



**Left: Crew transplanting native shrubs at Crowley Lake interchange on US 395 during April 1974. Right: Native shrub growth 3½ years after transplanting at Crowley Lake Interchange (November 1977).**

## Rehabilitation of eastern Sierra Nevada roadsides

P. Dean Smith

Jack Edell

Frank Jurak

James Young

The towering battlements of the eastern front of the Sierra Nevada provide travelers on US 395 in Inyo and Mono counties some of the most spectacular scenery in the western United States. From above 8,000 feet elevation on Conway Summit down to Bishop, summer vacationers or winter skiers have a breathtaking view from the highway. The White Mountains to the east complement the majestic grandeur of the Sierra.

Despite the beauty of the landscape, high elevation, short growing seasons, and relatively low precipitation severely limit the potential for plant growth. The environmental limitations are magnified on the margins of freeways, where construction has left exposed slopes with little or no soil for moisture retention or seedbeds.

A positive program was necessary if the damage from freeway construction was to be repaired. Trials were started in 1973 to see if native shrubs and hardy trees that appeared to be adapted to the site (table 1) could establish themselves and survive on the high elevation roadsides.

### Mammoth (Mono County)

Desert peach (*Prunus andersonii*), a hardy spring bloomer with beautiful, pale pink to rose flowers, was chosen for the first trial. This shrub spreads by underground stems and is native to

harsh sites with little soil development. Propagation of desert peach from cuttings is difficult; but many different types of paper, peat, or plastic containers are available for rearing and transplanting seedlings. In this test we used waxed-paper tubes, 16 inches long, that were excellent for rearing the seedlings but were too long for easy transplanting.

Planting holes were drilled with a power-driven post-hole digger into the bedrock on a slope cut in fractured volcanic rock at the highway interchange to Mammoth Lakes. On June 22, 1973, 40 shrubs were transplanted into the drilled holes. They were watered at planting and again after 1 and 2 weeks with the amount of water each site absorbed without runoff—from less than a pint to over a gallon. Other than the hole-drilling and watering, the shrubs received no care or maintenance.

In June 1976, 3 years after planting, 73 percent of the transplants were alive (table 2). The survival rate of desert peach in this harsh environment is highly encouraging.

### Crowley Lake (Mono County)

Larger plantings were attempted at the Crowley Lake interchange on US 395 on April 25, 1974 (figure 1), where planting holes were gouged in the barren rhyolite with garden shovels. In this and all subsequent plantings, seedlings were

reared in 6-inch-deep plastic pots, removed with the root-soil mass and placed in the transplant hole, and watered. They received no further maintenance.

Only four man-days were invested in planting and maintenance at the Crowley Lake interchange. In 1976, two years after planting, 80 to 90 percent of the transplants had survived (table 2).

A variety of native shrubs were planted at Crowley Lake: besides desert peach, there were spiny hopsage (*Grayia spinosa*), cliffrose (*Cowania stansburiana*), green rabbitbrush (*Chrysothamnus viscidiflorus*), gray rabbitbrush (*Chrysothamnus nauseosus*), four-wing saltbrush (*Atriplex canescens*), birchleaf mountain mahogany (*Cercocarpus betuloides*), and Utah juniper (*Juniperus osteosperma*).

Spiny hopsage and four-wing saltbrush, members of the Chenopodiaceae or Goosefoot family, are adapted to arid and often saline soil conditions. The flowers have no petals, so they are not showy; but their fruits are surrounded by bracts that can be very colorful and unique in appearance. Cliffrose, a member of the rose family, has attractive, dark green foliage and abundant, showy, pale cream flowers.

The rabbitbrush species belong to the sunflower or Compositae family, as do most of the dominant shrubs of the sagebrush vegetation. In fall, masses of tiny, golden-yellow flowers in compact inflorescences sometimes cover the entire shrub, complementing aspen groves of liquid honey-gold on the mountainsides. Being natural invaders of roadsides, rabbitbrush can grow very rapidly in roadside plantings.

### Sherwin Grade (Inyo and Mono counties)

Results at this lower elevation and environmentally poorer site midway down Sherwin Grade above Bishop were very different from the favorable results of the first two trials. In early fall 1974, 58 seedlings of several species were planted and watered once; none had survived by 1976. The survival condition of the transplant seedlings was questionable at time of planting because they had been poorly cared for at the Bishop holding site.

On November 14, 1975, seedlings were transplanted near the bottom of Sherwin Grade. Although the winter of 1975-76 was among the driest on record, survival was 98 percent at this site six months after planting and 89 percent in October 1976 (table 2).

On August 25, 1976, the first Sherwin grade site was replanted. Pinyon pine trees were included although the site is below the edge of the pinyon belt. A month later the survival rate was 83 percent. The tops of many pines had been clipped by rodents and left beside the trees.

### Mojave (Kern County)

The Mojave test plot, a low desert site on a highway off-ramp slope, is characteristic of more than half of the desert floor in Transportation District 9. Two plantings totaling 57 seedlings were set out October 1973 and February 1974. In May 1974, 90 percent had survived and were doing well (table 2). By December 1974, heavy rain had eroded the fill, making deep rivulets down slopes and exposing the roots of the transplants; by October 1975 no plants had survived.

### Conclusions

If these tests continue to show that seedlings can be quickly and cheaply planted in nearly barren rock and survive with almost no maintenance, the use of con-

tainer-grown native shrubs for transplanting in eastern Sierra roadsides appears highly feasible.

The costs, time, and facilities necessary for rearing native shrubs are quite substantial. Seed must be collected from native stands and germination sometimes depends upon special treatments to break dormancy. Seedlings are started in the greenhouse and transferred to lathouses before they are transplanted in the field, and the transplants require some care.

The cost of establishing desirable shrubs on roadsides would be greatly reduced if direct-seeding techniques were developed.

*P. Dean Smith is County Director and Farm Advisor, Inyo and Mono counties, UC Cooperative Extension. Jack Edell is Ecologist, California Department of Transportation, Bishop. Frank Jurak is Research Technician and James Young is Range Scientist, Agricultural Research Service, USDA, Renewable Resource Center, University of Nevada, Reno.*

*Burgess L. Kay, Wildland Seeding Specialist with the Agricultural Experiment Station, University of California, Davis, worked with some of the shrubs adapted to the Mojave Desert and made valuable suggestions to this project. The agricultural Research Service, U.S. Department of Agriculture, Range and Pasture Research Project at Reno, Nevada, provided container-grown native shrubs.*

TABLE 1. Species Transplanted to Roadside Sites in Inyo and Mono Counties, California; General Description of Adaptation.

Species planted	Common name	Area of adaptation	
		Upland trans-Sierra	Mojave Desert
<i>Atriplex canescens</i>	4-wing saltbrush	Alkaline soils	Higher rainfall areas
<i>Acamptopappys sphaerocephalus</i>	Goldenhead	—	Native of mojave
<i>Cercocarpus betuloides</i>	Birchleaf Mt. Mahogany	May not be hardy	—
<i>Chrysothamnus viscidiflorus</i>	Green rabbitbrush	Many disturbed areas both environments	
<i>Chrysothamnus nauseosus</i>	Gray rabbitbrush	Many disturbed areas both environments	
<i>Cowania mexicana</i> spp.	Cliffrose	Higher rainfall at edge of woodlands	—
<i>Eriogonum umbellatum</i>	Sulphur flower	Higher portion of sagebrush	—
<i>Ephedra nevadensis</i>	Gray ephedra	Both environments	
<i>Ephedra viridis</i>	Mormon or Squaw tea	Does best in sage brush environment	
<i>Eurotia lanata</i>	Winter fat	Lower edge of sagebrush	
<i>Franseria dumosa</i>	Burrowweed	—	Native of mojave
<i>Grayia spinosa</i>	Spiny hopsage	Rocky slopes in upper sagebrush	
<i>Isomeris arborea</i>	Bladderpod	—	Native of mojave
<i>Juniperus osteosperma</i>	Utah juniper	Rocky slopes in upper sagebrush	
<i>Pinus monophylla</i>	Single leaf pinyon	Rocky slopes in upper sagebrush	
<i>Purshia tridentata</i>	Bitterbrush	Upper portion of sagebrush at edge of woodlands	
<i>Prunus andersonii</i>	Desert peach	Sagebrush-especially granitic soils	
<i>Salazaria mexicana</i>	Bladder sage	—	Native of mojave
<i>Yucca brevifolia</i>	Joshua tree	—	Native of mojave

TABLE 2. Survival of Native Shrubs Transplanted to Mono and Inyo County Roadsides, 1973 through 1976.

Months after planting	Mammoth Interchange		Crowley Interchange		Sherwin grade (first planting)				Mojave	
					Middle		Bottom			
	No.	%*	No.	%	No.	%	No.	%	No.	%
0	40	100	275	100	58	100	100	100	57	100
6	34	85			21	36	98	98	51	90
12	26	65	245	89	0	0	89	89	1	2
24	28	70	239	87						
36	29	73								
40	28	70								

\* Apparent increase in percentage of survival is due to root sprouts from plants previously considered dead.