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Plant Succession in Post Fire Communities of Pinus nigra Arn.

Silviya S. Radanova

Trakia University, Faculty of Agriculture, Stara Zagora, BULGARIA
E-mail: syl_rad@yahoo.com

Abstract. Fires around settlements are a logical consequence of climate drought and the increased human activity today. Plant communities with specific composition and structure are formed on burned areas. This study aims to analyze the floristic composition on three of the after- fire communities, occurring at different times in the Stara Zagora green shelter belt. Analysis of Raunkiaer life forms is made, and the degree of canopy cover is calculated on Braun Blanquet. The results allow predicting the development of secondary plant succession on burned areas.

Key words: post fire communities, higher plants, plant succession, Stara Zagora region.

Introduction

Today fires are one of the most common disorders of forest ecosystems worldwide. Naturally or artificially caused, they inflict severe damage to plant communities. But if in the past they were described as a natural disaster, today it is good to know, that they have very positive consequences as well - they assist natural regeneration of vegetation cover and are used as a remedy for cleansing felling (HICKEY, 1994); initiate succession eliminating of all vegetation or separate floors of the plant community (ZWOLINSKI, 1988); determine the existence of a number of woody and herbaceous species (GILL, 1974; DE LUIS *et al.*, 2006). Natural fires leave more structural elements (DUNKAN, 1985; HICKEY *et al.*, 1998), their recurrence over a period of 90-100 years eliminates indigenous forest species (BAKER *et al.*, 2004; LINDERMAYER & FRANKLIN, 2002), but also supports the development of species of lower floors, enriches the soil with minerals, purifies the forest of old and diseased trees and the pathogenic microorganisms in them, clears weed plant remains in the understory. In after fire communities, we observe a gradual replacement of small, short-lived species with large, long-lived species, there begins a succession, described by Egler as "the initial floristic model" (EGLER, 1954). Usually, after the fire, patches of indigenous, vegetation remains (GARANDEL *et al.*, 2009; KEELEY, 2010)

First, the seed breeding species disappear while those with vegetative propagation develop (SMITH, 1970). More resistant to fires are oaks, giant sequoia, eucalypts, and other tree species with thick corky bark (SWAN, 1970). Of particular importance are the fires of the coniferous species - though they are highly vulnerable because of the flammable resin in their tissues; high temperature is required for the opening of the cone and seed germination (VERROIOS & GEORGIADIS, 2002; GANATSAS *et al.*, 2012).

Despite the obvious devastation that natural fires cause, they are defined as "the essence of health" for most ecosystems (KNEITEL, 2012).

The purpose of this study is to analyze the floristic composition of three after fire

communities, formed at different times, having established early and late succession species in terms of the transitional continental climate of Stara Zagora, South Bulgaria.

Materials and Methods

The burned areas are situated in the northern part of the green shelter belt of Stara Zagora, South Bulgaria, as the vegetation losing became at different time: № 1 - 2010, area - 1,2 ha, location – South East; № 2 -2007, area - 0,8 ha, location – North East; №3 - 1998, area - 0,6 ha, location South West. The route method is used; these sites are passed several times within the period from March to October. The altitudes 500 m above sea level, the soil is maroon, the climate - transient - continental with Mediterranean influence - cool summers and mild winters. Species diversity was determined based on the works of JORDANOV (1963-1989) and KOUZHUHAROV (1992).

The projective cover is calculated on the scale of Braun-Blanquet (POORE, 1955).

Results and Discussion

In the area, burnt in 2010 (№1), there lacks any vegetation except for shoots of *Quercus cerris* L. (Fig. 1, A - B).

B

Fig.1. A-B. Shoots of *Quercus cerris* L. in the burnt territory № 1.

In the burnt area №2 (2007) there are 32 recorded species belonging to 30 genera and 15 families of vascular plants (Table 1). Dominating are the representatives of *Asteraceae* family (18.7%), *Lamiaceae* family (15.6%) and *Poaceae* family (9.4%). The prevailing biological type is perennials (56%), all the other biological types (a,b, a - b, a - p, h, H) are with a little equity (3 - 9%). Raunkiers life forms follow this distribution, dominated by hemicryptophytes (69%) and a relatively good representation of phanerophytes (18.7%).

Burnt area №3 includes 40 higher plant species, belonging to 38 genera and 21 families. Among the biological types, perennials predominate (57.5%), others are under-represented. Among the life forms, hemicryptophytes prevail (50%), the phanerophytes group constitutes 20% of the studied flora, the therophytes and the cryptophytes are both represented by 15%. The prevailing family is *Rosaceae* (17.5%), *Liliaceae* family, *Lamiaceae* family and *Boraginaceae* family are represented by 10%.

The results can be interpreted as follows: The most recently burnt area (2010) lacks any species because the burnt plantation was from *Pinus nigra* Arn. and hardly allowed development of other species in the understorey. The recovery of the plant community starts from the understory (GARANDEL *et al*., 2009) - we observe this process with coppice regeneration of single survived specimens of *Carpinus orientalis* Mill. - native species, highly resistant to high temperatures. Due to the short period after the fire, plant diversity is still at its minimum, and then it will successively go through the phase of dominance of annuals and perennials.

Table 1. Floristic composition of burnt area.

Family/Species	Biological type	Raunkiaer Life forms	Burnt area №2	Burnt area №3
Anacardiaceae				
Cotinus coggygria Scop	ħ	Ph		+
Asteraceae				
Achillea millefolium L.	p	H	+	
Coniza canadensis (L.) Cronq.	a	Th	+	
Cirsium vulgare L.	b	H	+	
Crepis foetida L.	a-b	H	+	
Lactuca serriola L.	a-b	H	+	
Sonchus arvensis L.	p	H	+	
Apiaceae				
Eringium campestre L.	p	H	+	
Orlaya grandiflora (L.) Greuter.	a	Th		+
Apocynaceae				
Vinca herbacea L.	p	H		+
Betulaceae				
Carpinus orientalis Mill.	Ħ	Ph	+	
Boraginaceae				
Nonea atra L.	a	Th		+
Myosotis arvensis L.	b	H		+
Buglossoides purpurocaerulea (L.) Johnst.	p	H		+
Echium vulgare L.	b-p	H		+
Brassicaceae				
Sinapis arvensis L.	a	Th		
Thlaspi perfoliatum L.	p	H	+	+
Caprifoliaceae				
Sambucus nigra L.	ħ	Ph	+	
Caryophyllaceae				
Cerastium vulgare Hartm.	a-p	H	+	
Dipsacaceae				
Dipsacus lacinatus L.	p	H		+
Euphorbiaceae				
Euphorbia cyparissias L	p	H	+	+
Fabaceae				
Chamaecytisus hirsutus (L.) Link.	p	H		+
Bituminaria bituminosa (L.) Stirt.	p	H		+
Lathyrus annus L.	a	Th		+
Fagaceae				
Quercus cerris L.	Ħ	Ph	+	+
Geraniaceae				
Erodium cicutarium (L.) L'Hér.	a -b	H	+	
Geranium sanguineum L.	p	H		+
Hypericaceae				
Hypericum perforatum L.	p	H	+	
Iridaceae				
Crocus biflorus L.	p	Cr		+
Lamiaceae				

Ajuga chamaepitys (L.) Schreb.	p		+	
Calamintha sylvatica L.	p	H	+	
Clinopodium vulgare L.	p	H	+	
Lamium amplexicaule L.	a	Th		+
L. purpureum L .	a	Th		+
Marrubium peregrinum L.	p	H		+
Origanum vulgare L.	p	H	+	
Teucrium chamaedrys L.	p	H	+	+
Liliaceae				
Muscari racemosum Mill.	P	Cr		+
Leopoldia tenuiflora (Tausch.) Heldr.	P	Cr		+
Scila bifolia L.	P	Cr		+
Fritilaria pontica Wahb.	p	Cr		+
Oleaceae				
Fraxinus ornus L.	Ħ	Ph		+
Papaveraceae				
Fumaria officinalis L.	a	Th		+
Poaceae				
Brachypodium sylvaticum (Huds.) Beauv.	p	H	+	
Festuca pratensis L.	p	H	+	+
F. pseudovina Wiesb.	p	H	+	+
Poa pratensis L.	p	H		+
Polygalaceae				
Polygala major L	p	H		+
Primulaceae				
Anagalis arvensis L.	a	Th	+	
Ranunculaceae				
Clematis vitalba L.	ħ	Ch	+	
Heleborus odorus L.	p	Cr		+
Resedaceae				
Reseda lutea L.	a-p	H		+
Rosaceae				
Amygdallus communis L.	Ħ	Ph		+
Agrimonia eupatoria L.	p	H		+
Crataegus monogyna L.	ħ	Ph	+	+
Fragaria vesca L.	p	H	+	
Potentilla argentea L.	p	H	+	
Prunus spinosa L.	ħ	Ph		+
Rosa canina L.	ħ	Ph		+
Rubus caesius L.	ħ	Ph	+	+
Sanguisorba officinalis L.	p	H	+	+
Violaceae				
Viola odorata L.	p	H		+

At this second phase is the plant community in the burned area № 2 (2007) in which already dominate perennial representatives of the largest, evolutionarily advanced and plastic environmentally families - Asteraceae, Lamiaceae, Rosaceae, Poaceae. The majority of taxa have well-developed vegetative propagation, the role of seed propagation is lowered. The bushes reopening goes from dormant buds, grass

species form clumps (RUSSEL - SMITH *at al.*, 2006). Species are still arranged in small groups at random - projective cover 30-50%.

As an example of an open fire forest community (SOARES *et al.*, 2006) is that in burnt territory № 3. Long modified soil composition determines the development of new plant community, built mainly of shrubs and perennial herbaceous with projective cover 80-90 %. For a period of over 10 years, the dominant position has been taken by dicotyledonous shrubs in the family *Rosaceae* - dog rose, blackthorn, bramble, hawthorn and perennial grass species from family *Lamiaceae* - *Ajuga chamaepitys* (L.) Schreb., *Marrubium peregrinum* L., *Origanum vulgare* L., *Teucrium chamaedrys* L**.** Therophytes and cryptophytes found their place in the community**.**

In conclusion, we can summarize, that in its development the analyzed after-fire communities do not differ in their genesis from the established by general laws. The regeneration of plant communities does not restate the output, i.e. we have not observed auto succession. In the newly formed communities, local deciduous trees prevail as well as perennial grass species.

Oaks are especially fire resistant under transient - continental climate with Mediterranean influence, which predominate in Stara Zagira region; they first started breeding with shoots.

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