

# Prescribed fire use for cost effective fuel management in Spain

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## Abstract

- Prescribed fire use for cost effective fuel management (and other objectives as well) is growing in some areas of Spain. This paper details the use in both Catalonia and in Canary Islands regions. Wildland fire regimes are changing in Catalonia (NE Spain) and (Canary Islands, SW Spain) and large wildland fires (LWFs) are more likely to occur. This is a major change in the disturbance regime and it is a real threat for biodiversity and for total cost of fire management (fire losses, post-fire restoration, fire suppression and fire prevention expenditures). This paper studies cost effectiveness of prescribed burning as a mean to create fire resistant stands to allow wildland fire control. It is based in the recent (2000-2007) prescribed burning program both regions. We explicitly consider the benefits that prescribed burning provides to train firefighters and to help them with the necessary skills to later use fire as a forest fire suppression tool. Prescribed fires seems to be very efficient in maintaining those shaded fuel breaks accomplished firstly with either gazing or mechanical removal (mastication). We are interested not only in setting fuel-breaks but in providing strategic locations for those (after Farsite and FlamMap simulations). In this paper, we also show several case studies.
- **KEYWORDS:** prescribed fires, cost effectiveness simulation, Farsite, FlamMap

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## Assessment of prescribed fire use in two regions of Spain

Prescribed fire is a widely use tool in forestry and fire protection in many countries (Molina 2000a and b) and its use is increasing.

Our first study case is in NE Spain, Catalonia. Since 1999 firefighters of “Generalitat de Catalunya” are using prescribed burning in different typologies of forest structures, and under different management goals which are within the scopes of pre-extinction and forest management (Castellnou et al. 2002, Larrañaga et al., 2006). There have been 490 ha (table 1) treated by firefighters with prescribed fire as a management tool since 1999.

Additionally, we presume that this technique will continue to be used in the future.

Pre-extinction congregates all treatment directed to transform or maintain a forest structure that can be used safely and efficiently to anchor fire operations.

Forest management gathers different objectives; tree thinning, range improvement, habitat restoration for wildlife and the fuel management (fuel breaks) to protect wildland / urban interface areas.

Prescribed burning as a forestry tool has required a high effort in communication and training to overcome the initial distrust and strangeness. In order to reach acceptance, a detailed assessment of costs and efficiency of both traditional tools and fire should be carry out. The study is analyzing costs and productivity for different objectives and structures treated. The final evaluation will be defined by the conditionings and restrictions established which in turn depends on the management objective. This allows us to start a technical discussion about productivity and profitability of prescribed burning to compare with other treatments.

Table 1. Number and area of prescribed burns by type that involved firefighters in Catalonia (NE Spain) from 1999 to 2006.

<i>Prescribed burn type</i>	<i>number</i>	<i>number (%)</i>	<i>Area (ha)</i>	<i>Area (%)</i>
Strategic sites for fire suppression	32	43	66	135
Fuel breaks	13	18	76	15.5
Industry Empty Lots / Urban Interface	5	7	6	1.3
Wildland Urban Interface	4	5	16	3.3
Research sites	2	3	2	0.4
Range improvement	16	22	324	66.2
<b>Total</b>	<b>74</b>		<b>490</b>	

Mean burn size is 6.6 ha, ranging from research sites (< 1 ha) to range improvement sites where mean size is 20 ha

To assess both resources and safety needs, there was necessary to classify how difficult a given prescribed burn is. We consider this to be a combination of two factors a) fuel continuity (horizontal and vertical or fuel ladder) and b) objective of the burn

The mean cost per hectare of prescribed burning is 1200 €/ha for major types (Strategic sites for fire suppression, Fuel breaks and Range improvement that amount for 70% of all surface treated). Individual costs and number of person per day and hectare are displayed in Table 2. We can observe that range improvement objective reflect the best performance

Table 2. Cost and persons involved in each prescribed burn type that involved firefighters in Catalonia (NE Spain) from 1999 to 2006.

<b>Prescribed burn type</b>	<b>Cost (€/ha)</b>	<b>Person-day/ha</b>
Strategic sites for fire suppression	1247	8
Fuel breaks	1379	10
Industry Empty Lots / Urban Interface	1148	9
Wildland Urban Interface	566	3
Research sites	2727	19
Range improvement	242	2

Since 2002, Gran Canaria Forest Service is implementing a fuel management program that includes prescribed burning operations either alone or in combination with mechanical treatments (i.e., mastication). Additional details can be read in Molina et al (2006). In Gran Canaria, prescribed burning is aimed not only to mitigate wildland fire hazard but also to enhance rangelands and to favor forest restoration programs. A total of 103 burn units so far that means 166.5 ha of wildlands (Table 3) from 2002 to 2006. This is an equivalent to 0,27% of the total wildland area in the island. It is important to mention that additional objectives of these prescribed burns were research and the protection of special infrastructures (telecommunication).

Table 3. Number and area of prescribed burns by type that involved firefighters in Gran Canaria (Insular SW Spain) from 2002 to 2006.

<b>Prescribed burn type</b>	<b>number</b>	<b>number (%)</b>	<b>Area (ha)</b>	<b>Area (%)</b>
Previo a repoblaciones	7	6,8	24	14,4
Ayuda a repoblaciones	9	8,8	13,5	8,1
Mantenimiento de pastos	3	2,9	20,8	12,5
Dehesas	6	5,8	32,7	19,6
Áreas de baja carga	34	33	30,5	18,3
Defensa de infraestructuras	38	36,9	39,4	23,7
Investigación	6	5,8	5,6	3,4
<b>Total</b>	<b>103</b>		<b>166,5</b>	

Some costs and number of person per day and hectare are displayed in Table 4. These are estimates that are not as precise as those shown in table 2 for

Catalonia . We can observed that range magement objective reflect the best performance.

Table 4. Cost and persons involved in each prescribed burn type that involved forest Service personnel in Gran Canaria (Insular SW Spain) from 2002 to 2006.

<i>Prescribed burn type</i>	<i>Media ha/día</i>	<i>Cost (€/día)</i>	<i>Cost (€/ha)</i>
Previo a repoblaciones	3,4	1500	441
Ayuda a repoblaciones	1,5	1500	1000
Mantenimiento de pastos	6,9	1500	218
Dehesas	5,5	1500	273
Áreas de baja carga	0,9	2800	3111
Defensa de infraestructuras	1,0	2800	2800
Investigación	0,9	2800	3111

If we compare the two territories, there is a yearly mean of 36.3 ha burned (0.27%) by Gran Canaria Forest Service while there is a mean of 81.6 ha burned (0.025%) by Catalonia Fire Fighting Department. This is more than ten times larger in relative terms in Gran Canaria, although in absolute terms it is larger in Catalonia.

In El Hierro Island (Canary Islands as well), local Forest Service is willing to start a prescribed burning program. There are three main reasons for this move:

- a. some profitable technical visits to Gran Canaria prescribed burning experiences.
- b. mechanical (mastication) fuel treatments are more expensive ranging from 2000 to 4000 €/ha in El Hierro.
- c. prescribed burning operations are excellent training opportunities to personnel that will be involved latter in fire control operations.

## Conclusive remark

The last reason (c, in the El Hierro case) is going to be the topic for our conclusive remark. We strongly believe that in order to provide the best training to fire suppression workers prescribed burning is only second to real wildland fires. Some workers that are ready to be dispatched to a wildland fire that might have attended to a last fire weeks or months earlier. They do not have much real experience in fire. With prescribed burning operations, we can provide the extra hours that those employees need to better understand fire behavior changes (due to subtle changes in fuel model, fuel moisture content, exposure to the sun, etc), we can train them actively in fire suppression actions, in fire safety issues (Beaver 2001, Pous & Molina 2005, Pous & Molina 2006), communication efficiency, and also in fire effects in vegetation. Therefore, as we can profit so much from training options, the net

cost of prescribed burning per hectare may be easily assess as lower than reported earlier.

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