td>6</td>
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<tr>
<td>Erecting educational signs</td>
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<tr>
<td>Prescribed burning/fuels treatments</td>
<td>6</td>
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<td>Erosion protection</td>
<td>6</td>
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<tr>
<td>Burro removal</td>
<td>6</td>
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<td>Land exchanges</td>
<td>6</td>
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<tr>
<td>Staff education</td>
<td>6</td>
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<td>Developing areas of critical environmental concern</td>
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<td>Changing timing of various activities</td>
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The citation of the upcoming chapter is as follows:
Evaluating Efficacy of Restoration Techniques, Keys View Road Reconstruction, Joshua Tree National Park, California, U.S.A.

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Keys View Road in Joshua Tree National Park (JOTR) was recently repaved, resulting in a buffer of vegetation and soil disturbance along the road corridor. In order to mitigate the effects of the repaving, JOTR designed an experimental framework to test various revegetation strategies. They outplanted salvaged and nursery grown native plant species in conjunction with vertical mulch in a fully crossed design (outplanting only, vertical mulch only, outplanting + vertical mulch, bare ground) to examine if any of the treatments most efficiently establish native plant communities.

Outplanting was completed in February, 2008, and we began monitoring in April, 2009. We surveyed six replicates of each of the four treatment combinations along the 5-mile stretch of road. Because the disturbance was a linear feature along the roadside, we established 2 m × 20 m plots where we sampled plant composition by taking sub-samples around outplanted and vertical mulch individuals, and samples from open interspaces (open space between plantings) to examine the impact each microsite had on the composition at the whole plot level.

Our study goals were to address the following questions:

- What is the success rate of outplanting salvaged native perennial vegetation?
- Do any of the four treatments increase vegetation recruitment on the disturbed roadside?
- What is the effect of outplanting and vertical mulch addition on establishment of exotic invasive species?

Survival rates were high, with 13 out of 15 species monitored exhibiting a 50% or greater survival rate, and six out of the 15 species had a survival rate 86% or greater. However, plant community composition of species that recruited naturally into the disturbed roadside systems, along with richness and diversity, did not differ among treat-

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Evaluating efficacy of restoration techniques (continued from page 3).

ments. Richness, as expected, was lower in disturbed communities than in intact, undisturbed communities. Additionally, invasive grasses (brome species) had greater establishment rates in outplanted and vertical mulch microhabitats. Brome abundance at the plot level, however, was only greater in outplanting + vertical mulch plots than in bare plots, otherwise treatments did not differ. It appears that the combination of the treatments provide more microsites within which brome can establish, and therefore increases the plot level abundance. However, the same pattern was not followed by native species.

Overall, the techniques that JOTR have developed for establishing native perennial species through outplanting have been effective two years after outplanting. However, with the success of the outplantings, outplanted and vertical mulch individuals appeared to foster establishment of non-native brome grasses directly around individuals, and native plant community composition does not appear to benefit from these treatments. These results reflect just two years after disturbance and subsequent sampling. Succession in Mojave Desert communities is slow. The combination of planting success, which can contribute to propagation from the direct seed course, plus the increased rate of exotic invasion, may steer the treated communities on different trajectories from non-treated communities. Future plant community monitoring is necessary to track the establishment of native perennial and exotic annual species in these disturbed sites.

Figure 2. Pictures from Keys View Road restoration sites. (top left) Undisturbed site, (top right) vertical mulch plot, (bottom left) outplant and vertical mulch plot, (bottom right) example of an outplanted individual with abundant brome within the cage.
Renewable Energy Projects in Southwestern Deserts – Update on Our Involvement

Scott Abella

Like many in the conservation field, we have a good understanding of the urgent need for alternative energy sources, but also of the negative environmental tradeoffs of placing renewable energy developments on vast tracts of public lands in southwestern deserts as currently envisioned. We also understand political and economic reasons, good or bad, for not doing some obvious things that make sense for renewable energy like placing solar arrays on building tops in cities, within multi-use contexts such as crops, and on already impacted land when alternative energy projects (right or wrong) are to be placed on public land.

I was asked to be part of an independent scientific advisory panel to provide conservation recommendations for the California Desert Renewable Energy Conservation Plan, which deals with placing energy projects on public lands. This panel met on April 22-23, in Ontario, CA and includes representatives such as Reed Noss, other university and non-profit organization scientists, and U.S. Geological Survey scientists. The panel will be providing a written report of recommendations coming out at the end of summer. There are two key points I want to note: (1) the recommendations are in the context of the fact that the government is saying these projects are going to happen – other solutions that make sense are irrelevant in this context – and so reducing environmental damage to the extent possible given this situation is our focus; and (2) we as the scientific advisory panel have nothing to do with the implementation of the projects. I’ve been asked several times if “You can ensure a solar project is not sited here or stop these projects,” and my response is well, you’ll have to call up President Obama, the U.S. Congress, or Governor Schwarzenegger and talk to them.

As part of this multi-scientist panel, I was responsible for providing recommendations on exotic species management and restoration in the context of renewable energy developments. We have been encouraged to seek input on this report, and recommendations in these areas are provided below.

Exotic Invasive Species Management

We recommend that management of exotic plants be considered as part of the energy development process and as a strategy for partly mitigating direct native habitat destruction due to energy development. It is likely that activities associated with energy development will contribute to the establishment and spread of invasive, exotic plant species. Movement of mechanized equipment can distribute seeds, construction of linear corridors (e.g., transmission lines, roads) can harbor exotics and facilitate their spread, and disturbance promotes exotic species (Lodge et al. 2006). While mitigating for direct habitat destruction by managing other lands does not fully compensate for the destroyed habitat, we suggest that managing exotics on lands adjacent to energy installations (to limit any spread of exotics due to the disturbance) and in conservation areas be considered as part of plans for partly mitigating habitat loss.

Bossard et al. (2000) summarize troublesome exotic plants of the California desert. Some species are more harmful than others. Exotic annual grasses such as red brome (Bromus rubens) are currently of great concern to resource managers because these species are highly invasive and linked to wildfires by providing continuous fuel loads. Fires are not thought to have been prevalent historically in the Mojave Desert owing to discontinuous fuel loads, but have increased in extent in recent decades concurrently with expanding populations of exotic plants (Zouhar et
al. 2008). These fires devastate native communities dominated by long-lived perennials such as blackbrush (*Coleogyne ramosissima*), which are not considered fire-adapted due to the absence of fire in the evolutionary history of the desert (Abella 2010). We suggest that an analysis of fire potential (based on fuel loads and ignition probabilities) be used as a tool for prioritizing exotic species management treatments, in conjunction with locations of sensitive species or communities with high conservation priority, and corridors where transport of exotic plants might be greatest. We recommend that equal attention be paid to high- and medium-fire potential areas. High-potential areas require treatment because of high risk; medium-potential areas can benefit from treatment to avoid becoming at risk.

Little funding for research has been dedicated to developing treatment strategies for exotic plants in southwestern hot deserts such as the Mojave. However, studies such as Allen et al. (2005) suggest that there is potential for testing different herbicides and other treatments for reducing the prevalence of red brome and other exotic plants. Key factors that should be considered in evaluations of herbicides and other treatment strategies include whether the herbicide acts as a pre- or post-emergent, the timing and duration required for effective treatment, and effects on the non-target native community. Additionally, consideration should be given to post-treatment management, as often establishing a competitive native vegetation type can reduce probabilities of resurgence of the exotic species. Since exotic species management strategies are not well tested in desert areas, these projects could take the form of applied projects that are conducted at an operational scale but within a planned study design that includes untreated controls. This can enable conclusions to be drawn about the effectiveness of candidate treatments and allow development of strategies that may be feasible to implement over the broad scales necessary to make a difference ecologically.

**Restoration and Improvement of Habitat**

We recommend that other types of habitat management and ecological restoration be considered as partial mitigation for habitat destruction, including revegetating disturbed areas (including wildfires) with native plants within conservation reserves. Revegetation in arid lands is expensive and prone to failure due to unpredictable rainfall, but a recent review of revegetation practices in the Mojave Desert found that there are many examples of successful revegetation projects (Abella and Newton 2009). Seeding and planting of greenhouse-grown or salvaged plants are the most common methods of revegetation. There are advantages and disadvantages to both methods; for example, larger areas can be revegetated through seeding than through planting. Associated treatments, including protecting seeds and plants from being eaten by animals and insects, can make the difference between successful and failed projects. Abella and Newton (2009) compiled a list of the performance of an array of native species in revegetation projects as well as the effectiveness of treatments. In addition, restoration activities such as reestablishing native riparian vegetation and hydrological patterns along springs and water courses could greatly improve habitat value. This is especially appropriate given that some renewable energies require amounts of water that are not insignificant, further stressing scarce water supplies in the desert. Restoration efforts should not focus solely on “cosmetic” areas such as campgrounds or visitor centers, but should include meaningful areas for habitat conservation improvement purposes.

We suggest that consideration be given to incorporating vegetation within renewable energy installations to maintain some habitat. The current paradigm is to simply bulldoze the soil and vegetation to establish energy sites. Assessing alternative strategies that include retaining as much vegetation as possible would be a large improvement over clearing all vegetation. It is possible that that some vegetation can coexist with energy installations to provide renewable energy projects (continued from page 5).

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Renewable energy projects (continued from page 6).

some habitat as well as to sequester carbon. One little-addressed fact is that the benefits of renewable energy for reducing atmospheric CO$_2$/climate change may not be as large as expected, because by clearing vegetation/soil, year after year carbon storage capacity is lost. An initiative to incorporate vegetation within energy installations should include balancing any conflicts of retaining vegetation with fire hazard, maintenance and performance of the energy structures, and the ability of the vegetation to grow within the energy sites. If vegetation can co-exist within arrays, the best strategy would likely be to leave mature plants (i.e. not bulldoze them in the first place), as opposed to trying to revegetate after the fact. However, it is uncertain what type of native plant species are best adapted to co-exist with energy sites, so species that can thrive with shade cast by solar structures and other aspects of the sites may need to be identified and promoted. In addition, where energy installations are sited by leasing private agricultural land or private or public abandoned agricultural land, it may be possible to grow crops (or restore native desert vegetation) in concert with energy structures. Using agricultural land for energy installations has many advantages (e.g., the land is already relatively level) and is a strategy we recommend.

References


Recent publications


Thank you...

We thank our current funding partners for their support: Lake Mead National Recreation Area, Mojave Network, Joshua Tree National Park, BLM - Southern Nevada and Ely Districts, and the Ecological Restoration Institute at Northern Arizona University. We look forward to continuing these fruitful collaborations as well as working with new partners for mutual benefit.

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

Natural Resource Needs Related to Climate Change in the Great Basin & Mojave Desert: Research, Adaption, Mitigation drew 310 participants from a variety of federal, state, tribal and private organizations based throughout the West. The workshop was hosted at the University of Nevada, Las Vegas from April 20-22, 2010. All poster and oral presentations from the workshop can be viewed online at: <http://www.wr.usgs.gov/workshops/ccw2010/index.html>.

Additionally, a synthesis document is being developed and will be accessible online later this summer.