

Impact of wildfires on plant cover and biomass in shrublands of Lagadas County in northern Greece

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Abstract

Large forested areas are destroyed by wildfires in Greece every year. A significant part of these areas is composed of shrublands dominated by kermes oak (*Quercus coccifera*). The present study was carried out in kermes oak shrublands covered by various shrub densities and located at Lagadas County of the Thessaloniki prefecture. In 2007, an area of an 563 hectares extension was burned. In three cover degrees (10-40% - open, 41-70% - medium and 71-100% - dense) and two burning treatments with three replications plant cover and above ground biomass (herbaceous and woody) were measured at the end of the second growing season since the wildfire. Herbaceous plant cover was highest in the open and woody plant cover was highest in the dense shrubland. Vegetation (herbaceous and woody) recovered very fast and no significant differences were observed two years after the wildfire. Regarding the above ground biomass, herbaceous was increased considerably in burned areas due to the reduction of woody plants. Total biomass however was statistically similar in burned and unburned areas.

Key words: Unburned area, burned area, cover type, cover, biomass

Introduction

Shrublands dominated by kermes oak (*Quercus coccifera*) cover large areas in several Mediterranean countries. They are important grazing areas for goats significantly contributing to animal production since they are mainly used during the autumn and winter months (Papanastasis et al. 2008). In Greece, there is a gradual degradation of kermes oak shrublands over the last decades due to underutilization, or, even, abandonment of grazing resulting in fuel accumulation and in a great fire danger. Wildfires have become a considerable threat to these degraded shrublands. Although several studies have been carried out on the effects of wildfires on kermes oak shrublands (e.g. Papanastasis 1988, Papachristou et al. 1997), there is a lack of knowledge on how shrubland density is related to post-fire restoration of these ecosystems. In this paper, the impact of wildfires on plant cover and biomass was investigated so that the post-fire grazing management of kermes oak shrublands is properly organized.

Materials and methods

The research was conducted in kermes oak shrublands of Lagadas County of Thessaloniki prefecture. In August 2007, an area amounting to about 563 ha and covered by various shrub densities was burned by a wildfire (Figure 1). Measurements were taken two growing seasons later, specifically in May and June 2009. The study area is located at 450- 550 m a.s.l. and has soils derived from metamorphic rocks and climate semi-arid Mediterranean.

The experimental design involved three shrub cover classes (10-40% open, 41-70% medium and 71-100% dense) and two types of fire history (burned and unburned) with three replications. In each treatment combination, three transects of 25 m each were taken where plant cover and above ground biomass were measured. For plant cover, the point-line method was applied (Cook and Stubbendieck 1986). For biomass, five random quadrats of 1 m² were cut at the ground level in each transect, the herbaceous and woody vegetation was separated and transferred to the Laboratory. Before oven drying and weighing, the woody material was hand separated into current year's and old growth.

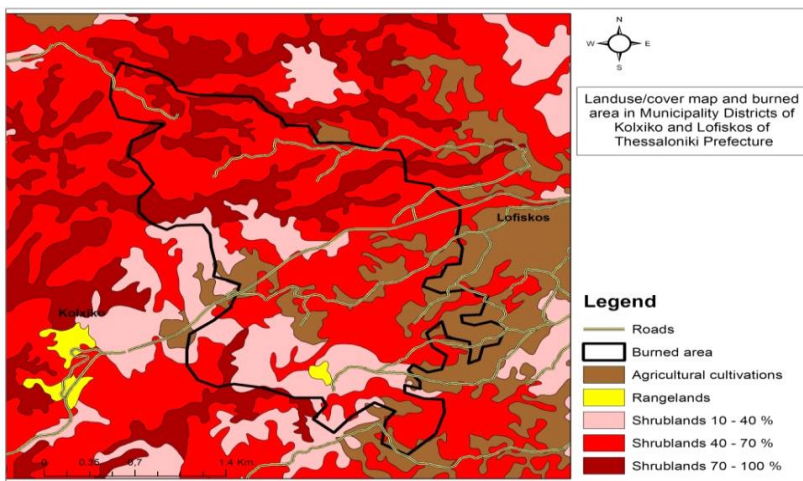


Figure 1. Study area with the three shrub classes.

Results and discussion

Dense shrublands had significantly lower herbaceous and higher woody cover than the other two classes while no significant differences were

observed between open and medium cover classes (Table 1). Litter and bare ground did not present any significant differences in the three shrub cover classes.

Category	Shrub cover		
	Open	Medium	Dense
Herbaceous	54.67 a ¹	58.33 a	42.33 b
Woody	24.83 b	26.17 b	39.83 a
Litter	10.00 a	8.00 a	5.33 a
Bare ground	18.00 a	8.00 a	15.83 a

¹ Means in the same line followed by the same letters are not significant different at the 0.05 level of significance.

As far as fire history is concerned, no statistical differences were found between the burned and unburned treatments (Table 2). This can be attributed to rapid recovery of the vegetation (herbaceous and woody) in the burned area two years after the wildfire. A rapid increase of kermes oak cover was also observed in the first two years after a wildfire in southern France (Trabaud 1977) as well as in Greece (Papanastasis 1988).

Category	Fire history	
	Burned	Unburned
Herbaceous	55.22 a ¹	48.33 a
Woody	26.00 a	34.56 a
Litter	7.11 a	8.44 a
Bare ground	14.56 a	13.33 a

¹¹ Means in the same line followed by the same letters are not significant different at the 0.05 level of significance.

For biomass, medium class shrubland had significantly higher herbaceous biomass than the open and dense ones (Table 3). The lower biomass of the herbaceous plants in light class shrubland should be attributed to the intensive grazing that was applied the first two years after the fire due to its higher attractiveness to the animals compared with the other two classes. In contrast, the dense class had significantly higher current year's growth than the other two treatments, while the old growth was statistically the same in all the cover classes. The total biomass

(herbaceous and woody), finally, was significantly increased from light to dense shrubland.

Table 3. Mean above ground biomass (kg/0.1ha) in the three shrub cover classes

Biomass category	Shrub cover		
	Open	Medium	Dense
Herbaceous	88.40 b	235,04 a ¹	120,60 b
Current's year growth	8,90 b	8,80 b	26,00 a
Old growth	37,80 a	71,40 a	134,63 a
Total woody	44,60 a	80,20 a	160,60 a
Total biomass	135,00 b	281,20 ab	315,30 a

¹ Means in the same line followed by the same letters are not significant different at the 0.05 level of significance.

Regarding fire history, herbaceous biomass was significantly higher in the burned treatment than the unburned while the woody biomass (especially the old growth) was significantly decreased (Table 4). The increased herbaceous biomass in the burned area was balanced by the reduction of woody biomass, resulting in no differences for the total biomass two years after the fire between the two treatments. Papanastasis (1988) also found that herbaceous vegetation recovered two years after the fire and significantly contributed to the total production of a burned kermes oak shrubland.

Table 4. Mean above ground biomass (kg/0.1ha) in the two burning treatments

Biomass category	Burning treatments	
	Burned	Unburned
Herbaceous	202.6 a ¹	93.4 b
Current's year growth	8.2 a	20.9 a
Old growth	6.7 b	155.8 a
Total woody	15.0 a	176.7 a
Total biomass	217.6 a	270.1 a

¹ Means in the same line followed by the same letters are not significant different at the 0.05 level of significance.

Conclusions

1. Woody plant cover increased from the open to dense kermes oak shrublands two years after the wildfire while the herbaceous plant cover decreased. The intense resprouting of kermes oak in the burned area resulted in a similar cover of woody plants with the unburned area.
2. Herbaceous biomass was affected by the grazing management applied after the wildfire more than woody biomass and was highest in the middle cover class of shrublands.
3. Burned shrublands had significantly higher herbaceous biomass than the unburned ones two years after the wildfire thus explaining why shepherds often set wildfires in these areas.

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