



Spatial analysis of a long-lived tree population in a hyper-arid zone as an indicator of past and present eco-hydrology

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Flash floods in arid zone occur in ephemeral streams (Wadi) which are dry for most of the year. Flash floods are characterized by short duration and relatively high peaks of discharge. The high and sudden intensity of a flash flood often causes the removal and deposition of sediments, which may result in changes of the flow route. Arid regions are characterized by high spatial and temporal variability of precipitation, resulting in high spatial and temporal variation of vegetation cover. Acacia trees in Israel are usually restricted to Wadi beds due to low precipitation. Spatial analysis of tree distribution in hyper-arid zones can contribute to our understanding of the geo-hydrologic regime, as water is the main limiting factor in such areas. The study area is located in southern Arava valley, Israel, where rain events are rare and flash floods may occur once every few years.

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. A map of individual acacia trees that was extracted from a combined near infrared aerial photograph of Wadi Ktora allowed us to examine the distribution pattern of two different parameters of the trees: size and foliage health status (NDVI). Tree size distribution was used as an indicator of long-term (decades) geo-hydrologic spatial processes affecting the acacia population. The tree health status (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 flash floods events.

We suggest that a lack of spatial correlation between tree size and health status is the result of spatial-temporal changes in the water supply. Comparison of tree size distribution and NDVI values distribution allowed us to divide the study area into three sections, each representing a unique combination of long and short-term geo-hydrologic processes (i.e. flash floods spatial spreading), reflected in the condition of the acacia trees.