Chaparral fires change soil moisture depletion patterns

C. M. MCKELL • J. R. GOODIN
C. C. DUNCAN

WILDFIRES IN CHAPARRAL occur with amazing regularity and consume a tremendous amount of fuel. Published figures indicate that the average fire in chamise consumes between 15 and 25 tons of fuel. However, only temporary changes in vegetation occur as a result of the fire; the resprouting habit of most chaparral species insures that there will be abundant fuel for the next fire. The relatively small changes in vegetation consist primarily of dramatic but short-duration increases in annual species.

Any opportunity for a permanent change in the composition of range vegetation species depends upon the length of time that favorable environmental conditions exist for the establishment of perennial species such as shrubs or grasses. One of the most critical factors in a Mediterranean-type climate is the supply of soil moisture during the long, hot, dry summer. Seeds of many species germinate with the fall rains and are able to grow during the cool, wet winter months, but the drought of late spring and summer acts as a barrier to successful permanent establishment of perennial species. To utilize chaparral-covered lands for greater forage production, increased water yield, improved recreation and wildlife conditions, and to reduce the hazard of future wildfires, a program of conversion to species other than chaparral may be desirable. A clear understanding of soil moisture availability is essential, however, for success in vegetation conversion.

In the fall of 1964, a wildfire swept through 85 acres of chaparral-covered hillsides near Lake Henshaw in San Diego County. The area was used primarily for livestock grazing and as a watershed for the nearby lake. The important brush species in the area were chamise (*Adenostema fasciculatum*), scrub oak (*Quercus dumosa*) and manzanita (*Arctostaphylos glandulosa*). Under the brush and in open spaces were red brome (*Bromus rubens*), filaree (*Erodium botrys*), and other grasses and forbs. The site was generally a northeast-facing 20-degree slope with soil 30 to 36 inches deep.

The pattern of soil moisture depletion was observed for three years on four sites in the burned area and on four similar sites in the adjacent unburned area. Gypsum electrical resistance blocks (concentric-electrode type) were placed in the soil at 12-, 24-, and 36-inch depths equidistant to the nearby chaparral plants. Block readings were made generally at 3-week intervals and notes on the vegetation were taken at the same time.

During the first year, very large differences in soil moisture depletion between the burned and unburned areas were evident (see the graph). While the soil under the unburned chaparral became extremely dry, there was sufficient soil moisture at the 24- and 36-inch depth in the burned area to permit the carryover of some young seedlings. Even at the 12-inch depth in the burned area, drought occurred three months later than in the unburned area.

Soil moisture depletion on the burned area during the second year after the fire was essentially the same as on the nearby unburned area. Only at the 36-inch depth on the burned area was there any delay in the rate of moisture use. The rapid regrowth of the chaparral and abundant growth of annual species placed a heavy demand on the existing soil moisture.

By the end of the third year the volume of chaparral regrowth and herbaceous vegetation had developed to such an extent that soil moisture depletion occurred earlier on the burned area than on the unburned area. Competition for soil moisture in the burned area was emphasized by rapidly recovering chaparral as well as by considerable annual vegetation.

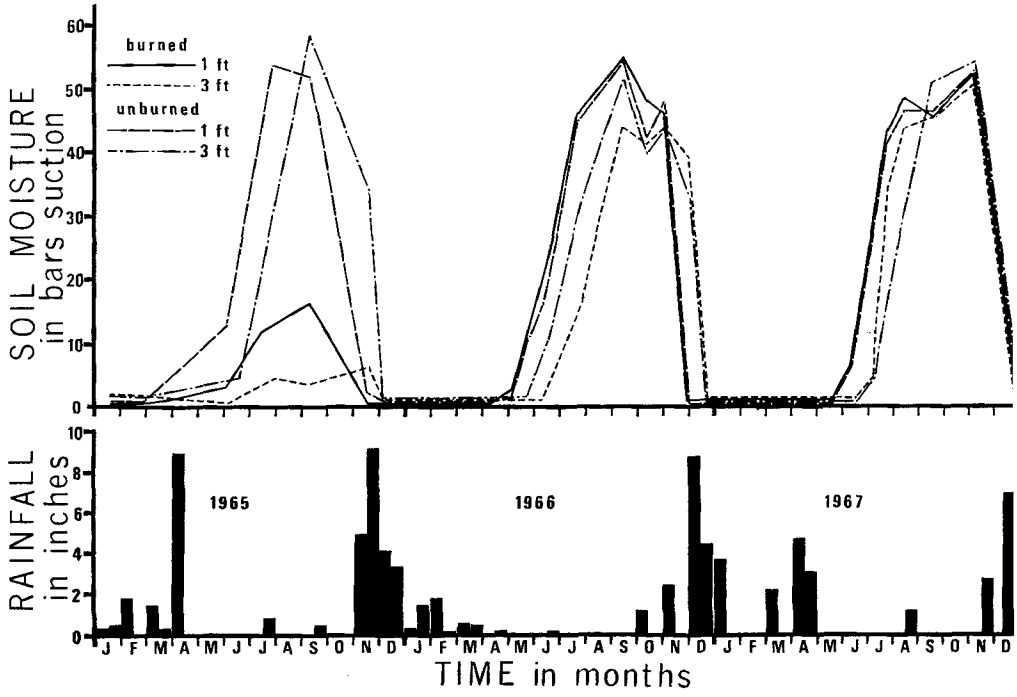
RATE OF CHAPARRAL REGROWTH AFTER BURNING LAKE HENSHAW, CALIFORNIA, 1966–68

	Chamise	Oak	Manzanita
	Height of live vegetation (inches)		
Unburned			
January 3, 1968	80	180	96
Burned regrowth			
September 15, 1966	24	60	12
November 29, 1966	24	70	24
May 19, 1967	24	72	38
January 3, 1968	30	78	48

This study shows that the period of favorable soil moisture for the establishment of perennial species as a replacement for chaparral is very short, under natural conditions. Species that have a sufficiently rapid rate of growth to achieve establishment in the early post-fire period must be adapted to intense competition for soil moisture as the regrowth of chaparral intensifies moisture use. Under some conditions it may also be possible to retard or stop the recovery of the chaparral by using herbicides and thus increase the duration of a favorable soil moisture supply.

Not all burned areas recover with the

RAINFALL AND SOIL MOISTURE AT 1-FT AND 3-FT DEPTHS IN BURNED AND UNBURNED CHAPARRAL TEST PLOTS, SAN DIEGO COUNTY



same speed as did the one in this study. Numerous factors may influence the rate of recovery of burned vegetation. Even so, the chances for success in chaparral conversion will be improved if full use is made of the short period of favorable soil moisture, or if steps are taken to increase its duration.

C. M. McKell is Agronomist, J. R. Goodin is Assistant Agronomist, and C. C. Duncan is Laboratory Technician, Department of Agronomy, University of California, Riverside.

University of California Division of Agricultural Sciences, Agricultural Experiment Station, Berkeley, California 94720

C. F. Kelly
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