Agricultural drivers of wildfire outbreaks and spread in French Mediterranean regions

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INRA SCIENCE & IMPACT

PROVIDE
PROVIding smart DElivery of public goods by EU agriculture and forestry

Major public good hotspot issues (WP3)

Wildfires represent one of the major calamities for French Mediterranean regions. Last decades witnessed an increment of social engagement against fires, due to the increasing ecological and socioeconomic concerns. Our study examines the impact of agricultural activities on the risk of forest fires in Southern France and contributes to the understanding of the main drivers of forest fires.

Total surface burned per year
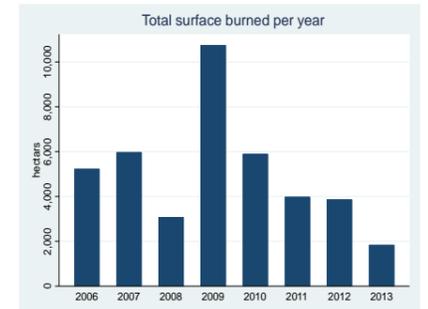
The value of public good provision (WP4)

We have assessed the relation between wildfires outbreaks and agricultural cultivations, in order to discuss results as an externality of agriculture.

Evaluation of mechanisms (WP5)

We followed an empirical approach based on quantitative analysis to model fire occurrence and spread. At first, we investigated the impact of agricultural land on the number of fire ignitions, through a zero-inflated negative binomial (zinb) model. At a second stage, we used a logit model to study the impact of agriculture activities in preventing that, once an ignition occurs, the fire becomes of large dimensions.
The study area covers 67456 km² and consists in 2713 municipalities grouped in the three French Mediterranean regions, namely PACA, Languedoc-Roussillon and Corsica. The analysis has been conducted over a period of 8 years, from 2006 to 2013.

ZINB MODEL		LOGIT MODEL	
Variable	**Coeff. sign**	**Variable**	**Coeff. Sign**
Altitude		Altitude	
Surface	+***	Surface	
Pop density	+***	Pop density	
Temperature	+***	Temperature	
Rain	-***	Wind	+**
Tourism1	-*	Rain	
Tourism2	+***	Tourism1	
Heterogeneous space	+***	Tourism2	
Annual crops	-***	Int forest cereal	
Vineyards		Int forest urban	-***
Olive trees	+***	Int forest vineyards	
Arboriculture	-**	Heterogeneous space	-***
Intensive pastures	+***	Forest	
Extensive pastures		Shrubland	+***
Inflated		Annual crops	
Forest	-***	Vineyards	
Shrubland	-***	Olive trees	
Int forest cereal		Arboriculture	
Int forest urban	-***	Intensive pastures	
Int forest vineyards	+***	Extensive pastures	
*** p-value<0,01 - **p-value<0,05 - *p-value<0,1			

Results

We draw a global mechanism which links agriculture and wildfire risk. The zinb model shows that municipalities characterised by annual crops, arboriculture and vineyards located at the edge of forests have a lower probability of being affected by a forest fire. In contrast, the presence of olive trees, heterogeneous agricultural areas and intensive pastures, increase the probability of wildfire ignition. Worth mentioning the double impact of heterogeneous spaces and urban-forest interfaces which, on the one hand lead to a higher probability of ignition and, on the other hand, limit the fire spread. That may be due to the fire-fighting means efficiency for the urban-rural interface case, but for the heterogeneous agricultural landscape (mainly dedicated to livestock activity) the question is open.

Conclusions

The relation between agriculture and wildfire hazard in the Mediterranean area is the result of multifactorial phenomena in which their outcome depends on the surrounding characteristics. Despite isolating the agricultural effect from the impact of other factors occurs to be a challenging task, our results indicate that crops characterised by an area with low mass of combustible material prevent fire ignitions. A spatial analysis at a precise scale, contemplating a complex combination of agricultural spaces and the surrounding landscapes relative to the areas burned, is likely to provide a better understanding of the relationship between wildfire hazard and agricultural activities.

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