



Research Brief for Resource Managers

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Facilitating Natural Recruitment for Desert Revegetation

Abella, S.R., L.P. Chiquoine, and J.F. Weigand. 2019. *Developing methods of assisted natural regeneration for restoring foundational desert plants. Arid Land Research and Management (in press).*

<https://doi.org/10.1080/15324982.2019.1649320>

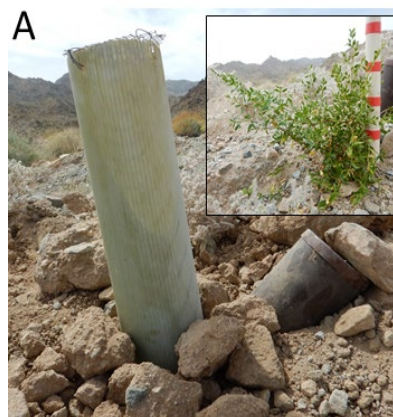
Reestablishing native plants is often fundamental to successful ecological restoration on disturbed sites in drylands, including those affected by wildfires. Seeding and outplanting nursery-grown seedlings are two main techniques for restoring native plants, but these techniques can be expensive and contingent on uncertain germination and seedling survival. Seeding and outplanting further assume that propagule limitation (e.g., lack of seeds) is a main impediment to restoration and that introducing propagules will facilitate plant establishment. Assisted natural regeneration (ANR) is an alternative aimed at encouraging site conditions favorable for natural regeneration through actions such as alleviating limitations on viable seed production, germination, and seedling survival. This approach has the potential advantages of favoring local genetics, avoiding resource-intensive preparation and transport of plant material, and lowering costs. However, which species may be amenable and which treatments are needed for successful ANR are uncertain in drylands.

We conducted an experiment to test ANR methods for a foundational shrub of the Mojave Desert, creosote bush (*Larrea tridentata*). This species forms shaded, nutrient-enriched microsites termed fertile islands, which are important to recruitment of other native plant

Management Implications

- Applying slow-release irrigation to naturally occurring seedlings of creosote bush did not enhance survival
- Sheltering seedlings did not improve survival either, but it did triple height growth
- The concept of enhancing survival of natural seedlings through assisted natural regeneration may have potential but further work is required to identify effective treatments.

species and as sheltered habitat for wildlife such as the desert tortoise. The experiment occurred in collaboration with the Bureau of Land Management, in the Dead Mountains Wilderness, northwest of Needles, southern California.



Natural creosote bush seedling that received both a shelter and slow-release irrigation gel (inside the brown tube). Irrigation had minimal effect during the two-year experiment. Shelters tripled seedling height.

Our study site was a disturbed area with mostly bare, compacted soils. At this site, there was occasional creosote seedlings (< 2-yr-old) with

high mortality rates. At this site, we located 72 seedlings in February 2017.

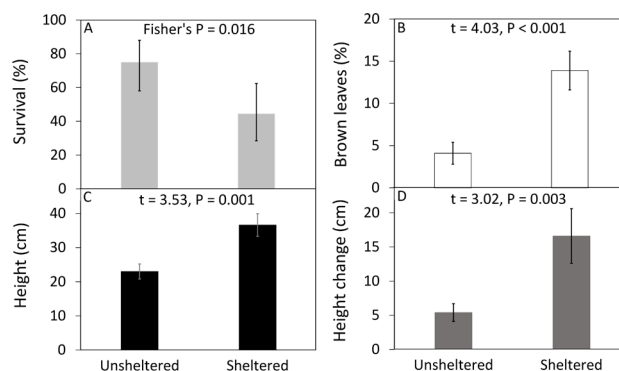
The experimental design included two levels each (present or absent) of irrigation or protection. We randomly assigned one of the four treatment combinations to each of the 72 seedlings, until there were 18 seedlings per treatment. Irrigation was slow-release gel applied and replenished to provide a year of supplemental moisture. The protection treatment consisted of installing a green, 10 cm diameter × 60 cm tall, double-walled, plastic tree shelter around seedlings.

Three times within a two-year period after treatment installation, we assessed seedling status (live or dead, distinguished by green foliage being present or absent) and height in April 2017 (spring, two months after treatment installation), November 2017 (autumn, nine months), and in March 2019 (spring, two years after installation). We also categorized (in 5% increments) the portion of total foliage that was brown after we noted in November 2017 that some sheltered seedlings had brown foliage.

After two years, more sheltered seedlings died than unsheltered seedlings. However, those that did survive grew three times faster and were three times taller than surviving unsheltered seedlings. Sheltered seedlings proportionally had three times the brown foliage as unsheltered seedlings. Irrigation was not significant for any measure. Two-year survival of irrigated seedlings was 67% compared to 53% for non-irrigated seedlings. Between April 2017 and March 2019, irrigated seedlings increased in height by 8.4 cm, compared to 11.0 cm for non-irrigated seedlings.

In summary, the two treatments tested for assisting the establishment of natural creosote bush seedlings had either minimal influence (slow-release irrigation) or reduced survival but tripled height growth of surviving seedlings (protection via shelters). Effectiveness of protection thus hinged on whether: 1) the added height growth of surviving seedlings compensated for reduced total survival and potentially altered plant morphology, and 2) the ecological benefits were worth the labor and cost of the treatment. These are uncertainties.

Results suggest that ANR can affect natural seedlings and has potential as a low-cost restoration tool, but additional work is required to explore other treatments. For example, using different colored shelters or structures that have better air flow to and from seedlings may help alleviate potential overheating and carbon dioxide buildup. Testing ANR with other species may also be useful.



Characteristics of creosote bush regeneration in March 2019 after two years of protection in shelters as an assisted natural regeneration treatment in the Mojave Desert, California. (A) Plant survival was higher for unsheltered plants (B) Mean percentage of brown leaves (C) plant height, and (D) change in plant height (March 2019 minus April 2017). Irrigation had minimal influence. All tests showed significant differences.

Suggestions for further reading:

Oliet, J. A., et al. 2019. Should we use meshes or solid tube shelters when planting in Mediterranean semiarid environments? *New Forests* 50:267–282.

Overview of Mojave Desert revegetation:
Abella, S.R., and A.C. Newton. 2009. A systematic review of species performance and treatment effectiveness for revegetation in the Mojave Desert, USA. Pp. 45-74 in *Arid environments and wind erosion*. Available from: <https://sites.google.com/site/scottrabella/>