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Supplementary material for

A multivariate approach to assess the structural determinants of large wildfires: evidence from a Mediterranean country

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Figure S1. Variable transposition to grid: shapefiles (proximity variables)

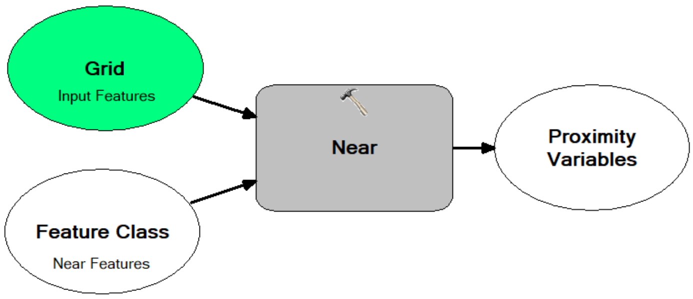

Figure S2. Variable transposition to grid: shapefiles (all variables connected to administrative units - CAOP)

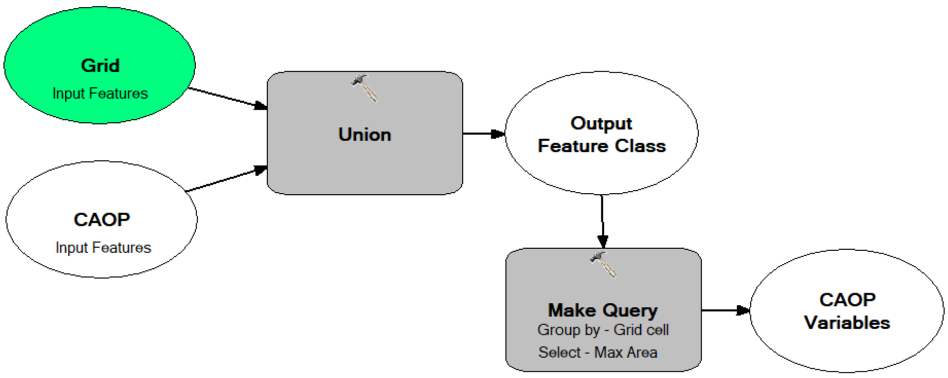

Figure S3. Variable transposition to grid: raster files (interpolated climate variables)

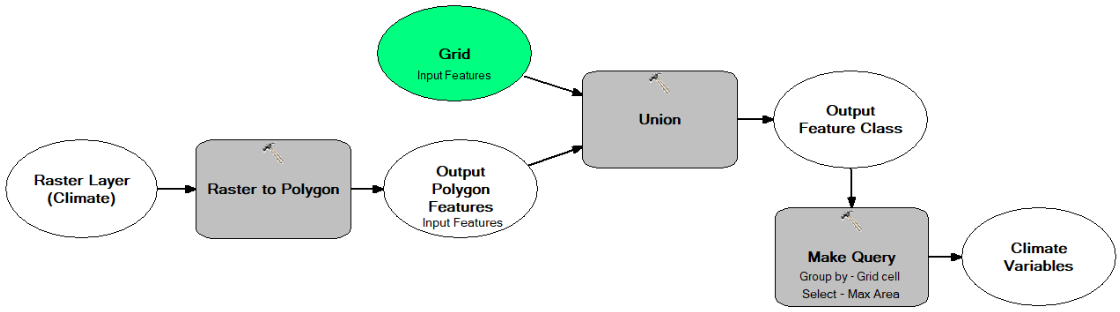

Figure S4. Variable transposition to grid: raster files (topographic variables)

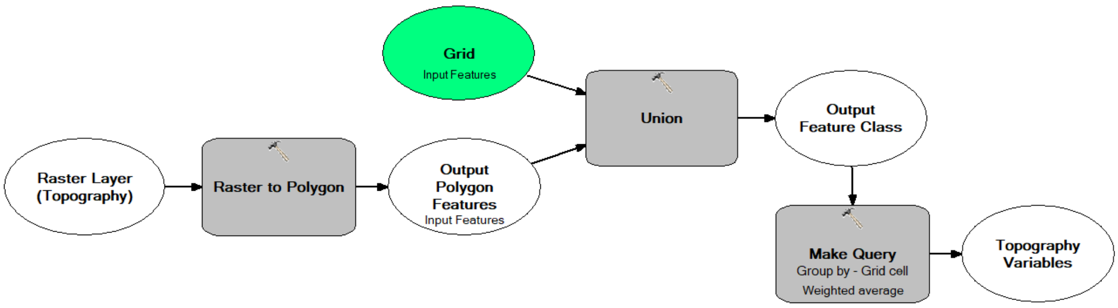

Figure S5. Variable transposition to grid: shapefiles (all other variables)

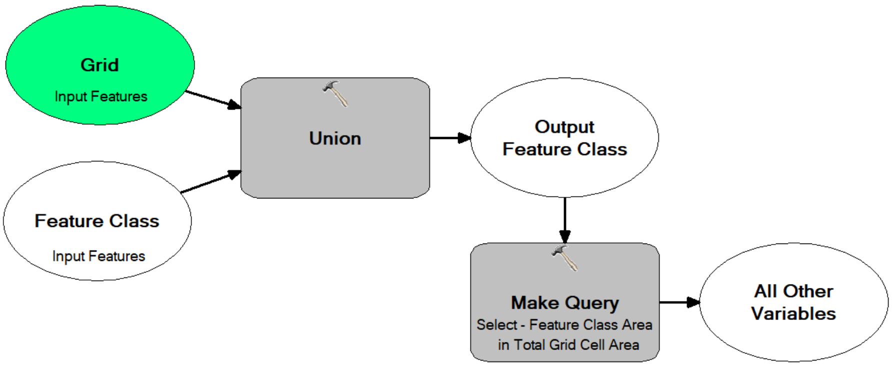

Figure S6. Variable transposition to grid: shapefiles (target variable generalisation)

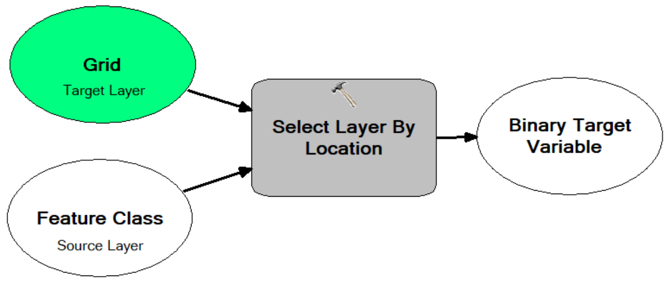

Table S1. Initial set of collected variables; from a comprehensive literature review and considering data availability constraints, data on 37 variables were initially collected

FACTORS	VARIABLES	ACRONYM	RESOLUTION	SOURCE	THEORETICAL SUPPORT
Aging of population	Aging index	AGE_INDEX	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Dondo Bühler *et al*. 2013; Nunes *et al*. & Vieira, 2013
Agricultural workforce	Population employed in agriculture, livestock, fishing, forestry and hunting (%)	PRIM_PERC	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Álvarez-Díaz *et al*. 2015; Balsa-Barreiro & Hermosilla, 2013; Ganteaume *et al*. 2013; Martínez-Fernández *et al*. 2013; Mhawej *et al*. 2015; Nunes *et al*. 2016; Ricotta & Di Vito, 2014; Rodrigues *et al*. 2014; Rodrigues *et al*. 2016; Vasilakos *et al*. 2009; Vilar *et al*. 2016
Animal density	Livestock units per utilised agricultural area (no./ha)	LUNITS_NSAU	Municipality	Statistics Portugal (National Statistical Institute)	Balsa-Barreiro & Hermosilla, 2013; González-Olabarria *et al*. 2015; Nunes *et al*. 2013; Nunes *et al*. 2016; Oliveira *et al*. 2014; Rodrigues, de la Riva, & Fotheringham, 2014; Romero-Calcerrada *et al*. 2010; Romero-Calcerrada *et al*. 2008; Srivastava *et al*. 2014
Aspect	Aspect (°)	ASPECT	Original: 30 m Generalised: 450 m	National Mapping Agency (PT)	Calviño-Cancela *et al*. 2017; Dimitrakopoulos *et al*. 2011; Dondo *et al*. 2013; Guo *et al*. 2016; Mhawej *et al*. 2015; Oliveira *et al*. 2014; Salis *et al*. 2015; Vasilakos *et al*. 2009
Changes in land cover	Areas changing from agricultural to forested areas in cell (1995-2010) (%)	LCC9510_COS	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Martínez-Fernández *et al*. 2013; Nunes *et al*. 2013; Rodrigues *et al*. 2014
Drought	Number of dry months (Gaussen index)	DRYMONTH	Weather station (1.5 km interpolation)	Daily temperature and precipitation data from the National Oceanic and Atmospheric Administration (USA)	Ganteaume *et al*. 2013; Ganteaume & Jappiot, 2013; Mhawej *et al*. 2015; Nunes *et al*. 2013; Riley *et al*. 2013.
Elevation	Elevation (m)	ELEVATION	Original: 30 m Generalised: 450 m	National Mapping Agency (PT)	Balsa-Barreiro & Hermosilla, 2013; Calviño-Cancela *et al*. 2017; Dimitrakopoulos *et al*. 2011; Bühler *et al*. 2013; Ganteaume *et al*. 2013; Ganteaume & Jappiot, 2013; González-Olabarria *et al*. 2015; Guo *et al*. 2016; Holsinger *et al*. 2016; Martínez-Fernández *et al*. 2013; Mhawej *et al*. 2015; Nunes *et al*. 2013; Nunes *et al*. 2016; Oliveira *et al*. 2014; Ricotta & Di Vito, 2014; Salis *et al*. 2015; Vasilakos *et al*. 2009
Farm density	Farm density (n./km2)	FARMDEN_KM	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Nunes *et al*. 2013

FACTORS	VARIABLES	ACRONYM	RESOLUTION	SOURCE	THEORETICAL SUPPORT
Fire prevention	Distance to the primary network of fuel management tracks (km)	RPFGC_DIST	-	Nature Conservation and Forestry Institute (PT)	Srivastava *et al*. 2014
Flammability	Area of highly flammable vegetation in cell (%) (classes M-CAD + M-ESC + M-PIN + M-EUC + V-MAb + V-MAa + V-MMa)	HIGHFLAM	Min. area: 5 km^2 Min. width: 20 m (from the National forest inventory)	National fuel model, Nature Conservation and Forestry Institute (PT)	Salis *et al*. 2015; Vasilakos *et al*. 2009
Fuel density	Area of dense vegetation in cell (%) (classes 3.2.2.01.1 + 3.2.3.01.1)	FUELDEN_COS	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Chuvieco *et al*. 2014; Dimitrakopoulos *et al*. 2011; Bühler *et al*. 2013; Holsinger *et al*. 2016; Mhawej *et al*. 2015
Grazing	Grazing area in cell (%) (classes 2.3 + 2.4.1.03 + 2.4.4.03)	GRZ_COS	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Balsa-Barreiro & Hermosilla, 2013; González-Olabarria *et al*. 2015; Nunes *et al*. 2013; Nunes *et al*. 2016; Oliveira *et al*. 2014; Rodrigues, de la Riva, & Fotheringham, 2014; Romero-Calcerrada *et al*. 2010; Romero-Calcerrada *et al*. 2008; Srivastava *et al*. 2014.
Housing density	Housing density	ALOJ_GRID	1x1 km grid	Statistics Portugal (National Statistical Institute)	Álvarez-Díaz *et al*. 2015; Ganteaume *et al*. 2013; González-Olabarria *et al*. 2015; Martínez-Fernández *et al*. 2013
	Building density	EDIF_GRID			
Land cover/ Type of vegetation	Area of shrubland in cell (%)	SHRUB_COS	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Calviño-Cancela *et al*. 2017; Chuvieco *et al*. 2014; Fernandes *et al*. 2016; Ganteaume & Jappiot, 2013; González-Olabarria *et al*. 2015; Guo *et al*. 2016; Martínez-Fernández *et al*. 2013; Mhawej *et al*. 2015; Moreira *et al*. 2010; Nunes *et al*. 2016, 2013; Oliveira *et al*. 2014; Ricotta & Di Vito, 2014; Salis *et al*. 2015; Srivastava *et al*. 2014.
	Area of eucalyptus forests in cell (%)	EUC_COS			
	Area of other types of forests in cell (%)	OUTR_COS			
	Area of pine forests in cell (%)	PIN_COS			
Land use	Agricultural area in cell (%)	AGR_COS	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Calviño-Cancela *et al*. 2017; González-Olabarria *et al*. 2015; Nunes *et al*. 2013, 2016.
	Forest area in cell (%) (class 3 except 3.3.1 + 3.3.4.01)	FOREST_COS			

FACTORS	VARIABLES	ACRONYM	RESOLUTION	SOURCE	THEORETICAL SUPPORT
Livestock activity	Average livestock by farm (n.)	LVSTK_NFARM	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Balsa-Barreiro & Hermosilla, 2013; González-Olabarria *et al.* 2015; Nunes *et al.* 2013; Nunes *et al.* 2016; Oliveira *et al.* 2014; Rodrigues *et al.* 2014; Romero-Calcerrada *et al.* 2010; Romero-Calcerrada *et al.* 2008; Srivastava *et al.* 2014.
Natural protected areas	Distance to protected sites (km)	AP2015_DIST	-	Nature Conservation and Forestry Institute (PT)	Chuvieco *et al.* 2014; Rodrigues *et al.* 2014; Rodrigues *et al.* 2016; Vilar *et al.* 2016.
Ownership	Housing owned by residents	HOBR_PERC	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Balsa-Barreiro & Hermosilla, 2013; Dondo Bühler *et al.* 2013; Grala *et al.* 2017; Martínez-Fernández *et al.* 2013.
Population density	Population density (n./km2)	POP_GRID	1x1 km grid	Statistics Portugal (National Statistical Institute)	Balsa-Barreiro & Hermosilla, 2013; Dondo Bühler *et al.* 2013; Ganteaume *et al.* 2013; Ganteaume & Jappiot, 2013; González-Olabarria *et al.* 2015; Grala *et al.* 2017; Guo *et al.* 2016; Moreira *et al.* 2010; Nunes *et al.* 2013, 2016; Oliveira *et al.* 2014; Romero-Calcerrada *et al.* 2010; Vilar *et al.* 2016.
Population dynamics: variation and potential	Potentiality index	POTENT_INDEX	Municipality	Statistics Portugal (National Statistical Institute)	Balsa-Barreiro & Hermosilla, 2013; González-Olabarria *et al.* 2015; Martínez-Fernández *et al.* 2013; Nunes *et al.* 2013; Rodrigues, de la Riva, & Fotheringham, 2014; Rodrigues, Jiménez, & de la Riva, 2016.
	Rate of population change by parish (2001-2011) (%)	POPCHANG_RT	Parish (before 2013)		
Precipitation	Total annual precipitation (mm)	PRECTOT	Weather station (1.5 km interpolation)	National Oceanic and Atmospheric Administration (USA)	Balsa-Barreiro & Hermosilla, 2013; Ganteaume & Jappiot, 2013; Guo *et al.* 2016; Martínez-Fernández *et al.* 2013; Mhawej *et al.* 2015; Nunes *et al.* 2013; Oliveira *et al.* 2014; Riley *et al.* 2013; Sarris *et al.* 2014; Vasilakos *et al.* 2009.
Proximity to ignition	Distance to ignition locations (km)	IGN_DIST	-	Nature Conservation and Forestry Institute (PT)	-
Proximity to urban areas/infrastructures	Distance to urban areas and infrastructures (km) (classes 1.1 + 1.2.1)	USB_DIST	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Álvarez-Díaz *et al.* 2015; Balsa-Barreiro & Hermosilla, 2013; Ganteaume *et al.* 2013; Grala *et al.* 2017; Guo *et al.* 2016; Mhawej *et al.* 2015; Ricotta & Di Vito, 2014; Romero-Calcerrada, Barrio-Parra, Millington, & Novillo, 2010; Romero-Calcerrada, Novillo, Millington, & Gomez-Jimenez, 2008; Srivastava, Saran, de By, & Dadhwal, 2014; Vasilakos *et al.* 2009.
Relative humidity	Mean dew point (°)	DEWPOINT	Weather station (1.5 km interpolation)	National Oceanic and Atmospheric Administration (USA)	Balsa-Barreiro & Hermosilla, 2013; Dimitrakopoulos *et al.* 2011; Guo *et al.* 2016; Vasilakos *et al.* 2009.

FACTORS	VARIABLES	ACRONYM	RESOLUTION	SOURCE	THEORETICAL SUPPORT
Road network	Distance to primary roads (km)	PROAD_DIST	-	Open Street Map	Ganteaume *et al*. 2013; Ganteaume & Jappiot, 2013; Grala *et al*. 2017; Guo *et al*. 2016; Martínez-Fernández *et al*. 2013; Mhawej *et al*. 2015; Moreira, Catry, Rego, & Bação, 2010; Nunes *et al*. 2016; Oliveira *et al*. 2014; Ricotta & Di Vito, 2014; Rodrigues, Jiménez, & de la Riva, 2016; Romero-Calcerrada *et al*. 2010, 2008; Srivastava *et al*. 2014; Vasilakos *et al*. 2009; Vilar *et al*. 2016.
Secondary residence housing	Seasonal, secondary use and empty housing (%)	SSEHOUS_PERC	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Romero-Calcerrada *et al*. 2010, 2008.
Size of farms	Average utilised agricultural area per farm (ha)	SAUFARM_HA	Parish (before 2013)	Statistics Portugal (National Statistical Institute)	Nunes *et al*. 2013.
Slope	Slope (°)	SLOPE	Original: 30 m Generalised: 450 m	National Mapping Agency (PT)	Calviño-Cancela *et al*. 2017; Chuvieco, Martínez, Román, Hantson, & Pettinari, 2014; Dimitrakopoulos *et al*. 2011; Dondo Bühler *et al*. 2013; Guo *et al*. 2016; Mhawej *et al*. 2015; Oliveira *et al*. 2014; Salis *et al*. 2015.
Temperature	Daily mean temperature (°)	MEANTEMP	Weather station (1.5 km interpolation)	National Oceanic and Atmospheric Administration (USA)	Dimitrakopoulos *et al*. 2011; Ganteaume *et al*. 2013; Ganteaume & Jappiot, 2013; Guo *et al*. 2016; Hernandez, Drobinski, & Turquety, 2015; Holsinger *et al*. 2016; Martínez-Fernández *et al*. 2013; Mhawej *et al*. 2015; Nunes *et al*. 2013; Oliveira *et al*. 2014; Sarris *et al*. 2014; Vasilakos *et al*. 2009.
Wildland urban interface (WUI)	WUI cells (binary variable)	WUI	Min. polygon width: 20 m Min. distance between lines: 20 m Min. unit size: 1 ha	Land use and land cover map (2010), National Mapping Agency (PT)	Calviño-Cancela *et al*. 2017; Chuvieco *et al*. 2014; Ganteaume *et al*. 2013; Martínez-Fernández *et al*. 2013; Oliveira *et al*. 2014; Rodrigues *et al*. 2014, 2016; Vilar *et al*. 2016.
Wind speed	Daily mean wind speed (km/h)	WINDSPEED	Weather station (1.5 km interpolation)	National Oceanic and Atmospheric Administration (USA)	Dimitrakopoulos *et al*. 2011; Ganteaume *et al*. 2013; Ganteaume & Jappiot, 2013; Guo *et al*. 2016; Hernandez, Drobinski, & Turquety, 2015; Mhawej *et al*. 2015; Salis *et al*. 2015; Vasilakos *et al*. 2009.

Table S2. Average partial effects (APE) of the fire presence models (probit models) and associated statistical significance: global model and for each of the five clusters

VARIABLES	GLOBAL	SOUTHERN URBAN COASTLINE	NORTHERN URBAN COASTLINE	BEIRA BAIXA AND BORDER AREAS	NORTH-EASTERN HIGHLANDS	CENTRAL FORESTS
PRIM_PERC	-0.003870 ***	-0.005990 ***	-0.004420 ***	-0.003320 ***	-0.002670 ***	-0.003830 ***
SAUFARM_HA	0.000896 ***	-0.010970 ***			-0.003840 ***	
LVSTK_NFARM	0.000007 ***		-0.000024 ***	0.000499 ***	0.000260 ***	
HEADS_NSAU		-0.006020 ***			-0.054140 ***	-0.011034 **
SSEHOUS_PERC	0.002147 ***	0.001721 ***		0.001509 ***	0.004694 ***	
POTENT_INDEX	-0.007650 ***		-0.002150 **	-0.006210 ***	-0.010810 ***	-0.004310 ***
AGE_INDEX	-0.000038 ***		0.000160 **		-0.000034 ***	-0.000023 **
POP_GRID	-0.000064 ***		-0.000024 *			
AGR_COS	-0.000740 ***		-0.000920 ***	-0.000340 *	-0.003190 ***	
EUC_COS	0.001402 ***	0.004372 ***	0.000937 ***	0.000547 **	-0.003100 ***	0.002259 ***
OUTR_COS		0.000614 *			-0.003030 ***	
SHRUB_COS	0.002700 ***	0.004314 ***	0.006178 ***		0.001626 ***	0.003562 ***
AP2015_DIST	0.001526 ***	0.001709 **		0.001672 *	0.007463 ***	0.003850 ***
PROAD_DIST		0.010724 ***	0.018557 ***	-0.001940		0.008157 ***
DRYMONTH			0.131673 ***	-0.072830 ***	-0.285730 ***	-0.101140 ***
SLOPE	0.005608 ***	0.014619 ***	0.013525 ***		0.003301 **	
ASPECT	0.000117 *					
ELEVATION		0.000339 ***		-0.000150 ***		-0.000340 ***
IGN_DIST	-0.065413 ***	-0.069130 ***	-0.071940 ***	-0.013630 ***	-0.076680 ***	-0.072020 ***

Significance of coefficients: *** ($p < 0.01$), ** ($p < 0.05$), * ($p < 0.1$). Blank cells indicate the variables were excluded by the forward-stepwise selection procedure.

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