

ISSN 1821-1046

UDK 630

INSTITUTE OF FORESTRY
BELGRADE



INSTITUT ZA ŠUMARSTVO
BEOGRAD

SUSTAINABLE FORESTRY ODRŽIVO ŠUMARSTVO

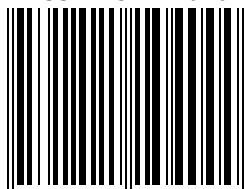
COLLECTION
Vol. 71-72

ZBORNIK RADOVA
Vol. 71-72



BELGRADE BEOGRAD
2015.

ISSN 1821-1046



9 771821 104000

ISSN 1821-1046
UDK 630

**INSTITUTE OF FORESTRY
BELGRADE**



**INSTITUT ZA ŠUMARSTVO
BEOGRAD**

SUSTAINABLE FORESTRY ODRŽIVO ŠUMARSTVO

COLLECTION
Vol. 71-72

ZBORNIK RADOVA
Vol. 71-72

**BELGRADE BEOGRAD
2015.**

**INSTITUTE OF FORESTRY
BELGRADE
COLLECTION OF PAPERS**

**INSTITUT ZA ŠUMARSTVO
BEOGRAD
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
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
Vera Lavadinović, 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 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 Vera Lavadinović
Institut za šumarstvo, Beograd
Assoc. Prof. Dr Iantcho Naidenov
Bugarska
Prof. Dr Nikola Hristovski
Makedonija
Dr Kalliopi Radoglou
Grčka

Editor-in-Chief

Snežana Rajković, Ph.D.

Glavni i odgovorni urednik

Dr Snežana Rajković

Technical Editor and Layout

Tatjana Ćirković-Mitrović, Ph.D.

Tehnički urednik i prelom teksta

Dr Tatjana Ćirković-Mitrović

Secretary

Tatjana Ćirković-Mitrović, Ph.D.

Sekretar Zbornika

Dr Tatjana Ćirković-Mitrović

Printed in

100 copies

Tiraž

100 primeraka

Printed by

Black and White
Beograd

Štampa

Black and White
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, 2015

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

Beograd, 2015

Cover Page: Author of the Photos Tatjana Ćirković-Mitrović, Ph.D.

Naslovna strana: Autor fotografije dr 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 : Black and White). - 24
cm

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

CONTENT SADRŽAJ

Vol. 71-72

<i>Etleva CANAJ, Elvana RAMAJ, Hajri HASKA, Eneida HASKA</i> PROTECTED AREAS - AS MAIN AND VERY IMPORTANT SPACE FOR BIODIVERSITY EVALUATION AND THEIR CONSERVATION	1
<i>Miroslava MARKOVIĆ, Snezana RAJKOVIĆ, Ljubinko RAKONJAC</i> REDUCTION THE MECHANICAL PROPERTIES OF OAKWOOD UNDER THE INFLUENCE OF EPYXILOUS FUNGUS	7
<i>Vladan POPOVIĆ, Tatjana ĆIRKOVIĆ-MITROVIĆ, Ljubinko RAKONJAC, Aleksandar LUČIĆ</i> EFFECT OF FERTILIZERS ON CONCENTRATION OF PHOTOSYNTHETIC PIGMENTS IN JUVENILE SEEDLINGS OF EASTERN BLACK WALNUT (<i>Juglans nigra</i> L.)	19
<i>Mara TABAKOVIĆ-TOŠIĆ, Marija MILOSAVLJEVIĆ</i> IMPACT OF EXTREME WEATHER CONDITIONS ON THE POPULATION DYNAMICS OF BARK BEETLES IN THE FORESTS OF EASTERN SERBIA	27
<i>Renata GAGIĆ SERDAR, Tomislav STEFANOVIĆ, Goran ČEŠLJAR, Svetlana BILIBAJKIĆ, Radovan NEVENIĆ, Ilija ĐORĐEVIĆ, Zoran PODUŠKA</i> AIR POLLUTION IMPACT ASSESSMENT AND MONITORING, ITS EFFECTS ON THE FOREST ECOSYSTEMS IN THE TERRITORY OF THE REPUBLIC OF SERBIA IN 2015	39
<i>Branka SPASOJEVIĆ, Vlado ČOKEŠA, Đorđe JOVIĆ</i> STATE OF ARTIFICIALLY-ESTABLISHED STANDS OF INTRODUCED CONIFERS ON THE SITE OF SESSILE OAK IN MU 'CER-VIDOJEVICA'	63
<i>Sonja BRAUNOVIĆ, Mihailo RATKNIĆ, Tatjana RATKNIĆ, Milan KABILJO</i> CHANGES IN LAND USE IN THE REGION OF GRDELICA GORGE IN THE PERIOD 1963-2011	77
<i>Tomislav STEFANOVIĆ, Svetlana BILIBAJKIĆ, Radovan NEVENIĆ, Ilija ĐORĐEVIĆ, Zoran PODUŠKA, Goran ČEŠLJAR, Renata GAGIĆ SERDAR</i> THE RESULTS OF THE STUDY OF DEFOLIATION AT BIOINDICATION POINTS IN THE REPUBLIC OF SERBIA IN 2014	85
<i>Milorad VESELINOVIĆ, Suzana MITROVIĆ, Snežana STAJIĆ, Nevena ČULE, Dragica VILOTIĆ, Dragana DRAŽIĆ, Zoran MILETIĆ</i> LOCALITY 'JOZICA KOLIBA' IN SERBIA-THE FOREST COMMUNITY CHARACTERISTICS	93

UDK 630*416.11(497.11)“2014“=111

Original scientific paper

THE RESULTS OF THE STUDY OF DEFOLIATION AT BIOINDICATION POINTS IN THE REPUBLIC OF SERBIA IN 2014

Tomislav STEFANOVIĆ¹, Svetlana BILIBAJKIĆ¹, Radovan NEVENIĆ¹, Ilija DORĐEVIĆ¹, Zoran PODUŠKA¹, Goran ČEŠLJAR¹, Renata GAGIĆ SERDAR¹

Abstract: *The Forest Condition Monitoring Project (ICP Forests) operates as an international European project where annual monitoring of forest condition, along with recording of data on defoliation, changes in colour and presence of other forms of tree damage, are performed on a network of bioindication points. The main aim of the programme is monitoring of forest condition in permanent, representative areas, distributed in a systematic European network. The paper analyses data on defoliation, as a part of the results of work on monitoring of forest condition at bioindication points in the Republic of Serbia in 2014. The assessment of defoliation at the points is performed regardless of the cause of leaf loss, thus the obtained results do not aim at determining casual-resultive connection, but only at representing the state of defoliation at the bioindication points in 2014.*

Key words: defoliation, bioindication points, assessment of crown condition

REZULTATI ISTRAŽIVANJE DEFOLIJACIJE NA BIOINDIKACIJSKIM TAČKAMA U REPUBLICI SRBIJI U 2014. GODINI

Izvod: *Projekat Praćenja stanja šuma (ICP Forests) funkcioniše kao međunarodni evropski projekat u kome se, na mreži bioindikacijskih, svake godine prati stanje šuma i beleže podaci o defolijaciji, promeni boje i prisustvu ostalih šteta na stablima. Glavni cilj programa je praćenje stanja šuma na stalnim, reprezentativnim površinama, raspoređenim u sistematsku mrežu na površini Evrope. U ovom radu analizirani su podaci o defolijaciji, kao deo rezultata rada na praćenju stanja šuma na bioindikacijskim tačkama u Republici Srbiji u 2014. godini. Na tačkama se ocena defolijacije vrši bez obzira na uzrok gubitaka*

¹ Institute of Forestry, Kneza Viseslava 3, Belgrade, Serbia

lišća, pa dobijeni rezultati nemaju za cilj utvrđivanje uzročno-posledičnih odnosa, već samo reprezentuju stanje defolijacije na bioindikacijskim tačkama u 2014. godini.

Ključne reči: defolijacija, bioindikacijske tačke, procena stanja krošnji

1. INTRODUCTION

The Forest Condition Monitoring Project (ICP Forests) operates as an international European project where annual monitoring of forest condition, along with recording of data on defoliation, changes in colour and presence of other forms of tree damage, are performed on a network of bioindication points. The main aim of the programme is collection of data on forest condition based on a uniform methodology and obtainment of data on spatial and temporal variation of the condition of forests in European countries (Stefanović, T., 2003.). Continuous monitoring of forest condition is performed at two levels of monitoring, of different intensity. The level 1 includes monitoring of forest condition at the bioindication points distributed in a 16x16 or 4x4 km system network.

The first assessment of forest condition, in line with the above programme, in the Republic of Serbia was performed in 1988. During 2003, the network of points was restored, while the majority of bioindication points had to be re-established. In 2004, it was observed that 103 reconstructed bioindication points in the 16 x 16 km network did not fully represent the condition of vegetation coverage in Serbia and, for that reason, another 27 points in a 4 x 4 km network were established (Stefanović, T., 2013). In previous years, clear cuts were performed on the localities of certain bioindication points, while from some points necessary data were not obtained continuously, on account of technical reasons. For that reason, another reconstruction of bioindication points was performed in 2014, where some points were excluded from the programme, and new ones were defined instead.

This paper analyses the data on defoliation, as a part of the result of work on monitoring of forest condition at bioindication points in 2014.

2. MATERIAL AND METHOD

In order to ensure viability of the ICP goals, the methods and data must be uniform, that is, it is necessary to comply with prescribed procedures and standards upon collection and processing of data. In the above-mentioned project, the condition of crowns is expressed by the classes of leaf mass loss. The assessment of crown condition is performed every year on permanent sample plots named bioindication points.

A permanent sample plot or bioindication point consists of the centre, which is determined based on coordinates and is clearly marked by metal bars. Sample plots were established at the distance of 25 metres from the centre, in the direction of four cardinal points. Within each sample plot, six trees were selected and marked by numbers from 1 to 6. The selected trees were permanently marked by numbers, while trees removed for any reason were replaced by new selected trees (Stefanović, T., 2013).

Defoliation, or loss of needles or leaves in a crown, is assessed for each tree in permanent sample plots in intervals of 5%, while the results are grouped into five classes of unequal scope (Table 1). The assessment is performed regardless of the cause of leaf (needle) loss. The assessment of crown condition is performed at all points and every year, in the period in which leaves and needles are fully developed.

Table 1. *Defoliation classes*

Class	Defoliation level	Percentage of leaf/needle loss
0	None	0-10 %
1	Low	10-25 %
2	Moderate	25-60 %
3	Strong	60-100 %
4	Dead	100 %

3. RESULTS AND DISCUSSION

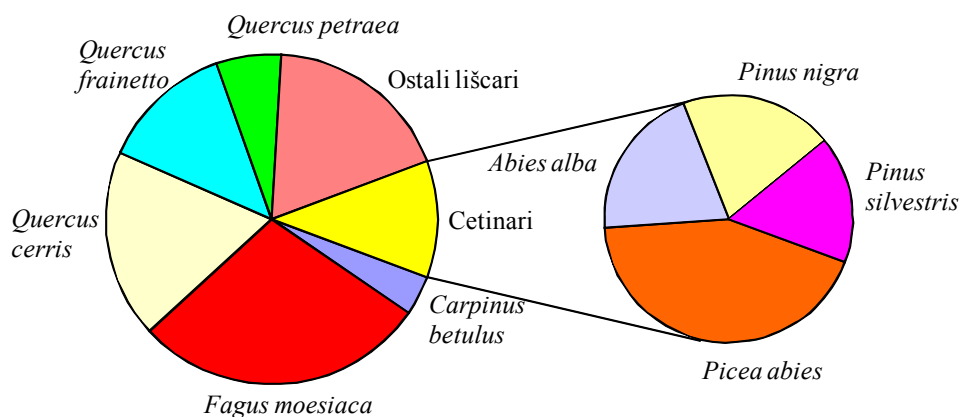
In 2014, the assessment of the forest condition on the territory of Republic of Serbia was performed at 128 bioindication points. The field work on data collection (observations and measurements) was performed in the period June-September.

The points were distributed in the altitudinal belt of 75-1,558 metres, where the highest number of points was in the altitudinal belt of 200-400 and 400-600 metres, 27 points in total (Table 2).

Table 2. *Distribution of bioindication points as per altitudes*

Altitude (metres)	0 - 200	200 -400	400 -600	600 -800	800 -1000	1000-1200	1200-1400	1400-1600	Total
Number of points	19	27	27	17	9	13	11	5	128

The defoliation assessment is performed on the total of 2,943 trees, out of which 2,607 were broadleaf and 336 coniferous species. The most represented tree species at the bioindication points are *Fagus moesiaca* (841 trees), *Quercus cerris* (543), *Quercus frainetto* (382), *Quercus petraea* (186) and *Carpinus betulus* (114). Among coniferous trees, the represented species include *Abies alba* (68 trees), *Picea abies* (145), *Pinus nigra* (67) and *Pinus silvestris* (56) (Graph 1).



Graph 1. *Represented tree species*

The assessment of defoliation level was performed in all bioindication points, while the level of exposure to defoliation processes of the most represented broadleaf and coniferous tree species is presented in Tables 3 and 4.

In 2014, beech had the highest percentage of trees without identified signs of defoliation (81.6%). At the same time, sessile oak proved the least resistant species, since defoliation of various degrees was identified on more than a half of the total number of its trees.

Table 3. *Defoliation – broadleaves in 2014*

	Horn beam	Beech	Turkey Oak	Hungarian Oak	Sessile Oak	Other	Broad leaves
None	74.5	81.6	64.6	69.6	48.9	58.4	68.9
Low	14.9	12.6	21.7	19.1	33.9	21.8	19
Moderate	5.3	3.2	10.3	7.3	16.2	14.2	8.6
Strong	5.3	2.4	2.8	3.2	0.5	3.2	2.7
Dead	0	0.2	0.6	0.8	0.5	2.4	0.8

In 2014, defoliation (needle cast or needle drop) was not detected in 89.7% of fir trees, 80.0% of spruce trees and 87.4% of white pine trees. As in previous years, in 2014 black pine proved drastically the most sensitive and susceptible to defoliation processes, that is, needle drop. 13.4% of black pine trees were affected by strong defoliation, 29.9% was affected by moderated defoliation, 20.9% was affected by low defoliation, while in only 34.3% of black pine trees defoliation was not detected.

Table 4. *Defoliation – conifers in 2014*

	Fir	Spruce	Black Pine	White Pine	Conifers
None	89.7	80	34.3	87.4	74.1
Low	0	14.5	20.9	5.4	11.3
Moderate	1.5	4.8	29.9	1.8	8.6
Strong	7.3	0.7	13.4	5.4	5.4
Dead	1.5	0	1.5	0	0.6

In 2014, as in previous years, broadleaves were more strongly affected by defoliation than conifers. In 74.1% of conifers there was no defoliation, while 68.9% of the total number of broadleaf trees was not affected by defoliation.

4. CONCLUSION

The Forest Condition Monitoring Project (ICP Forests) operates as an international European project where annual monitoring of forest condition, along with recording of data on defoliation, changes in colour and presence of other forms of tree damage, are performed on a network of bioindication points.

The paper analyses data on defoliation, as a part of the results of work on monitoring of forest condition at bioindication points in the Republic of Serbia in 2014. During this year, the assessment of crown condition was performed in 128 bioindication points, on the total of 2,943 trees. The field work on collection of data (observations and measurements) was performed in the period June-September.

As regard the broadleaf species, in 2014, as in previous years, beech and hornbeam proved to be the species more resistant to defoliation processes in comparison to oaks. Sessile oak proved to be the most endangered among broadleaf species at bioindication points in 2014. Among coniferous species, fir, white pine and spruce proved more resistant, while black pine trees were the species by far the most endangered by these processes of all species identified at the bioindication points.

The assessment of defoliation at bioindication points is performed regardless of the cause of leaf loss, thus the obtained results do not aim at determining casual-resultive connection, but only at representing the state of defoliation at the bioindication points in 2014. The conducted studies represent an underlying basis for monitoring of changes in forest condition, while linking these results to other indicators of environmental condition will enable obtaining concrete findings and drawing conclusions on dependence of plant vitality on environmental conditions.

REFERENCES

Stefanović, T., Nevenić, R., Bilibajkić, S., Marković, N. (2003): Istraživanje i ocena praćenja efekata vazdušnih zagađenja na šume u okviru Programa EU - ICP Forests. Zbornik radova, Institut za šumarstvo, Tom 48-49, Beograd, str. 79-87.

Stefanović, T., Bilibajkić, S., Nevenić, R., Đorđević, I., Poduška, Z., Češljarić, G., Gagić Serdar, R. (2013): Results of Research of Defoliation on Bio-Indicator Plots in Republic of Serbia in 2013, SUSTAINABLE FORESTRY, Institute of Forestry, Collection, Tom 67-68, Belgrade, pp. 95-101.

THE RESULTS OF THE STUDY OF DEFOLIATION AT BIOINDICATION POINTS IN THE REPUBLIC OF SERBIA IN 2014

Tomislav STEFANOVIĆ, Svetlana BILIBAJKIĆ, Radovan NEVENIĆ, Ilija ĐORĐEVIĆ,
Zoran PODUŠKA, Goran ČEŠLJAR, Renata GAGIĆ SERDAR

Summary

The Forest Condition Monitoring Project (ICP Forests) operates as an international European project where annual monitoring of forest condition, along with recording of data on defoliation and presence of all forms of tree damage are performed on a network of bioindication points. The main aim of the programme is monitoring of forest condition in permanent, representative areas, distributed in a systematic European network. In order to ensure the viability of the goals, the methods and data must be uniform, that is, it is necessary to comply with prescribed procedures and standards upon collection and processing of data and their submission in prescribed forms. The paper analyses the data on defoliation, as a part of the results of work on monitoring of forest condition at bioindication points in the Republic of Serbia in 2014. The assessment of crown condition was performed at 128 bioindication points and the total of 2,943 trees, out of which 2,607 were broadleaves and 336 conifers. The most represented tree species in the bioindication points are *Fagus moesiaca* (841 trees) and *Quercus cerris* (543 trees). Among broadleaf species, beech proved the most resistant to defoliation processes in the observed period (81.6% of trees without any signs of defoliation identified). Among coniferous species, it is fir with 89.7% of trees without visible damage.

Sessile oak proved to be the most endangered species among broadleaves in the bioindication points in 2014, where over 50% of trees are threatened by defoliation of various degrees. Among conifers, black pine is the species most endangered by these processes. As in previous years, in 2014 black pine proved drastically most sensitive and most susceptible to defoliation processes, that is, to needle cast. 13.4% of black pine trees is affected by strong defoliation, 13.45 by moderate defoliation, 29.9% by low intensity defoliation, while only on 34.3% of trees defoliation was not detected. Black pine trees are by far most threatened by these processes of all species identified in bioindication points. The assessment of defoliation in bioindication points is performed regardless of the cause of leaf loss, thus the obtained results do not aim at determining casual-resultive connection, but only at representing the state of defoliation in the bioindication points in the observed period. The conducted studies represent an underlying basis for monitoring of changes in forest condition, while linking these results to other indicators of environmental condition will enable obtaining concrete findings and drawing conclusions on dependence of plant vitality on environmental conditions.

REZULTATI ISTRAŽIVANJE DEFOLIJACIJE NA BIOINDIKACIJSKIM TAČKAMA U REPUBLICI SRBIJI U 2014. GODINI

Tomislav STEFANOVIĆ, Svetlana BILIBAJKIĆ, Radovan NEVENIĆ, Ilija ĐORĐEVIĆ,
Zoran PODUŠKA, Goran ČEŠLJAR, Renata GAGIĆ SERDAR

Rezime

Projekat Praćenja stanja šuma (ICP Forests) funkcioniše kao međunarodni evropski projekat u kome se, na mreži bioindikacijskih tačaka, svake godine prati stanje šuma, beleže podaci o defolijaciji i evidentiraju sva oštećenja na stablima. Glavni cilj programa je praćenje stanja šuma na stalnim, reprezentativnim površinama, raspoređenim u sistematsku mrežu na površini Evrope. Da bi ciljevi bili ostvarivi metode i podaci moraju biti uniformni, odnosno neophodno je pridržavanje propisanih procedura i standarda prilikom prikupljanja podataka, njihove obrade i dostavljanja u propisanim formama.

U ovom radu analizirani su podaci o defolijaciji kao deo rezultata rada na praćenju stanja šuma na bioindikacijskim tačkama, na području Republike Srbije, u 2014. godini.

Procena stanja kruna izvršena je na 128 bioindikacijskih tačaka i na ukupno 2943 stabla, od toga 2607 lišćarskih i 336 stabala četinarskih vrsta. Najzastupljenije vrste drveća na bioindikacijskim tačkama su *Fagus moesiaca* (841 stabalo) i *Quercus cerris* (543 stabala).

Kod lišćarskih vrsta, bukva se, u obrađivanom periodu, pokazala kao najotpornija vrsta procesima defolijacije (81.6 % stabala na kojima nisu registrovani nikakvi znakovi defolijacije). Kod četinara to je jela sa 89.7 % stabala bez vidljivih oštećenja. Kao najugroženija vrsta među lišćarima, na bioindikacijskim tačkama u 2014. godini pokazao se hrast kitnjak, kod koga je više od 50 % stabala ugroženo defolijacijom različitog stepena. Među četinarima stabla crnoga bora su najugroženija ovim procesima. Kao i predhodnih godina i u 2014. godini crni bor se pokazao drastično najosetljiviji i najpodložniji procesima defolijacije, odnosno opadanju četina. Jakom defolijacijom zahvaćeno je 13.4 %, umerenom defolijacijom 29.9 %, defolijacijom slabog inteziteta 20.9 %, dok na samo 34.3% stabala crnog bora nije registrovana defolijacija. Stabla crnoga bora daleko su najugroženija ovim procesim od svih vrsta registrovanih na bioindikacijskim tačkama.

Procena stanja kruna, odnosno ocena defolijacije na bioindikacijskim tačkama, vrši se bez obzira na uzrok gubitaka lišća (četina), pa dobijeni rezultati nemaju za cilj utvrđivanje uzročno-posledičnih odnosa, već samo reprezentuju stanje defolijacije na bioindikacijskim tačkama u obrađivanom periodu. Sprovedena istraživanja predstavljaju tek polaznu osnovu za praćenje promena stanja šuma, a povezivanje ovih rezultata sa drugim pokazateljima uslova sredine omogućiti će konkretnija saznanja, i donošenje zaključaka o zavisnosti vitalnosti biljaka od uslova sredine.

