CHAPARRAL TO GRASS CONVERSION

doubles watershed runoff

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Conversion of chaparral-covered watersheds to native grasses and forbs resulted in production of significantly more surface water runoff—without appreciable erosion after conversion—in southern California test areas. Grazing potential of the watersheds was also greatly increased and wildfire hazards reduced.

Runoff and erosion were measured from small plots and from a pair of fractional-acre watersheds on chaparral-covered watersheds in southwestern Riverside County—largely during the period 1943 to 1959. The land is typical of the chaparral watersheds of San Diego County and of portions of Riverside and Orange counties—but probably not similar to those of the San Gabriel and San Bernardino Mountains, where slopes are often unstable.

Watershed records of runoff, erosion, and vegetation were compiled over a 3- to 5-year period before hand clearing of brush and raking off of litter. A hand spray program was used to kill brush regrowth. Seeding to grasses was attempted somewhat unsuccessfully, but the conversions ended up with reasonable stands of native annual grasses and forbs.

Some information was also obtained from two wildfires that swept through varying parts of the area. Records showed that the vegetation conversion caused by the fires resulted in a statistically significant increase in surface runoff. There was increased erosion from some plots during the several years it took to obtain a reasonable stand of grasses and forbs but other plots did not show such an increase.

Paired 50 ft. × 50 ft. plots in dense chaparral with scrub oak predominating. Picture taken in fall of 1961, 2 years after plots abandoned. Plot on left (at arrow), was first cleared in 1949. Brush regrowth was prevented at first by mechanical (pruning) measures and subsequently by a spray program. After a conversion period of several years, there was a good cover of grasses and forbs on the plot. Brush is again invading the plot (last spraying in spring of 1958). Plot on right is still covered with original chaparral (can be located by the surge tank at the lower right hand corner).

Rainfall data

Rainfall from 1943 to 1959 at the plots averaged slightly under 16 inches per year compared with long-time records indicating an average rainfall of 19 inches or better. Obtaining these records during a period of below normal rainfall was considered an advantage because water production is most critical at such times.

Research in other parts of California, particularly by the University's Department of Irrigation at Davis, has also indicated a saving in water by conversion from brush to grasses and forbs. This saving occurred because the annual grasses and forbs extracted moisture from the soil only to a depth of 4 feet, while brush species would exhaust the available moisture throughout the soil profile. This was not an important factor, however, in the southern California experiments because the rainfall usually did not provide appreciable wetting below a depth of 4 feet.

The increased runoff was a surface ef-

Low corner of plot in chamise that was cleared in 1950, and given the last spray treatment in the spring of 1958. Picture taken in September 1961. Chamise is again beginning to invade plot. Sparse cover of grasses and forbs is because of very low rainfall in the winter of 1960–61, and because of extremely heavy browsing subsequently. Deer and cattle strongly favor such open areas in brushlands, particularly after the driest year on record.

fect. It did not appear to be affected by any loss of infiltration capacity of the soil, but rather by the lessened amount of litter on the soil surface. Thick layers of litter, largely dead leaves and twigs, gradually accumulate under brush in this climate, and apparently serve to hold precipitation during periods of intense rainfall. This detention increases the infiltration period so that more water enters the soil. While it is conceivable that grasses could reach such density as to lengthen infiltration periods, such densities were never approached on these plots—and are highly improbable.

Doubled runoff

Under the prevailing conditions, the scanty direct surface runoff on the slopes where the precipitation occurred was about doubled by vegetation conversion.

The records show that there was often, but not always, erosion resulting from wildfire or from the clearing procedures used to effect vegetation conversion. Gullying of colluvial or alluvial soils from canyon bottoms was not involved. There was no evidence of appreciable erosion following establishment of a reasonable cover of grasses and forbs.

In regard to erosion, a great deal of "dry creep" was observed on steeper slopes under heavy brush with thick litter. This is the gradual drifting of a mixture of litter and soil crumbs down the slopes during dry summers. Surface soil under thick litter tended to be loose and crumbly. With the litter burned out from around the soil crumbs following wildfire, the drift of this loose soil down the slopes was greatly accelerated. Conversion to grasses and forbs tended to keep the soil crusted, with little or no evidence of dry creep.

More water

Test conclusions indicate that if such watersheds can be maintained in grasses and forbs rather than brush more water could be produced for downstream use—and such a program might well result in less rather than more erosion. It must be mentioned that the slopes involved in this work were not unstable (steeper than the angle of repose of the soil). It is presumed that vegetation management would not be attempted, or would be severely restricted, on unstable slopes.

Vegetation conversion can also be expected to result in substantial increases in the grazing potential of the land, according to work by University departments at Davis. It also appears that conversion would greatly lessen the fuel available for wildfires and would simplify fire fighting problems.

It is not to be inferred that controlled burning is being suggested. The vagarities of southern California's weather, smog, and the density of population make such a practice an untenable hazard. It is suggested, however, that vegetation management could well be practiced on watersheds following wildfires.

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HEAT AND MATURITY OF ORANGES

Samples of fruit from the same Washington Navel orange trees have been analyzed for maturity on the same calendar date for eight consecutive years. The Brix/acid ratio in the juice of the fruit has varied from 8.75 to 15.39. Evaluation of the data indicates that these year-to-year variations in fruit maturity are more closely related to total heat at certain critical periods in the development of the fruit than to any other climatic factor. Available heat units above 55° F are significantly correlated with the Brix/acid ratio for April and with the percent acid in the juice for August. April and August represent the time of flowering and the beginning of acid formation respectively. Thus it appears that the date of maturity may be predicted several months in advance of actual maturity. This work is continuing.—*W. W. Jones, Dept. of Horticultural Science, Riverside.*

STUDIES ON FOREST SOIL NITROGEN

Tree productivity of forest soils varies widely. For example, 300-year-old ponderosa pines range from less than 65 to more than 210 feet in height. Such variations, as measured by site index, are positively correlated with soil nitrogen content over a wide range of conditions in California. Nitrogen contents—to a depth of 4 feet—range from 1,960 pounds per acre, on the less productive soils, to 12,350 pounds per acre on the best sites.

Cooperative studies in the San Dimas Experimental Forest showed that manipulation of cover species can affect soil nitrogen content and fertility significantly. Over a 10-year period, soil under chamise lost almost 28 pounds of nitrogen per acre per year, and soil left barren also lost nitrogen. Under ceanothus cover, a similar soil gained an average of 57 pounds of nitrogen per acre per year during the same period. The nitrogen gain under ceanothus was more than three times that under Coulter pine.—*Paul J. Zinke, School of Forestry, Berkeley.*