



## Research Brief for Resource Managers

**Release:**

July 2023

**Contact:**

Scott Abella

**Phone:**

702-774-1445

**Email:**

scott.abella@unlv.edu

Deserts Region, California Fire Science Consortium, School of Life Sciences, University of Nevada, Las Vegas, 89154-4004

# Long-Term Change in Desert Annuals during Restoration, Joshua Tree National Park

Abella, S.R., L.P. Chiquoine, M.A. Balogh, A.J. Taylor, and S.M. Munson. 2023. Do nurse plants strengthen over time? Results from 12 years of desert habitat restoration. *Plant Ecology* 224:299-314.

Stimulating plant facilitation, whereby plants enhance recruitment or fitness of other plants, is often a major goal in ecological restoration. For example, if restoration practitioners can plant or seed native plants that trigger the natural recruitment of other plants, then restoration can produce benefits beyond the initial human inputs. Ideally, this would result in sustainable recovery in plant populations and the broader ecosystem.



Fig 1: Example of an outplanted shrub, which has a mixture of native and non-native annuals growing below. Photo along Keys View Road, Joshua Tree National Park (S.R. Abella).

In deserts, one of the ways that plant facilitation can occur is through the process of established perennial plants (often shrubs) favorably changing microclimate (e.g., providing shade,

### Management Implications

- Outplanting native desert perennials may initially facilitate growth of undesirable non-native plants below the canopies of the perennials. As restoration sites mature, however, native annuals may increasingly benefit from the planted perennials.
- Pairing desert plantings with strategically treating non-native annuals may help tip facilitative benefits to natives while reducing hazardous fuels and fire risk.

ameliorating temperate extremes) and forming fertile islands, nutrient-enriched soil. Plants doing this and facilitating other plants are termed nurse plants (Fig. 1). To initiate recovery on disturbed sites, a major restoration treatment is planting shrubs and large perennial grasses with the intention that they will form fertile islands and facilitate further plant recruitment.

There is a potential conundrum, however, facing practitioners seeking to restore fertile islands and initiate native plant recovery: desert perennials can facilitate both native and non-native annuals. Non-native annuals, especially grasses such as red brome (*Bromus rubens*) and cheatgrass (*B. tectorum*), are of particular concern because they provide fuel for desert wildfires and can compete with native plants. It is not well understood whether desert plantings can facilitate recruitment of other natives (or mainly just non-

---

natives), or whether facilitation changes through time as a restoration site matures.

To address these uncertainties, we partnered with the National Park Service to study plant community change below planted perennials and in interspaces (areas between perennials) during 12 years (2009-2020) in Joshua Tree National Park, California, in the southern Mojave Desert (Fig. 2).

A main conclusion of the study was that planted perennials facilitated other plants intermittently during the 12-year period. Whether facilitation occurred depended on which response metric was considered (the cover or number of species present of potential beneficiary species), the group of beneficiary species (native or non-native annuals), and measurement year.

There was, however, a general trend for beneficiary plant groups below outplants to shift through time. Non-native annual cover initially benefited when outplants were 1-9 years old, but native annuals benefited when outplants were 9-12 years old. Additionally, facilitation was not strongest in dry years. Instead, facilitation was strongest in wet years, perhaps when annuals were best able to utilize favorable microclimates and soil nutrients below outplants when moisture was less limiting.

The switch from primarily non-native annuals being facilitated below outplants to native annuals being facilitated as the restoration site matured was an encouraging result. However, non-native species continued to form much of the total annual plant cover at the sites throughout the study. To ensure that native annuals are the

primary beneficiaries of facilitation, results suggest that further treatments to reduce non-native annuals could be useful. For example, planting of perennials could be accompanied by strategically treating non-native annuals, such as testing whether pre-emergent herbicides could reduce non-native annuals while not harming the established perennials nor potentially later-emerging native annuals (Fig. 3). Managing annual plant communities is important to reduce hazardous fuels, offer native floral resources to pollinators, and provide quality forage to desert animals such as threatened desert tortoises.

### Suggestions for further reading:

Abella, S.R., K.H. Berry, and S. Ferrazzano. 2023. Techniques for restoring damaged Mojave and western Sonoran habitats, including those for threatened desert tortoises and Joshua trees. *Desert Plants* 38:4-52.



*Fig 3: Planted native shrubs becoming established and growing in one of the restoration plots in Joshua Tree National Park. The cover of outplanted perennials tripled on restoration plots within the first three years after outplanting and was maintained through at least 12 years after planting. Photo by S.R. Abella.*



*Fig 2: Example of one of the roadside restoration plots in which native perennials were planted. The restoration plot is shown on the left side of the road with the sampling tapes and shows early establishment of perennials. The roadside soil disturbances were created during road maintenance activities, and planting native perennials was intended to hasten ecological recovery while concealing the disturbance. Photo by S.R. Abella.*