Revegetation of disturbed sites in the Mojave Desert with native shrubs

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Increasingly man's population pressures, technological activities, and search for recreation expand into fragile ecosystems. The deserts of southern California, especially the Mojave Desert, are experiencing activities such as use by off-road vehicles and construction of rights-of-way which often destroy native shrub vegetation. A conspicuous example, clearing and construction of a right-of-way for the second Los Angeles aqueduct, prompted this study of revegetation possibilities.

Seeding or revegetation failures have been attributed to low seed germination, poorly adapted seed source, planting at the wrong depth or time of year, poor growing conditions, inadequate seedbed preparation, the removal of seeds or clipping of plants by animals, competition with resident vegetation, and poor match to soil type.

We studied the revegetation potential of five native shrub species: *Ambrosia dumosa* (Gray) Payne *(Franseria d.)* (white bursage), *Atriplex canescens* (Pursh.) Nutt. (fourwing saltbrush), *Atriplex polycarpa* (Torr.) Wats (desert saltbush), *Larrea tridentata* (Sesse & Moc. ex. DC.), Cov. *(L. divaricata)* (creosote bush), and *Lepidospartum squamatum* (Gray) Gray (scalebroom). Revegetation trials have been reported previously only for *A. canescens* and *A. polycarpa*.

Seed collections were made by a commercial seed collector along the west side of the Mojave Desert at approximately 900 m (3000 feet) elevation from December 1970 to October 1971, and were provided to us by the U.S. Bureau of Land Management. The seeds were put in cold storage (10°C) for 6 months prior to use. Seed age and germination at the time of the fall 1972 greenhouse seeding were 15 months and 16 percent for *Ambrosia dumosa*, 21 months and 40 percent for *A. canescens*, 21 months and 13 percent for *A. polycarpa*, 13 months and 38 percent for *Larrea tridentata*, and 11 months and 47 percent for *Lepidospartum squamatum*.

The seedlings for transplanting were grown in a greenhouse and hardened for 2 weeks before planting in late December and early January. The hardening process was too severe for *Ambrosia*, and additional plants were started for this species in December and hardened under warmer conditions for a February planting.

Two sites, designated Mojave and South Freeman, located respectively 10 km north and 59 km northeast of Mojave, Kern County, were chosen with the cooperation of the Bureau of Land Management along the denuded part of the 100 m right-of-way of the second Los Angeles Aqueduct. At each site, an area of approximately 0.3 ha was fenced for protection from wildlife and domestic animals. Both sites are on Arizo gravelly loamy sand soil (Typic Torripsamments) with 0 to 5 percent slope. Vegetation next to each site is creosote bush shrub with an occasional Joshua tree occurring near the south Freeman site. The estimated mean annual precipitation is 200 mm (8 inches) for the Mojave site and 180 mm (7 inches) for the south Freeman site, with 90 percent of this precipitation occurring from November through April.

Revegetation treatments were designed to test the effects of a single irrigation on stand establishment and the value of transplanting vs. direct seeding. Direct seeding rate per spot was 18 fruits (0.12 kg/ha) of *Ambrosia*, 10 fruits (0.67 kg/ha) of *A. canescens*, 22 fruits (0.037 kg/ha) of *A. polycarpa*, 10 belt-harvested hulled thiourea-treated seeds (0.11 kg/ha) of *Larrea*, and 10 fruits (0.02 kg/ha) of *Lepidospartum*. Planting distance was 2 x 2.5 m and treatments were replicated four to eight times and completely randomized at each site.

Water was applied at 2 liters per transplant or spot seeding on all species for the one-time-irrigated treatment. Half of the once-watered treatments (both transplants and spot seeded) received 0.1 percent in solution of "SSO Anti-Stress Agent." This product contains 10 percent sarasaponin, an active ingredient that has been reported to promote seed germination and vegetative growth.

Stand counts were made on April 17, 1973 and March 25, 1975. On June 22, 1973 seed spots stocked with more than one seedling were reduced to a single seedling. Plant heights were monitored each time plant counts were made, and flowering and seed production were recorded.

Establishment

The results of spot seeding and transplanting varied widely among the five shrub species on both sites. Rainfall approximated average conditions during the initial growing season of December 1972 through June 1973, but rainfall in the second and third seasons was below normal.

At both sites, *A. canescens* was superior in its ability to establish from spot seeding and was comparable to the best transplant establishment species, *Ambrosia* (see table). The pooled seed spot establishment of *A. canescens* (44 percent) at the Mojave site matched the *Ambrosia* pooled transplant establishment (44 percent) and was similar at the south Freeman site (53 percent vs. 48 percent). Spot seeding gave very poor results for the other four species.

Transplants of *A. polycarpa*, *Lepidospartum*, and *Larrea* did not survive well at the Mojave site. *Larrea* was disappointing even though it is dominant in the vegetation at both sites. This tends to confirm our previous findings that late fall and winter seedings of *Larrea* are inappropriate because it requires warm temperature for germination.

The one-time irrigation did not significantly improve spot seeding or transplant establishment of any species at either site. Seed production occurred on approximately 20 percent of the transplants of *Ambrosia*, *A. canescens*, and *A. polycarpa* at the Mojave site during the first year, but almost no seed was produced at the other site. Sarsaponin was not an effective treatment.

This study, though of limited scope, shows that artificial revegetation is feasible on these low rainfall sites. If seeding or transplanting is done in late fall or early winter, a one-time irrigation at planting is not helpful in a year with normal rainfall.

For aesthetic reasons, it might be desirable to consider revegetation of disturbed sites in this or any other region with the "dominant" species that make up the resident vegetation. To assure stand survival, it may be necessary to design seed mixes containing species that are compatible with artificial reestablishment methods. Other native shrub species should be screened for revegetation potential in this and other California deserts.

Seed-spot Emergence and Survival and Transplant Survival for Different Seeding Treatments of Five Shrub Species Planted at Two Mojave Desert Sites

Species and observation date		Mojave				South Freeman			
		Seed spot		Transplant		Seed spot		Transplant	
		Irrig.	Control	Irrig.	Control	Irrig.	Control	Irrig.	Control
		%				%			
Ambosia dumosa	4/17/73	0	4	75	69	0	4	58	58
	3/25/75	0	4	44	44	0	0	42	54
Atriplex canaescens	4/17/73	50	75	31	19	81	62	19	12
	3/25/75	31	56	28	19	62	44	19	12
Atriplex polycarpa	4/17/73	12	12	31	25	0	12	12	0
	3/25/75	12	6	31	25	0	6	0	0
Lepidospartum squamatun	4/17/73	50	38	0	17	8	12	—	—
	3/25/75	0	8	0	8	0	0	—	—
Larrea tridentata	4/17/73	0	0	17	21	4	0	0	6
	3/25/75	0	0	12	12	0	0	0	0

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