

CPER Field Day, August 24, 1990

Hydrology at the CPER

Research at the site on the CPER is being conducted by the ARS Hydro-Ecosystem Research Unit in cooperation with the LTER program on the Shortgrass Steppe.

The objective of hydrology research being conducted by the Hydro-Ecosystem Research group of the ARS at CPER in cooperation with the CPER/LTER project is to validate a spatially explicit hydrologic simulation model for semiarid grassland, and to provide long-term observation of hillslope hydrologic processes. The research involves both natural runoff plots and rainfall simulation studies.

The field experiment is designed to sample 2 dissimilar toposequences to represent much of the variability of soil properties at the CPER. Since the soils are not uniform and slopes are quite variable, runoff, infiltration, and soil water are also variable. Runoff can be produced at upper slope positions and infiltrate at lower slope positions so that although runoff reaching the bottom of a hillslope is minor, substantial redistribution of water may occur. To characterize the spatial patterns of run-off, run-on, infiltration, and resulting soil water dynamics, we are using 2 series of successively longer microwatershed plots with automated instrumentation. This approach allows us to estimate process rates in each of four slope segments without isolating each segment from upslope influences. Four rain gages and a complete micromet station are located within the hydrology experiment area. Observations of natural rainfall events are being supplemented with simulated rainfall events using small (22 by 7 m) plots representing individual slope segments.

Small (patch)-scale soil water dynamics at this site are determined by soil hydraulic properties and precipitation patterns. Toposequence-scale soil water dynamics depend on processes and controls at the patch scale as well as on redistribution by overland and subsurface horizontal flows. On most dates, toposequence-scale water dynamics can be treated as a series of isolated patches. Infrequently, a large or high intensity rainfall event will result in important horizontal flows of both water and material (Fig. 3.11). Data from the site provide information about run-off and run-on of water along catena segments of varying length. This work is beginning to provide information about the conditions required to generate water flows along toposequences and the magnitude of those flows over segments of the slope. Results for 2 rainfall events, one resulting in 86 mm of rain in 1.5 hours and the other producing 40 mm of rain in 8 hours, illustrate the variability in runoff and infiltration that can occur as a function of intensity and duration of rainfall, aspect, and the length of the toposequence segment over which runoff was measured (See figure on reverse of this page).

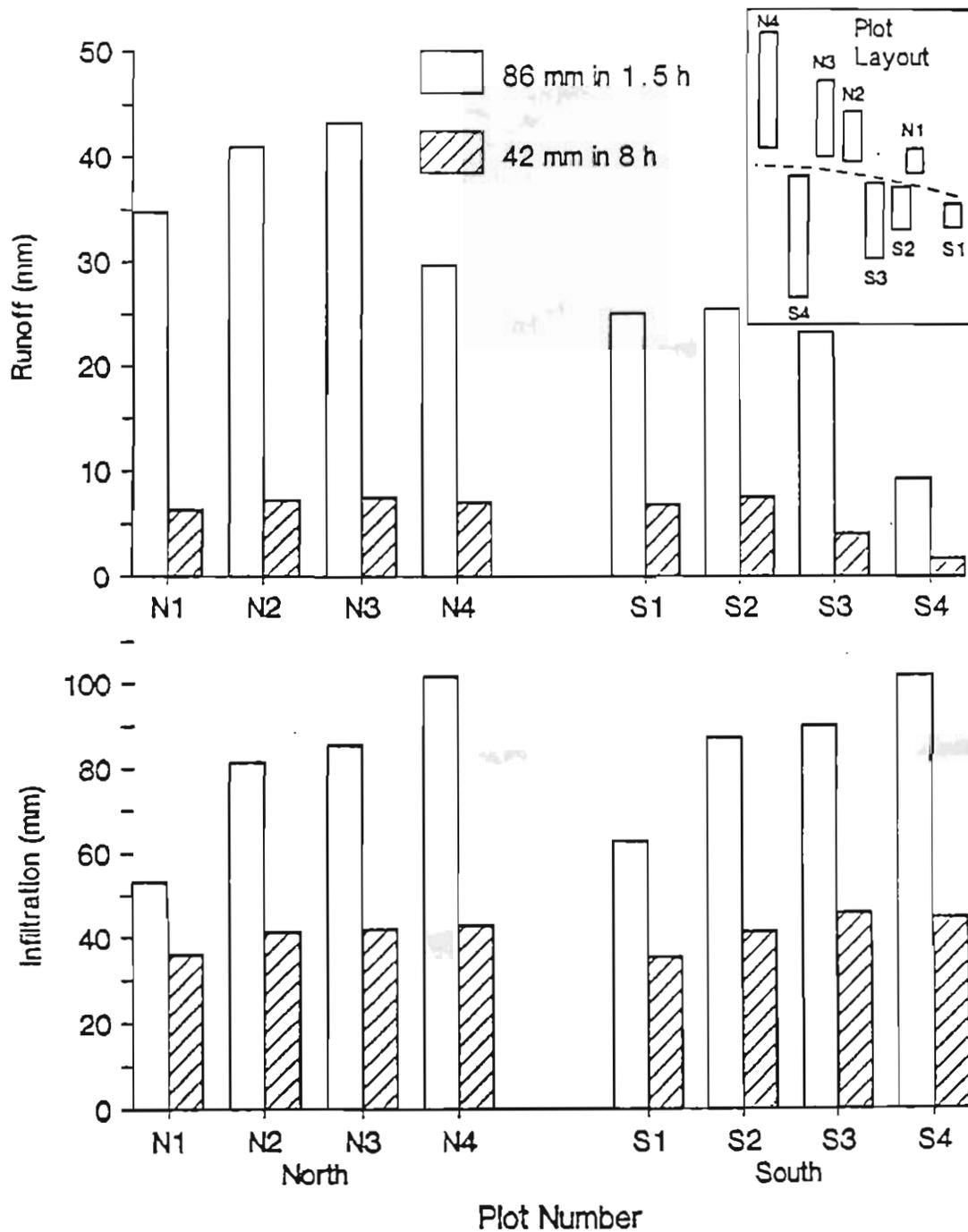


Figure 3.11 Quantities of runoff and infiltration for two rainfall events at the CPER. Soil depth increases downslope and is greater on the the south than the north slope. The inset indicates the relative position and length of each of the plots.