Geomorphological restoration of steep slopes in the "Shazar-Dakar" urban forest, Haifa, Israel

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On 24 November 2016, an extreme hot and dry weather led to the occurrences of more than 1,000 fires in Israel. One of the largest fires occurred in the city of Haifa. The fire damaged 120 ha on the wildland-urban interface (WUI). Three main areas were damaged in the fire: gardens area, urban forests and along Ahuza Wadi. The urban forests restoration process included the characterization and definition of an "identity card" for each urban forest. In each area a field survey was done where all plant species and points of interest were recorded and documented.

The "Shazar-Dakar" urban forest is an area of about 5 ha located on steep slopes, of 1:1.5 ratio~, and was densely covered in a planted mixed forest with invasive and cultured species.

Considering the geographical location of this urban forest and the extent of its observation - near the main road "Hankin Road" - which requires immediate removal of the burnt trees. In May 2017 a rehabilitation process of the forest initiated. This process included opening of a main forest road based on steep slope topography and the removal of all the dead trees.

In August 2017, with the understanding of the complexity of the restoration and the topographical properties, actions of treating the forest road and slopes began to mitigate the danger of landslides and erosion. Essential data was collected for analysis of rain intensities and quantities; mapping sequences of ground-based connectivity to identify the runoff potential, erosion.

Due to the high potential of accelerated runoff and soil erosion that might end with landslide and collapse of the uphill steep slopes the paved road and its boundaries covered with local pruned woody remains to absorb raindrop impact and mitigate uphill runoff flow. Aerial geodetic mapping, based on UAV point cloud generated model, used for detection of potential depression ponding areas that might endanger the downhill slopes. These depressions used as pre-structured sinks while diverting ponding and runoff water along the road to these points of interests. At each depression a specific subsurface drainage system constructed to divert the accumulated runoff water toward a pre-selected sink along the lower section of the steep slope (e.g. cavities, vegetation patches, boreholes). Slope physical and chemical soil properties analyzed to assess runoff-rainfall potential, infiltration rate and aggregate stability. A rainstorm event that occurred following the rehabilitation process, at 56.5 mm hour-1 that lasted more than 60 minutes, at a probability of about 2% (1:50 years) had no significant impact on the rehabilitated area and its surrounding.