

The frequency of fires and land degradation - Cabeço da Vessada do Monte, Serra da Cabreira

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Key-words: Cabreira mountain, forest fires, recurrence interval, soil degradation

Introduction

The mapping on the spatial distribution of scorched areas in the municipality of Vieira do Minho, in the period 1990-2007, unequivocally confirms the high vulnerability of this territory to forest fires (Bento-Gonçalves, A., 2006, Ferreira-Leite et al., 2010), especially in the area of the Serra da Cabreira.

The maximum recurrence of fires in this area, recorded over a period of 18 years (1970-2007) shows that in some situations certain areas were scorched by fire five times, as is the case of Cabeço da Vessada do Monte, which is located in the northern sector of Serra da Cabreira, in the Cabeço da Vaca (Ferreira-Leite, F. and Bento-Gonçalves, A., 2008) (Fig. 1).

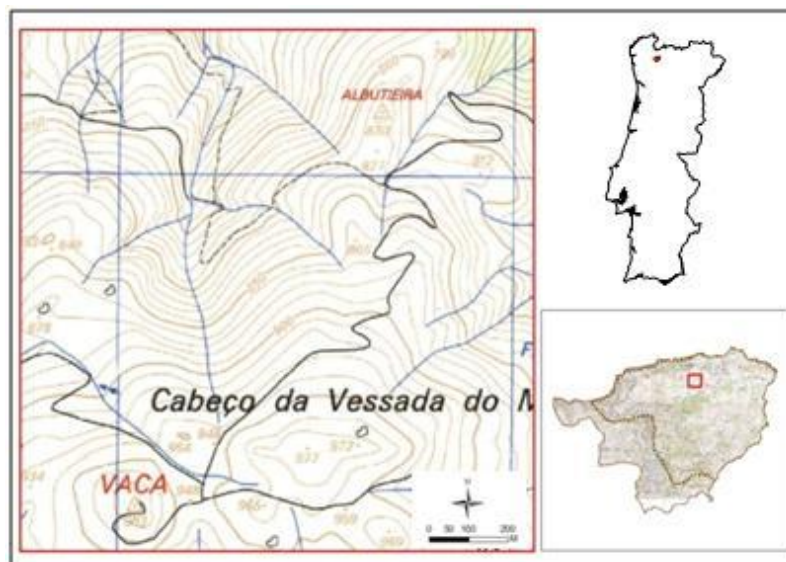


Figure 1. Location of the Cabeço da Vessada do Monte study area

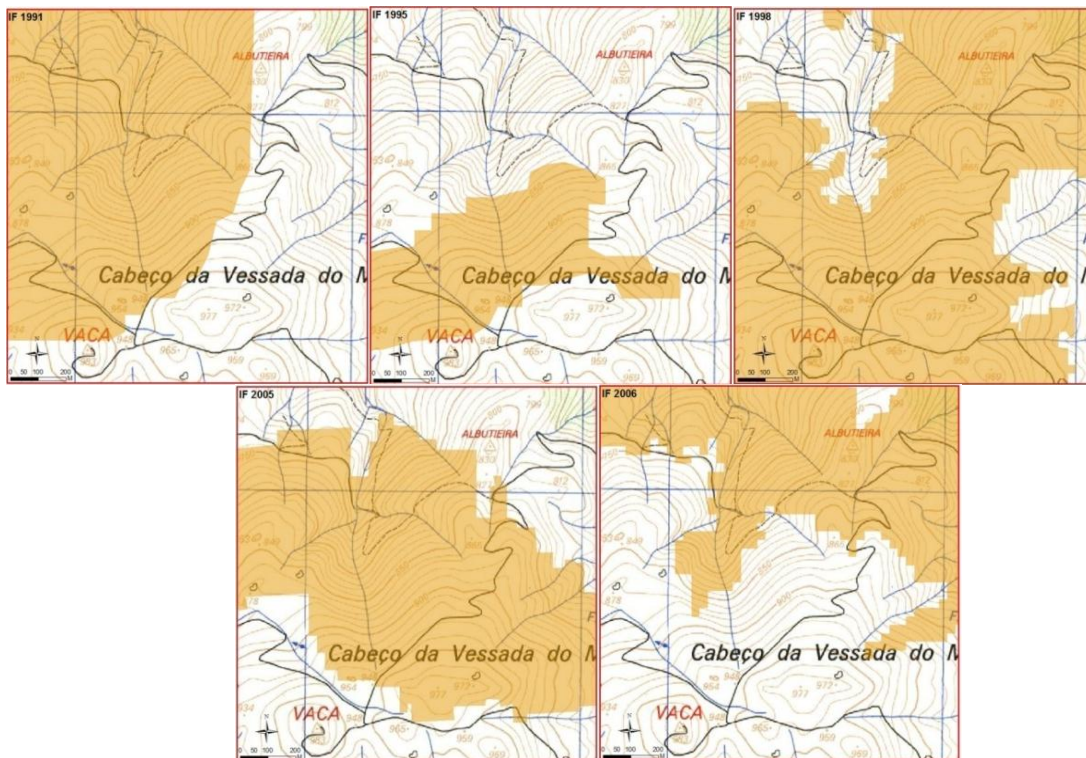


Figure. 3. Burnt areas in 1991, 1995, 1998, 2005 e 2006 - Cabeço da Vessada do Monte study area.

Similarly to what happened in much of the mountain, the area of Cabeço da Vessada do Monte was scorched by the great fires of 1975 and 1981. These scorched almost all the decades old forest (Bento Gonçalves, 2006), which accounted, as already mentioned, for the replacement of the woodlands by thickets.

Subsequently, many reforestation plans have been approved throughout the years, corresponding to the reforestation several dozen hectares. However, most plans did not make it off the paper. In the cases when they did, most of the times the young stands were scorched before they could ever develop into true forest areas.

This area has been particularly affected by the more recent forest fires, having been scorched by fire, between 1990 and 2007. It was scorched a maximum of 5 times (Fig. 2), in the years 1991, 1995, 1998, 2005 and 2006 (Fig. 3).

In the medium term, there seems to be a tendency for the time required for these same areas to be scorched again to be lessened, revealing that some portions of this territory are subject to frequent and sometimes large demonstrations of forest fire risk (Ferreira-Leite, F. et al., 2010).

Unlike the fires of the 1970s and early 1980s that were of high intensity due to the presence of adult forest tree populations, the fires more recent fires have occurred essentially in scrublands meaning that the fires are of medium and low intensity.

In this area, where soil is still present, weeds can reach 50 cm in height in about 2 years (photo 1), which makes for a high level of combustibility that allows fires to occur every two years. This is due, in large part, to the high levels of precipitation (Table I).

TABLE I. Udometeric Post located in the Cabreira Mountain, Municipality of Vieira do Minho (1961-1990).

Udometeric Post	Average Annual Precipitation (mm)	Altitude (m)
Guilhofrei	2705,7	350
Salamonde	2281,9	550
Zebraal	3071,1	775

Source: INMG, 1961-1990

In effect, the precipitation concentrated in the autumn and winter months could help to dramatically accelerate the erosion process. However, despite this concentration, it occurs throughout the whole year, contributing primarily to a very fast recovery rate of vegetation, allowing for a high productivity of biomass that will be crucial in protecting the soil against physical erosion (fot. 2).



Photo 1 and 2. Scrublands in serra da Cabreira, municipality of Vieira do Minho.

In fact, the scrublands are the dominant trait in the regional landscape, mainly due to the fact that it represents about 50% of the total occupied area of the mountain (Smith, 2000, p. 46).

Inside the scrubland unit there are several types of species, namely the *Cytisus striatus*, *Genista cinerea*, *Erica arborea* L. There are also areas where other species, such as *Ulex* and various types of heathers, are predominant.

These species have pyrophytic characteristics, with flammability and calorific values of medium to high level (Table II), which can influence fire behaviour and facilitate the ignition and consequent spread of fires.

Table II. Inflammability and Calorific power - shrub species.

	Inflammability	Calorific power
<i>Erica</i>		
<i>Genista falcata</i>		
<i>Ulex parviflorus</i>		
<i>Cytisus multiflorus</i>		

low
 medium
 high
 unknown

Source: Adapted from Vallette, 1990; Martin and Lara, 1989 in Silva e Páscoa, 2002.



Rather than consider the different species in isolation, it is especially important to characterize the vegetation formed by these species. Therefore, we are also interested in the combustibility of scrubland (Table III), since this landscape unit is the dominant type in the study area.

Table III – Combustibility of scrubland.

Underdeveloped Height <30 cm	low
Intermediate Height 30-50 cm	medium
Developed Height >50 cm	high

Source: Adapted from Ronde *in* Silva and Páscoa, 2002

By destroying or reducing, even if temporarily, the vegetation coverage and taking into account the dominant presence of steep slopes (Ferreira-Leite, F., 2008) and the high values of precipitation, the fire contribute significantly to degrading the soil and accelerating erosion. However, the severity of this degradation is a function of the frequency and the intensity patterns of the fires.

The low intensity of recent fires⁵, due to a high recurrence rate, can be verified in the field immediately after their occurrence. Also, the severity of the effect of the recurrence of the fires was evaluated using the vegetation as a bioindicator of the soil status (Calvo, 1996), and it was found that, on average, where there was soil (cambisols - 10-20 cm) it was dense to less dense and the roots were covered, thus indicating a low degree of physical erosion, a fact corroborated by the presence of small incisions and marks on the ground.

Concluding Remarks

In the international literature there are many studies on the effects of different intensities of fires on soil properties (Smith, A. et al. 2010; Jordán, A. et al. 2010; Lawrence, L., 2010). However, the frequency has been relatively under studied, which calls for promoting this kind of study.

This study, albeit in a very early stage, plans to launch the discussion on the relationship between the frequency of fires and physical erosion, showing that in particular situations, a high frequency does not always correspond to an accelerating loss of soil.

Indeed, in our sample area, which has a recurrence of up to 5 fires, the recovery rate of vegetation seems to go against the physical loss of soil. This is due to the high volume of precipitation, which contributes decisively to the high rate of vegetation growth which avoids that the soil is not unprotected for too long and subject to an accelerated erosion process.

References

- Bento Gonçalves, A. J. (2006) – *Geografia dos incêndios em espaços Silvestres de Montanha – o caso da serra da Cabreira*, Tese de Doutoramento, Instituto de Ciências Sociais da Universidade do Minho, Braga, 438 pp.
- Bento Gonçalves, A. J. (2006) – “A “construção” e a “desconstrução” do património florestal português no séc. XX – breve abordagem ao caso do concelho de Vieira do Alentejo”

⁵ Fires with an area of less than 10ha, maintenance of some green branches, partially or totally burned shrubs (Lampin et al., 2003).



- Minho”. GEO-Working Papers, Série de Investigação 2006/8, NIGP – Universidade do Minho, Guimarães.
- Calvo, D. A. (2002) – *Ciencias de la tierra y del médio ambiente*, 2.º Bachillerato, McGraw-Hill, Madrid, 333pp.
- Ferreira Leite, F. e Bento Gonçalves, A. J. (2008) – “Alterações no ciclo de fogo na serra da Cabreira”, *Actas XI Colóquio Ibérico de Geografia*, Universidad de Alcalá de Henares, Espanha.
- Ferreira Leite, F.; Bento Gonçalves, A.J.; Vieira, A. e Martins, C. (2010) – “A recorrência dos incêndios na serra da Cabreira como manifestação do risco de incêndio florestal”, *Territorium* 17, 2010, p. 93-98.
- Ferreiro, A., Fontúrbel, T., Fernández, C, Merino, A., Veja, J. A. (2010) – “Indicadores visuales de severidad del fuego y relaciones com câmbios en parâmetros químicos y microbiológicos después de incêndio”, *Jornadas Internacionales*, Diaz Raviña, M., Benito, E., Carballas, T., Fontúrbel, M. T., Veja, J. A. (eds.) - *Investigación y Gestión para la Protección del Suelo y Restauración de los Ecosistemas Forestales Afectados por Incendios Forestales*, FUEGORED 2010, Santiago de Compostela.
- Jordán, A., Zavala, L. M., Mataix-Solera, J. (2010) – “Impact of fire severity on soil structure and water repellency in the neo-volcanic axis range (Central Mexico)”, *Jornadas Internacionales*, Diaz Raviña, M., Benito, E., Carballas, T., Fontúrbel, M. T., Veja, J. A. (eds.) - *Investigación y Gestión para la Protección del Suelo y Restauración de los Ecosistemas Forestales Afectados por Incendios Forestales*, FUEGORED 2010, Santiago de Compostela.
- Lampin-Cabaret C., Jappiot, M., Alibert, N. e Manlay, R. (2003) – “Une échelle d'intensité pour le phénomène Incendie de forêts”, *SIRNAT – JPRN Orléans*.
- Lourenço, L., Bento Gonçalves, A. (2010) – “Erosión violenta post-incendios forestales en Portugal”, *Jornadas Internacionales*, Diaz Raviña, M., Benito, E., Carballas, T., Fontúrbel, M. T., Veja, J. A. (eds.) - *Investigación y Gestión para la Protección del Suelo y Restauración de los Ecosistemas Forestales Afectados por Incendios Forestales*, FUEGORED 2010, Santiago de Compostela.
- Pyne, S. J. *et al.* (1996) – *Introduction to Wildland Fire*, New York. John Wiley & Sons.
- Soares, A. (coord.) (2000) – *Atlas da fauna e flora da serra da Cabreira*, CIASC, p. 219.