

Effect of Fire on a Mixed Grass-Shrub Range in Southern Arizona

R. R. HUMPHREY AND A. C. EVERSON

*Range Ecologist and Research Assistant, Department of Botany and Range Ecology,
University of Arizona, Tucson, Arizona*

LOW-VALUE shrubs have been invading southern Arizona grassland ranges for many years. These woody plants generally produce much less forage than the grasses they have replaced. Various eradication methods have been tried including the use of fire. The present study was made to determine the effect of burning on certain shrubs and grasses on a mixed grass-shrub range near Tucson, Arizona.

PREVIOUS SOUTHERN ARIZONA STUDIES ON BURNING

There have been indications that control methods on certain southwestern shrubs are most effective at the driest seasons of the year. Parker (1939) noted that with most southwestern plants burning can be accomplished most effectively during April, May and June. Thornber (1907) reported that burning an area of burroweed in June not only killed the burroweed but such other shrubs as catclaw (*Acacia Greggii*), creosote bush (*Larrea divaricata*), Mormon tea (*Ephedra trifurca*) and graythorn (*Zizyphus lycioides*).

Streets and Stanley (1938) concluded that the only practicable time to burn burroweed was in late spring (May and June) before the summer rains and in late fall (October and November) before the winter rains. Others have made similar observations.

LOCATION AND HISTORY OF STUDY AREA

The study was made on the Page-Trowbridge Experimental Ranch, about

35 miles north of Tucson, Arizona. An extensive outwash plain, or bajada, on which the ranch is located slopes gently to the west from a northern extension of the Santa Catalina Mountains.

The study area was a portion of a 10-acre plot that had been seeded in 1943 to a mixture of grasses, including Lehmann lovegrass (*Eragrostis lehmanniana*). A good stand of the lovegrass was established but there was little or no germination or survival of the other species.

Six shrubs or half-shrubs were abundant on the area: burroweed (*Haplopappus tenuisectus*), snakeweed (*Gutierrezia lucida*), jumping cholla (*Opuntia fulgida*), cane cholla (*Opuntia spinosior*), prickly pear (*Opuntia engelmannii*), and velvet mesquite (*Prosopis juliflora* var. *velutina*).

TREATMENT

Because the earlier studies of burning all indicated the greatest kill while soil moisture was low, the present study was planned so that burning in 1949 would take place before the advent of the summer rains. On June 15, however, 1.15 inches of rain fell earlier than normal. Although there had been no rain for the preceding 70 days, the June 15 moisture had penetrated the soil more than 8 inches at the time of the burn on July 1.

In the interim between June 15 and July 1 all of the shrubs in the area had presumably had ample opportunity to absorb moisture and recover at least partially from such desiccation as they had undergone during the preceding 70-day drought. The area was not burned,

therefore, at the theoretically optimum time for killing the shrubs.

The study area was selected to include as many plants of cholla, burroweed, and snakeweed as possible. Care was taken to locate the plot in a fairly dense stand of grass that would carry a fire.

The study area was divided into a north and a south half, each 225 by 80 feet. Prior to burning all shrubs were mapped. The height of each was recorded to determine possible relationships between size of plant and degree of kill. Because the shrubs were all growing, the plants in a given height class in 1950 were not necessarily the same individuals recorded in that height class the year before.

Eight 225-foot line transects were established at 10 foot intervals in each of the two areas. The number of Lehmann lovegrass plants that occurred on the eight transects in each area was recorded. The north half of the area was burned on July 1, 1949; the south half served as a check. The fire carried well and was classed as extremely hot over two-thirds of the area. The flames were high enough to envelop 3 to 5 foot mesquites. Where individual shrubs were missed by the main fire, local patches of grass surrounding them were ignited with a kerosene torch. In the absence of any grass the shrubs were individually handburned. The torch flame was applied for only a few seconds in an attempt to simulate as nearly as possible the heat derived from burning grasses.

Approximately a year after the 1949 mapping, the shrubs were remapped and the number of Lehmann lovegrass plants were recounted.

RESULTS

The 1949 summer and fall rainfall was unusually favorable for plant growth. In spite of this, fewer individuals of each of the five principal shrubs were recorded on both the burn and the check in 1950

than the year before. There was, however, a greater mortality of shrubs on the burned area (Fig. 1). The number of

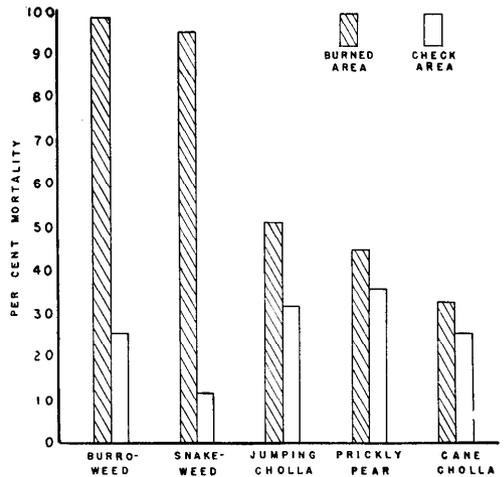


FIG. 1. Mortality of shrubs on burned and check areas in 1950 expressed as a percent of the number present in 1949.

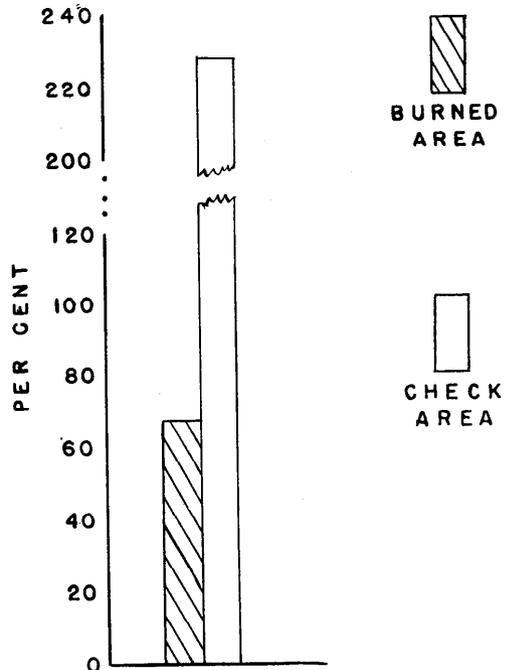


FIG. 2. Number of lovegrass plants on burned and check areas in 1950 expressed as a percent of the number present in 1949.

Lehmann lovegrass plants decreased on the burn and increased on the check (Fig. 2).

The reaction of the shrubs and grass in the check area was taken as the expected value and the data from the burned and check areas were analyzed by the chi-square test (Snedecor, 1940).

Burroweed

In spite of the favorable 1949 summer and fall precipitation, 25 percent fewer burroweed plants were recorded on the check plot in 1950 than the previous year. This may have been due in part to competition from the Lehmann lovegrass, which was dense and growing vigorously.

In contrast with the 25 percent decrease in burroweed plants on the check, there was a highly significant 98 percent decrease on the burned area. This represented a total of 329 plants ranging in height from 2 to 22 inches, all but 8 of which were killed.

Snakeweed

On the check area only 11 plants of snakeweed out of 98, or 11 percent, died between 1949 and 1950. On the burned plot all but 16 out of 335, or 95 percent died during this same period. This highly significant mortality was not restricted to any particular height class but was distributed rather uniformly among plants ranging in size from 1 to 18 inches.

Cactus

There were fewer plants of jumping cholla, cane cholla and prickly pear on both the burn and the check in 1950 than in 1949. Each of the three species, however, had a greater mortality on the burn than on the check. Jumping cholla had a mortality of 61 and 32 percent on the burned and check areas, respectively; a significant difference. There was a 32 percent mortality of cane cholla on the

burned area and 25 percent on the check. Prickly pear showed 44 percent mortality on the burned area and 35 percent mortality on the check area. Although the results with both cane cholla and prickly pear were not significantly different, the greater mortality of all three cactus species on the burned area indicates that all these cacti may be susceptible to fire.

Lehmann lovegrass

Burning reduced the stand of Lehmann lovegrass about one third. A count of the number of lovegrass plants on the transects in the burn showed 67 percent as many individuals one year after burning (Fig. 2). During this same period there was a 125 percent increase on the check. These differences are highly significant.

Although fire did kill some of the plants, the balance of the stand was growing vigorously one year later. Many new individuals had been established by nodal propagation and a good crop of seed had been set. Because of the ease with which Lehmann lovegrass becomes established, a temporary reduction in the stand is normally of little permanent consequence when compared with the benefits derived from control of noxious plants.

LITERATURE CITED

- PARKER, K. W. 1939. Control of Noxious Plants in the Southwest. Research Note No. 77. Southwestern Forest and Range Experiment Station. 4 pp. Mimeo.
- SNEDECOR, GEORGE W. 1940. Statistical Methods. Iowa State College Press, Ames, Iowa.
- STREETS, R. B., AND E. B. STANLEY. 1938. Control of Mesquite and Noxious Shrubs on Southern Arizona Grassland Ranges. Univ. of Ariz. Agr. Exp. Sta. Tech. Bull. No. 74, p. 491.
- THORNBUR, J. J. 1907. Destruction of Range Weeds. Ariz. Agr. Exp. Sta. Bull., 18th Annual Report, p. 228.