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Acacia trees pattern distribution as an indicator for changes in flow spatial distributions in a hyper-arid environment

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Arid regions are characterized by high spatial and temporal variability of precipitation, resulting in high spatial and temporal variation of vegetation cover. Because of low rainfall, the acacia trees in southern Israel are usually restricted to ephemeral stream (Wadi) beds, which possess higher soil moisture content than the surrounding landscape. Spatial analyses of tree distribution at the drainage basin scale contributes to a better understanding of the geo-hydrologic regime because water is the main limiting factor in such areas. That is, the spatial distribution of trees and their characteristics within the Wadi may reflect the spatial variance of water availability within different segments of the Wadi.
The main objective of this study was to use the spatial distribution of different parameters of acacia trees as an indicator of past and present hydrological regimes within different segments of the Wadi. Tree size distribution was used as an indicator of long-term (decades) geo-hydrologic spatial processes affecting the acacia population. The tree health (NDVI) distribution was used as an indicator of short-term (months to a few years) geo-hydrologic spatial processes, such as the paths of recent flashfloods events.
The distribution of the trees in the Wadi (ephemeral river) was divided into three distinct categories: (1) large trees with high NDVI values, (2) large trees with low NDVI values and (3) small trees with medium NDVI values. Using the resulting classification, we divided the Wadi into three sections, each representing a unique combination of long- and short-term geo-hydrologic processes affecting the acacia trees. We suggest that the lack of spatial correlation between tree size and health status is a result of spatio-temporal changes in the water supply. Our main conclusion is that past and current alterations of the runoff path can be detected by the spatial analysis of trees in hyper-arid regions