

Preface

This volume is a tribute to the contributions made by Asher Schick to the science of geomorphology. The papers derive from a conference organized in May 1999 at the Hebrew University, Jerusalem. The conference, under the leadership of Marwan Hassan, was organized around the theme of drainage basin processes and morphology, and was intended to reflect those research themes that have most captivated the attention of Asher Schick. The success of Schick's work derives in large part from his single-minded focus on the fundamental links between geomorphology and hydrology, especially as demonstrable from his experimental watershed at Nahal Yael in Israel.

The contributions included in this volume reflect the complex functioning of the drainage basin sediment cascade and have been arranged in six groups to follow, as closely as possible, the flux of water and sediment from source to sink.

Asher Schick and the Nahal Yael experimental watershed In a warm and moving personal tribute by Reds Wolman, we are introduced to Asher Schick, the model scientist and then we are introduced by Asher Schick himself to the model experimental watershed at Nahal Yael "whose results have the potential to guide modellers with real world processes".

Drainage basin precipitation processes One of these two studies deals with the spatial variability and the other with the temporal variability of rainfall events. Many geomorphologists have shown no interest in the input of water into their system. Schick is an exception to this generalization and he has been fortunate in having colleagues such as David Sharon to assist him in this area. Sharon *et al.* strike the right note when they emphasize the importance of understanding rainfall distribution in small watersheds in order to be able to model the process adequately. The good fit of their simulated rainfall distributions results from a comprehensive phenomenology of the rainfall process itself.

Barzilay *et al.* prefer stochastic modelling of time series of rainfall events and demonstrate the value of their approach by comparing a synthetic 1000 year daily precipitation record with a dataset from the hyper-arid Eilat in southern Israel.

Drainage basin runoff One of the distinctive problems of runoff in arid regions is the discontinuity of the flow both spatially and temporally. One of Schick's most important contributions has been to establish a reliable hydrological record in a hyper-arid zone such as Nahal Yael. Lange & Leibundgut use a distributed rainfall-runoff model to simulate two high-magnitude floods in the Negev Desert, Israel, one with high intensity rainfall detected by radar over the whole basin and the other with localized heavy precipitation. The latter event allowed the reconstruction of precipitation distribution from the runoff. An independent application of the model allowed the role of major tributaries to be analysed.

Ben-Zvi & Shentsis use two hydrological models to characterize runoff events in the Negev. One model predicts magnitude and frequency of runoff events and the other assesses transmission losses. Spatial variations in runoff generation and flow processes are well represented.

Drainage basin slope erosion The variable source concept in hydrology was not introduced by Schick but both in terms of runoff and sediment sources, he has made extensive use of the concept. In this section of the book authors grapple with different ways of dealing with the variable source concept. Most interestingly, land use effects, which represent one obvious example of variable watershed sources of water and sediment, are also explored.

Shanan shows how ancient “water harvesting” irrigation projects in the Negev Desert, based on very small watersheds (less than 50 ha), were so much more efficient than projects based on large watersheds. He also estimates the amount of erosion associated with sheet erosion and gully erosion both independently in small watersheds and cumulatively in large watersheds.

Johnson & Julien describe an upland erosion algorithm implemented within a two-dimensional rainfall–runoff model and apply the model to the Goodwin Creek watershed (Mississippi, USA). Shoshany explains the value of historical black and white photographs in understanding general erosion trends and patterns of source–sink processes on slopes in central Israel.

Loughran *et al.* examine soil loss in vineyards and adjacent forest and grazing land in New South Wales, Australia. They use splash boxes, runoff–erosion plots, caesium-137 and modified USLEs. All methods show soil losses of 1–2 orders of magnitude greater under viticulture than forest and grazing land. Stankoviansky *et al.* demonstrate the huge impact of collectivization of agriculture in western Slovakia since 1948. They document a “pulse of disequilibrium” that affected runoff and sediment production processes and perturbed the landscape quasi-equilibrium that had prevailed from the end of the nineteenth century.

Schmidt & Meitz propose a direct relationship between scarp slope morphology on the Colorado Plateau (USA) and moisture availability. They use this information as an indicator of morphoclimatic changes during the Quaternary and suggest, specifically, that the lower limit of inactive landslides shows the limit of humid phase mass movements in the past.

Fluvial processes Perhaps pre-eminently, Schick is a fluvial geomorphologist. The following chapters address some of the central questions in fluvial geomorphology, particularly the question of the geomorphic effectiveness of high magnitude events.

Inbar explores the geomorphic effectiveness of bed load transport by the upper Jordan River during four major flood events during the period 1969–1999. Mayer uses satellite remote sensing to identify the impact of tropical storms on the fluvial landscape of Baja, California, USA. The effects of Hurricane Nora in 1997 were analysed by remote sensing and associated field visits. Gupta poses the question of the relative geomorphic effectiveness of decadal tropical cyclones, as compared with both more and less frequent events in Australia, south Asia and the Caribbean. He identifies two factors: the size difference between hurricane floods and 1–2 year floods, and the texture of the sediment in the channel.

Grodek *et al.* describe the unusual impacts of a 1997 flood in Eilat (Israel) on the urban infrastructure. The event was the second most intense event since 1949 and although urban development has spread all over the alluvial fans of the region, the damage was minimal. A balance between flood conveying and flood reducing systems is recommended in flood management and urban planning.

Hooke examines spatial variation in channel morphology and sediment dynamics in the Gila River in Arizona, USA. Morphologically distinct reaches can be identified along a 100 km length of the valley floor, and they are shown to respond differently even when exposed to the same sequence of high magnitude hydrological events.

Lacustrine sediments Although Schick has published little on lake sediments, the logic of his insistence on treating the drainage basin as a geomorphic system suggests that the following studies of lacustrine sedimentation are entirely consonant with his approach. The sediment output term has, until the last decade or two, been comparatively neglected by geomorphologists in general. The following examples all seek to provide information about the functioning of drainage basins from lacustrine sedimentary evidence.

Shteinman *et al.* have used radioactive, magnetic and fluorescent tracers to describe sedimentation processes in the near shore zone where the Jordan River enters Lake Kinneret (Israel). They show that 75% of the sediment that is delivered from the basin is deposited along this 100 m reach. Laronne discusses event-based sediment deposition in a reservoir in Israel. He claims to be able to characterize sedimentary event couplets and interpret the past environments at times of deposition. Klein describes the formation and disappearance of a delta, associated with an extreme flood event in 1975 in the El Arish (Israel).

Finally, Slaymaker & Menounos working in glacially conditioned terrain (British Columbia, Canada) use lacustrine sediments from 14 basins to try to reconstruct their provenance. Glacier cover, hillslope-channel coupling and upstream sediment trapping complicate the picture but a general pattern of lake sediment yield conforms to the earlier established fluvial sediment yield-drainage area relationship.

Olav Slaymaker

*Department of Geography,
The University of British Columbia, Canada*

Marwan Hassan

*Department of Geography,
Hebrew University of Jerusalem, Israel*

Simon M. Berkowicz

*Arid Ecosystems Research Centre,
Hebrew University of Jerusalem, Israel*

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