

ISSN 1821-1046

UDK 630

INSTITUTE OF FORESTRY
BELGRADE



INSTITUT ZA ŠUMARSTVO
BEOGRAD

SUSTAINABLE FORESTRY ODRŽIVO ŠUMARSTVO

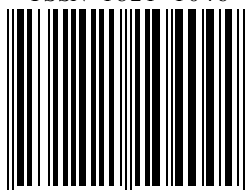
COLLECTION
TOM 63-64

ZBORNİK RADOVA
TOM 63-64



BELGRADE BEOGRAD
2011.

ISSN 1821-1046



9 771821 104000

ISSN 1821-1046
UDK 630

**INSTITUTE OF FORESTRY
BELGRADE**



**INSTITUT ZA ŠUMARSTVO
BEOGRAD**

SUSTAINABLE FORESTRY

COLLECTION
TOM 63-64

ODRŽIVO ŠUMARSTVO

ZBORNIK RADOVA
TOM 63-64

**BELGRADE BEOGRAD
2011.**

**INSTITUTE OF FORESTRY
BELGRADE**

**INSTITUT ZA ŠUMARSTVO
BEOGRAD**

PROCEEDINGS

ZBORNİK RADOVA

Publisher

Institute of Forestry
Belgrade, Serbia

Izdavač

Institut za šumarstvo
Beograd, Srbija

For Publisher

Ljubinko Rakonjac, Ph.D.

Za izdavača

Dr Ljubinko Rakonjac

Editorial Board

Snežana Rajković, Ph.D.
Institute of Forestry, Belgrade
Dragana Dražić, Ph.D.
Institute of Forestry, Belgrade
Ljubinko Rakonjac, Ph.D.
Institute of Forestry, Belgrade
Mara Tabaković-Tošić, Ph.D.
Institute of Forestry, Belgrade
Miloš Koprivica, Ph.D.
Institute of Forestry, Belgrade
Radovan Nevenić, Ph.D.
Institute of Forestry, Belgrade
Mihailo Ratknić, Ph.D.
Institute of Forestry, Belgrade
Zoran Miletić, Ph.D.
Institute of Forestry, Belgrade
Milorad Veselinović, Ph.D.
Institute of Forestry, Belgrade
Biljana Nikolić, Ph.D.
Institute of Forestry, Belgrade
Vesna Golubović-Čurguz, Ph.D.
Institute of Forestry, Belgrade
Assoc. Prof. Iantcho Naidenov, Ph.D.
Bulgaria
Prof. Nikola Hristovski, Ph.D.
Macedonia
Dr Kalliopi Radoglou, Ph.D.
Greece

Redakcioni odbor

Dr Snežana Rajković
Institut za šumarstvo, Beograd
Dr Dragana Dražić
Institut za šumarstvo, Beograd
Dr Ljubinko Rakonjac
Institut za šumarstvo, Beograd
Dr Mara Tabaković-Tošić
Institut za šumarstvo, Beograd
Dr Miloš Koprivica
Institut za šumarstvo, Beograd
Dr Radovan Nevenić
Institut za šumarstvo, Beograd
Dr Mihailo Ratknić
Institut za šumarstvo, Beograd
Dr Zoran Miletić
Institut za šumarstvo, Beograd
Dr Milorad Veselinović
Institut za šumarstvo, Beograd
Dr Biljana Nikolić
Institut za šumarstvo, Beograd
Dr Vesna Golubović-Čurguz
Institut za šumarstvo, Beograd
Assoc. Prof. Dr Iantcho Naidenov
Bugarska
Prof. Dr Nikola Hristovski
Makedonija
Dr Kalliopi Radoglou
Grčka

Chief Editor

Snežana Rajković, Ph.D.

Glavni i odgovorni urednik

Dr Snežana Rajković

Technical Editor and Layout

Tatjana Čirković-Mitrović, M.Sc.

Tehnički urednik i prelom teksta

Mr Tatjana Čirković-Mitrović

Secretary

Tatjana Čirković-Mitrović, M.Sc.

Sekretar Zbornika

Mr Tatjana Čirković-Mitrović

Printed in

150 copies

Tiraž

150 primeraka

Printed by

Klik tim DOO
Beograd

Štampa

Klik tim DOO
Beograd

All rights reserved. No part of this publication might be reproduced by any means: electronic, mechanical, copying or otherwise, without prior written permission of the publisher.

Belgrade, 2011

Preuzimanje članaka ili pojedinih delova ove publikacije u bilo kom obliku nije dozvoljeno bez odobrenja

Beograd, 2011

Cover Page: Author of the Photos Tatjana Ćirković-Mitrović, M.Sc.

Naslovna strana: Autor fotografije mr Tatjana Ćirković-Mitrović

CIP – Каталогизација у публикацији
Народна библиотека Србије, Београд

630

SUSTAINABLE Forestry : collection =
Održivo šumarstvo = zbornik radova / chief
editor = glavni i odgovorni urednik Snežana
Rajković. - 2008, T. 57/58- . - Belgrade
(Kneza Višeslava 3) : Institute of forestry,
2008- (Beograd : Klik tim). - 24 cm

Godišnje. - Je nastavak: Zbornik radova -
Institut za šumarstvo = ISSN 0354-1894
ISSN 1821-1046 = Sustainable Forestry
COBISS.SR-ID 157148172

SADRŽAJ CONTENTS

TOM 63-64

Vladan POPOVIĆ, Vera LAVADINOVIĆ

DEPENDENCE OF DOUGLAS-FIR MEAN DIAMETER ON GEOGRAPHIC ORIGIN OF CANADIAN PROVENANCES IN SEEDLING NURSERY CONDITIONS

7

Snežana STAJIĆ, Vlado ČOKEŠA, Zoran MILETIĆ, Ljubinko RAKONJAC
CHANGES IN THE GROUND FLORA COMPOSITION OF ARTIFICIALLY ESTABLISHED EASTERN WHITE PINE, DOUGLAS-FIR AND LARCH STANDS AT THE SITE OF HUNAGRIAN OAK AND TURKEY OAK WITH HORNBEAM

17

Milorad VESELINOVIĆ, Dragana DRAZIĆ, Biljana NIKOLIĆ, Suzana MITROVIĆ, Nevena CULE, Marija NESIĆ
SEED GERMINATION ANALYSIS IN ORDER TO IMPROVE THE PRODUCTION OF SEEDLINGS

27

Svetlana BILIBAJKIĆ, Tomislav STEFANOVIĆ, Radovan NEVENIĆ, Zoran PODUŠKA, Renata GAGIĆ SERDAR, Ilija DJORDJEVIĆ, Goran ČEŠLJAR
THE INTENSITY OF EROSION IN THE CATCHMENT OF THE TORRENT LEŠJANSKI DO

33

Ljiljana BRASANAC-BOSANAC, Tatjana CIRKOVIC-MITROVIC, Nevena CULE
ADAPTATION OF FOREST ECOSYSTEMS ON NEGATIVE CLIMATE CHANGE IMPACTS IN SERBIA

41

Nevena CULE, Ljubinko JOVANOVIĆ, Dragana DRAZIC, Milorad VESELINOVIĆ, Suzana MITROVIC, Marija NESIĆ
INDIAN SHOOT (CANNA INDICA L.) IN PHYTOREMEDIATION OF WATER CONTAMINATED WITH HEAVY METALS

51

Radovan NEVENIĆ, Svetlana BILIBAJKIC, Tomislav STEFANOVIĆ, Zoran PODUSKA, Renata Gagić SERDAR, Ilija ĐORĐEVIĆ, Goran ČEŠLJAR
FOREST CONDITION MONITORING: INTENSIVE MONITORING OF AIR POLLUTION IMPACT ON FOREST ECOSYSTEMS AT LEVEL II SAMPLE PLOT KOPAONIK

65

Suzana MITROVIĆ, Milorad VESELINOVIĆ, Dragica VILOTIĆ, Nevena ČULE, Dragana DRAŽIĆ, Biljana NIKOLIĆ, Marija NESIĆ
TEMPORARY DEPOSITED OF DEPOSOL AS THE POSSIBLE AREA FOR SHORT ROTATION PLANTATION ESTABLISHMENT – MODEL CASE

77

<i>Miloš KOPRIVICA, Bratislav MATOVIĆ</i> RELIABILITY OF THE STAND REGRESSION MODELS DEVELOPED ON THE BASIS OF SAMPLE PLOTS	87
<i>Mara TABAKOVIĆ-TOŠIĆ</i> GYPSY MOTH PREDATORS, PARASITES AND PATHOGENS IN BELGRADE FORESTS IN THE PERIOD 2010-2011	101
<i>Mara TABAKOVIĆ-TOŠIĆ, Dragutin TOŠIĆ, Miroslava MARKOVIĆ, Katarina MLADENOVIC, Zlatan RADULOVIĆ, Snežana RAJKOVIĆ</i> GYPSY MOTH OUTBREAKS IN FOREST COMPLEXES OF THE BELGRADE REGION IN THE PERIOD 1996-2011	113
<i>Miroslava MARKOVIC, Snezana RAJKOVIC, Katarina MLADENOVIC</i> SIMULTANEOUS ATTACK OF LYMANTRIA DISPAR L. AND MICROSPHAERA ALPHITOIDES GRIFF. ET MAUBL. ON QUERCUS SPECIES (Q. CERRIS, Q. FARNETTO AND Q. PETRAEA) IN CERTAIN PARTS OF SERBIA FROM 2004 TO 2006	123
<i>Katarina MLADENOVIC, Bojan STOJNIĆ, Miroslava MARKOVIĆ</i> SPIDER MITES AND PREDATORY MITES (ACARI: TETRANYCHIDAE, PHYTOSEIIDAE) ON OAK TREES IN THE CITY OF BELGRADE AND ITS VICINITY	133
<i>Vesna GOLUBOVIĆ ĆURGUZ, Zoran MILETIĆ</i> SOIL EXAMINATION FOR THE PURPOSE OF FORECASTING OCCURRENCE OF ENTOMOPATHOGENIC AND BENEFICIAL MICROORGANISMS	141
<i>Ilija DJORDJEVIĆ, Radovan NEVENIĆ, Zoran PODUŠKA, Renata GAGIĆ, Goran ČEŠLJAR, Svetlana BILIBAJKIĆ, Tomislav STEFANOVIĆ</i> ASSESSMENT OF THE SYSTEM FOR MANAGING PROTECTED AREAS IN THE REPUBLIC OF SERBIA	151
<i>Zoran PODUŠKA, Svetlana BILIBAJKIĆ, Renata GAGIĆ-SERDAR, Goran ČEŠLJAR, Ilija ĐORĐEVIĆ, Tomislav STEFANOVIĆ, Radovan NEVENIĆ</i> IMPACT OF INNOVATIVENESS ON NEW TECHNOLOGY IMPLEMENTATION IN FORESTRY COMPANIES	161

UDK 630*182.8=111
Original scientific paper

**CHANGES IN THE GROUND FLORA COMPOSITION OF
ARTIFICIALLY ESTABLISHED EASTERN WHITE PINE, DOUGLAS-
FIR AND LARCH STANDS AT THE SITE OF HUNGARIAN OAK AND
TURKEY OAK WITH HORNBEAM**

Snežana STAJIĆ¹, Vlado ČOKEŠA¹, Zoran MILETIĆ¹, Ljubinko RAKONJAC¹

Abstract: *The paper presents the results of phytocoenological investigations conducted in a mixed coppice Hungarian Oak and Turkey Oak with hornbeam forest (Carpino betuli-Quercetum farnetto-cerris) and artificially established eastern white pine, Douglas-fir and larch stands in the area of Bogovada. The terrains of Bogovada forests are situated in the area of a climatologically conditioned Hungarian Oak and Turkey Oak forest (Quercetum farnetto-cerris). It is the most common phytocenosis in this forest complex. It has been established that the floristic composition of artificially established coniferous stands, set up at the site of Hungarian Oak and Turkey Oak with hornbeam (Carpino betuli-Quercetum farnetto-cerris), is significantly less diverse in comparison to natural stands. The reduction of floristic composition diversity is to some extent the result of morphological properties of introduced coniferous species. In the course of their development, those cultures were exposed to various anthropogenic impact, and responded differently to microhabitat conditions, which was largely reflected in their floristic composition.*

Key terms: Hungarian Oak and Turkey Oak forest, floristic composition, conifers, Bogovada.

¹ Institute of Forestry, Kneza Visislava 3, Belgrade, Serbia
Translation: Dejan Arsenovski

PROMENE SASTAVA PRIZEMNE FLORE U VEŠTAČKI PODIGNUTIM SASTOJINAMA BOROVCA, DUGLAZIJE I ARIŠA NA STANIŠTU SLADUNA I CERA SA GRABOM

Izvod: U radu su prikazani rezultati fitocenoloških istraživanja u mešovitoj izdanačkoj šumi sladuna i cera sa grabom (*Carpino betuli-Quercetum farnetto-cerris*) i veštački podignutim sastojinama borovca, duglazije i ariša na području Bogovađe. Tereni bogovaških šuma nalaze se u području gde je šuma hrastova sladuna i cera (*Quercetum farnetto-cerris*) klimatogeno uslovljena. To je najrasprostranjenija fitocenoza u ovom šumskom kompleksu. Utvrđeno je da je u veštački podignutim sastojinama četinaru, koje su osnovane na staništu sladuna i cera sa grabom (*Carpino betuli-Quercetum farnetto-cerris*) floristički sastav osiromašen u odnosu na prirodne sastojine. Smanjenje brojnosti florističkog sastava posledica je delom morfoloških osobina unešenih vrsta četinaru. Tokom razvoja navedene kulture nalazile su se pod različitim antropogenim uticajem, i različito su reagovala na mikrostanišne uslove, što se takođe u znatnoj meri odrazilo i na njihov floristički sastav.

Ključne reči: Šuma sladuna i cera, floristički sastav, četinari, Bogovađa.

1. INTRODUCTION

A Hungarian Oak and Turkey Oak forest is one of the first described forest associations in Serbia, present in the nearly entire region and in consequence a frequent subject to examination (Gajić, M. 1959, Glišić, M. 1977, Jovanović, B. 1954, 1986, Jovanović, B. & Dunjic, R. 1951, Vukićević, E. 1966, Tomić, Z. 2000, et al). The terrains of Bogovađa forests are situated in the area of a climatologically conditioned Hungarian Oak and Turkey Oak forest, which is the most represented phytocenosis in this forest complex.

In the course of afforestation and reclamation of degraded forests conducted in previous decades, insufficient attention was paid to complex properties of vegetation-forest ecosystems, which resulted in plantation of coniferous monocultures. Pines, white and black, and, to a lesser extent, spruce, were the species most commonly used for forest reclamation in the process of the introduction of conifers into beech and oak forests in Serbia. An increased use of other coniferous species in small areas, without a prior verification of their suitability for specific forest sites, began since 1970s and involved the following species: eastern white pine (*Pinus strobus* L), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), larch (*Larix decidua* Mill.), white fir (*Abies concolor* Lindl. et Gord.) and other species.

The forests of Bogovađa, the subject of the investigation, had been owned by the Bogovađa monastery until 1945, and, hence, are relatively well-preserved. The highest percentage of coppice forests in this complex were established during WWI, which means that their age is approximately 90-100 years. An intensive work on substitution of the existing coppice forest by introduction of fast-growing coniferous trees, primarily domestic pine species, eastern white pine, Douglas-fir and larch, was initiated in this area in 1964.

2. FOREST FACILITY AND WORK METHOD

The forest complex 'Bogovađa' is located in the upper upstream part of the Colubara basin, at an approximately 4km straight line distance from the confluence of the river Ljig into the river Kolubara, in the south direction. The total surface area of this management unit, operated by Forest Administration Valjevo, is 379.61ha. The complex stretches over a strip of land of the altitude ranging from 130 to 235m; the terrain is quite conical, intercepted by depressions and valleys of numerous watercourses. The research of site conditions and the state of the stand was performed by means of series of trials, conducted in natural stands of Hungarian Oak and Turkey Oak with Hornbeam (section 10,17,18), and artificially established stands of eastern white pine (*Pinus strobus* L.), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and larch (*Larix decidua* Mill.). Collection and processing of data were performed according to standard work procedures. For the purpose of the investigation of the floristic composition, phytocoenological records were collected by means of the Brown-Blanquet method, with a view to establishing a phytocoenological position of the investigated stands. Creation of pedological profiles and soil sampling were performed in all trial areas, with the aim of determining a pedological position.

3. RESEARCH RESULTS AND DISCUSSION

The parent substrate of the Bogovađa complex soil is composed of marl and claystone (bedded and laminated), conglomerates and sandstones (bedded and thick-bedded) and reef limestone, a complex of lake sediments of Older Neogene and Oligocene, contorted and strongly cracked (Antić, M., Marković, D. 1971). Based on detailed studies, it has been established that the soil in all investigated stands is pseudogleyed luvisol (loess soil with elements of pseudogley).

The investigated stands are located at the altitude of 207-212m, at different slope expositions and mild elevations of 3-8°. The canopy ranges in the interval from 0.7 to 0.9. The basic data on the investigated stands are presented in table 1 (Stajić, S., Rakonjac, Lj. 2006).

Table 1. *Basic characteristics of investigated stands*

Tree species	Age	Taxation elements			
		N(num/ha)	G (m ² /ha)	V(m ³ /ha)	Iv(m ³ /ha)
Hungarian Oak and Turkey Oak	100	455	32,85	392,84	5,3
Hungarian Oak and Turkey Oak	90	763	32,76	375,39	7,2
Eastern white pine	40	775	36,63	354,42	11,5
Douglas-fir	40	656	32,25	282,75	9,1
Larch	40	625	25,41	271,61	7,9

3.1 Floristic composition

According to the studies conducted by Glišić, M. (1968), the climatologically conditioned Hungarian Oak and Turkey Oak forest (*Quercetum farnetto-cerris Rudski*) is represented in two variants on the terrains of the

Bogovada forest complex: a Hungarian Oak and Turkey Oak with butcher's broom forest (*Rusco-Quercetum farnetto-cerris* Jov.1951.) and a Hungarian Oak and Turkey Oak with hornbeam forest *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979.

Based on their floristic composition, it has been established that the investigated natural stands phytocoenologically belong to a Hungarian Oak and Turkey Oak with hornbeam variant *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979, whereas the artificially established stands, aged 40, were also established at the site of this forest. Phytocoenological table consists of 13 records (table 2).

Table 2. Phytocoenological table

Association	<i>Carpino betuli-Quercetum farnetto-cerris</i> (Rud.1949) Jov.1979												
Record number	1	2	3	4	5	6	7	8	9	10	11	12	13
Management unit	Bogovada												
Department (section)	18a	18a	10a	10a	18	18	17	17	17	17	18c	17c	17f
Size p.p. (m ²)	600	600	600	600	600	600	600	600	600	600	1600	1600	1600
Altitude (m)	212	211	210	210	207	211	210	210	210	210	211	207-211	210
Exposition	N-NE	N-NE	S-SW	S-SW	N	N	N-NW	N-NW	N-NW	N-NW	N	N-NE	N-NW
Elevation in ⁰	7	5-7	3	-	3	7	4	6	4	7	3	3	8
Geological substratum	marl and claystone												
Soil	pseudogleyed luvisol												
I STOREY													
Canopy	0.8	0.8	0.7	0.7	0.8-0.9	0.8	0.8-0.9	0.8-0.9	0.8	0.8	0.8-0.9	0.8-0.9	0.8
Height-mean (m)	29	28	26	26	25	23	24	27	25	25	21	24	21
Diameter-mean(cm)	35	34	27	27	26	27	27	27	26	26	24	25	23
Distance (m)	2-5	2-5	2-5	2-5	2-5	3-5	2-5	2-5	2-5	2-5	3	2-4	2-4
<i>Quercus cerris</i>	3.3	3.3	2.1	2.2	3.3	3.3	3.3	3.3	2.2	2.2			
<i>Quercus farnetto</i>	2.2	2.2	3.3	3.3	2.2	2.2	2.2	3.3	3.3	3.3			
<i>Carpinus betulus</i>	2.2	2.2	2.2	1.2	1.1	2.2	1.1	1.1	2.2	2.1		+1	1.1
<i>Tilia argentea</i>	+1		+1	+1	1.1	+1		1.1	1.1	+1	1.1	1.1	1.1
<i>Tilia grandifolia</i>			+1			+1	+1		+1		+1	+1	+1
<i>Fraxinus ornus</i>			+1	1.1									
<i>Quercus petraea</i>	+	+											
<i>Prunus avium</i>													+
<i>Pinus strobus</i>											4.4		
<i>Pseudotsuga menziesii</i>												4.4	
<i>Larix europeae</i>													4.4
II STOREY													
Canopy	0.5	0.5	0.5	0.5	0.3	0.3	0.4	0.4	0.4	0.4	0.2	0.1	0.6
<i>Carpinus betulus</i>	1.1	2.1	2.2	2.3	2.1	1.1	2.1	1.1	2.1	1.1	1.1	1.1	3.3
<i>Tilia argentea</i>	1.1	1.1	1.1	+1	2.1	1.1	1.1	1.1	1.1	1.1	1.1	+1	+1
<i>Crataegus monogyna</i>	1.1	1.1	1.1	+1	+1	1.1	1.1	1.1	1.1	1.1			2.1
<i>Acer campestre</i>	1.1	1.1	+1	+1	+1	1.1	+1	+1	+1	1.1			
<i>Fraxinus ornus</i>	1.1	1.1	1.2	1.1	1.1	+1	1.1	1.1	1.2	2.2	+1		1.1
<i>Acer tataricum</i>	1.1	1.2	2.1	1.1	+1	+1	+1						
<i>Lonicera caprifolium</i>	4.4	3.3	2.2	3.3		2.2			3.2	2.2			
<i>Rubus hirtus</i>	2.2	2.2	2.2	1.2			2.2	2.1					
<i>Pyrus pyraeaster</i>	+1	+1			+1	1.1		+1					
<i>Rosa arvensis</i>	+1	1.1	2.1	1.1								+1	
<i>Cornus mas</i>	+1	1.1	+1	1.1									
<i>Quercus cerris</i>									1.1	+1			

<i>Sorbus domestica</i>	+1	1.1											
<i>Sorbus torminalis</i>				+1									
<i>Prunus avium</i>										+1			
III STOREY													
Cover	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	0.5	0.5	0.3
<i>Quercus cerris</i>	1.1	1.1	1.1	1.1	1.1	1.1	1.1	2.1	+1	1.1			
<i>Quercus frainetto</i>	1.1	1.1	2.1	1.1	1.1	1.1	1.1	1.1	+1	+1		+1	
<i>Carpinus betulus</i>	+1	1.1	2.2	3.2	+1	1.1	+1	1.1	1.2	2.2	+1	+1	+1
<i>Rubus hirtus</i>	2.2	1.2	1.2	+2	1.2	2.2	1.2	+2	2.2	2.2		1.1	1.2
<i>Lonicera caprifolium</i>	3.3	2.2	2.2	4.3	1.1	2.2	1.1	2.1	3.3	2.3			
<i>Hedera helix</i>	1.1	1.1	1.2	1.1	+1	1.1	+1	1.1	1.1	+1	+1	+1	1.1
<i>Ruscus aculeatus</i>	3.3	3.2	1.2	2.2	1.2	+2	1.2	2.2	2.2	2.1	1.2	1.1	+1
<i>Glechoma hirsuta</i>	2.1	1.1	1.1		2.2	2.1	2.2	1.2	2.2	2.2	1.2	2.3	1.2
<i>Veronica chamaedrys</i>	+1	1.1	+1	1.2	+1	+1		+1		+1	+1		
<i>Helleborus odorosus</i>	+1	+1			+1	+1	+1	+1	+1		+1	+1	+1
<i>Ligustrum vulgare</i>	1.2	+2			1.2	1.2		1.2	1.2	+2			
<i>Galium silvaticum</i>			1.1	+1	+3	1.3		+3	2.2	2.1			1.1
<i>Euphorbia amygdaloides</i>	+1		1.2	+1	+1		+1		+1		+1	+1	+1
<i>Acer tataricum</i>	1.1	1.2				+1		+1	+1	+1			+1
<i>Polygonatum multiflorum</i>	+1	+				+1	+1	+1			+1		
<i>Viola silvestris</i>		1.2			+1	+1	1.1	+1			+1	1.1	
<i>Rosa arvensis</i>	+1	1.1	+1	1.1					+1				
<i>Cardamine bulbifera</i>	+1				+1	+1	+1				+1	+1	+1
<i>Mycelis muralis</i>	+1				+1		+1	+1			+2		
<i>Tamus comunis</i>	+1	+	1.1	+1									+1
<i>Fraxinus ornus</i>		+							3.2	2.2		+1	+1
<i>Melica uniflora</i>	+1		+1	+2									
<i>Prunus avium</i>					+1	+1		1.1					
<i>Galium cruciata</i>	+2		+2	+2							+1	+2	
<i>Fragaria vesca</i>	+1		+1	1.1									
<i>Ruscus hypoglossum</i>									1.1	+1	+1		+1
<i>Primula vulgaris</i>	+1					+1							
<i>Calamintha officinalis</i>	+1	1.1											
<i>Veronica pseudo-chamaedrys</i>			+1	1.1							+1		
<i>Stelaria holostea</i>									1.1	+1			
<i>Crataegus monogyna</i>			+1	1.1									
<i>Poa nemoralis</i>			1.2	+2									
<i>Tilia argentea</i>			1.2	1.1									
<i>Carex pilosa</i>						+1	1.1						
<i>Nefrodium filix mas</i>					+1			+1					
<i>Chamaecytisus hirsutus</i>		+1		+1									
<i>Dactylis glomerata</i>			+1							+1			
<i>Asarum europeum</i>	1.1	+									1.2	+1	+1
<i>Asperula odorata</i>	+2										+2	+3	+2
<i>Glechoma hederaceae</i>	1.1												
<i>Hepatica nobilis</i>	+												
<i>Geranium robertianum</i>	+1												
<i>Sorbus domestica</i>	+1												
<i>Viola tricolor</i>	+1												
<i>Polygonatum odoratum</i>										+1		+1	
<i>Galium aparine</i>											+1	+2	
<i>Sorbus torminalis</i>											+1		
<i>Clematis vitalba</i>											+1		

Hornbeam, as a differential species, in addition to Hungarian Oak and Turkey Oak, also appears in the tree storey of the investigated Hungarian Oak and Turkey Oak natural stands. According to Tomić, Z. (2004), a Hungarian Oak and Turkey Oak with hornbeam forest - *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979. is a specific ecological variant of a Hungarian Oak and Turkey Oak forest of a more mesophilic character, which is generally present at the contact point of zonal forest with sessile oak-hornbeam communities. Other species occurring in this storey are small-leaved linden, large-leaved linden, flowering ash and sessile oak. In addition to edificator species, the shrub storey is composed of linden, hornbeam, field maple, common hawthorn, Tatar maple, honeysuckle and blackberry, and, somewhat less frequently, of dog rose, wild pear, European cornel and service tree. The ground flora cover ranges between 0.9 to 1.0. In the ground flora layer, in addition to young growth of main edificator species - Hungarian Oak and Turkey Oak, the species characterised by the most permanent presence are the following: *Ruscus aculeatus*, *Carpinus betulus*, *Lonicera caprifolium*, *Hedera helix*, *Glechoma hirsuta*, *Helleborus odoratus*, *Ligustrum vulgare*, *Veronica chamaedrys*, *Acer tataricum*, *Polygonatum multiflorum*, *Rosa arvensis*, *Tamus communis*. The following species are characterised by a slightly less permanent presence: *Euphorbia amygdaloides*, *Galium cruciata*, *Melica uniflora*, *Fragaria vesca*, *Viola silvestris*, *Calamintha officinalis*, *Primula vulgaris*, *Cytisus hirsutus*, *Ruscus hypoglossum*, *Asperula odorata*, *Glechoma hederaceae*, *Hepatica nobilis*, *Sorbus domestica*, *Viola tricolor* and other.

In the tree storey of the artificially established eastern white pine stand, in addition to the above-mentioned species, the presence of large-leaved linden and silver linden was observed. The shrub storey is poorly developed, and along with silver linden (*Tilia argentea*), flowering ash (*Fraxinus ornus*) occurs individually. The ground layer has a cover of 0.5. In the areas in which the stand is interrupted due to snowbreak and windbreak, the ground layer is abundant, as a result of an increased light inflow. The following species are observed in those areas: *Glechoma hirsuta*, *Carpinus betulus*, *Hedera helix*, *Ruscus aculeatus*, *Helleborus odoratus*, *Mycelis muralis*, *Euphorbia amygdaloides*, *Polygonatum multiflorum*, *Viola silvestris*, *Cardamine bulbifera*, *Galium cruciata*, *Ruscus hypoglossum*, *Veronica pseudochamaedrys*, *Galium aparine*, *Sorbus torminalis*, *Clematis vitalba*.

In the tree storey of the artificially established Douglas-fir stand, in addition to Douglas-fir, hornbeam (*Carpinus betulus*), silver linden (*Tilia argentea*) and large-leaved linden (*Tilia grandifolia*) occur individually. The shrub storey is poorly developed and, as in the case of eastern white pine, *Tilia argentea* and *Pyrus pyraeastero* are individually present. The ground layer has a cover of 0.5. Among present species, *Glechoma hirsuta* is slightly more represented, whereas other species constitute 5-10%. The species observed in this layer are the following: *Carpinus betulus*, *Rubus hirtus*, *Hedera helix*, *Ruscus aculeatus*, *Helleborus odoratus*, *Euphorbia amygdaloides*, *Viola silvestris*, *Cardamine bulbifera*, *Fraxinus ornus*, *Galium cruciata*, *Asarum europeum*, *Asperula odorata*, *Polygonatum odoratum*, *Galium aparine*.

In the tree layer of the artificially established larch stand (*Larix decidua* Mill.), naturally mixed linden (*Tilia argentea* i *Tilia grandifolia*) is also present, in addition to larch. The shrub layer is far more represented in comparison to previous

two stands, and it is composed of hornbeam, linden, common hawthorn and flowering ash. Thinning of this stand was not performed in due time, whereas the late thinning was not of adequate intensity, which resulted in presence of a large number of larch trees with reduced crowns and a high slimmness coefficient. Such condition of the investigated larch stand led to a snowbreak, which inflicted a severe damage, and resulted in opening of the canopy and the presence of a large number of accessory species in the shrub storey. The ground story consists of *Carpinus betulus*, *Rubus hirtus*, *Glechoma hirsuta*, *Hedera helix*, *Ruscus aculeatus*, *Helleborus odoratus*, *Galium silvaticum*, *Euphorbia amygdaloides*, *Acer tataricum*, *Cardamine bulbifera*, *Tamus communis*, *Fraxinus ornus*, *Ruscus hypoglossum*, *Asarum europeum*, *Asperula odorata*.

The depletion of floristic composition of artificially established conifer stands occurred to some extent as a result of morphological properties of introduced species, in this instance, eastern white pine, larch and Douglas-fir. However, in the course of their development, the above-mentioned species were exposed to various anthropogenic impact, and responded differently to microhabitat conditions, which was largely reflected in their floristic composition. As a result of the late thinning, trees with a high slimmness coefficient were formed in all coniferous stands, which contributed to infliction of severe damage caused by snow and wind, to which those species are particularly sensitive. As a consequence, an increased diversity of ground species was created, whereas in the larch stand, on the account of larch being a species with a thin crown, it resulted in an increased number of accessory species in the shrub storey.

A submontane beech forest *Fagetum submontanum* Jov., which occurs at the immediate vicinity of the investigated stands, is orographically conditioned in this area and it appears in shaded and humid stands, where it remains as a permanent stadium. That is the reason for the appearance of certain species of ground flora, typical of beech forests, in the phytocoenological records.

4. CONCLUSION

The investigated stands are located at the altitude of 207-212m, at different slope expositions and mild elevations of 3-8°. The parent substrate of the Bogovada complex soil is composed of marl and claystone (bedded and laminated), conglomerates and sandstones (bedded and thick-bedded) and reef limestone, a complex of lake sediments of Older Neogene and Oligocene, contorted and strongly cracked, whereas the soil in all investigated stands is pseudogleyed luvisol. By means of a detailed investigation, it has been established that the examined natural stands phytocoenologically belong to a Hungarian Oak and Turkey Oak with hornbeam forest *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979, whereas the artificially established eastern white pine, Douglas-fir and larch stands are also set up at this forest site. This variant of a Hungarian Oak and Turkey Oak with hornbeam forest belongs to a more mesophilic variant of Hungarian Oak and Turkey Oak forest, and it is characterised by a larger proportion of mesophilic species in its composition. A differential species is hornbeam, which, in addition to edicator species of Hungarian Oak and Turkey Oak, dominates in the tree storey.

The depletion of floristic composition that occurred in artificially established coniferous stands, is evident when compared to natural stands. The decrease of floristic composition diversity is, to some extent the result of morphological properties of introduced coniferous species. In the course of their development, the above-stated cultures were exposed to various anthropogenic impact and responded differently to microhabitat conditions, which was largely reflected in their floristic composition. The presence of large-leaved linden and silver linden was observed in the tree storey of all artificially established stands. The shrub storey is poorly developed, except in the artificially established larch stand. The ground layer has a cover of 0.3-0.5.

Thinning was not performed in due time in the artificially established stands, whereas the late thinning was not of adequate intensity, which resulted in presence of a large number of larch trees with reduced crowns and a high slimness coefficient. Such state of the investigated stands led to the occurrence of snowbreak, which caused severe damage. That was most evident in the artificially established larch stand in which, as a result of snowbreak, a sudden opening of canopy occurred and conditioned the presence of a large number of accessory species in the shrub storey.

REFERENCES

- Antić, M., Marković, D. (1971): Osobine zemljišnih tvorevina pod šumskim zajednicama kompleksa Bogovađa, Zbornik radova Instituta za šumarstvo i drvnu industriju br. 10, Beograd.
- Gajić, M.(1959): Asocijacija *Quercetum confertae-cerris serbicum* Rudski i *Quercetum montanum* Cer. et Jov. na planini Rudnik i njihova staništa, Glasnik Šumarskog fakulteta 16, Beograd.
- Glišić, M. (1968): Šumske fitocenoze šumskog kompleksa "Bogovađa", Zbornik radova Instituta za šumarstvo i drvnu industriju 8, Beograd.
- Glišić, M. (1977): Regresione sukcesije i degradacione faze sladuna i cera (*Quercetum farnetto-cerris* Rudski) u Grdeličkoj klisuri, Šumarstvo br. 5, Beograd.
- Jovanović, B. (1954): Fitocenoza *Quercetum confertae-cerris* kao biološki indikator, Glasnik Šumarskog fakulteta 8, Beograd.
- Jovanović, B. (1986): Srpska šuma sladuna i cera (*Quercetum farnetto-cerris serbicum*), Allgemeine Forst Zeitschrift, 759-761.
- Jovanović, B., Dunjić, R. (1951): Prilog poznavanju fitocenoza hrastovih šuma Jasenice i okoline Beogarda, Zbornik radova SAN 11, Institut za ekologiju i biogeografiju 2, Beograd.
- Tomić, Z. (2000): Fitocenoza *Quercetum farnetto-cerris scardicum* Krasn.1968. u Lipovici kod Prištine, Glasnik Šumarskog fakulteta br.82.
- Tomić, Z. (2004): Šumarska fitocenologija, Udžbenik za studente Šumarskog fakulteta, Beograd.
- Stajić, S., Rakonjac, Lj. (2006): Unošenje četinarara na stanište sladuna i cera na području Bogovađe, Šumarstvo 3, UŠITS, Beograd, str.149-163.

Vukićević, E. (1966): Šumske fitocenoze planine Gučevo, Glasnik Šumarskog fakulteta, serija A, br. 50, Beograd.

CHANGES IN THE GROUND FLORA COMPOSITION OF ARTIFICIALLY ESTABLISHED EASTERN WHITE PINE, DOUGLAS-FIR AND LARCH STANDS AT THE SITE OF HUNGARIAN OAK AND TURKEY OAK WITH HORNBEAM

Snežana STAJIĆ, Vlado ČOKEŠA, Zoran MILETIĆ, Ljubinko RAKONJAC

Summary

The terrain of Bogovađa forests is situated in the area of climatologically conditioned Hungarian Oak and Turkey Oak forest (*Quercetum farnetto-cerris*). Based on their floristic composition, it has been established that the investigated natural stands phytocoenologically belong to a Hungarian Oak and Turkey Oak with hornbeam forest community *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979, whereas the artificially established eastern white pine, Douglas-fir and larch stands were also set up at this forest site.

Hornbeam, as a differential species, is present in the tree storey of natural stands of Hungarian Oak and Turkey Oak, along with Hungarian Oak and Turkey Oak. Linden, common hawthorn, field maple, flowering ash, Tatar maple, honeysuckle and blackberries, etc. are most commonly present in the shrub layer, in addition to edicator species. The species characterised by the most permanent presence in the ground layer, along with the young growth of the main edicators, Hungarian Oak and Turkey Oak, are the following: *Ruscus aculeatus*, *Carpinus betulus*, *Lonicera caprifolium*, *Hedera helix*, *Glechoma hirsuta*, *Helleborus odoratus*, *Ligustrum vulgare*, *Veronica chamaedrys*, *Acer tataricum*, *Polygonatum multiflorum*, *Rosa arvensis*, *Tammus communis*.

The depletion of floristic composition occurred in the artificially established stands. The reduction of floristic composition diversity is to some extent the result of morphological properties of introduced coniferous species, and partly it is due to the different response to microhabitat conditions, which is largely reflected in their floristic composition.

The late thinning in the artificially established stands conditioned the presence of a large number of trees with reduced crowns and a high slimness coefficient, which led to a snowbreak, causing a severe damage. That was most evident in the artificially established larch stand, where a sudden opening of the canopy occurred, conditioning the presence of a large number of accessory species in the shrub storey.

PROMENE SASTAVA PRIZEMNE FLORE U VEŠTAČKI PODIGNUTIM SASTOJINAMA BOROVCA, DUGLAZIJE I ARIŠA NA STANIŠTU SLADUNA I CERA SA GRABOM

Snežana STAJIĆ, Vlado ČOKEŠA, Zoran MILETIĆ, Ljubinko RAKONJAC

Rezime

Tereni bogovađskih šuma nalaze se u području gde je šuma hrastova sladuna i cera (*Quercetum farnetto-cerris*) klimatogeno uslovljena. Na osnovu florističkog sastava utvrđeno je da istraživane prirodne sastojine fitocenološki pripadaju šuma sladuna i cera sa grabom *Carpino betuli-Quercetum farnetto-cerris* (Rud.1949) Jov.1979., a veštački podignute sastojine borovca, duglazije i ariša osnovane su takođe na staništu ove šume.

U prirodnim sastojinama sladuna i cera u spratu drveća pored sladuna i cera, kao diferencijalna vrsta javlja se i grab. U spratu žbunja pored edifikatora javljaju se najčešće lipa, grab, klen, glog, crni jasen, žešlja, orlovi nokti i kupina, itd. U sloju prizemnog bilja, pored podmlatka glavnih edifikatora, sladuna i cera, najveću stalnost imaju: *Ruscus aculeatus*, *Carpinus betulus*, *Lonicera caprifolium*, *Hedera helix*, *Glechoma hirsuta*, *Helleborus odorus*, *Ligustrum vulgare*, *Veronica chamaedrys*, *Acer tataricum*, *Polygonatum multiflorum*, *Rosa arvensis*, *Tammus communis*.

Kod veštački podignutih sastojina četinarara došlo je od osiromašenja u florističkom sastavu. Smanjenje brojnosti florističkog sastava posledica je delom morfoloških osobina unešenih vrsta četinarara, a i različito su reagovale na mikrostanišne uslove, što se takođe u znatnoj meri odrazilo i na njihov floristički sastav.

U veštački podignutim sastojinama neblagovremeno izvođenje proreda je uslovalo prisustvo velikog broja stabala sa redukovanim krošnjama i velikim koeficijentom vitkosti, što je dovelo do snegoloma, koji su prouzrokovali znatne štete. To se najviše ispoljilo u veštački podignutoj sastojini ariša (*Larix decidua* Mill.), gde je došlo do naglog otvaranja sklopa, i istovremeno uslovalo prisustvo većeg broja pratećih vrsta u spratu žbunja.