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Mapping Forest Fire Susceptibility in Temperate Mountain Areas with Expert Knowledge. A Case Study from Iezer Mountains, Romanian Carpathians

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Forest fires in Romanian Carpathians became a frequent phenomenon during the last decade, although local climate and other environmental features did not create typical conditions. From 2004, forest fires affect in Romania more than 100 hectares/year of different forest types (deciduous and coniferous). Their magnitude and frequency are not known, since a historical forest fire inventory does not exist (only press papers and local witness for some selected events). Forest fires features the summer dry periods but there are dry autumns and early winter periods with events of different magnitudes.

The application we propose is based on an empirical modeling of forest fire susceptibility in a typical mountain area from the Southern Carpathians, the Iezer Mountains (2462 m). The study area features almost all the altitudinal vegetation zones of the European temperate mountains, from the beech zone, to the coniferous zone, the subalpine and the alpine zones (Mihai et al., 2007).

The analysis combines GIS and remote sensing models (Chuvieco et al., 2012), starting from the ideas that forest fires are featured by the ignition zones and then by the fire propagation zones.

The first data layer (ignition zones) is the result of the crossing between the ignition factors: lightning – points of multitemporal occurence and anthropogenic activities (grazing, tourism and traffic) and the ignition zones (forest fuel zonation – forest stands, soil cover and topoclimatic factor zonation). This data is modelled from different sources: the MODIS imagery fire product (Hantson et al., 2012), detailed topographic maps, multitemporal orthophotos at 0.5 m resolution, Landsat multispectral imagery, forestry cadastre maps, detailed soil maps, meteorological data (the WorldClim digital database) as well as the field survey (mapping using GPS and local observation).

The second data layer (fire propagation zones) is the result of the crossing between the forest fuel zonation, obtained with the help of forestry data, the wind regime data and the topographic features of the mountain area (elevation, slope declivity, slope aspect). The analysis also consider the insolation degree of mountain slopes, that creates favourable conditions for fire propagation between different canopies.

These data layers are integrated within a simple GIS analysis in order to intersect the ignition zones with the fire propagation zones in order to obtain the potential areas to be affected by fire.

The digital map show three levels of forest fire susceptibility, differenced on the basis of expert knowledge.

The map can be validated from the statistical point of view with the polygons of the forest fire affected areas mapped from Landsat TM, ETM+ and OLI satellite imagery.

The mapping results could be integrated within the forest management strategies and especially within the forest cadastre and development maps (updated every ten years). The result can confirm that the data gap in terms of forest fire events can be filled with expert knowledge.

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