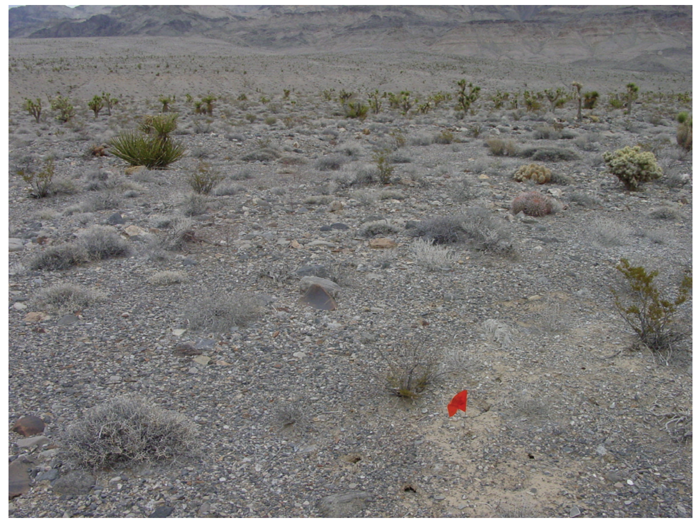
Completed Research

Urban Flood Demo Program & Southwest Demo Program

US Army Corps of Engineers®

Assess and Improve Infiltration Analyses to Support Estimates of Recharge and Initial Abstraction

Products An analysis of the impact of heterogeneity of soil hydraulic properties on runoff generation in the Corn Creek fan area, NV.



Corn Creek Fan Complex, Desert National Wildlife Refuge

Benefits This study provides knowledge to correlate soil physical properties to hydrological processes. Soil hydraulic properties and their spatial variation on an alluvial fan area were measured. The potential hydrologic impacts of this heterogeneity are better understood. The study demonstrates the research approach for characterizing alluvial fan hydrology.

Issue Infiltration characteristics of undisturbed desert surfaces can greatly influence the amount of precipitation that becomes surface runoff or recharges deep soil. Estimates of surface runoff potential are of interest to many flood control agencies and other stakeholders. Lumped parameter approaches are typically used to estimate the runoff potential. In these approaches, however, the infiltration processes generally do not account for spatial variability of land surface conditions such as the soil properties, the canopy cover, and land use pattern. The impact of the physics of infiltration can be significant, affecting the initial abstraction of water (precipitation which is intercepted before it infiltrates), and the volume and timing of the peak flow. It can also affect the interaction between vadose zone soil water and deep ground water, which are important issues for flood control and water resource management agencies.

Description The overall goal of this work is to incorporate estimates of spatial variability of soil infiltration into precipitation-runoff models, and to compare surface runoff predictions to a commonly used model that incorporates a different modeling approach. Field work and data analyses were done at the Corn Creek Fan Complex at the Desert National Wildlife Refuge, north of Las Vegas, NV. The tasks of this project included (1) using geomorphic analyses to identify soil surfaces of varying ages and distinguishing characteristics; (2) characterizing hydraulic properties of surface materials that exist in distinct geomorphic surfaces on the Corn Creek Fan; (3) conducting rainfall simulation experiments to estimate time needed to initiate surface runoff; (4) using results from field measurements to correlate hydraulic and runoff properties with surface materials and features; and (5) collaborating with U.S. Army Corp of Engineers (USACE) scientists and engineers to implement physical and hydraulic relationships into simulation codes. Model comparisons between HEC-1 and a physically-based distributed model were also done using the Corn Creek database, to examine whether incorporating the spatial heterogeneity of soil properties and topography would influence the different predictions of runoff. The results showed that a three-fold decrease in hydraulic conductivity would lead to a 50% increase in peak discharge, an effect exacerbated by nonuniform storm distributions. Significant differences in runoff potential were also found when compared to the HEC-1 model used by the local regional flood agency.

Sponsor

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