ABSTRACT

One of the most striking features of the landscape in the northeastern Badia of Jordan is the presence of desert stone pavements covering the vast majority of the ground surface of the late Cenozoic volcanic landscape. These desert pavements armor the accretionary mantles of eolian origin that cover the volcanic surfaces, influencing long-term landscape stability, flood hydrology, and geomorphic evolution of the valley floor in this part of Jordan. In combining detailed files and laboratory studies, the interrelationships among the physical characteristics of the stone pavements and the underlying mantle, morphological and hydrologic properties of soils developed in the mantles, drainage network development, and hydrologic responses resulting in flood generation are quantified.

Spatial variations in desert pavement characteristics are measured over a 320-square-kilometer catchment of the Wadi el Ghussien. Based on stone-cover size, stone-cover percent, and stone sorting described on the most stable, flat surfaces of the volcanic landscape, three pavement units—DP1, DP2, and DP3—were determined. Map unit DP1 is 100% covered with stones having a 22-mm average size, DP2 is 88% covered with stones having a 41-mm average size, and DP3 is 64% covered with stones having a 154-mm average size.

Chemical and geomorphological properties of the soils beneath the individual desert pavement map units show significant variations in pedogenic processes. Variations in soil-water movement and salt leaching are significant between the different types of pavement. Within the same pavement type (map unit), variations also exist between volcanic upland and volcanic lowland soils. Drainage networks appear to be adjusted to

the hydraulics of the flow on each pavement type and to the underlying soil properties within each map unit. Surface runoff and integration of flow from different parts of the catchment appear to be controlled by pavement characteristics and channel morphometry. High-magnitude floods derived from the desert pavements are primarily associated with convective storms affected by the influence of the Red Sea Trough during the transitional seasons.

Floods in the catchment are the main source of water recharge to the shallow perched aquifer found along the main channel of the Wadi el Ghussien catchment. Recharge primarily occurs as transmission losses through the rough, bouldered channel bed. The stone pavements of the Badia desert reflect a long-term history of geomorphic stability, resulting in broad zones of regional runoff from convective storms and recharge along the floors of valleys set into the landscape.