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Species diversity of small mammals community in different stages of post-fire succession in Marmaris National Park, Turkey

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ABSTRACT: Fires have been important ecological force shaping landscapes and communities in Mediterranean ecosystems. The habitat changes caused by fire influence communities of small mammals.
In this study we aimed to study species diversity of small mammal communities in plots (burned in 1999, 1995, 1979 and unburned for at least 45 years) represented different successional stages after fire. The result of trapping carried out regularly during a year, we found four species; *Apodemus mystacinus, Mus musculus, Crocidura suaveolens* and *Dryomys nitedula.* In 1995 plot species diversity was the highest. Abundance of species was found nearly equal in this plot. 1979 and control plot have similar species diversity. It showed that 1979 plot almost recovered. In 1999 plot species diversity was the lowest. *Apodemus mystacinus* was the dominant in this plot with high abundance. The results obtained in this study supported the idea that fire have positive effects on biodiversity.

1 INTRODUCTION

Fire is a common disturbance in Mediterranean ecosystems (Prodon et al., 1987) and the most spectacular phenomenon in forest ecosystems (Granström, 2001).

The fires play an important role in the maintenance of species diversity in Mediterranean ecosystems both plants and animals (Monimeau, 2002). Species diversity is expression of community structure and community complexity (Brower et al., 1989). To know the species diversity in different stages of succession is important.

Fires create a sequence of microhabitats that in plant succession after fire or new habitats for the different mammalian species. Species of small mammals peak abundance in an orderly replacement sequence exhibiting mammalian secondary succession. The abundance of small mammals after fire is mainly related with vegetation change (Fox, 1982).

The small mammals are the indicator groups represented the ground surface which is one of the three main ecosystem layers (Prodon, 1987). For this reason the studies of small mammals in post-fire areas are very important. The community of small mammals in post-fire areas has been studied widely (Fox, 1982; Prodon et al., 1987; Haim et al, 1996; Haim et al., 1997), but there are not any study about community of small mammals in post-fire areas.

Our aim was to show changes in species diversity of small mammals community during post-fire succession in Marmaris National Park, Turkey.

2 MATERIAL AND METHODS

2.1 *Study area*

The study was carried out at the Marmaris National Park (N 36° 50', E 28° 17') which is located in the southwest of Turkey. The area has a typical Mediterranean climate with dry summers and wet winters, and was mostly covered by *Pinus brutia* Ten. forests. It is approximately 34.000 ha and it has many sites burned in different years like other Mediterranean ecosystems.

Four plots were selected representing the different stages of succession in post-fire areas; I. Burned in 1999 (N 36º 50' 11", E 28º 18' 10"), II. Burned in 1995 (N 36º 51' 16", E 28º 17' 14"), III. Burned in 1979 (N 36º 49' 37", E 28º 19' 34"), IV. Control plot (that have not burned at least for 45 years) (N 36º 50' 47", E 28º 17' 24"). These plots are located on the same geological material and very close to each other.

2.2 *Sampling design*

Small mammals were captured using Sherman live-traps. In all study plots, 10x5 trapping grid with 10 m intervals were established Traps were baited with peanut butter and set in the afternoon and checked out in the early morning of the following day. In each session, trapping was carried out for three successive nights. Trapping was carried out from September 2000 to December 2001 at two months intervals. Trapped animals were identified to species and marked with ear-tag before being released at the point of capture. Necessary permission has been taken from "Hacettepe University Ethical Community" for the study of small mammals.

On each study plot "Minumum Alive Number" is used to calculate for the total number of small mammal species (Fox, 1982; Krebs, 1999).

Diversity of small mammals for each plot was calculated using Shannon-Weaver index (Krebs, 1999).

3 RESULTS

We captured 211 individuals, representing four species in 4800 trap-nights during the study. In all study plots three species were captured in different numbers of individuals; broad-toothed field mouse *Apodemus mystacinus* (Danford & Alston, 1877), house mouse *Mus musculus* Linnaeus, 1758 and *Crocidura suaveolens* (Pallas, 1811). With 164 individuals captured broad-toothed field mouse was the most common small mammal species in all plots, the house mouse was the second most common one with 33 individuals captured. Lesser white-toothed was represented with 11 individuals in all plots. The forest dormouse *Dryomys nitedula* (Pallas, 1779) was detected with very limited number in only 1979 plot (Kaynas, 2002) (Table 1.).

Although species richness was the highest in 1979 plot, species diversity was the highest in 1995 plot (H=0,318). There was no significant difference between 1979 (H=0,292) and control (H=0,286) plots. The site burned a year ago (1999 plot) had the lowest species diversity (H=0,224). 1999 plot was significantly different from others (1999-1995 P<0,001, t=13,06, DF=65; 1999-1979 P<0,001, t=4,53, DF=44; 1999-Control P<0,001, t=4,77, DF=44) and difference between 1995 and control plots was significant (P<0,05, t=2,29, DF=51) too (Table 2.) (Figure 1.).

Table. 1. Total number of small mammals in plots with calculating "MNA" (Kaynas, 2002).

Species	1999 Plot	1995 Plot	1979 Plot	Control
Apodemus mystacinus	77	30	30	27
Mus musculus	17	13	1	2
Crocidura suaveolens	1	1	5	6
Dryomys nitedula	0	0	3	0
All species	95	44	37	35

Table. 2. Species diversity of small mammals in burned plots (Different superscript letter denotes significant differences between plots).

Burned Plots	1999	1995	1979	Control
Species diversity	$0,224^{a}$	$0,318^{b}$	$0,292^{bc}$	$0,286^{c}$

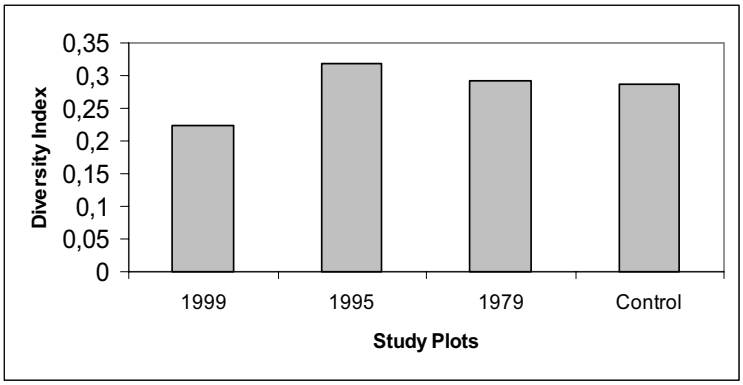

Fig. 1. Species diversity (as measured by the Shannon diversity index) of burned plots in different years and control plot.

4 DISCUSSION

The species diversity of small mammals is fairly low in Mediterranean areas (Prodon et al., 1987). In such post-fire areas the species of *Mus, Apodemus* and *Crocidura* have been frequently studied in different successional stages (Fox, 1982; Prodon et al., 1987; Friend, 1993; Haim et al., 1996; Haim et al., 1997).

Our results shown that in 1995 plot the species diversity were the highest. Similarly Haim, (1996) reported that highest species diversity was seen in forth year after fire. The abundance of *A. mystacinus* was lower than 1999 plot. The presence *A. mystacinus* and *M. musculus* with nearly equally abundance was caused to increase the species diversity of small mammals.

In 1999 plot had the lowest species diversity and it was significant different from the other plots. This result may arise from population of *A. mystacinus* constituted high proportion of the total abundance. If the abundance of species distribute evenly, species diversity occurs high, whereas if few species have most of the total abundance, the species diversity will be low (Zar, 1996). In 1999 plot that had large population of *A. mystacinus, Quercus infectoria* was the one of the dominant species (Tavsanoglu, 2002). Haim and Rubal (1992) found similar results about *A. mystacinus* in the wetter *Quercus calliprinos* habitat. Although one of the *Apodemus* species that is *Apodemus sylvaticus* is known a mid-successional species (Prodon et al., 1987; Churcfield, 1997), there are very limited knowledge about ecology and place through succession of *A. mystacinus*. Furthermore the higher abundance of *M. musculus* found in 1999 plot, supported the common observations which shows *Mus* as an early successional species with excellent dispersal capabilities and high reproductive capabilities (Fox, 1982). *M. musculus* may prefere post-fire vegetation, in terms particularly of food or cover, as a habitat specialist (Whelan, 1995).

The species diversity of the small mammal community was similar in plots that burned 1979 and control. The 1979 plot seems to be recovered because abundance of insectivores species was seen as high as control plot. Since they are small body size secondary consumers, shrews can serve as bioindicators for assessing the various stages of post-fire recovery. Haim et al. (1997) reported that abundance of *C. suaveolens* was higher in unburned area than burned area.

During the succession changing of habitat heterogeneity with plant succession may provide better conditions for small mammals. This results displayed that fire may contribute to biodiversity of small mammals.

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