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Connectivity as a factor of wildfire spreading across the urban area: review, test and evaluation fire modeling approaches

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For a long time, cities and wildlands/wildfires were widely considered to be worlds apart. It was believed that elaborate forest-fire management and the special regime near cities could prevent wildfires in urban areas. For this reason, fire management methodologies focused on wildlands and their interaction with cities, while urban areas with their green infrastructures were excluded from such management. Nevertheless, experience has proven the inconsistency of the concept of the nonflammable city. Practice shows (wildfires in Greece (Athens 2009&2015, Thasos 2016, Mati 2018), France (Marseilles 2009&2016), Spain (Javea 2012&2016) etc.) that urban areas are sensitive to wildfire. In contrast to fires in forest areas, where the main damage is associated with the amount of the burnt fuel, urban wildfires can be dangerous because of their rapid spreading in the city by spotting fire ignition from one green patch to other bypassing nonflammable structures. A new outlook of the city as a fire-sensitive territory requires the revision of existing fire management approaches and a reassessment of their applicability.
In this study, existing fire modeling approaches were reviewed in case of applicability on urban areas. Particularly, two fire simulation models (Fire Dynamics Simulator and FARSITE) were tested to assess their performance in the city. The results of the modeled fire propagation were compared with actual fire dynamic patterns obtained in Haifa in November 2016. The dynamic of the fire in Haifa's event was reconstructed and mapped from the list of incoming calls to firefighter's station and supplemented by firefighters' report and surveyed burned area.
The results show that raster-based approach for fire modeling is limited on the urban area. When simulated fire meets fire resist objects (built up environment), it stops because of fuel lack. While in practice the fire crossed most of the city. Also, object-based fire modeling wasn't suitable for simulation realistic fire behavior. The complexity of the urban landscape and its impact on the wind flows didn't allow to correctly predict the fire behavior in Haifa. To assess the potential of application fire models on the urban area, the standard fuel zoning was replaced by fuel connectivity. Estimated fuel connectivity was introduced to FARSITE simulation. The outputs of the adjusted simulation correspond to the fire behavior observed in Haifa 2016.