JOURNAL OF
THE IRRIGATION
AND DRAINAGE DIVISION

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DISCUSSION

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Functions to Predict Optimal Irrigation Programs, by J. Ian Stewart, Robert M. Hagan, and William O. Pruitt (June, 1974. Prior Discussion: Mar., 1975).
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Note.—This paper is part of the copyrighted Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 101, No. IR3, September, 1975.

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Estimation of Rainfall Erosion Index[a]

Discussion by Kenneth G. Renard,[2] M. ASCE

Difficulties associated with estimating the rainfall erosion index (R) of the Universal Soil Loss Equation (USLE) in mountain and range country where orographic precipitation effects are prevalent will make erosion estimates truly educated guesses until precipitation patterns are better quantified. The author is to be commended for his contribution to this complex problem.

To assume that rainfall in all parts of the country, except the Pacific slopes of California, Oregon, and Washington, can be expressed by one dimensionless rainfall graph as was done in Fig. 2 is not realistic. Nevertheless, such an approach *might* be applicable for broad planning purposes, but it should not be expected to suffice for detailed investigation.

The rain storms of the Palouse area in Washington, Oregon, Idaho, and the air mass thunderstorm-dominated precipitation area of the Southwest are two interesting examples of why such a rainfall distribution will not suffice for computing the rainfall erosion index.

Some of the most severe erosion per unit area in the United States occurs in the Palouse area. Yet in this area, the 2-yr, 6-hr rainfall values from Fig. 5 vary between about 0.75 in. and 1.0 in. which indicates very low values of R. Work by McCool in this area indicates an adjusted R value must be developed to account for snow, rain on snow, or rain on frozen ground plus the overland flow from contributing areas upslope.

In most of the rangeland areas of the Southwest, air mass thunderstorms dominate the runoff response of a watershed to precipitation. Such storms are characteristically of limited aerial extent, high intensity, and very short duration (11). Examples of the depth-duration curves for selected air mass thunderstorms are superimposed on the two curves of Fig. 8. These data are from storms (the central gage from storms creating high runoff) at the 90-gage Walnut Gulch Experimental Watershed near Tombstone in Southeastern Arizona, and at the 66-network on the Alamogordo Creek Experimental Watershed near Santa Rosa in Eastern New Mexico.

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[a]September, 1974, by John K. H. Ateshian (Proc. Paper 10817).

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The figure shows clearly that the type II distribution poorly represents storms that produce runoff on these two experimental watersheds. Air mass thunderstorms normally last less than 2 hr unless they are associated with a frontal storm system such as occasionally occurs on Alamogordo Creek. Accordingly, the individual storm erosion index for such short duration events required using very short time increments (often 5 min or less) from the recording raingage. Some additional comments follow in a discussion by the writer and Simanton.

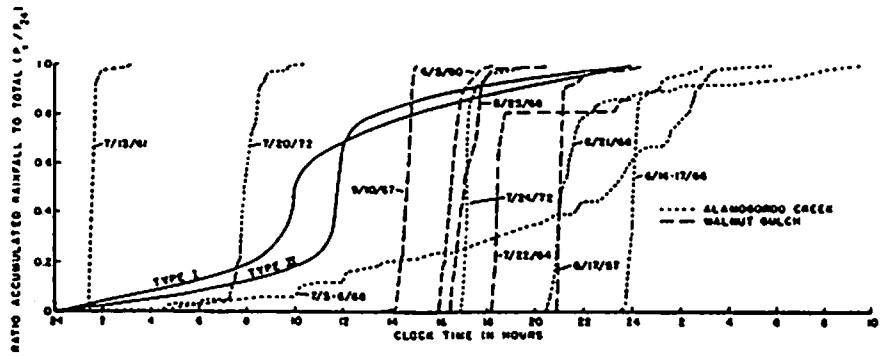

FIG. 8.—Revised Time Distribution of Dimensionless Rainfall Depth for Two Storm Types (1)

In many areas, erosion is produced not only from raindrop impact, but also from the combined action of raindrop impact and shear of the water as it moves over the land. The relative significance of each factor undoubtedly varies geographically and seasonally. Onstad and Foster (10) modified the R term as

$$R_{eq} = aR + bc\,Qq_p^{1/3} \quad \text{(22)}$$

in which R_{eq} = equivalent R factor; R = rainfall factor as defined in the USLE; Q = runoff volume, in inches; q_p = peak runoff rate, in inches per hour; a,b = weighting parameters ($a + b = 1$); and c = equality coefficient determined from rainulator plot data.

Such a modification of the USLE should facilitate application to a much wider range of conditions. The modification was used in an agricultural chemical transport model (9) with considerable success.

Appendix.—References

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*Discussion period closed for this paper. Any other discussion received during this discussion period will be published in subsequent Journals.