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Interface fires in built-up areas. A real-case study on the risk assessment of fires interacting with urban domains

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Wildland Urban Interface

The Wildland Urban Interface is the area where human built structures are in close contact with wildland vegetation. It is considered to be a hotspot during wildland fires due to the presence of both high value assets and high fuel loads. It is also a potential area of ignitions, due to the proximity to anthropogenic activities [1].

The CROSSIT SAFER Project

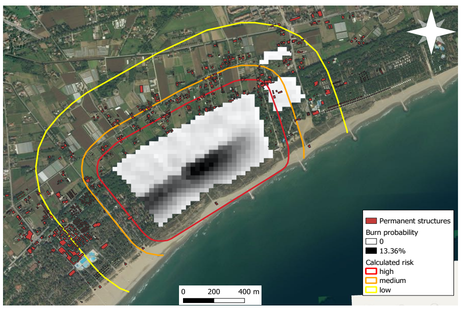
Action 3.2.3 of the project CROSSIT SAFER funded by Cooperation Programme INTERREG V-A Italy-Slovenia 2014-2020 (www.ita-slo.eu/en/crossit-safer) is aimed at finding an innovative method to map and assess wildland fire risk with a focus on WUI areas (Fig. 1).

Sentinel-2 cloudless - https://s2maps.eu by EOX IT Services GmbH (Contains modified Copernicus Sentinel data 2016 & 2017); © EuroGeographics for the administrative boundaries.

Fig. 1 *Study areas for the Action 3.2.3 of CROSSIT SAFER project.*

Tab. 1 *Inputs and outputs data for FLAMMAP case study simulation.*

INPUTS	Fuel models	102 and 165 [3]
	Windspeed	2.68, 10.73 mph at 6 m above ground
	Wind direction	100 °N
	Fuel moisture	4 classes, from fully cured to fully green
	Ignitions	1000 random
	Simulation duration	30 minutes
OUTPUTS	Fireline intensity	5523 kW/m
	Flame length	0-8 m
	Rate of spread	0-0.18 m/s
	Burning probability	0-13.4%
	Type of fire	Surface, passive crowning



Basemap from Bing™ maps service ©Microsoft 2020.

Fig. 2 *Risk contours based on thermal effect on permanent light structures.*

Fire risk analysis in the Interface

A combined approach based on a fire simulation tool, exposure functions and a GIS-based system was used to spatially map fire risk in a case study within the Project area.

The hazard component of the risk was defined with FLAMMAP [2], a software which depends on quasi-empirical equations to spatially simulates wildland fires in a lean and resources-saving way (Tab. 1).

Risk evaluation combines the scenario probability and consequences magnitude, and risk contours were derived according to threshold values whereas expected effects were calculated from Probit functions [4].

The resulting risk matrix was overlapped to the land map to identify high-risk areas for human targets and structures.

Results for the case study

In the interface considered, permanent structures are made both in light materials (PVC, wood) and concrete.

Light structures as campsite buildings are at high yearly risk (>10^{-6} /yr) in the first 200 m from the simulated fire (red contour) and will suffer light damages up to 500 m from flames (Fig. 2, yellow contour). Concrete structures, instead, do not fall within high yearly risk areas, but are at moderate risk (10^{-7}/yr) at 100 m from the hazard source.

Fire triggering prevention measures and management actions are required to reduce risk, especially within high-risk contours.

Limitations and perspectives

The quasi-empirical nature of the fire simulation software is both a flaw (low precision) and a strength (efficiency) of the process chain. Nonetheless, the combination with exposure Probit functions and the spatialisation of the analysis can result in valuable outputs.

Land managers will benefit greatly from the resulting fire risk maps, including closer-to-reality fuel and assets arrangement: this would allow them to better allocate resources for risk mitigation and management.

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