

Record Low Fuel Moisture Follows Drought in Southern California

Arthur R. Pirsko and Lisle R. Green

PROLONGED DROUGHT is like a cumulative poison to southern California chaparral. In some areas drought has killed as much as a fourth of the standing brush—either as parts of plants or whole plants—and thus contributed to the hazardous fire situation that plagues firefighters in southern California.

Precipitation there has been subnormal in all but one of the past seven years, and in all but three of the past 18 (Fig. 1). It was particularly dry in the period July 1, 1958 to June 30, 1961; rainfall then averaged less than 50 percent of normal throughout most of southern California.

This low rainfall had a deleterious effect on the chaparral. *Ceanothus* species, in particular, were hard hit. They died out of the stand in some localities. Sage (*Salvia* spp.) was generally not killed outright, but looked as if it had been because a large proportion of the branches and twigs died. Foresters were alarmed over the appearance of such abundant species as chamise and oak in 1960-1961, and they frequently

expressed fear that extensive stands of these species were dying. This fear proved unjustified, but leaves dried and fell to the ground and dead branches accumulated (Figs. 2, 3) on the living shrubs.

Most new chaparral plant growth occurs in spring, after the winter rains and when air temperatures rise. New foliage normally has moisture contents of 160 to 180 percent of its dry weight. But in chamise study plots in 1959 the peak moisture was about 95 percent in early May; the low point was 59 percent moisture in mid-September (Fig. 4). Moisture content was somewhat higher in 1960, ranging from 120 percent in early April to 69 in July, when the study plot was destroyed by wildfire, and a comparable adjacent site was selected for subsequent measurements.

A rainy season 40 percent of normal got the 1961 growing season off to a bad start. By May the average chamise moisture was already down to 74 percent. Weather continued hot and dry, and plant moisture dropped to the 45 percent range by mid-July. This level held until October 11, when the first major Santa Ana foehn wind started. Moisture in leaves and twigs of chamise fell to 25.7 percent and in scrub oak (*Quercus dumosa*) to 35.8 percent on October 31 (Table 1). These are the lowest figures on record. The moisture content remained near this level until the first significant rain November 20.

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Fig. 1.—Annual precipitation as represented by average for ten index stations.¹ Stations included: San Diego Airport, Los Angeles, Santa Barbara, Santa Maria Airport, Riverside Fire Station 3, Cuyamaca, Big Bear Lake Dam, Mt. Wilson FC 338 B, Ozena, Indio (U.S. Date Garden).

¹ Pearson, Elmer G. Water-Resources summary for southern California, 1963. U.S.D.I. Geo. Surv. Los Angeles, Calif.

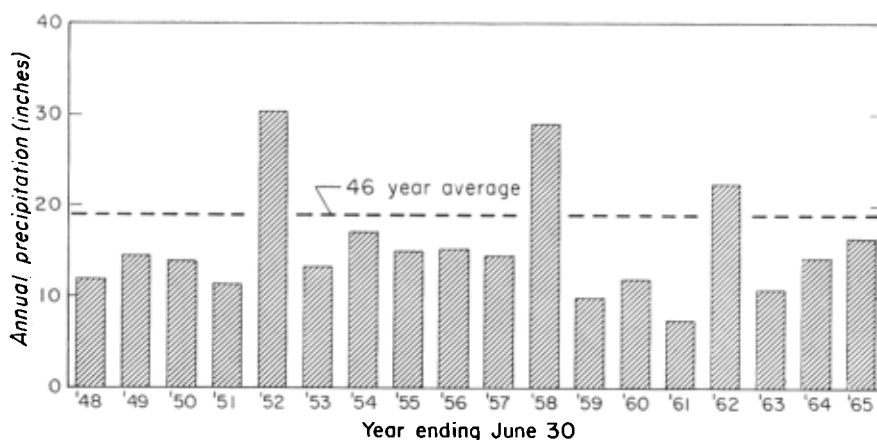




Fig. 2.—Only a few branches have green leaves on this chamise plant. (above)



Fig. 3.—Dead twigs and branches accumulated on scrub oak plants during the drought years. (right)

What do such moisture levels mean to fire control forces? As one indicator of the problem, you can calculate that the difference between a normal 70 percent and the recorded 26 percent represents a deficit of about 1,600 gallons of water per acre in a chamise stand averaging 16 tons, dry weight. Burning conditions become more hazardous, and extra fire prevention measures are needed to protect chaparral watersheds. Once fire is established, its spread is assured. Experience so far suggests that moisture content in living fuel becomes critical in terms of fire behavior at about 70 percent. Below that point fires spread fast and are difficult to control. As the moisture content drops to 25 to 40 percent, the potential for a conflagration becomes extreme.

Table 1.—Moisture Content, Dry Weight Basis, of Living Leaves and Twigs, Angeles National Forest, at Specified Dates¹

Species and plot no.	October 31, 1961	November 14, 1961
Chamise:		
Plot 1	28.0	23.7
Plot 2	23.5	31.1
Plot 3	—	31.1
Average	25.7	28.6
Scrub oak:		
Plot 1	41.9	40.7
Plot 2	29.7	39.1
Plot 3	—	32.2
Average	35.8	37.3

¹ Moisture content determined by solvent distillation method.

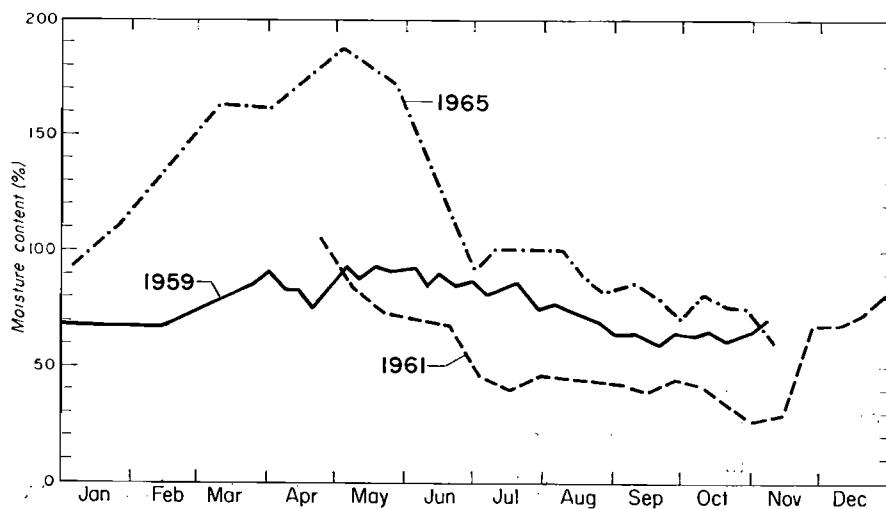


Fig. 4.—Annual changes in chamise moisture content, Angeles National Forest.