

SOME RESEARCH FINDINGS ON THE
ALAMOGORDO CREEK EXPERIMENTAL WATERSHED

R. V. Keppel and J. L. Gardner^{1/}

The climate of more than three-quarters of the land surface of New Mexico is arid or semiarid. Such lands yield only a very small proportion of their low annual precipitation as useable water for downstream areas. On the other hand, they contribute the major part of the sediment entering reservoirs.

Most of this vast area is devoted to the grazing of livestock, but there is little reliable information concerning the relation of range conservation programs on water and sediment yields from ranges receiving limited rainfall. In 1951, therefore, the Operations Division of the Soil Conservation Service requested its Research Division to initiate research aimed at furnishing such information, using watersheds of approximately 50-square miles with annual precipitation of 12-16 inches. Accordingly, investigations were started in 1953 on the Walnut Gulch watershed at Tombstone, Arizona, and in 1954 on the Alamogordo Creek watershed southeast of Santa Rosa, New Mexico. The work was subsequently transferred to the Agricultural Research Service and is being continued in cooperation with the Agricultural Experiment Stations of New Mexico and Arizona, the Soil Conservation Service, the local Soil Conservation Districts, and the ranchers upon whose land the research is being done.

Originally, one possibility considered was to collect hydrologic data from pairs of watersheds, treating one of the pair with a practical range conservation program and leaving the other untreated. The difficulty of finding two comparable, contiguous, 50-square-mile areas, however, led to adoption of the present plan of a calibration period long enough for a reasonable sampling of climatic variation, followed by at least a similar period of treatment. The work is still in the calibration phase.

Alamogordo Creek is an ephemeral tributary of the Pecos, entering just above the Alamogordo reservoir. The area under study comprises 67 square miles on the upper reaches of the south branch. The vegetation is mainly grassland, with some pinon and juniper on the breaks and some of the shallower soils. Annual precipitation averages approximately 14 inches; but it is highly variable from point to point and from year to year. Precipitation is measured in 60 recording raingages; runoff, by a pre-rated, critical depth flume at the watershed outlet. It is planned to install additional instrumentation on several subwatersheds representing the different soil-vegetation complexes.

A distinctive feature of the hydrology of these semiarid regions is the very small areal extent of runoff-producing rains. A high proportion--90 percent or more--of the runoff results from summer convectional thunderstorms. Five years of data from the dense raingage network on the Alamogordo Creek watershed show that 80 percent of the runoff-producing storms have covered

^{1/} Agricultural Engineer and Botanist, respectively, Watershed Technology Research Branch, Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Department of Agriculture, Tucson, Arizona.

areas of no more than three square miles. Several such storms may occur simultaneously on the watershed, and the resulting runoff hydrograph is strongly influenced by the pattern and intensities of the storms.

Owing to the small size of the runoff-producing storms, the resulting runoff from one or more of them may flow through an extensive network of dry channels before reaching the watershed outlet, and much of it may be absorbed. On the 58-square-mile Walnut Gulch watershed at Tombstone, Arizona, where runoff from several subwatersheds is measured, these transmission losses have amounted to 20 acre-feet per mile of channel during a single flow. Since subwatersheds have not as yet been instrumented at Alamogordo Creek, these channel losses have not been measured. Because of finer-textured channel material, however, they are not expected to be as large as those at Walnut Gulch. This phase of the problem will receive more attention as we become able to extend the instrumentation on the watershed.

Although yearly precipitation has been highly variable, runoff has depended more on areal extent and intensity of individual storms than on yearly total precipitation. In 1956, a very dry year on the area, precipitation recorded by different gages varied from two to seven inches. Total runoff from the 67 square miles was 0.22 inch, of which 98 percent resulted from a single intense storm. This storm, which came in July, accounted for about half of the yearly precipitation on that part of the area upon which it fell. Precipitation in 1958 was higher than usual over most of the area: the gage receiving the lowest amount recorded 8.5 inches; that receiving the highest, 24 inches. Total runoff that year was 0.15 inch, of which 75 percent came from August storm of smaller size and lower intensity than the July, 1956 storm. The remaining 25 percent of the 1958 runoff resulted from several small storms of relatively low intensity.

This effect of storm size and intensity is further emphasized by the rain and resulting runoff of June 5, 1960, which covered nearly 50 square miles of the watershed with two inches or more of precipitation. Rainfall over much of the storm area was very intense, and runoff from the 67-square-mile study area was 0.93 inch, which exceeded the total amount recorded for the preceding four years.

Although the period of study has been too short to permit drawing firm conclusions, a few tentative ones are emerging:

Where variability in thunderstorm and runoff occurrence is so great, a relatively long calibration period is necessary before beginning watershed treatment. As yet, the period is insufficient at Alamogordo Creek.

Since during the past five years more than 80 percent of the total runoff at Alamogordo Creek resulted from four large runoff events, it appears probable that application of range management practices that might affect the smaller runoff events could have little effect on total water yield from such upstream areas.

Continuing research on the Alamogordo Creek Experimental Watershed will provide additional basic information on storm patterns, rainfall-runoff relationships, and effects of conservation programs on water and sediment yields from rangeland watersheds of the Southwest.