



# Wildfires, forest management and landowners' collective action: A comparative approach at the local level



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## ABSTRACT

The increase in frequency and extent of fires in Portugal has favoured the approval of a new legal frame for forest management, the Forest Intervention Zone (FIZ). Under this frame, a large contiguous surface involving numerous owners is subject to a single management plan, providing an opportunity for cooperation. Since 2005, 161 zones have been created but only half of them have had their management plan approved and very few are nearing its implementation.

Cooperation amongst private forest owners has usually been explained at the owner level. In an approach at the local level we examine local constraints and key-factors for cooperative landscape management. Building on the theory of collective action, a typology of FIZ/territories is established by Cluster Analysis using a group of ecological and socioeconomic variables expressing the characteristics of natural resources, owners' group, institutional arrangements, and external environment of FIZs.

Three clusters are identified. Where FIZs are smaller and biophysical resources impose greater wildfire susceptibility, the transaction costs for collective management are highest due to more numerous, aged, and dispersed owners and the absence of a land registry. Conversely, larger FIZs have fewer owners, more powerful management bodies, and higher public financial incentives, leading to greater performance rate. Nonetheless, since their resources are less fire-prone, and private profitability is higher, public support for collective action has a lower social return.

Addressing the heterogeneity of local systems of ecological and socioeconomic constraints is therefore a challenge faced by public policy makers seeking to mitigate wildfire risk.

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## 1. Introduction

Wildfire is one of the main risks facing forests and rural areas in Mediterranean-climate zones. Frequency, severity, and extent of fires have been on the rise for the last 40 years and are expected to increase in the scenario of global climate change (Santos-Pereira et al., 2006; Fernandes et al., 2011). In Southern European countries fire hazard has been aggravated by socioeconomic and land-use changes in recent decades, namely agricultural and rural abandonment, dissociation between farming and forest activities, and shrubland growth (Baptista, 2010; Fernandes et al., 2014).

Despite the prevalence of fire suppression strategies, supra-national authorities and the scientific community recognize that prevention is not only preferable but also a cost effective way to

manage fires when compared to fire suppression (MCPFE, 2010). Fuels management is therefore discussed with regard to its potential to buffer the extent and severity of fires (Ager et al., 2006; Fernandes, 2013; Collins et al., 2013).

Because more than half of Europe's (EU-27) or the USA's forests are privately owned and non-industrial owners account for a considerable part of that area (Pulla et al., 2013; Mondal et al., 2013), landownership structure is viewed in those contexts as an obstacle to the implementation of fuel management strategies. The small scale of most of those landowners hinders the necessary landscape-level management (Bengston et al., 2001; Schulte et al., 2008; Gass et al., 2009). Multi-owner arrangements come then as solutions for individual owners to manage their land as part of larger units (Stevens et al., 1999; Rickenbach et al., 2004; Van-Gossum and De-Mayer, 2006).

Portugal presents the greatest density of burned area by territorial surface in all of Europe (Pereira et al., 2006). The years 2003 and 2005 stand out for that ratio and the emergence of extremely large fires, i.e. continuous burned areas covering 10,000 ha or more (Rego et al., 2013). The country also has the highest proportion

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(73%) of forest land owned by non-industrial private forest (NIPF) owners, with the smallest average size: most owners hold small ( $\geq 1$  to  $< 5$  ha) and very small ( $< 1$  ha) forests scattered over several holdings (Radich and Baptista, 2005; Baptista and Santos, 2005; Pulla et al., 2013).

Seeking to overcome what has been portrayed in Portugal as the small-scale property's huge problem, the adjustment of forest ownership structure has long been an ambition of the State and foresters (Pinho and Santos, 2012). The aftermath of the catastrophic summers of 2003 and 2005 provided the political momentum to address that purpose through the approval of a new legal frame for forest management, the "Forest Intervention Zone" (FIZ). The FIZ legislation (2005, revised in 2009) prescribes that the State is responsible for promoting the constitution of forest holdings large enough to enable efficiency gains in their management, thereby increasing "territorial resilience to fires".

The FIZ law calls for establishing a multi-owner contiguous surface of at least 1000 ha (in 2005, 750 ha in 2009) and that a minimum of half of this working area is owned by enrolled members. To be created, the FIZ should also have a managing body (MB), responsible for drawing up a single Forest Management Plan (FMP) for the whole area. This plan is then to be approved by the National Forest Authority, subject to compliance with the regional spatial plans devised by this entity. Once approved it would become mandatory inside FIZ boundaries for members and even non-members. Public funding for the establishment and first two years of operation was afterwards foreseen as well as positive discrimination in accessing rural development policy tools.

Compared to other multi-owner arrangements reported in the literature, the innovative character of this frame stems from its ambition to take the landscape as the effective management unit with a centralized planning approach (Kittredge, 2005; Schulte et al., 2008).

The first FIZ was created in 2006. By 2012 there were already 161 FIZs, whose accumulated area exceeded 800,000 ha and included more than 20,000 members (owners). This success was diminished in the implementation figures: only half of the FIZs had seen their FMP approved and only a negligible fraction was close to implementing coordinated management on individual properties. As FIZs range from North to South in the Portuguese Mainland, this implementation deficit shows considerable regional differences. At odds with initial legal goals, the approval of collective management plans has been slower precisely for those FIZs where wildfire susceptibility is greatest.

This innovative frame for multi-owner management and its policy context configure a policy instrument intended to promote the reduction of wildfire risk (Van-Gossum and De-Mayer, 2006; Brukas and Sallnäs, 2012), which needs owners' collective action. The aims of this study are: (1) explain regional differences in the performance of multi-owner management under FIZs by comparing the ecological and socioeconomic structural constraints to collective action; and (2) discuss from a socioeconomic perspective the enforcement (carrots or sticks) of cooperative management for mitigating wildfire risk under this legal frame, providing guidance for the reformulation of the policy instrument.

## 2. Analytical framework

Multi-private-owner cooperation for wildfire risk mitigation is still a largely unexplored matter of research (Fischer and Charnley, 2012). In order to build the analytical framework for our approach on NIPF owners' cooperation, we first address the issue of scale and nature of management for wildfire risk mitigation in which the need and goal of cooperation is conceptualized. The choices of the unit of analysis (the organization and its territory rather than

the owner), and of the theoretical frame (collective action theories) are also addressed below.

### 2.1. Management for wildfires risk mitigation: the scale and nature of its production

From an ecological point of view landscape-level management is considered to be the appropriate scale for enhancing environmental and nature conservation values (Ask and Carlsson, 2000; Bengston et al., 2001; Gass et al., 2009; Schulte et al., 2008). Most of the values or outputs procured at that management level are non-marketable ones and can be pure or impure public goods (Ostrom, 2003).

Reduced wildfire risk via fuels management (fuelbreaks, stand density, forest composition, fuel treatments like pruning, thinning, clearing of brush or prescribed burning) can be viewed as an environmental value with pure public good characteristics (Busby and Albers, 2010). In fact, as a landscape attribute, it is impossible to exclude anyone from consuming it (non-excludable) and to diminish by anyone's consumption the consumption opportunities for others (non-rival) (Madureira et al., 2013). Because large wildfires affect landscapes with many landowners, thereby making property limits perfectly irrelevant, the risk an individual owner faces is a function of his decisions and those of all other surrounding landowners.

Landscape fire risk mitigation follows a non-linear or threshold production function because its production needs a "certain minimum amount of supply in order to provide significant value" (OECD, 2013). The spatial threshold for wildfire risk mitigation has to do with attaining landscape heterogeneity (patches of distinct forest species and agricultural uses), minimum infrastructures (such as neighbouring roads, fuelbreaks, water supply), key-spot interventions, and scale economies in fuel treatments (Hartsough et al., 2008; Moreira et al., 2011; Collins et al., 2013; Fernandes, 2013). The non-linear relationship between wildfire risk mitigation and scale of fuels management has been established by Ager et al. (2006): fuels treatment on 20% of total area (around 16,000 ha) resulted in 20%–50% reduction in burned area compared to the no-treatment situation.

### 2.2. Private owners' cooperation: choosing the unit of analysis

Most recent literature on wildfires and owners' attitudes and practices refers to homeowners or residents rather than forest owners, and seldom considers the issue of collaboration amongst the latter (Jarret et al., 2009; Brummel et al., 2010; Bihari and Ryan, 2012; Fischer, 2012; Wyman et al., 2012). Busby and Albers (2010) and Fischer and Charnley (2012) address that issue exploring it in mixed ownership landscapes where public lands are relevant, but not in contexts of NIPF predominance.

All of these studies take the individual owner or resident as the unit of analysis, even when the sample covers several geographic locations (Bihari and Ryan, 2012). This is not surprising in light of the more general basis of studies on NIPF cooperation for forest management, which centre on owners' values, attitudes, and motivations in order to explain willingness to cooperate, or preferences toward alternative scenarios of coordination (Stevens et al., 1999; Klosowski et al., 2001; Belin et al., 2005; Berlin et al., 2006; Finley et al., 2006; Vokoun et al., 2010). Owners' segmentation makes it possible to design appropriate messages and adapt incentives for the desired behaviour.

However, the organization and its context can also be found as the unit of analysis in a few studies on NIPF owners' cooperation (Van-Gossum and De-Mayer, 2006; Blinn et al., 2007; Rickenbach, 2009). Investigating "natural resource partnerships" Williams and Ellefson (1996) explore the factors that favour the

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