International Scientific Conference

FORESTS IN FUTURE
Sustainable Use, Risks and Challenges

THE BOOK OF ABSTRACTS

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FORESTS IN FU-TURE Sustainable Use, Risks and Challenges

photo M. Veselinović, Jastrebac mountain

4th-5th October 2012, Belgrade, Republic of Serbia

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SECTION I

Forest Assessment, Modelling and Management, Forest management planning

STRUCTURAL AND PRODUCTION CHARACTERISTICS OF MIXED FORESTS OF BEECH AND SPRUCE ON KOPAONIK

Medarević M.[1], Banković S.[1], Pantić D.[1], Šljukić B.[1], Obradović S.[1], Borota D.[1]

Abstract: *Mixed conifer and broadleaf forests are the most valuable parts of the growing stock in Serbia, thanks to their high productivity, ecological diversity, stability and structural complexity. The subject of this study is beech and spruce mixed forests in the area of the NP "Kopaonik". The study of structural and production characteristics of these forests is based on the data of 8 (eight) permanent sample plots of average size 0.51 ha, established within the two previously defined groups of ecological units: EJ-A Fago-piceetum luzuletosum on acid brown soil and EJ-B Fago-piceetum oxalidetosum on acid brown and brown podzolic soil. The study stands are well stocked, with a pronounced domination of spruce, especially in the category of smaller-diameter trees. Multiply toothed individual and summary lines of diameter and height structure, and their great variation width imply the structural all-agedness of these forests. Small-diameter and medium-diameter trees are dominant, and the percentage of the largest-sized trees is minimal. Average volume is above 530 m3•ha–1, with mixture proportion about 0.6:0.4 in favour of spruce. Average value of current volume increment is about 9 m3•ha–1, with spruce percentage about 70% and beech about 30%. Increment percent is above 3%, in which spruce accounts for more than 2%, and beech accounts for about 1%. Taking into account the altitudinal position of these forests and the resulting site characteristics which are more favourable to shade loving species, the most productive species is spruce as a typical sciophyte. However, beech productivity is also significant, and its role in the concrete conditions is multi-dimensional, from the prevention of soil acidification, to the enhancement of multiple functionality (protection, recreation, amenity, etc). Site potential, stand characteristics and inter-relationships of tree species resulted in high productivity, ecological stability and structural complexity of these forests, therefore, in future management. Radical measures and felling which could disturb the established relations and dynamic processes should be avoided.*

Key words: forests of beech and spruce, structure, productivity, Kopaonik

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CHARACTERISTICS OF SILVER FIR DEVELOPMENT IN EVEN-AGED FORESTS AT DIFFERENT SITES ON Mt. GOČ

Pantić D.[1], Banković S.[1], Medarević M.[1], Šljukić B.[1], Obradović S.[1], Borota D.[1]

Abstract: *The study of tree and stand growth and increment laws in general is highly significant for silviculture, forest management planning, forest ecosystem monitoring, etc. In that sense, silver fir dynamic processes were studied in even-aged, mixed silver fir and beech forests at different sites on Mt. Goč. The study results point to exceptionally high silver fir adaptation capacity to different site conditions reflected in entirely opposite characteristics developed at extremely different sites. With the deterioration of site conditions, silver fir light demand increases, its dynamic processes accelerate, growth lines become curvilinear, current increment of growth elements culminates earlier, and at the poorest sites, silver fir becomes a heliophytic tree species. Conversely, as site conditions improve, silver fir shade tolerance increases, its growth dynamics decelerates, growth lines are flattened, and increment culmination shifts to older ages, so that at the best sites, silver fir becomes an extremely shade tolerant species. The application value of the study results, inter alia, is reflected in the accurate determination of silver fir rotation periods in even-aged forests at different sites, and the correct selection of structural forms of stands for silver fir cultivation. At inferior sites, it is by all means an even-aged stand, whereas selection stands should be selected only at the best sites, where silver fir can tolerate extreme shade, stagnate, and in this way contribute to a specific vertical forest structure.*

Key words: silver fir, growth, increment, site, even-aged forests

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DETERMINATION OF THE MOST APPROPRIATE METHOD OF ORIENTAL BEECH (*Fagus orientalis* Lipsky) STEM FORM COEFFICIENT IN TURKEY

Carus S.[1], Çatal Y.[1]

Abstract: *In this study, in order to development of breast height form coefficient according to diameter and height and the best form factor formula for Oriental beech (Fagus orientalis Lipsky) trees in West and Middle Black Sea region, a number of 50 trees were selected. As a consequent, each tree's volume was precisely calculated as the real volume. Next, the breast height form coefficient was calculated and its average was statistically compared to the averages of natural ($f_{0.1}$), artificial ($f_{0.5}$), absolute (f_0) and Hohenadl's (fh) form coefficients using pair sample t-test. Results showed that there is significant difference between the averages of natural, artificial, absolute and Hohenadl's form coefficient. Furthermore, the averages of absolute and artificial form factors were not significantly different with diameter at breast height (10, 20, 30 and 40cm) and height (10, 20, 30 and 40m) classes. As a result, natural and Hohenadl's form coefficients are capable to replace the breast height form coefficient of some oriental beech (diameter>30cm and height>20m) trees over the study area.*

Key words: Form factors, Oriental beech, t- test, Stem volume

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MONITORING OF FOREST AREA CHANGES USING SNOW COVERED SATELLITE IMAGERY IN NORTHERN EUROPE

Peterson U.[1,2] , Liira J.[3]

Abstract: *Boreal and northern temperate forests cover substantial parts of European land area. These forests are subjected to several kinds of tree removal disturbances, dominated by clear-cut logging. There is a need for quick and cost-efficient remote sensing methods to provide an independent means of detecting disturbances and recording the history of disturbances both at regional, national as well as at European level.*

The forests at northern latitudes are characterized by winters in which snow cover remains for some months of the year. Winter images are particularly suitable for change detection, while snow provides a uniformly bright background that accentuates tree crowns and their shadows and provides remarkable conditions for separating forested from non-forested areas.

We highlight a methodological approach of remote sensing based mapping of forest patches and forest disturbances in the Baltic region using multi-temporal winter imagery, obtained from medium resolution satellites Landsat and Spot and from scanner Aster. The mapping examples cover the areas in Eastern Europe in Estonia, Latvia and western parts of Russia. The time period covered is from 1987 to 2011.

Results show that a very simple approach using winter images are useful in mapping forest patches, canopy removal disturbances in forests and appearance of new forest patches within the context of agricultural lands in the situation of abandonment of agricultural land. We conclude that the use of snow-covered satellite images for forest change detection can be very efficient alternative to the use of summer images.

Key Words: Forest mapping, forest change detection, medium resolution satellite images, winter images

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HORIZONTAL SPATIAL ARRANGEMENT OF BEECH TREES IN PURE AND MIXED BEECH STANDS IN SERBIA

Stajić B. [1], Vučković M. [1], Smiljanić M.[1], Koprivica M.[2], Matović B.[3]

Abstract: *The spatial distribution of beech trees in three large complexes of beech forest in Serbia was analyzed in this paper. For this purpose, coordinates of 2066 beech trees in 25 experimental plots in unmanaged or poorly managed pure (7 plots) and mixed (18 plots) uneven-aged beech stands in Serbia were established. The following approaches were applied: distance based spatial indices (Clark-Evans index, Index of dispersion and Index of spatial pattern) and the second-order spatial statistics (K- and L-function).*

The results of applying distance based spatial indices pointed to contradictory conclusions on spatial distribution of beech trees in pure and mixed stands. In order to understand what is essentially a real form of the spatial distribution of the beech in the studied forest stands, the spatial pattern of trees was also evaluated in terms of second-order statistics. The statistics used in this analysis were Ripley's (1977) K function and its linear form by Besag's (1977) L function, which estimate the average change of spatial trend with the increasing distance from the tree's base points. According to the obtained results of functions K and L application, beech trees in pure stands had a tendency to be randomly dispersed in their immediate vicinity but with increasing distance from the tree it began to drift towards uniformity on the whole studied distances interval. In mixed forest stands, spatial distribution of beech trees showed general tendency towards clustering, although in some cases this trend was not significant.

Finally, it is emphasized that the pattern of tree spatial distribution has important effects on a variety of physical and ecological processes in a forest stand including inter-tree competition, tree size variability and distribution as well as the growth and development of trees.

Key words: stand structure, spatial distribution of trees, beech, Serbia

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ACCURACY OF NUMERICAL INTEGRATION METHODS IN TREE VOLUME ESTIMATION

Kitikidou K.[1], Milios E.[1], Gotsi M[1], Stampoulidis A.[1], Vrizas K.[1], Ketipis V.[1]

Abstract: *For many integrals, none of the known integration methods can be applied. Many researchers have attempted to develop other methods of integrals calculation, the so-called numerical integration methods. The task is to calculate the volumes of solids generated by rotating a curve around the x-axis, using three methods of numerical integration (trapezium rule, Simpson rule and Gauss squaring) and compare them to the actual volumes of trees. The analysis revealed that the three integration methods do not differ significantly, while the volumes calculated by these methods of integration differ significantly from the actual tree volumes.*

Key words: Numerical integration, tree volume, volumes' comparison.

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OPTIONS FOR USING REMOTE SENSING AND ITS RELIABILITY IN STRUCTURAL AND SPATIAL DETERMINATION OF FOREST ECOSYSTEMS

Pantić D.[1], Medarević M.[1], Tubić B.[2], Borota D.[1]

Abstract: *High diversity of forest communities and other ecosystems makes the Autonomous Province of Vojvodina an important biodiversity region, both locally and regionally. Also, forest ecosystems in the territory of Vojvodina are of high protection, social and economic importance. Forest vegetation is unevenly distributed and mostly concentrated in the regions of Fruska Gora, Vrsacke Planine (Vrsac Mountains), on the banks of big plain rivers – Danube, Sava, Tisa and Tamis, and in the region of Deliblato and Subotica Sand as well. The researches on vegetation cover (in the broadest sense) are multidisciplinary and relied on scientific achievements in biogeography, landscape and conservation ecology, physical geography, phytocoenology and other scientific disciplines, and the constant development of information technologies has led to a growing importance of remote sensing technique and methodology, combined with GIS technology, in regards to valuing of forest potentials, and permanent monitoring of the status of forest resources. Structural and phenological variations between forest communities, and tree species they are composed of, create characteristic spectral images which can be recorded by sensors. Processing and analysis of these images by specialized software packages offer various useful information about development and distribution (fragmentation) of forest communities by areas. This paper presents options for using remote sensing techniques (supervised and unsupervised classification) for preparing vegetation maps, where Landsat images were used to determine vegetation cover. The level of reliability and usability of remote sensing and Landsat images was tested by comparison of areas, tree species and forest communities with standard terrestrial methods of their determination. A reference area used in the process was the Management Unit "Topolik" managed by the Public Company "Vojvodinasume", Forest Holding "Novi Sad" respectively.*

Key words: remote sensing, forest vegetation, structure, spatial distribution

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EFFECTS OF THINNING CUT OF BRUTIAN PINE (*PINUS BRUTIA* TEN.) PLANTATION STANDS OF BURDUR REGION OF TURKEY

Çatal Y.[1], Carus S.[1], Demirkol M.[1]

Abstract: *Brutian pine (Pinus brutia Ten.) is highly important species for Turkey forestry, both in terms of the extent of its natural and artificial areas in Turkey and because of its productive, ecological and functions. This study presents the growth response of 36 year old brutian pine plantation to thinning of different intensities in Ağlasun-Burdur forest region in western Turkey. The thinning intensity was measured by using the residual basal area (%) as parameter. End of 2006 year in brutian pine, thinning treatments were tested light (0-10%), moderate (11-20%) and heavy (21-40%) thinning. Variables such as diameter at breast height and height were measured. Volume elements were measured end of 2010 year on trial plots. Growth rate interpretations were supported by analysis of covariance (ANCOVA). As a result of this study, with regard to tree height different, tree breast diameter not different in brutian pine and tree volume different in brutian pine at between thinning levels. The results of this study have similar to the results of many other studies.*

Key Words: Brutian pine, thinning, volume and volume elements in stand.

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ASSESSING STAND DENSITY INDEX FROM NATIONAL FOREST INVENTORY DATA

Eastaugh C.[1]

Abstract: *Stand density is a key descriptive trait of forests, pertaining to the relationship between the tree size and number per hectare. In 1933 Reineke developed his Stand Density index, and postulated that the log of the quadratic mean stem diameter was linearly related to the log of the number of stems per hectare. Since that time many authors have discussed the meaning of this relationship in terms of stand self thinning, and have offered refinements, rebuttals or support for Reineke's thesis. Empirical work on stand density however is normally conducted using a relatively limited number of research plots, and often used curve fitting methods that have since been shown to be biased and inaccurate. This study applies modern statistical methods of maximum likelihood estimation to determine the self thinning line for several Austrian forest species and species mixtures, based on a large body of National forest Inventory data collected between 1981 and 2009. Besides possible species differences, the size of the dataset also allows us to study the effects of species mixtures and mixed age stands on the self thinning characteristics of forests. The work is unique in that it is the study into stand density involving a National inventory based on sampling proportional to size (angle-count sampling). Although this introduces some methodological challenges, it also has advantages over a fixed-area based inventory due to the higher probability of the larger, more influential trees being included in the sample.*

Key words: Stand Density Index, National Forest Inventory, angle-count, basal area, Austria

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OPERATING EFFICIENCY OF MTZ 1025 TRACTOR EQUIPPED WITH A SENSOR DISC HARROW IN THE TREATMENT OF POPLAR PLANTATIONS

Danilović M.[1], Gačić D.[1], Đorđević Z.[2]

Abstract: *This article presents the results of the research concerning operating efficiency on jobs of inter-row cultivation in poplar plantations with a sensor disc harrow. Research was conducted on the territory of the forest holding "Sremska Mitrovica" in various working conditions.*
Working conditions varied depending on the spacing of planting, soil humidity as well as the size and density of weeds. Spacing between rows and plants was 5×5 and 6×6 m.
Evaluation of the efficiency of used technology in conditions that were the subject of the research was conducted from technical, economic, ecological and energetic aspect. Data was recorded by photo-chronometric method, and the duration of working operations was measured by flowing method. Besides that, the consumption of fuel was also measured by the method of refilling the reservoir.
Share of the time needed for turning, in the total time of harrowing, depends on the length of the parcel. This time is in the correlation with the number of turns.
Relation between the number of turns and the length of parcels can be presented by linear function. The share of turning time in the effective working time is 25.8%.
Average tractor speed during mulching is 77.3 m/min.

Key words: poplar plantation, sensor disc harrow, tractor MTZ 1025, productivity

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FOREST REGENERATION SURVEY WITH AN ANGLE-DISTANCE METHOD: STUDY CASE OF NATURALLY REGENERATED *CHAMAECYPARIS* TREES

Trifković S. [1], Sakai T. [1] , Yamamoto H.[2]

Abstract: *Success of forest regeneration is a one of the most important prerequisites in attaining sustainability of forest management. Spatial distribution and density of juvenile trees are very important parameters to evaluate a success of forest regeneration. The mean-of-angles method is proven as a rapid approach to index spatial distribution of trees. The c-tree sampling method is known as a rapid method to estimate density of forest trees. We propose to use the combined angle-distance methodology in forest regeneration surveys. Several theoretical point populations were simulated. Also, the combined angle-distance methodology was tested in a population of naturally regenerated Chamaecyparis saplings in Kiso area of Japan. Maximum-likelihood estimator is applicable in random and the GM estimator in regular populations. The (c-1) estimator can be used in clustered populations. However, an increased degree of clustering and an increase in c-values will increase the amount of bias; the true density is greatly overestimated in highly clustered populations and with higher c-values. Therefore, using the (c-1) estimator with small c-values, such as 2-tree or 3-tree sampling, can be more reliable to estimate density of clustered populations with unequal size and shape of clusters. Although a great variety of tree-spatial-patterns may occur in nature, the angle-distance method has proved as fast and reliable for the use in forest regeneration surveys.*

Key words: forest regeneration surveys, mean-of-angles, c-tree sampling, spatial pattern, tree density

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GROWTH MODELS OF SERBIAN SPRUCE (*PICEA OMORIKA* PANČIĆ/PURKYNĚ) TREES IN DIFFERENT BIOLOGICAL POSITIONS IN THE SEED ORCHARD "ZANOŽJE VITEZ"

Dukić V.[1], Mataruga M. [1], Maunaga Z.[1], Petrović D.[1], Cvjetković B.[1]

Abstract: *This paper presents the results of the growth progress analysis of Serbian spruce trees in different biological positions. The trees originate the from thinnings in Serbian spruce seed orchard "Zanožje Vitez", in the Management unit of Sasa Žabokovic, Srebrenica, B&H, registered as a seed object. To approximate the height and diameter growth in relation to age, six functions that are commonly used for modelling of tree growth were tested. To approximate the height growth, Bertalanffy function appeared to be the best and to approximate the diameter growth the best was Prodan function. In the studied stand the culmination of height growth occurs before the culmination of the diameter growth. Among the dominant trees the difference is four years, among the overtopped only one year. When we compared the overtopped trees to the dominant trees, the stagnation in diameter is much more evident than in height growth. Based on the obtained growth models of the height of the dominant trees, it was optimal to start the thinning of the studied culture at the age of about 14 years. The absence of thinning up to the age of 31 years negatively affected the growth progress, especially the diameter.*

Key words: Serbian spruce, growth functions, dominant trees, overtopped trees

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DEAD WOOD IN THE MANAGED BEECH FORESTS IN SERBIA

Koprivica M.[1], Matović B.[2], Stajić S.[1], Čokeša V.[1], Jović Đ.[1]

Abstract: *Dead wood in the forests of Serbia hasn`t been studied so far, although it is an important component of forest ecosystems. This paper presents results of investigating volume, biomass, and carbon stock bound in the dead wood of beech high forests. The sample includes eleven beech pure stands selected in six forest regions. They are all uneven-aged stands that have been managed for the last several decades, mostly under selection or group-selection management systems. Their site class is I/II-III/IV and the altitude ranges from 400 to 1380 m. One stand belongs to submontana (Fagenion moesiacae submontanum B. Jov. 1976) and ten to montana (Fagenion moesiacae montanum B. Jov. 1976) beech forests. A systematic sample was used to determine the presence, quantity, diameter structure and state of dead wood considering its degree of decomposition both in standing and fallen position. Sample plots of 500 m^2 in size, at a distance of 100 x 100 were used as the elements of the sample. Altogether 242 sample plots were established. The volume of the aboveground dead wood was determined by applying familiar dendrometric methods, while the dry biomass was calculated on the basis of its volume and wood density at different degrees of decomposition (Marjanovic et al. 2010). The biomass of the belowground dead wood, roots of the stumps and snags, was obtained directly using the relevant regression equation (Wutzler et al. 2008). The quantity of the carbon bound in deadwood was calculated by multiplying dry biomass of dead wood by 0.5 coefficient (IPCC 2003). A simple and a stratified sample were used for the purposes of estimating the average and total volume, biomass and carbon stock. It was concluded that the average aboveground deadwood volume in all studied stands amounted to 19.24 m^3 ha^{-1}. The aboveground biomass was 6.06 t ha^{-1} and the belowground 17.34 t ha^{-1}, or 23.40 t ha^{-1} in total. The carbon-bound stock in the total estimated dry biomass of dead wood was 11.70 tC ha^{-1}.*

Key words: dead wood, managed beech forests, stand, volume, biomass, carbon, sample

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FOREST MANAGEMENT IN PROTECTIVE WATERSHED AREA OF PALJANSKA MILJACKA ON JAHORINA MOUNTAIN

Rajić-Bijelić B.[1], Čabaravdić A.[2]

Abstract: *Forests are one of the most complex ecosystems on Earth, which is a dynamic complex of plant and animal communities, micro-organisms and their abiotic environment. Different forest functions play important roles depending of particular forest and environmental potentials on one side and the social needs on other side. Jahorina is forested mountain in the eastern part of Bosnia and Herzegovina, near the capital – Sarajevo in Bosnia and Herzegovina. The particular importance of this area is connected with forest productivity and water resources originated from forested areas. Particular attention is paid on forest productivity on protective watershed area of Paljanska Miljacka on Jahorina. The research question is how protections of watershed zones influence forest production or are there some differences in forest production on regular economic and protective watershed areas. Survey was conducted in high forests of beech and fir with spruce on limestone soils in two departments in commercial forest of economic character and water protection forest.*
On the basis of field data statistical comparisons is carried out. In the characterization of production are analyzed: the growing stock, volume increment and felling on the basis forest plans for selected departments of the two categories of forests. For the analysis of structural characteristics were compared to the projected volume of the structure of wood stock.

Key words: forest management, commercial forest, watershed

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PRINCIPAL SCENARIOS OF BOREAL FORESTS MANAGEMENT: ESTIMATION FROM POINT OF VIEW OF SUSTAINABILITY AND THEORY OF GROWTH

Alekseev A.[1]

Abstract: *Generally there are two principally different strategies of forest resources use and management – intensive rotation forestry when development follows a succession of cutting cycles, usually define by a rotation age and characterized by thinning, periodic clear fallings and re-plantings and continuous cover forestry which is characterized by selective harvesting of individual trees when forest remains in a state of undefined age, oscillating about a specified level of growing stock. The aim of this contribution is systematically, on relevant mathematical and theoretical basis of three stand model of growth, consider the advantages and limitations of above strategies of forest resources use from point of view sustainable forest management principles as well as minimum of risk.*

As a analytical tools for analysis was used S-shape growth curve and mathematical theory of optimal control. S-shape growth curve was used for distinguishing of special periods of time (ages) during total time tree stand of growth. Growth acceleration curve derived from S-shape growth curve was used for such a periodization.

Optimal strategy of tree stands growing stock use obtained by resolve of the optimal control problem may be formulated as free (or with pre-commercial thinning) growth up to maturity age and subsequent selective harvesting of determined amount of wood with strongly determined remaining part of growing stock. Such a strategy theoretically closes to continuous cover forestry scenario and has a number of advantages comparatively with rotation forestry.

Advantages of optimal management strategy from sustainability and minimum risk point of view may be summarized as follows: more harvest of wood, more remaining volume of wood (better carbon conservation), close to normal biodiversity, ecologically sound including more climate, water and soil control, prevailing of natural regeneration, more possibilities for multi-purpose use, low level of growth related risks.

Key words: tree stand growth, sustainability, risk, continuous cover forestry, rotation forestry.

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REAL FORESTS PRODUCTIVE WORTH DETERMINATION METHOD

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Abstract : *Proper determination of forest productive worth as the base for forest tax-rent establishing from forests owner to forest managers, is a problem which existing more hundreds years. This question was solved on different ways in history, depends of social-economic settlement, ownership relation in forestry area, forestry practice and knowledge about forests. In some cases this question is not solved at all, such as in B&H. Here, there is a problem of non equal validation of the same work in different state forestry region.*

In general, worth determination of some forest, because of forest tax establishing could be based only on worth of particular forest functions which foresters utilise. That is only productive function in the most cases. Productive forests worth depends of timber quality, real direct and indirect costs of forest management. Based on optimal enterprices organisation and technical capacity, adequate to planed system of management, the cost of management shoud be calculated.

Forests are different regarding volume and quality of income, current structure and accessibility for exploitation, so it could not be established only one proper tax value for all forests and different regions. There is a need for investments in forests at the same time also. How, how much, and which dynamic of the investments should be applied for economically sustainable way?

In the states with regular forestry, two ways for forest tax determination exist. First is based on market mechanism, and second is based on direct calculation of forest worth where market mechanisms are no only factors or not developed.

The concept of methodological approach, which is real for adoption in B&H, for solving this problem in short time, is presented in this paper. Its essence comes from first understanding of term normal forest, established for forest tax determination. Productive worth of forest was calculated for forest management region (FMR) "Olovsko" as the real example. FMR has four different management units (MU) regarding forest types, geomechanical properties of terrain, average slope… The results of calculated productive worth, for these MU, shows the logical and significance differences in absolute values.

Key words: productive forests worth, forest tax

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HOMOGENEITY OF THE FIR AND SPRUCE STANDS IN MANAGEMENT UNIT "IGMAN"

Ibrahimspahić A.[1], Balić B.[1], Lojo A.[1]

Abstract: *This paper analyzes the homogeneity of the stands, using the index of homogeneity (H) and the Lorenz`s curve. These indicators have been brought into connection the percentage of diameter distribution of trees and volume of stand and determined the level of homogeneity stands in relation to an absolutely homogeneous stands. Under homogeneous stands implies hypothetical stand constructed of trees with the same volume. Determined the effect of habitat quality to used indicators of stand homogeneity and confirmed the possibility of using homogeneity index as an additional parameter for the assessment of site quality of selection stands.*

Key words: forest stand homogeneity, Lorenz curve, homogeneity index

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TREE RINGS, FORESTS AND WATER

Cherubini P.[1]

Abstract: *Water is one of the most important resources for human life and human societies on the Earth. For plants, water is essential too. Without water and CO_2 no photosynthesis processes occur, and trees don't grow. Tree rings, as indicators of tree growth and physiological activity, have been used since long time ago, i.e., the beginning of the past century, for reconstructing past precipitation at local to regional scales over centuries.*

At sites where tree growth is limited by summer precipitation, such as in arid and semiarid, but also mediterranean, regions, tree-ring width is strongly affected by precipitation, and thus can be used to reconstruct past variability in precipitation patterns. At these sites, dendrochronological studies have helped in climatic reconstructions, the understanding of ecological processes, and archaeological dating. Moreover, recently, ring width has been used for reconstructing past streamflow too. Such studies are particularly critical and instrumental for water management in regions politically very sensitive, i.e. in the Middle East, where disputes on water are often a cause of war.

In temperate-climate forests water is important too, although not limiting tree growth. Here, stable isotopes in tree rings, such as ^{18}O, enable us to deepen our understanding of the type of source, i.e. what kind of water, is used by trees, for example if they take water from the watertable and at what depth, or from the sea or the lake, with a very wide promising spectrum of applications in environmental and hydrological studies.

In this talk I shall present some examples from the literature and from my own research experience on the different possible uses of tree rings in hydrological applications.

For the future, I predict that tree-ring studies on water quality, based on the wood chemical content, will provide useful information to understand what kind of water are we drinking or using for agricultural purposes. Is the chemical content of the water from our home wells changing through time? Future research should concentrate on the biochemical reaction of cambial activity to water stress, in order to better understand what kind of signal one should expect to find in tree-ring cell structure and biochemistry, aiming at answering these fundamental questions of key relevance for the society.

Key words: Tree rings, dendroecology, forest ecology, forest hydrology, long-term forest monitoring

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INVESTIGATION OF STRUCTURAL CHARACTERISTICS OF FAGETUM-ORIENTALIS, NAV, ASALEM, GUILAN, IRAN

Razavi M.[1], Abedi T.[2], Pourbabaei H.[3]

***Abstract**: For studying quantities condition, silvicultural characteristics and changes in the type of trees in Fagetum orientalis community, regard to changes in altitude and establishment of indicator species, 5 sample plots with size 1 hectare of forest stands between 2 sample lines were considered. By using of hundred percent inventory method, all of the height and diameter of trees and coverage stair (canopy) was evaluated. The structural triangle method was used for determining of forest structure. For exactly study of characteristics soil of area, 5 profiles in the center of each sample plots were excavated. According to the results from the structure triangle, soil profiles, altitude and indicator species, the second forest stand has irregular structure and laree average height and basal area is high in it. These two factors mentioned above are one of the criteria predicting for site index. Other forest stands have low diameter structure.*

Key words : *Fagus orientalis*, Assalem, silvicultural characteristics , Altitude

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GEOMATICS IN FORESTRY: ANALYSIS OF SCIENTIFIC JOURNALS (2010-2011)

Gajos M.[1]

Abstract:*The goal of this article is to identify the research problems in application of geomatics technology in forestry by reviewing international scientific journals. The selection of journals to be investigated is based upon journal profiles and their scientific prestige. Four journals of geomatics subject are studied for the 2010–2011 period: International Journal of Applied Earth Observation and Geoinformation, International Journal of Geographical Information Science, ISPRS Journal of Photogrammetry & Remote Sensing, Photogrammetric Engineering & Remote Sensing.*

Key words: geomatics, forestry, journals analysis

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SECTION II

Biodiversity of forest ecosystems

POPULATION VARIABILITY OF *QUERCUS ROBUR* L. POLLINATION

Batos B. [1], Ninić-Todorović J. [2], Miljković D. [3]

Abstract: *Penduculate oak (Quercus robur L.) is one of the most highly esteemed woody forest species, yet the area its forests cover worldwide, as well as in Serbia, was significantly decreased in the last century as a result of global climatic changes. The anthropogenic activity in form of mass exploitation of this species, along with other interventions, resulted in change of underground water regime, which exerted a direct impact on the occurrence of desiccation and aggravating conditions for natural regeneration of penduculate oak. Considerable efforts have been made in recent years to increase areas covered by penduculate oak, primarily by means of plantation of relevant provenances. For that reason, the understanding of phenological variability is beneficial for the purpose of acquiring a deeper knowledge of biology of the species.*

In the framework of the population variability, the flowering phenophase was analysed, with particular emphasis laid on the time of maturing and release of pollen (pollination period). The observations were conducted in two penduculate oak populations, at two localities ('Ada Ciganlija' and 'Bojčinska šuma') in the Belgrade area, on 29 trees in each population in the course of three successive years.

According to the results of the conducted research, maturing and release of pollen – a penduculate oak pollination period - begins at earliest on 7 April and at latest on 2 May. The individual variability is more pronounced at the locality 'Ada Ciganlija', extending the pollination period at this locality for one week, in comparison to the locality 'Bojčinska šuma'. According to the population phenological pattern, most trees at both localities preserve the identical trend over the years (they remain within the same group: 'early', 'average', 'late' or they shift group for one level), which confirms the genetic influence on manifestation of this characteristic.

In view of the fact that the populations are exposed to similar environmental and site conditions, the obtained differences can be regarded a result of a pedunculate oak intra-specific variability and the genetic structure of the population.

Key words: penduculate oak, phenological variability, trees, localities

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SPATIAL AND TEMPORAL VARIABILITY OF A PEDUNCULATE OAK (QUERCUS ROBUR L.) LEAF-FALL PHENOPHASE

Batos B. [1], Ninić-Todorović J. [2], Miljković D. [3]

Abstract: *In the framework of the research of phenological variability of pedunculate oak (Quercus robur L.), observations of a leaf-fall phenophase were conducted in two populations at two localities in the Belgrade area ('Ada Ciganlija', 'Bojčinska šuma'). The observations were carried out on 29 trees in each population, in the course of three successive years (2004, 2005, 2006).*

The spatial variability was confirmed by the results of the research of Mann-Witney U Test: in 2004 p-level=0.0000; in 2005 p-level=0.3274; in 2006 p-level=0.0281. According to the average established during three years of observations, the leaf-fall begins earlier at the locality 'Ada Ciganlija' – in the third week of September, and one week later at the locality 'Bojčinska šuma', whereas it comes to an end at both localities in the same week, the final week of November. At the locality 'Ada Ciganlija' there were significant discrepancies among observed years with respect to onset of leaf-fall (F-test (2,84)=27.37, p=0.0000), whereas there were no such discrepancies (F-test (2,84)=1.9608, p=0.1471) at the locality 'Bojčinska šuma'.

The average leaf-fall lasts 78.8 days („Ada Ciganlija") and 72.0 days (Bojčinska šuma), creating the difference of approximately one week between the localities. The earliest leaf-fall phenophase commences at the beginning of September and the latest lasts until the end of December, on the basis of which it can be said that individual variability is strongly pronounced at both localities. According to a population phenological pattern, only a low percentage (31.0 % - 'Ada Ciganlija'; 24.1 % - 'Bojčinska šuma') of trees in the course of three years of observations did not shift from one group to another with respect to onset of leaf-fall ('early', 'average' and 'late'), which indicates a very low stability of the population in relation to onset of leaf-fall.

In view of the fact that phenological characteristics are under considerable influence of gene factors, the results concerning the differentiation of trees into 'early', 'average' and 'late' group are of particular importance for the selection of more resistant forms of pedunculate oak. As the analysed populations are exposed to similar environmental and site conditions, the obtained differences can be regarded a result of a pedunculate oak intra-specific variability and the genetic structure of the population.

Key words: pedunculate oak, phenological variability, trees, localities, onset, duration

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INDIVIDUAL VARIABILITY OF MORPHO-ANATOMICAL PROPERTIES OF NEEDLES OF SERBIAN SPRUCE, BOSNIAN PINE, PYRAMIDAL FIR AND SWISS PINE

Nikolić B.[1], .Ratknić M.[1], .Dražić D.[1], Veselinović M.[1]

Abstract: *In investigation of variability of morpho-anatomic properties of Serbian spruce (Picea omorika /Panč./ Purkyně), Bosnian pine (Pinus heldreichii Christ.), Pyramidal fir (Abies alba var. pyramidalis Tošić) and Swiss pine (Pinus cembra L.), 13 characteristics of two-year old needles were measured: needle length, fascicle sheat length, needle width, needle thickness, cuticle + epidermis thickness, hypodermis thickness, central cylinder width, central cylinder thickness, number of vascular bundles, vascular bundle width, vascular bundle thickness, number of resin canals and resin canal diameter. The most variable properties were needle length and needle thickness as well as central cylinder width and central cylinder thickness. In Picea omorika needles the average values were 10.3 mm for needle length, 1.5 mm for needle width and 0.8 mm for needle thickness. In P. heldreichii needles the average values were 82.2 mm for needle length, 1.4 mm for needle width and 0.7 mm for needle thickness. In A. alba var. pyramidalis needles the average values were 20.0 mm for needle length, 1.95 mm for needle width and 0.5 mm for needle thickness. In P. cembra needles the average values were 77.5 mm for needle length, 1.1 mm for needle width and 0.9 mm for needle thickness. Average resin canal diameter was 33.8 µm in P. omorika needles, 41.3 µm in P. heldreichii needles, 127.9 µm in A. alba var. pyramidalis needles, and 76.8 µm in P. cembra needles. All analysed properties were compared with appropriate literature sources.*

Key words: morphology, anatomy, cuticle + epidermis, hypodermis, central cylinder, vascular bundles, resin canals

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COMPARATIVE RESEARCH OF SIZE AND NUMBER OF STOMATA OF DIFFERENT BEECH CULTIVARS

Nonić M.[1], Jokanović D.[1], Knežević R.[1]

Abstarct: *This paper presents the results of the variability of stomatal parameters (stomatal dimensions and number) of the leaves of ornamental cultivars of beech: red-leaf Fagus sylvatica L. 'Purpurea' and variegated-leaf Fagus sylvatica L. 'Roseomarginata' (= F. Sylvatica L. 'Purpurea Tricolor'), as well as the leaves of Fagus moesica Domin, Maly / Czeczott (control). This trees, from which the leaves are collected, grow in the garden of the White Palace in Belgrade, in identical environmental conditions.*
Ten leaves were taken from each tree for the research of size (width and length) and number of stomata per unit area. The number and size of stomata were measured on the lower epidermis of the leaf. The caracteristics of stomata were determined by the method "collodion process", stomata were taken between the third and fifth leaf vein. Analysis was performed using the computer system and a microscope with a camera. The values obtained for stomatal sizes were processed by computer program "Statistica" There are differences between the ornamental cultivars and the Moesian beech. The research results will be shown in the paper.

Key words: stomata, red-leaf beech, variegated-leaf beech

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COMPARATION OF FLORISTIC COMPOSITION OF BLACK PINE- CINQUEFOIL FOREST (*Potentillo heptaphyllae-Pinetum gocensis* B. Jovanović 1959) AND WINTER HEATH-BLACK PINE FOREST (*Erico-Pinetum gocensis* Krause 1957) ON CRNI VRH MT. NEAR PRIBOJ, SERBIA

Novaković-Vuković M.[1], Perović M.[1]

Abstract: *Crni vrh near Priboj is a part of serpentine-peridotite massif of Balkan peninsula, which is located on the border between Ilirian and Moesian floristic provinces and which possesses high vegetation diversity. Black pine forests are the most widespread vegetation segment of this area. The comparation of floristic composition of black pine plant communities Potentillo heptaphyllae-Pinetum gocensis B. Jovanović 1959 and Erico-Pinetum gocensis Krause 1957 is presented in this paper with the aim to ascertain what is the difference in the floristic composition between these two communities, considering they are located in immediate vicinity of each other. Testing with t-test showed there are no significant differences between researched communities considering canopy and elevation. There are significant differences in the coverage of herbacious layer and aspects in which these communities are located. Total number of recorded plant species in communities is 97, of which 39 occur in both communities. Jaccard similarity index is 0.39. Community Potentillo heptaphyllae-Pinetum gocensis B. Jovanović 1959 is more xerophilous and intolerant than community Erico-Pinetum gocensis Krause 1957, and contains more xerophilous elements in the spectre of distribution types also. Apart from similarities, which are the consequence of the same geologic bedrock, these two communities show also significant dissimilarities which differ them clearly.*

Key words: black pine, Pinus nigra, Crni vrh, plant community, floristic composition

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PRELIMINARY RESULTS ON THE VARIABILITY OF WILD CHERRY (*PRUNUS AVIUM* L.) IN SOME POPULATIONS IN SERBIA

Mikić T.[1], Ballian D.[2], Kovačević B.[1], Pilipović A. [1], Marković M. [1]

Abstract: *The variability of seven populations of wild cherry in Serbia was examined according to eight morphological leaf characters. All examined characters showed statistically significant variability among populations, which is confirmed by Duncan test. The highest differences among examined populations were found in leaf blade width. The grouping of populations was described also by discriminant analysis. In spite entomophyllic crossing and zoohorial seed spreading, variability among examined populations was considerable, especially related to the recent results in Bosnia and Herzegovina. Such variability present significant genetic resource for the further work on the improvement of wild cherry in Serbia, and should be preserved by methods of in situ and ex situ conservation*.

Key words: wild cherry, genetic variability, leaf morphological characters

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PROTURA (HEXAPODA) IN DIFFERENT FOREST LITTERS

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Abstract: *In paper are given the investigation results of protura in several forest litter ecosystems. (in different deciduous trees: as oaks, beech, accacia and elm). From earth samples separated individuals belong to sixteen (16) species and three families (Acerentomidae, Eosentomidae i Protentomidae). The greatest progress in proturan research over the past 100 years has been made in the field of taxonomy. Nonetheless, the road of taxonomy was bumpy and the proturans proved to be awkward travel companions. Species are exceedingly difficult to determine; and the number of living scientists that are able to unambiguously identify specimens at the species level can be counted on two hands. Proturans inhabit soils in all terrestrial regions of the earth (excepting the Arctic and Antarctic regions). Presently, a total of 787 valid species has been described.*

Key woeds: hexapoda, protura, acerentomidae, eosentomidae

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FLORISTIC AND EDAPHIC CHARACTERISTICS OF BALKAN BEECH AND TURKISH HAZEL PLANT COMMUNITY (*CORYLO COLURNAE-FAGETUM* JOV. 1979) IN NATIONAL PARK "ĐERDAP" IN SERBIA

Cvjetićanin R.[1], Knežević M.[1], Košanin O.[1], Novaković M.[1], Perović M.[1]

Abstract: *Floristic and edaphic characteristics of Balkan beech and Turkish hazel plant community (Corylo colurnae-Fagetum B. Jovanović (55) 1979) are researched in national park "Đerdap"in eastern Serbia. This plant community in national park Đerdap" ccupies cold aspects-northern, northwestern and northeastern. Inclinations are very different, from flat terrains to very steep slopes.*

Balkan beech and Turkish hazel plant community in national park "Đerdap" are distributed mainly on calk bedrock. Soils are very different and next soil units interchange on very small area: Rendzic Molic Leptosol (Humic Eutric Sceletic), Rendzic Molic Leptosol (Humic Eutric Brunic), Rendzic Leptic Phaeozem, Leptic Cambisol (eutric, clayic), Colluvic Regosol (eutric).

Seventeen tree species are recorded in tree layer. Dominant species are Balkan beech (Fagus moesiaca K. Maly) Czecz) and Turkish hazel (Corylus colurna L.), but beech has greater abundance. Other tree species with high presence level in this layer are: Acer platanoides L., Fraxinus excelsior L., Fraxinus ornus L., Acer campestre L., Carpinus betulus L. and Acer pseudoplatanus L. Seventeen species are recorded in the shrub layer also. The highest abundance has beech regeneration, while high presence level have also Sambucus nigra L. and Cornus mas L. High presense level in ground layer have: Asperula odorata L., Rubus hirtus W. et K., Mercurialis perennis L., Prunus avium L., Viola sylvestris Lam., Pulmonaria officinalis L., Fagus moesiaca K. Maly) Czecz., Festuca drymeia M. et K and Lamium galeobdolon (L.) Crantz.

Phanaerophytes are most numerous in the life forms spectrum (39.5%), which indicates polidominant and relic character of these forests. Increased number of geophytes (16%), confirms that this community belongs to the alliance of beech forests Fagion moesiacae Bleč et Lakš 1970.

The Balkan beech and Turkish hazel plant community excels with flora richness and ecological diversity, which ensures joint life to various ecologically different plant species.

Key words: *Corylo colurnae-Fagetum* Jov. 1979, floristic composition, edaphic conditions, life forms, arealtypes, Đerdap

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DIVERSITY OF ECTOMYCORRHIZA IN BEECH STANDS FROM DIFFERENT LOCALITIES IN SERBIA

Katanić M.[1], Matović B.[1], Pekeč S.[1], Grebenc T.[2], Kraigher H.[2]

Abstract: *Beech forests that make almost one half of forestry fond in Serbia have important function in biomass production and influence on environmental status. Valuable information about functioning of forest ecosystems can be provided by investigating the structure of mycorrhizal community. The aim of this study was to preliminary describe and identify ectomycorrhizal types in natural managed beech (Fagus sylvatica L.) stands from four different localities in Serbia: Homolje mountains, Čemernik-Ostrozub, East Boranja and Fruška gora. Samples were collected in December 2011 with soil corer of 274 ml volume at a distance of about 1m from the tree trunk. The total number of samples was 12 i. e. 3 samples per locality. Identification of fungal partner in ectomycorrhiza was obtained with morphological and anatomical characterization according to published descriptions. Different types of ectomycorrhiza were observed, described and identified. Shannon-Weaver diversity index and Species richness index were calculated. Total number of ectomycorrhizal types found in examined beech stands was 27 (8 types of ectomycorrhiza were found in the locality Fruška gora, 9 types in Čemernik-Ostrozub and East Boranja and 10 ectomycorrhizal types were observed in Homolje mountains). The preliminarily results indicated high ectomycorrhiza diversity which is at the level of diversity published for other comparable beech stands in central and SE Europe. However, seasonal dynamics of ectomycorrhizal community structure should be investigated and identification of ectomycorrhizal types should be supplemented with molecular methods*.

Key words: ECM, *Fagus sylvatica* L., morphological-anatomical characterization, Serbia

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THE TOPOGRAPHIC POSITION OF CUTTINGS AS A FACTOR IN THE SUCCESS OF DIFFERENT POPLAR CLONES ROOT STRIKING

Rebić M.[1], Vilotić D.[2], Rončević S.[3]

Abstract: *In raising poplar plantations several types of planting material have been used. The raw materials used for it are cuttings and roots produced by the „stool bed" system (rooting bed and stool bed).*
This paper analyses the quality of a sprout from which the raw material (cutting) is produced and the topographic location of the cutting on the sprout as factors in the successful root striking and survival of the cutting. The research was conducted in the "Ljutovo" nursery in Bečej, which is a part of the forest holding "Banat" Pančevo, a section of "Vojvodinašume" Public Company. The experiment was repeated four times, each time with a random disposition of treatment. Three clones of Populus deltoides (cl. B-229; 665; S_{1-5}) and two clones of Populus x euramericana cl. Panonia (M-1) i cl. I-214 were used in the research.
The research showed that the best results were obtained with the cuttings taken from the basal part of the sprout, somewhat poorer with the cuttings from the middle part of the sprout and the poorest from the cuttings obtained from the top part of the sprout of all the clones used. The topographic position of the cutting on the sprout had an influence on the root striking success, but not on the quality of the seedlings produced.

Key words: poplar, clone, position of the cutting, root striking success

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THE DIVERSITY OF HERBACEOUS PLANTS IN DIFFERENT ASSOCIATIONS OF BEECH FORESTS IN SERBIA

Vukov D.[1] , Igić R.[1], Rućando M.[1], Krstivojević M.[1]

Avstract: *Beech forests in Serbia belong to the order FAGETALIA SYLVATICAE Pawl. 1928, suborder FAGENALIA MOESIACAE B. Jov. 1986, and are divided into three alliances: Fagion moesiace Bleč. et Lak. 1970, Carpion betuli moesiacum B. Jov. 1986, and Fraxino – Acerion Fuk. 1969. Forests that belong to the alliance Fagion moesiace Bleč. et Lak. 1970, have the widest distribution in Serbia, and are of the greatest economical importance. On the Balkan Peninsula and in Serbia this alliance is divided into eight suballiances represented with numerous associations. A great number of researchers have contributed to the knowledge of the composition, distribution, ecology of these associations in Serbia. The assemblage of herbaceous plants in beech forest associations is rich and diverse. It bears the valuable information on the habitat ecology, naturalness, ecosystem functionality, etc. The aims of this study were: to create a data base of herbaceous plant species recorded in the alliances of beech forests in Serbia; to compare the floristic composition of herbaceous plant assemblages in the same association on different localities, and among different associations; to measure the diversity of herbaceous plant assemblage in the beech forests associations and to compare gained values; and to use the potential of herbaceous plant species in indication of ecological conditions in different habitat types of beech forests.*

Key words: diversity index, similarity, ecological indicators

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COMPARATIVE ANALYSIS OF THE FLORISTIC COMPOSITION AND DIVERSITY OF THE VASCULAR FLORA OF NEUTROPHILE BEECH AND FIR FORESTS WITH SPRUCE IN BOSNIA AND HERZEGOVINA

Vojniković S.[1], Višnjić Ć.[1], Balić B.[1], Mekić F.[1]

Abstract: *This paper presents a study of the diversity of vascular plants within neutrophile beech and fir forest with spruce from the Illyrian area (Abieti-Fagetum illyricum Treg. 1957. nom ill.). Comparative studies using an identical method were conducted in two areas within the range of these forests in Bosnia and Herzegovina: Bjelašnica in central Bosnia, and Grmeč in the west of the country. Though these are the same plant communities, the starting point was the hypothesis that there are differences, both floristic and in diversity, between these forests within the sites studied, arising from their phytogeographical position as well as from the impact of management. The studies revealed that the Grmeč beech and fir forest with spruce is floristically somewhat richer both in number of species and in diversity (average number of species 30; average Shannon index 2.64; average equality index 0.85) than that of Bjelašnica (average number of species 28; average Shannon index 2.46; average equality index 0.83). Minor floristic differences were observed in the Illyrian species Cardamine trifolia, Cardamine kitaibelii (syn. Cardamine polyphylla) of Grmeč, which are not present in the Bjelašnica area. As regards diversity by number of tree species and the proportion of each species by number of individuals, greater diversity was observed on Grmeč, with a Shannon index value of 1.551, as against that of 1.303 for Bjelašnica. A variance analysis revealed a statistically significant difference in diversity by number of species and number of individuals on the areas studied. Diversity by basal area on Grmeč was 1.538, compared with 1.182 for Igman- Bjelašnica. Here too the differences were statistically significant, with a probability of 95%.*

Differences in tree species diversity by number of individuals in these areas were the result of the local climate, habitat-related orographic and edaphic conditions, and human activity past and present, with latitude and altitude, along with the interaction between animals and plants within these forests, playing a decisive part. However, as regards tree species diversity by basal area, the main impact is anthropogenic – the nature of forest management in these areas.

Key words: diversity, floristic composition, neutrophile beech and fir forest, BiH

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PROTECTION AND PROMOTION OF THE BIODIVERSITY OF DEGRADED FOREST ECOSYSTEM BY ANTHROPOGENIC ACTION THE EXAMPLE OF THE CITY FOREST KOŠUTNJAK IN BELGRADE

Cvejić M.[1], Tomićević J.[2]

Abstract: *City forest Košutnjak is one of the most visited forests in Belgrade. In the mid of 19th century the forest Košutnjak officially declared to be the hunting ground of the Obrenovic dynasty and Topčider at its base, becomes a place of National gatherings and celebrations. Hunting fence was removed by order of the Karadordjevic dynasty, 1913.,when the hunting definitely leaves the forest Košutnjak. The main users of forest became vacationers. Until then, Košutnjak forest was a habitat for many plant and animal species. Man entering the area of forest Košutnjak is constantly present by gradual degradation of the forest and forests lands, which manifests by reducing the biodiversity of forest ecosystems.*

Needs of the population of the city is to go out into nature and to spend their leisure time in recreation. However, in the urban forest Košutnjak, there are elements which degrade the forest created by anthropogenic effects. There is present construction of facilities to the outer edge of the forest complex as well as in the forest itself. Local landfill of municipal and construction waste, noise from vehicles which using the forest as a transit route because of which car noise goes beyond permitted level of noise in the forest for the recreation.

Comparative analysis of the benefits of urban forests for recreational function was tested by using a custom Rupperts method. The manner of forest using and the level of its degradation, indicate the need to educate all users of forest.

The study shows the need for legal regulations and plan documents restrict illegal settlement expansion at the expense of forest, construction of buildings on forest lend, and the need to prohibit or commit to a particular type of behavior in the forest, in order to protect, preserve and enhance the delicate forest ecosystem and biodiversity in it.

Key words: urban forest, protection and enhancement of biodiversity, degradation of forests and forest lends, anthropogenic factors, education.

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SURVEY OF MACROFUNGAL DIVERSITY IN THE FOREST ECOSYSTEMS OF STARA PLANINA, KOPAONIK AND TARA

Novaković M.[1], Karaman M.[1], Marković M.[2], Matavuly M.[1], Rućando M.[1], Trudić B.[2]

Abstract: *Forests represent one of the ecosystems with exceptional biodiversity and yet they are among the most threatened ones nowadays, due to unsustainable management, pollution, climate change. Fungal diversity is one of the most important indicators of overall forest biodiversity and its health. However, scarce information exists on the macrofungal diversity of mountain forests in Serbia. Survey conducted during four months in 2011, on three sites (Vidlič – Nature Park Stara Planina, Metođe – National Park Kopaonik, Mitrovac – National Park Tara), yielded in 119 species of macrofungi. They were recorded from the five selected permanent plots, each with the size of 1000m^2. Plots no.1 and 2 are situated on Stara planina (beech stand and stand of spruce and Douglas fir, respectively), plot no. 3 on Kopaonik (stand of beech and spruce), while plots no. 4 and 5 are located on Tara (stand of spruce, fir and beech and stand of spruce and beech, respectively). Fifteen species were collected from more than one plot, while 104 were collected from only one plot. Twenty-seven species were reported during more than one investigated month and 92 were reported only once during investigated year. Forty-four species couldn't be identified. Among the identified species only 4 belong to division Ascomycota and 71 to division Basidiomycota. Determined fungal species were members of following ecological trophic groups: 33 identified species were lignicolous (wood-decaying), 25 were terricolous saprotrophs and 17 mycorrhizal. This survey gave only a slight insight into the fungal diversity of investigated forests. Further ivestigations will give us more accurate picture and enable us to monitor the well-being of selected forest ecosystems*.

Key words: diversity, forest, fungi, mountain, ecosystem

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SECTION III

Climate changes

PLANTING METHOD INFLUENCE SPRUCE SEEDLINGS GROWTH ON FORESTED AREA ON Mt KOPAONIK AND IMPACT ON MICROCLIMATE

Đukić M.[1], Đunisijević Bojović D.[1], Dožić S.[1], Obratov Petković D.[1], Grbić M.[1], Bjedov I.[1]

Abstract: *Area without woody vegetation exposed to unfavorable microclimate at the locality "Rendara" on the Mt Kopaonik was forested 1996th with spruce seedlings (Picea abies Karst.), age of 2+2 years. This is area with special climatic characteristics, strong winds and snow drifts, the coldest and longest winters in Serbia with the lowest average annual temperature and duration of snow cover is about 150 days a year. Planting was done by two methods: in pits and furrows ("by ripping").*

It was recorded a very good success of seedling survival in both planting methods (about 80%) but later the chlorosis various intensity was observed in a number of seedlings.

The analysis of physiological vitality of seedlings, 2 years after planting, by evaluation of chlorosis degree (1-5), needle macronutrients N, P, K, Mg content, needle mass and length, was conducted on 600 spruce seedlings from six selected experimental plots. Lower physiological vitality, greater percentage of plants with chlorosis (64.29%) was observed on seedlings planted in pits than on those planted in the furrows (48.49%), reflecting the size, average weight and length of needles.

Analysis of growth and physiological vitality was done also in 2012 th and mean value of plant height planted in pits and furrows was 4 m and 4.5 m.

According to this research, it is possible to recommend afforestation with spruce seedlings in order to mitigate unfavorable microclimate with lot of snow and wind. Planting method in furrows showed an averagely better growth and physiological vitality, probably because of better root development water and mineral nutrients supply.

Key words: microclimate, spruce, afforestation, planting method.

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FOREST FIRE PREVENTION AND CLIMATE CHANGE IN GREECE

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Abstract: *Fire danger is expected to increase throughout Europe, especially in the already fire-prone Mediterranean area. Adaptation options related to forest fires and climate change include fuel management and modification of forest structure (clearing, thinning and biomass removals, prescribed burning, grazing), change species composition (replacement of highly flammable species), active post-fire management (reforestation, slope restoration treatments, salvage logging) and investments in infrastructure (communications networks, monitoring schemes, watchtowers, road network), training and equipment. A critical review of adaptive fire management measures will be presented with particular reference to results from evaluation studies in Greece. The results of a questionnaire survey on public and forest practitioners perceptions will also be discussed.*

Key words: forest fires, climate change, Greece, adaptation, survey

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THE RESPONSE OF NORWAY SPRUCE, EUROPEAN BEECH AND SILVER FIRON CLIMATE VARIATION IN WEST CARPATHIANS

Petráš R.[1], Bošeľa M.[1], Mecko J.[1], Šebeň V.[1]

Abstract: *We present up-to-now knowledge about the response of radial growth of spruce, beech and fir trees in homogeneous and species-mixed forests on climate variation in West Carpathians, of which the majority part is within the Slovakia territory. We use the results from different studies that had been conducted recently as well as first results of ongoing project focused especially on mixed forest stands created by species of so called "Carpathian mixture". The first material come from the central part of Slovakia and was acquisited in 2004-2006. The material consists of 455 dominant and co-dominant trees of spruce and beech from 18 homogeneous and even-aged forest stands. Second material has being conducted during the ongoing project. Here, the main attention is paid to the mixed, uneven-aged stands constituted by spruce, fir and beech trees. The inter- and intra-species variation in the response of radial growth on climatic variation is analyzed. The use of standard dendrochronological methods for study of the response of the species on climate variation is analyzed here, and several suggestions are presented.*

Key words: climate change, dendrochronology, spruce, fir, beech

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FORESTS – THE CRUCIAL PLAYER OF THE GLOBAL CARBON CYCLE – ENVIRONMENTAL SENSITIVITY AND SEASONAL COURSE OF THE

Marek M.[1]

Abstract: *Carbon fluxes between the stands of plants and atmosphere could be regarded as the key process of the global mass and energy exchange, i.e. biological pumping of the carbon which is the extremely sensitive to internal ontogenic and external of environmental factors. Moreover the different types of forest ecosystems are different from the carbon storage capacity point of view. Their carbon pumping sensitivity is conditioned by the real synoptic situation b and by the sink strength. This make possible to realize some sylvicultural management practises leading to the increase of growth sink of the forest stand and thus to increase their carbon storage potential.*

Key words: carbon storage, sensitivity of carbon fluxes.

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CLIMATE CHANGE IN SERBIA AND ITS IMPACT ON FOREST ECOSYSTEMS

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Abstract: *It is known that climatic factors determine habitat conditions that influence regeneration and survival of forests and other plant formations in a given area, and that the distribution of specific types of forest vegetation is adapted to existing climatic conditions. According to the Intergovernmental Panel on Climate Change (IPCC), the current changes in global and regional climate in the future will be, among other things, manifested by increasing the temperature and temperature extremes, and reducing the amount of rainfall. This would seem particularly stressful to trees (forest), particularly through reduction of biodiversity, reduction of vitality of trees, drying (extinction) of some tree species, etc. Forests will be difficult to adapt to sudden changes, which may lead to their demise. Therefore, forest management has to be adapted to altered environmental conditions, and one of the solutions is through application of nature-based silviculture.*

The paper presents the results of analyzes of climate change in Serbia based on data for two typical meteorological stations: one lowland in urban conditions (Belgrade) and other typical altitude meteorological station in the forest area (Zlatibor). The data relate to the measurement period from 1991 to 2010, and they were compared with reference data for the period 1961-1990. We analyzed the basic elements of climate - air temperature and precipitation regime. In particular, the analysis of climatic parameters important for the development of forest vegetation (such as evapotranspiration and soil water regime) has been performed. Comparative values of evapotranspiration are presented by applying methods of Penman-Monteith, Thorntrhwaite, and Thornthwaite-Mather, as different parameters are used in different methods for determination of evapotranspiration. Also, annual variation for this period is shown along with determined differences between methods, and there is a recommendation for the use in our conditions.

The data are particularly important from the point of forestry, especially for the purpose of defining, selecting and applying specific needs of silvicultural treatments in terms of current and expected future climate change.

Key words: climate change in Serbia, evapotranspiration, soil water regime, impact on forests

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NORWAY SPRUCE MONOCULTURE VERSUS NEAR-NATURAL FOREST MANAGEMENT: COMPARISON OF ENERGY, CARBON AND ECONOMIC BALANCE

Plch R.[1,2], Pecháček O.[3], Vala V.[3], Pokorný R.[1,3], Cudlín P.[1]

Abstract: *If the assumption of climate change is confirmed, the Norway spruce stands in the middle and lower altitudes in the Czech Republic would be highly unstable. Decreased susceptibility of trees to abiotic stress impacts in combination with favorable conditions for pests can lead to decline of spruce stands. Nevertheless, most forest owners justify spruce monoculture forestry on unsuitable sites by its economic potential up to date. The contribution aim is to analyze the current state of costs (inputs) and benefits (outputs) of energy, carbon and economic balances, including use of LCA (Life Cycle Assessment) method, to compare forest stands with different management in Novohradské hory Mts. For this purpose two types of management, taking into account the expected impact of climate change, were selected: i) continuing current management practices in forest stands with prevalent spruce, ii) near-natural forest management with altered tree species composition corresponding to the potential vegetation under expected climate conditions.*

Individual management types were modeled for one rotation period The energy balance method, applied to forest stands, consists in the comparison of the quantified inputs (fossil fuels, electricity, used machinery, fertilizers, etc., converted into energy units in Joules) with quantified outputs (biomass production in Joules). Calculation of carbon balance in both compared management types enables to estimate their sustainability - the ratio of emitted carbon into the atmosphere to the amount of carbon bound in the biomass. In addition, the LCA method was adopted to assess their environmental load. Accordingly, the economic analysis of expenses and benefits were carried out. Comparison of energy, carbon and economic balance and environmental load enables us to select an appropriate forest management into individual given conditions.

Kew words: *Picea abies*, energy budget, carbon cycle, Life Cycle Assessment

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CLIMATE CHANGE IN THE REPUBLIC OF SRPSKA, BOSNIA AND HERZEGOVINA AND POTENTIAL IMPACT ON FOREST ECOSYSTEMS

Trbić G.[1], Krstić M.[2], Govedar Z.[3], Bjelanović I.[2], Keren S.[3]

Abstract : *The paper presents the changes in air temperature and precipitation that result in climate changes in the Republic of Srpska, Bosnia and Herzegovina. Score variability and climate change are made on the basis of analysis of climate data from 22 meteorological stations. Changes in temperature and precipitation are given on the basis of comparison of results for the period 1981-2010 compared to the period 1961-1990. Potential impacts are determined on the basis of a regional climate model for the completed Second National Communication of Bosnia and Herzegovina to the United Nations Framework Convention on Climate Change (UNFCCC SNC BiH). We analyzed the possible climate change scenarios A1B and A2 and their possible impact on forest ecosystems in the Republic of Srpska, Bosnia and Herzegovina. A1B scenario is characterized as a "medium" and A2 a "high" scenario. The results point out that climate change is evident in the Republic of Srpska, Bosnia and Herzegovina, along with the fact that these changes have strong regional character. Changes in temperature and pluviometric regime cause increased intensity and frequency of periods of drought on which plans and strategies for adaptation of forest ecosystems to climate change in the Republic of Srpska, Bosnia and Herzegovina should be based.*

Key words: climate change, forest ecosystems

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CHANGES IN SPECIES COMPOSITION OF VEGETATION AND EPIGEIC SPIDER COMMUNITIES IN OAK-HORNBEAM FOREST IN BÁB (SLOVAKIA) DURING 40 YEARS

Oszlányi J.[1], Gajdoš P.[2], Halada L.[2], David S.[2]

Abstract: *Authors studied the herb layer and ground-living spider communities of the lowland forest in the permanent research site Báb (SW Slovakia). The site is part of the Slovak Long-Term Ecological Research (LTER) network and the presented research is continuation of research realised in the site in years 1967-1974 in framework of the IBP and MaB programmes. We evaluated changes in species comp osition between first period of the research (1967-1974) and the current research (2007-2011). The results indicate that typical forest species still dominate in the herb layer, but we recorded in recent samples quite high number of synanthrop plants and expansive spiders. This reflects recent disturbance when part of the research plot was cut down and the open space is colonised especially by ruderal, invasive and expansive species. The climate changes could represent another driver of big changes in species composition during last 40 years: Šiška and Cunev (2006) documented gradual drying out of the studied locality by climate data and demonstrated it by increased abundance of many xerotermophilous beetle species and decreasing abundance or absolute disappearance of several others, more hygrophilous species.*

Key words: species composition changes, epigeic spiders, tree species, shrub species, plant species

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THE OCCURRENCE AND DEVELOPMENT OF FUNGI ON TREES WITH MECHANICAL INJURIES UNDER THE INFLUENCE OF THE ANTHROPOGENIC FACTOR AND CLIMATIC CHANGES

Marković M.[1], Rajković S.[1], Čokeša V.[1]

Abstract: *The climatic changes have brought about numerous injuries on trees, which along with damages caused by the anthropogenic factor, leads to occurrence of numerous wood-decay fungi in the stands. For the purposes of protection and preservation of beech in Serbia, this paper researched the occurrence of pathogenic microorganisms on beech trees relative to the presence of injuries on trees. The testing was conducted in the Forest Holding Kucevo, in a hillside beech forest Fagetum moesiacae submontanum of generative origin. The research was carried out on 23 testing plots with a total of 324 trees. It was found that the appearance of fungi primarily depends on the presence of mechanical damage on trees (as much as 73.46%), while the presence of abiotic damage has almost no bearing (only 3.21%), which indicates that the health condition of high beech stands is heavily dependent on careful and proper manipulation during harvesting. Each injury inflicted on a beech live tree during logging opens the door to infection with pathogenic microorganisms.*

Key words: Climatic changes, damage, forest, fungi

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THE GROWTH AND BIODIVERSITY OF SPRUCE STANDS IN VARIABLE CLIMATE CONDITIONS (CASE STUDY)

Gil W.[1], Ambroży S.[2], Grodzki W.[2]

Abstract: *BACCARA is project realized in frame of 7.FP. The main aim is to build the tools that will enable forest managers and policy makers to evaluate the risk of European forest biodiversity and productivity loss under climate change.*
One of the experiments was established in Poland (Carpathian Mountains, Radziejowa Massif). 8 populations of Picea abies growing on elevations from 500 m to 1200 m a.s.l. (every 100 m elevation) were measured. In each population one wood core sample per tree at 1.3 m above the ground from 15 trees (120 cores) were collected to determine the response of spruce to various climate conditions. The cores were analyzed using Corim Maxi measuring device. On 4 elevations from 500 m to 1100 m a.s.l. (every 200 m elevation), the diversity of ground vegetation was evaluated. Additionally, temperature loggers were installed on each elevation (every 100 m) in order to determine the average temperature variation.
The main threats to spruce stands in this region are: the damage caused by the wind and related outbreaks of bark beetles (mainly Ips typographus), so on the same elevations, where the diversity of ground vegetation was evaluated, the diversity of bark- and wood-boring insects and their natural enemies was also evaluated, to determine the response of this group of organisms to various climate conditions.
As the result, the influence of variable climate conditions on forest growth, stability and resistance, was assessed.

Key words: climate change, forest biodiversity, spruce stands

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THE ANTIOXIDATIVE CAPACITY OF FOUR BASIDIOMYCETOUS FUNGAL SPECIES FROM FRUŠKA GORA PROVENANCE AS A POTENTIAL BIOCHEMICAL INDICATORS OF ENVIRONMENTAL DISTURBANCE

Trudić B.[1],Karaman M.[2],Kebert M.[1], Galović V.[1],Novaković M.[2]

Abstract: *In the last decades, basidiomycetous fungal species became of great importance as sources of natural bioactive molecules. Moreover, macrofungal species have been also used as a good bioecological indicator of contamination of ecosystem in biodiversity monitoring examinations, determining conditions of soil, wood species and air. Biochemical parameters of oxidative stress in four macrofungal species were analyzed for their antioxidative capacity referring of possibility of disturbance of Fruška Gora Provenance and its forest ecosystem by environmental (e.g. climate) changes above Vojvodina region. Organic extracts (70% methanol and 100% chloroform), made of four lignicolus fungal species (Panus tigrinus, Fomes fomentarius, Agrocybe aegerita, Omphalotus olearius) from natural Fruška Gora Provenance were examined directly for their antioxidative capacity by 3 tests in vitro: DPPH• assay, FRAP assay and total phenol content determination. The highest radical scavenging capacity (RSC) and the lowest IC–50 value (129,22 μg/ml) in DPPH• assay was noticed in the extract of F. fomentarius, while the extract of A. aegerita showed ≈ 13 times higher value (1746,38 μg/ml) indicating lower antioxidant potential. O. olearius extract showed the highest antioxidative capacity in all tests obtained. However, F. fomentarius species showed higher value in FRAP test (69,1 mg equivalent of ascorbic acid/g dw) and total phenol content (240,55 mg equivalent of galic acid/g dw) then P. tigrinus and A. aegerita species in the same tests, showing its stronger antioxidative defense against oxidative stress. Positive correlation (r=0.97) between total phenol content and ferric reducing power of fungal extractst indicated the possibility that phenols are major active constituents in obtained antioxidative activity. According to results for DPPH• assay, two fungal species, P. tigrinus and A. aegerita indicate possibility that different, non-phenolic secondary metabolites can be responsible for high IC 50 value and strong anitoxidative reaction. The obtained results suggest that all analyzed fungi from natural Fruška Gora Provenance are of potential interest as a good bioecological indicator for Fruška Gora Provenance which ecosystem is in balance, as opposed to the obvious climate changes.*

Key words: antioxidative capacity, basidiomycetous fungi, climate change, in vitro assays, ROS

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EROSIVE PROCESSES IN THE ĐORĐEVAČKA RIVER BASIN (SOUTH-EAST SERBIA) IN THE PERIOD 1953-2011

Braunović S.[1], Kabiljo M.[1]

Abstract: *The Đorđevačka River (Davidovačka, Vrtogoška) is a left tributary of Južna Morava, flowing into it at approximately 5km north-south of Bujanovac. The paper presents the results of the study of erosion intensity change in 1953, 1970 and 2011. The intensity of erosive processes in 1953 and 1970 was established on the basis of available erosion maps, whereas the intensity in 2011 was determined by means of satellite images and field research. The calculation of erosion coefficient Z for all three reference periods was performed by application of the Prof Gavrilović's methodology, which enabled a comparative analysis of the obtained results.*

Key words: erosion intensity, socio-demographic factor, land use

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THE IMPACT OF CLIMATE CHANGE ON REPRODUCTIVE POTENTIAL OF INVASIVE SPECIES *ASTER LANCEOLATUS* WILLD

Nešić M.[1], Obratov-Petković D.[1], Bjedov I.[1], Skočajić D.[1], Đunisijević-Bojović D.[1]

Abstract: *Understanding and predicting changes in community composition, plant distributions and ecosystem function in the era of climate change has become a central issue of invasive plant ecology. There is a large volume of published studies suggesting that traits related to reproduction, such as timing of flowering, high seed production, good seed viability and long-distance dispersal ability can promote species invasion potential. This paper present results of the research conducted on several locations in Belgrade where Aster lanceolatus Willd. spread rapidly, forming dense patches over large areas. Late flowering period, high seed production, long-distance dispersal ability and rapid vegetative spread were noticed. This results suggest that Aster lanceolatus Willd. have high reproductive potential. This characteristic will be even more significant with the climate change driving extreme weather conditions, which are likely to support the spread of this invasive perennial.*

Key words: *Aster lanceolatus* Willd., invasive plants, reproductive potential, climate change

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EFFECTS OF CLIMATE CHANGE ON THE TURKISH FORESTS

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Abstract: *Climate chancing by this way risk of drought and desertification danger is the most global problem in present. Also, Turkey is situated in the most risky countries related to this problem with its geographical location, climate, topography and soil characteristics. Approximately, 51 million hectares areas have (65 % of total area in Turkey) arid and semi arid features. 54 % of forest stands, 59 % of agricultural areas and 64 % of pastures are exposed medium strong and strong erosion problem. A total of 21.189.000 million hectares are forests and this come across 27,7 % of total terrestrial area of country. A half of these grounds are unproductive. It is expected that negative effects of climate changing will increase on forests and forest products in the big part of earth. Reflects of forests ecosystems against to this changing are differed between systems. Managing forests like plantation forests are face to face with human activities as breeding, thinning and other applications. This kind of managing activities can reduce the effects of changing on climate.*

Flora composition varies belonging to altitute differences, existing of different climate types. Approximately 12000 plant taxa are growing up in Europea and 9000 of them are present in Turkey. Also, 3000 taxa are endemic plant. These endemic species can be damaged by exposing to negative effects of climate changing. Also, biological diversity, fresh water resources and wild life habitats will be effected by this problem. In addition to this, by global warming, damages of pest insects and other forest pests will be increased and unexpected problems can be occured in controlling of them. Mediterranean Basin of Turkey is under risk for forest fires. Also, increasing of burned areas by forest fires will be inevitable by global climate chancing. Approximately 7,5 million forest villagers who live in rural areas will be directly effected by changing in forest ecosystems of Turkey.

Key words: Climate change, effects, the Turkish forests

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NORWAY SPRUCE (PICEA ABIES (L.) H. KARST.) DAMAGE AND CLIMATE CHANGE

Žemaitis P.[1], Stakėnas V.[1], Ozolinčius R.[1]

Abstract: *It is evident that climate change involve alteration of biotic and abiotic stressors. As a result it is difficult to predict the impact of all these factors on trees. Norway spruce (Picea abies (L.) H. Karst.) damages was selected as the* object *of this* study, *regarding implicit vulnerability of this species in a changing environment.*

The data from Lithuanian regional forest monitoring (1989-2010) and State Forest Service (1968-2009) have been used.

Paper present an analysis of the average annual temperature trends in Lithuania since 1968 till 2009. The crown defoliation, the number of healthy trees, stands damages by bark beetles (ha) and stands damages by Heterobasidion annosum (Fr.) Bref. (ha) was used as indicators of spruce condition and damages. Windthrow (ha) damages was selected as abiotic indicator. In addition was also analyzed the interaction between these variables.

During the analyzed period (1968-2009) the average temperature has trend to increase, especially during the past two decades. This trend coincides with increased frequency of severe storms and windtrhrow damages area. The latter factors accelerate stands damages by bark beetles. The crown defoliation and the number of healthy trees (particularly) during the past two decades have a deterioration trend. Results indicate that defoliation change is mostly related to stands damages by bark beetles and variability of meteorological factors.

Key words: Norway spruce, climate change, trees damages, trees defoliation

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BIOENGINEERING METHODS FOR ERODED REGIONS WITH APPLICATION OF SOME USEFUL PLANT SPECIES

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Abstract: *Paper is considering possibilities of application of some useful plant species as innovative approach in bioengineering protection of soil and groundwater. The analysis included melliferous, aromatic and medicinal plants that provide effective erosion control and high level crops in agricultural production, i.e. beekeeping. This kind of slope stabilization also bears importance for landscape planning providing new image of degraded areas, revitalization of degraded and eroded mountain areas and revival of their local communities and traditions. Since inappropriate harvest of these plants and intensive farming are endangering land conservation, paper examines new possibilities for embankments and slope designs and conservation and protection of existing natural areas. Species most suitable for application were reviewed on their biological and aesthetic characteristics such as depth and root development, growth rate, sprouting capacity, canopy width and power of water retention, visual characteristics of plants, color and appearance of leaves, flowers and fruits and average yields in production of honey.*

Key words: bioengineering, erosion control, land conservation, useful plant species

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SECTION IV

Forest genetics, nursery production and plant breeding

USE OF INNOVATIVE PRACTICES AND NEW TECHNOLOGY IN THE PRODUCTION OF WIDE VARIETY AND HIGH QUALITY FORESTRY SEEDLINGS IN ORDER TO ENHANCE REGENERATION SUCCESS AND INCREASE BIODIVERSITY

Radoglou K.[1]

Abstract: *A high priority for Greek Forestry nurseries is cost-effective regeneration efforts in order to enhance forest biodiversity and sustainability. Nonetheless, overcoming transplanting stress in Mediterranean forest ecosystems is a great challenge. Adverse growth conditions in semi-arid environments, such as intense droughts, substantially decrease regeneration success. Nurseries target to produce the best seedlings that have the potential to overcome transplanting stress and successfully grow on a site. The main aim of this project is the introduction of new technology based on pre-cultivation protocols in mini-plugs in order to serve large-scale production of forest regeneration material for a wide range of species. Specifically, 26 species will be studied and initially their germination and growth protocols will be determined. This will help understand the physiology of each species, and consequently increase seedling quality and quantity through the integration of this new technology. Both morphological (e.g. seedlings height) and physiological (e.g. root to shoot ratio) variables will help determine the best growth conditions (e.g.. use of a specific soil substrate) for each species in order to achieve the best seedling quality. This combined with the increased seeding production that mini-plus can achieve should help maximize both the quantity and the quality of the seedlings. Furthermore, these seedlings will be studied under field conditions at three highly disturbed sites that had been burned in the past. The use of this new technology will allow a large scale production of seedlings that until now was unreachable through the use of the conventional techniques. The new technology, in conjunction with increased number of different forestry species will result to increased biodiversity levels that lead to more sustainable ecosystems.*

Key words: Planting stock material, reforestation, restoration

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SIBERIAN STONE PINE CLONES IN KRASNOYARSK FOREST STEPPE

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Abstract: *Grafting methods of different tree species as one of the most efficient methods of vegetative reproduction started to be widely developed from the moment of foundation of seed plantations. In the last 50 years the grafting of conifer species obtained a wide recognition in forestry as one of selection methods.*
Siberian pine grafting to Scots pine takes a special place among activities in establishing seed grafting plantations. Some work was realized to improve grafting methods, to reveal the best rootstocks, to study grafted tree growth and their seed producing also to introduce Siberian pine in regions where it does not naturally grows. Besides, the recommendations in Siberian pine reproduction by grafting for obtaining seeds and establishing seed plantations have been elaborated.
Results of studying the grafting methods are successfully applied in industry. According to foreign classification the foundation of collection- maternal graft plantations is considered as a formation of the bank of genes. The valuable rare forms of trees as well as vegetative posterity of plus trees can be kept safe in these plantations.
A large collection of Siberian pine clones established in 1963- 1965 in Krasnoyarsk forest steppe enabled to study the character of individual and geographical variability of growth, biology of anthesis and seed producing of grafted Siberian pine trees. The most economically valuable clones have been selected: fast growing, vital and high productive. The plantation of the half-sibling posterity of studied Siberian pine clones has been established. Observing the growth and state of graftings of Siberian pine trees, also studying the radial growth in components of heteroplastic grafts enabled to ascertain reasons of anatomical-morphological incompatibility and death of mature grafts. Presently the new collection graft plantation of more perspective Siberian pine clones is being established where Siberian pine trees are as stocks.

Key words: conifer, Siberian pine, grafts, clone plantation

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THE QUALITY OF SEEDS OF MACEDONIAN PINE *PINUS PEUCE* GRISEBACH IN MACEDONIA

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Abstract: *The Makedonian pine Pinus peuce Griss refers to the endemic and relict pines of the Tertiary period. It is widespread in the Balkan Peninsula: in Macedonia, Serbia, Albania, Montenegro, Bulgaria and Greece. This is a fast growing, stable, beautiful pine tree, it can be found in many gardens and parks. For reforestation, breeding and plantations of cedar pines need high quality seeds. The study of quality seeds Pinus peuce in natural populations will assess the seed production of trees, select the best population and recommend them for breeding work.*

The task of the research was to study the quality of seeds in Pinus peuce National Perk Pelister, where this species is more widespread. Four natural populations were studied: 1-population Nizhopole, 900 m altitude above sea level; 2nd Rotino, 1050m above sea level; 3rd - Magarevo, 1100 m above sea level and the 4th population Capari, 1010 m above sea level.

To determine the viability of the seeds in our study used industry-standard X-ray diffraction method, designed specifically for Siberian pines Laboratory of Forest Genetics and Plant Breeding Institute of Forest SB RAS, Krasnoyarsk.

Our studies have shown that the seeds of the three studied populations-Nizhopole, Rotino Capari and have a high seed viability to 84%. Less than 70% viability of seeds in the population Magarevo. In seeds of this population was higher number of empty seeds have no embryo (18%), which is probably due to selfing. The degree of maturity and suitability of seed for sowing is determined by the level of development of embryos. Seeds of Pinus peuce all 4 populations have well-developed embryo, which occupies 0.8 - 1.0. For all the studied populations characterized by the presence of seeds with a polymorphism of 1.6 to 4%. As shown by our study of 4 populations were of higher quality seed population Capari.

Key words: *Pinus peuce*, populations, seed, quality, viability

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PROVENANCE OF A FOREST REPRODUCTIVE MATERIAL MATTERS: EXAMPLES WITH NORWAY SPRUCE, SILVER FIR, COMMON BEECH AND SESSILE OAK IN THE WESTERN CARPATHIANS

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Abstract: *Evaluation of common garden experiments of Norway spruce, common beech, silver, fir and sessile oak prove significant differences among their provenances. At the age of 45 years, mean stem volume differed by 21-44 % and growing stock 39-96 % among the provenances of Norway spruce. Comparative tests with silver fir and sessile oak revealed the difference of 64-88 % in the mean stem volumes, while 181-196 % in their growing stock.*

In order to analyze adaptability at the species level, effects of ecological distances between source populations of individual provenances and provenance plots (planting sites) on the growth and survival were assessed.

Eleven autochthonous provenances of Norway spruce were studied at the series of 5 parallel provenance plots situated along an altitudinal gradient from 480 to 1,310 m. Changed altitude, temperatures, precipitation and vegetation period influenced their growth and survival significantly. Our findings indicate adaptation of Norway spruce to a common optimum located in a somewhat lower altitude than the origin of tested provenances. Altitudinal shift, mean temperature of July and number of days warmer than 10°C proved to be the most important underlying variables.

Effects of changed site conditions on the growth and survival of beech, silver fir and sessile oak were tested in single-plot provenance trials. Despite of a simple experimental design, ecological distances between source populations and planting sites were significant for all species. From among the underlying variables, altitudinal shift had the strongest effect on the growth and survival of silver fir and sessile oak. Provenances of silver fir performed better when they were planted in a lower altitude while oak provenances in a higher altitude from their source populations.

Key words: forest reproductive material, provenances, ecological distances, adaptability

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VARIABILITY OF FLOWERING AND SEED CROPS IN A CLONE SEED ORCHARD OF SCOTS PINE (*PINUS SYLVESTRIS* L.)

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Abstract: *The analysis of the quantitative and qualitative characteristics of flowering and cones crop abundance was carried out in a clone seed orchard of Scots Pine (Pinus sylvestris L.) at the location Stanovi near Doboj on 37 year-old trees. Phenological observations were carried out on 214 ramets in 20 clones in the springs of years 2005 and 2006. The obtained results indicate the presence of the notable variability of regularity and the abundance in creation of micro-and makrostrobili of Scots Pine in the seed orchard, where all the flowering abundance grades ranged from "+" to "5". The conducted analyses of crop abundance showed a high percentage of ramets without crops (70% - 79%). The results indicate that the function of the orchard is not compatible with its purpose, and that there are possible genetic and ecological factors that cause the absence of seed crops. The results of two-year-old analyses are important for future activities related to establishing new seed orchards.*

Key words: Scots pine, clone seed orchard, flowering, crop

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EFFECTS OF GIBBERELLIC ACID, KINETIN AND COLD STRATIFICATION ON SEED GERMINATION OF *PYRUS PYRASTER* BURGSD. AND *MALUS DASYPHYLLA* BORKH

Pipinis E.[1], Milios E.[2], Karaoglanidou E.[1], Smiris P.[1]

Abstract: *Pyrus pyraster and Malus dasyphylla can be used in reforestation programs for enhancing the biodiversity since many wild mammals feed on their fruits so a successful propagation method is needed. Germination tests were carried out to determine the best treatment to use in order to overcome dormancy and to maximize germination of Pyrus pyraster and Malus dasyphylla seeds. In both species the effects of gibberellic acid (GA_3), kinetin, cold stratification and combinations of GA_3 plus cold stratification and kinetin plus cold stratification on seeds germination were investigated. Seeds of both species were treated with three solutions of GA_3 or kinetin for 30 hours and then were cold stratified at 3-5ºC for 0,1,2 and 3 months. The concentrations of GA_3 and kinetin solutions were 500,1000 and 2000ppm. Moreover, seeds from each species that were not treated with GA_3 or kinetin (control) were subjected to only cold stratification for 0, 1,2 and 3 months. Non-stratified Pyrus pyraster seeds, even thought treated with GA_3 and kinetin solutions, exhibited very low germination percentages. In Pyrus pyraster, control seeds given a period of 2 or 3 months of cold stratification germinated to higher ($p<0.05$) percentages than those subjected to only 1 month of cold stratification. In each period of cold stratification, there weren't significant differences in germination percentages between control and seeds treated with GA_3 and kinetin solutions. In Malus dasyphylla, GA_3 or kinetin application was not effective in improving germination of non-stratified or a month stratified seeds. In control and seeds treated with GA_3 or kinetin increasing the period of cold stratification germination percentages were increased significantly. In each period of cold stratification, there weren't significant differences in germination percentages between control and seeds treated with GA_3 and kinetin solutions except from one case. After 2 months of cold stratification the control seeds gave higher germination percentages than those that had been treated with 500 and 2000 ppm kinetin. In both species, low values of mean germination time were observed for all treatments (control, combinations of GA_3 or kinetin and cold stratification). The results revealed that using only cold stratification the optimum germination percentage of Pyrus pyraster and Malus dasyphylla seeds was obtained by a 2-or 3-month and a 3-month cold stratification period respectively. In both species, the application of GA_3 or kinetin did not replace neither shorten the required cold stratification period for the achievement of analogous germination percentages.*

Key words: cold stratification, dormancy, gibberellic acid, kinetin, *Malus dasyphylla*, *Pyrus pyraster*

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AN IMPACT OF SUGAR TYPE AND CONCENTRATION ON INDUCTION OF EMBRYOGENESIS IN ANTHER CULTURE OF *AESCULUS CARNEA* HAYNE

Zdravković-Korać S.[1], Devrnja N.[1], Tubić Lj.[1], Milojević J.[1], Ćalić D.[1]

Abstract: *Haploid plant production increases variability of the germplasm, allows fixation of recessive traits, and accelerates plant breeding through double haploid production. This is especially important for the breeding of woody plants, as they have a long reproductive cycle with several years of juvenile phase. With the aim of increasing the efficiency of androgenesis in red horse chestnut, an impact of sugar type and concentration on embryo production in anther culture was tested. Anthers of red horse chestnut were isolated from surface sterilised flower buds (5 mm), cultured on solid MS medium supplemented either with sucrose or maltose at 2%, 5%, 10% and 15% and kept in darkness for 8 weeks. Thereafter, the anthers were transferred to MS medium with 0.01 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D), 1 mg/l 6-furfurylaminopurine (kinetin, Kin) and 2% sucrose and exposed to 16h light photoperiod. The highest embryogenic response was attained in anthers cultured on media supplemented with 10% and 15% maltose during the induction phase. Androgenic embryos were capable of high frequency secondary somatic embryo formation on medium with 0.01 mg/l 2,4-D and 1 mg/l Kin. Secondary somatic embryos (SSE) at cotyledonary stage of development germinated readily on the same medium, developing radicle at high frequency (82.16 ± 1.31%), while 11.59 ± 1.62% of SSEs developed epicotyl, and only 5.13 ± 0.92% of SSEs developed both radicle and epicotyl. Further research is needed to increase the conversion rate from embryos to plantlets.*

Key words: anther culture, embryo germination, red horse chestnut

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SOMATIC EMBRYO REGENERATION FROM FILAMENTS OF *AESCULUS FLAVA* SOL

Zdravković-Korać S.[1], Milojević J.[1], Tubić Lj.[1], Devrnja N.[1], Ćalić D.[1]

Abstract: *Somatic embryogenesis is a powerful technique widely used for propagation of elite genotypes, especially mature, difficult-to-propagate woody species, like ornamental species of the genus Aesculus. For the purpose of clonal propagation of A. flava, callus was induced from the stamen filaments cultured in darkness on MS medium with variable levels of 2,4-dichlorophenoxyacetic acid (2,4-D) and 6-furfurylaminopurine (kinetin, Kin). Among the 2,4-D/Kin combinations tested, 1 mg/l 2,4-D + 1 mg/l Kin was optimal combination for the highest callus growth. Some of the friable filament-derived calli were dispersed in liquid MS medium supplemented with 1 mg/l 2,4-D + 1 mg/l Kin, as to prepare cell suspensions. After 8 weeks of culture, the callusing filaments were transferred to solid plant growth regulator (PGR) - free medium, while microcalli in suspensions were spun down, resuspended in semisolid PGR-free medium and dispensed in Petri-dishes. Both types of cultures were exposed to 16h light photoperiod. Somatic embryogenesis was achieved by both techniques after approximately 4 weeks, but cell suspension was a more efficient method. Both 2,4-D and Kin were indispensable for the induction of callus competent for somatic embryogenesis. Primary somatic embryos obtained by both the methods exhibited a great potential of secondary somatic embryogenesis, yielding numerous secondary somatic embryos. Cyclic somatic embryogenesis allowed the establishment of permanent embryogenic cultures.*

Key words: filaments, cell suspension, somatic embryogenesis, tissue culture, yellow buckeye

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ANALYSIS OF SURVIVAL AND VITALITY OF BEECH PLANTS GRAFTED BY METHOD OF SPLICE GRAFTING

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Abstract: *Besides the significance of beech as a forest species, the great importance of its numerous ornamental cultivars are often left out. The research object were genotypes of several ornamental cultivars of beech in Belgrade: Fagus sylyatica L. 'Purpurea', Fagus sylvatica L. 'Tricolor', Fagus sylvatica L. 'Roseomarginata', and Moesian beech Fagus moesica Domin, Maly/Czeczott, as well as the posibility of their heterovegetative reproduction. Ten parent trees were selected from four different locations – 7 trees from White Palace and 3 trees from private gardens. Three hundred one-year rootstocks has been prepared for grafting. Grafting was done in the nursery of the Faculty of Forestry in Belgrade, in early spring 2011 year. A method of splice grafting was applied. The aim of this research was to analyze the percentage of survival and development of grafted beech trees, and to determine which parent trees are the most appropriate for reproduction. Analysis of the vitality included measuring of the* root neck *diameter and height of the grafted plants. The data were processed by the software package „Statistica". The percentage of surviving grafts was recorded four times during the growing season (June, August, September and October), to track changes and compare the values recorded at the beginning and the end of the growing season. While the first and second observations, grafted cultivares F. sylvatica L. 'Tricolor' and F. sylvatica L. 'Roseomarginata' from different sites, showed the highest percentage of successfully grafting (80-87%), but also the biggest change in the third and fourth observations - the percentage of survival was lowest, only 17-27%. A possible cause is incompatibility of the rootstock and the scion. In 3 cultivars of F. sylyatica L. 'Purpurea' from the White Palace and Dedinje, was observed almost constant survival rates from 50-60%, in all four periods of observation.*

Key words: survival rates, grafting, beech, ornamental cultivars

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ROOTING AND PREVENTING SHOOT-TIP NECROSIS OF *IN VITRO* CULTURED HORSE CHESTNUT SHOOTS

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Abstract: *Efficient bud regeneration was achieved from hypocotyls and cotyledons of germinating horse chestnut (Aesculus hippocastanum L.) somatic embryos cultivated on 1-10 M benzyladenine (BA). Adventitious buds were detached from the mother tissue and gave rise to permanent shoot cultures on 0-20 M BA. From the shoot base of these explants secondary buds were regenerated. Bud multiplication was very poor (1.9) and shoot-tip necrosis was very high (100%) on plant growth regulator (PGR)-free medium. The highest multiplication was achieved on 5 and 10M BA (16.8 and 18.7, respectively), with no shoot-tip necrosis, while hyperhydration was rather frequent on shoots cultivated on BA above 5M. Individual shoots were elongated on medium with 1M BA and 500 mg/l polyvinylpyrrolidone (PVP MW40 000) for 4 weeks. However, it was necessary to reduce BA level below 1M for shoot rooting and that caused mass shoot-tip necrosis. As classical rooting methods failed, the basal part of each elongated shoot was first wounded by cutting with a sterile blade and then dipped into 5 or 10 mM indole-3-butyric acid solution for 1 min and cultivated on solid half-strength MS PGR-free medium with 0.02% activated charcoal for 2-3 weeks. To prevent shoot tip necrosis during this phase, a BA solution was applied directly on apical meristem. Shoot-tip necrosis was completely eliminated by weekly application of 10l of 1M BA. As soon as the root initials were observed, the shoots were transferred to MS medium supplemented with 500 mg/l PVP and 5M BA. The frequency of rooting was still unsatisfactory (23%) and further optimisation of root-inducing phase is needed.*

Key words: *Aesculus hippocastanum*, rooting, shoots-tip necrosis

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SEED DORMANCY NATURE OF *PONCIRUS TRIFOLIATUS* (L.) RAF.

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Abstract: *The three-leaf lemon (Poncirus trifoliatus (L.) Raf.) is a high shrub from central China and Korea which is used in landscape horticulture and pomology (as understock for agrume grafting). The fruit, like all at Citrus genus, is hisperidium (kind of berry) which belongs to nonclimacteric fruits. It was interesting to investigate the influence of succulent pericarp on germination. A very frequent poliembriony is characteristic of this species. It was identified that apomictic embryos which orgin from nucelus are larger and those that developed from zygote are smaller and during germination are supresed by nucelar embryos. This can be significant for intraspecies taxa propagation.*

The inhibitor properties of succulent pericarp (exocarp and mesocarp) were investigated on the lettuce seed. It was identified that the solution of the mesocarp and exocarp sap influences germination retarding more or less, regarding to the concentration, and also influences seedling morphology. Explanted embryos shows a light physiological dormancy, because the samples treated with KNO_3 has a faster germination compared with nontreated.

Key words: seed dormancy, three-leaf lemon, generative propagation, presoving treatments

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VARIABILITY IN CONTAINS OF CALCIUM IN DOUGLAS FIR PROVENANCE NEEDLES ORIGINATES FROM NORTH AMERICA

Lavadinović S.V.[1], Miletić Z.[1], Isajev V.[2], Lučić A.[1], Popović V.[1]

Abstract: *Most conifer species, introduced in Europe is Douglas-fir (Pseudotsuga mensiesii Mirb / Franco) with the great number of provenance tests in Germany and France. Institue of Forestry established Douglasi-fir provenance experiment plots in Serbia in order to test the characteristics of the species to new ecological conditions.*

The intensity and dynamics of physiological processes of mineral nutrition of Douglas fir is one of the important indicators of successful adaptation and introduction of non-indigenous Douglas fir habitat.

In the experimental Douglas-fir habitat was established under the same stand conditions (Ass. Fagetum submontanum Rud on acid brown soil on gneiss) calcium content in needles was investigated. The established quantities of calcium in needles are indicative of different capabilities of certain Douglas-fir provenances to adopt this nutritive element from the soil, under the same stand conditions.

Key words: Douglas-fir, provenances, calcium, nutrition elements

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ROLE OF THE PERICARP IN *AILANTHUS ALTISSIMA* SEED GERMINATION

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Abstract*: Ailanthus altissima (Mill.) Swingle is an invasive tree species which has colonized numerous ecosystems and affected ecosystem processes worldwide. It is a common woody plant weed in the conditions of the urban environment, both in our and in other European countries. Tree-of-heaven (in English) abundantly fruits every year and successively suppresses indigenous shrubs and young native trees, preventing regeneration of the natural plant communities and habitats of other autochthonous species. It presents serious harmful factor to biodiversity and affects unsecure survival or much more fully impossible growth of indigenous species offspring by blocking source of sunlight, taking space and soil nutrition. The study of A. altissima biology has particular importance because the fact that this species is not closely studied in the territory of Serbia. Existing data of Tree-of-heaven's ecology is often related to populations from geographically distant areas of Europe. As a result, each closer study of A. altissima is a contribution to better understanding of this introduced plant. One of the major shortcomings of previous studies was often neglecting the geographical, ecological differentiation and the divergence of local A. altissima populations in the new settlements. Many questions in ecology, genetics and taxonomy of this woody plant are not yet determined. The aim of this study was to investigate the influence of pericarp on the germination of seeds of A. altissima, which would contribute to better understanding the biology of invasive prediction of future course of its expansion and opportunities for its suppression. Our study further refines our knowledge on the effects of similar and newly used treatments, improving our management techniques to reduce the presence and growth of this aggressive invasive tree.*

Key words: germination; *Ailanthus altissima;* pericarp; invasive tree species;

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MAIN CHARACERISTICS OF BALD CYPRESS SEED STAND (*Taxodium distichum* (L.) RICH.) NEAR BAČKA PALANKA

Popović V.[1], Lavadinović S.V.[1], Ćirković-Mitrović T.[1], Lučić A.[1], Jokanović D.[2]

Abstract: *Bald cypress as an allochthonous conifer species in Serbia can be considered as the species of rapid growth, one of the few conifer species that may be suitable for afforestation of lowland and especially floodplain habitats where it achieves high productivity.*
In Serbia is registered only one seed stand of Bald cypress located near Bačka Palanka, in the FMU "Palanačke Ade-Čipski poloj" section 11, department a, in area of 0.22 ha, with 111 trees. The plantation is about 70 years of age.
The goal of conducted researches is to introduce adaptive, productive and reproductive potential as a starting point for directed use of the available gene fund of this species. In October 2010 breast diameter and height of all trees were measured, yield was evaluated and seed was collected. The collected data were processed in the computer program "Statgraph 6.0".

Key words: Bald cypress, adaptive, productive potential, diameter, height

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MINI-PLUGS: A REVIEW ON SIZE, SOIL SUBSTRATE AND SEED SOURCE

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Abstract: *Greek forest nurseries are urged to produce a substantial number of seedlings in order to respond to regeneration needs. Nonetheless, the transplanting success faces many obstacles, mainly due to the adverse environmental conditions that Mediterranean ecosystems pose. The ability to produce adequate number of seedlings, accompanied with the "best" quality is a great challenge. The use of mini-plugs enables to combine the ability to grow a great number of seedlings within a short period of time, while also altering the seedling's quality by using the proper mini-plug size. Further, the use of right size in conjunction with other parameters, such as soil substrate, could also improve the seedling's quality. This paper reviews research that has been conducted on the effect of mini-plugs that varied based on their size, soil substrate and seed source. Specifically, the citied forestry species were Arbutus andrachne L., Cupressus sempervirens L., Pinus nigra J.F.Arnold Pinus brutia Ten., Picea abies L. Karst., Robinia pseudoacacia L. The studied seedling characteristics were morphological (ex. shoot length) and physiological (ex. root growth potential). Based on the reported results, size substantially affected the growth of those seedlings that varied among the studied species, as well as among the studied variables of each species. Similarly, soil substrate as well as seed source also affected the seedling growth. Moreover, these effects have also been found to be carried over even under field conditions by substantially affecting survival success. Overall, specific desired seedling characteristics that favor regeneration success, such as greater roots, could be achieved by the use of the proper mini-plug size, soil substrate and seed source. Nonetheless, the results varied substantially among species, suggesting that species is a key factor that should always be taken into account in order to achieve the best seedling quality.*

Key words: Mediterranean species, reforestation, restoration, seedling growth

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SECTION V

Afforestation, silviculture and forest ecology

FOREST VEGETATION IN THE FOOT OF THE MOUNTAIN "BESNA KOBILA"

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Abstract *: Forest vegetation of the footer of the Mountain Besna Kobila and glen of the Banjska river and its surrounding is most important ih this area. Glen of the Banjska river and its surrounding is differs in geomorphological and mesoclimatic sense in relation to the wider sense surrounding area of Vranje. This is the upper part of Banjska river, surrounded by high ridges and making a sheltered basin without great fluctuations of temperature and relative air humidity during the year. Forest vegetation of the footer of the Mountain Besna Kobila and glen of the Banjska river and its surrounding originates from mixed vegetation of refugial type.*

Phytocoenological investigations performed in 1998 to 2002. and have shown that the community Carpino orientalis-Quercetum frainetto-cerris B. Jov. (1953) 1979 is the climatogenic community in this part of the southeastern Serbia.

It is ascertained as the initial community within the area of the footer of the Mountain Besna Kobila and glen of the Banjska river and its surrounding is Carpino orientalis - Quercetum B. Jov. 1960 over silicates,with the participation of sessile oak and silver linde.

Key words: Glen, Mt Besna Kobila, Banjska river, vegetation, area, phytocoenoses

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INVESTIGATION OF SITE CHARACTERISTICS OF THE PESTER PLATEAU AS A BASIS FOR THE SELECTION OF POTENTIAL VEGETATION

Rakonjac Lj.[1], Ratknić M.[1], Dražić M.[1], Lučić A.[1], Stajić S.[1], Pižurica R.[1]

Abstract: *This paper presents the results of site characteristics investigations in the Pester plateau region. The aim of the investigation was to determine potential vegetation. The investigation included parent rock, climate characteristics and soil characteristics. A short outline of orographic and hydrological characteristics of the investigated area is given as well.*
The whole plateau is a depression with its own characteristic local cold highland climate. Regarding the parent rock, pester plateau can be divided into several areas. The soil is highly diverse: undeveloped, humus – accumulative, cambic, eluvial-alluvial, etc. The results are here presented in an abridged form because a detailed summary of the results will be given in a separate monograph.

Key words: Pester, site characteristics, climate, soil, potential vegetation

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DYNAMICS AND PROPERTIES OF GROUNDWATER IN HUMOFLUVISOL SOIL IN A PROTECTED PART OF THE ALLUVIAL PLAIN

Pekeč S.[1], Katanić M.[1], Galović V.[1], Kebert M.[1]

Abstract: *This paper presents the dynamics of groundwater, soil moisture and quality of groundwater in two years. During 2006 the highest relative level of groundwater was 147 cm from the soil surface, the middle level 234 cm, while the lowest level reached 285 cm. The amplitude of the groundwater variation was 138 cm. In 2007, the highest relative level of groundwater was 120 cm, the middle level of 260 cm, while the lowest was 385 cm. The amplitude of variation for this year was 265 cm. The correlation between the Danube water level and groundwater level was high during the first year of study and higher water levels (r = 0.96), while during the second year water level was lower and the correlation was low (r = 0.21). Soil moisture during the test period was accessible to plants, and was increased with depth of soil profile. Based on the groundwater analysis assessment of water quality was made according to U.S. Salinity Laboratory classification and the FAO classification and quality classes of the groundwater of humofluvisol soil are presented.*

Key words: ground water level, humofluvisol, class of water quality

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SOIL HABITAT CHARACTERISTICS IN ASS. FRAXINO ANGUSTIFOLIAE-QUERCETUM ROBORIS JOV. 1951, JOV. ET TOM. 1979. FORESTS IN RAVNI SREM

Ivanišević P.[1], Galić Z.[1], Rončević S.[1], Andrašev S.[1], Kovačević B.[1], Obućina Z.

Abstract: *This paper presents the results of multiannual study of soil in the forests of oak and ash Ass. Fraxino angustifoliae-Quercetum roboris Jov. 1951, Jov. et Tom. 1979, and its subassociation hygropyillum, typicum, aceretosum, deschampsio, subinundatum in the area of Ravni Srem, that covers 15430 ha. Forests of oak and ash grows on old river terraces, where the parent material is mixed clayish alluvial deposit with loess, known as lesoaluvium. Depending on the dominant process of sedimentation, fluvial or wind, lesoaluviums parent substrate contains variable proportions of alluvial deposits and loess. Because old river terraces have expressed microrelief, the effect of flooding and ground water was different. The effect reflected in the form of various processes, especially moving of $CaCO_3$ and colloidal clay, i.e. as an eluvial process, pseudogleying and water-logging. Depending on the dominant soil formation process forests of oak and ash grow on flooded and periodically flooded areas, where they form hydromorphic soils of different soil profiles: Pseudogley class (A-Eg-Bg-C morphology with pseudogley type) Gley class (Aa-Gso-Gr morphology with humogley type) and Semigley class (A-C-G morphology with humofluvisol type). Examined soils differ significantly in type and width of A horizon, in the position of the horizon G, i.e. with of the physiologically active horizon, granulometric composition (the dominance of the content of the silt + clay) and considerable excessive moistening of part or whole profile. Depending on soil conditions, the dominant processes of soil formation, due to changes in terrain and thus changes in hydrological regime, the structure of relations between oak and ash in some subassociation is changing. As the humidity rises the share of ash is inreasing too, and with the as the habitat is more dry, the proportion of oak increase in these, by soil conditions defined, mixed forests of oak and ash in Srem flat.*

Key words: Oak and ash forests, the old river terrace, lesoaluvium, soil, Sava river.

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ANALYSIS OF *FAGUS SYLVATICA* L. S.L. REGENERATION FORMATIONS UNDER OPEN CANOPIES IN THE CENTRAL RHODOPE MOUNTAINS OF NORTH-EASTERN GREECE, A PRELIMINARY STUDY

Milios E.[1], Kitikidou K.[1], Stampoulidis A.[1], Gotsi M.[1], Ketipis V.[1], Vrizas K.[1]

Abstract: *The present study was conducted in the central Rhodope mountains of north-eastern Greece. In order to analyze the Fagus sylvatica regeneration formations under open canopies, 20 plots of 2 m x 2 m were established. The plots were established, in F. sylvatica stands that were under a regeneration process using the shelterwood method, but the completion of the process has been significantly delayed. The establishment of plots was made using the simple random sampling method. In each plot, for all the F. sylvatica plants the height and diameter at the ground level (stem base) were recorded. Moreover all the F. sylvatica plants were cut and a cross section was taken from each plant, at the stem base. The number of annual growth rings (tree age) was counted in each cross section using a stereoscope. The age difference of regeneration plants inside a plot ranged from 11 to 37 years, while the height difference ranged from to 1.1 to 5.65 m. Moreover the highest mean annual height increment of all plants that were cut was 0.31 m and the lowest was 0.035 m. The relationships of height (h) and age (t) and height and base diameter (d) of plants that were cut were found been better expressed with the equations:* $h= 0.105t+0.001t^2$ *and* $h=0.794d-1.655/(d+1)+1.3$ *correspondingly. The better knowledge of growth characteristics, as well as other ecological features, of F. sylvatica regeneration plants established under open canopies will contribute to having improved silvicultural systems regarding the species as well as to more efficient silvicultural treatment of F. sylvatica regeneration formations.*

Key words: *Fagus sylvatica* L. s.l., regeneration plants, growth, shelterwood, south Europe.

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ADAPTATION PROCESS AND HEALTH CONDITION OF JUVENILE STAGES OF SPRUCE ON CALAMITY AREA AFTER DESTRUKTION IN THE SPRUCE MONOCULTURES

Tučeková A.[1], Longauerová V.[1]

Abstract: *Spruce stands in Kysuce region (north-western part of Slovakia) are heavily damaged due to infection by bark beetles (Ips typographus a Pityogenes chalcographus) and fungal diseases (Armillaria spp.) what results in a dieback of high number of adult spruce trees and trees in juvenile stage as well. In the paper we deal with screening of the most significant parasitic wood destroying fungi that attack spruce trees in Kysuce region. Wood destroying honey fungus Armillaria spp. prevails on the roots of the youngest spruce trees, on the trees from natural regeneration or artificial regeneration. We found that a frequent reason of the infection of spruce in juvenile stage by parasitic wood destroying fungi is a tree physiological weakening caused the most frequently by insufficient water or high seasonal fluctuations in water supplies and lowering of the pH value as a consequence long term influence of immissions in the spruce monocultures. Fine rootlets of young plants may be mechanically damaged also during their lifting and transplanting. Thus disturbed root system is more susceptible to infection by honey fungus and other parasitic fungi as well. Honey fungi attack all age classes of spruce – plants, plantations, adult stands as well as adult trees of different age from natural regeneration.*

Key words*:* Spruce, artifitial and natural regeneration, Armillaria spp.

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VEGETATION-CLIMATE CHARACTERISTICS OF GOČ MOUNTAIN IN SERBIA

Cvjetićanin R.[1], Krstić M.[1], Janić M.[1], Nikić Z.[1], Perović M.[1]

Abstract: *It is well known that the occurrence and survival of the vegetation in a certain area, its distribution and altitudinal differentiation, as well as zoning, in addition to the other ecological conditions, mainly depends on the climate characteristics of the area and their change due to the altitude. This paper presents the climate-vegetation (bio-climate) characteristics of the mountain massif Goč, in central Serbia (the highest summit is located at 1543 m above the sea level), based on the climate date obtained by the multi-annual measuring (from 1961 to 2005), at the selected meteorological stations, typical for this area. The method of the altitudinal gradients of the climate elements was applied. The values of the gradients were obtained by the use of the data of the lowland meteorological stations (Kraljevo – located at 215 m above the sea level), as well as the data collected by one mountain meteorological station (Kopaonik – located at 1,710 m above the sea level) in the investigated area. By the application of the calculated linear gradients, the values of the climate elements for the definite altitude (from 750 to 1543 m), characterized by the altitudinal distribution of the certain forest zones in Goč, were obtained. Both annual values and values in the vegetation period of the major climate elements, important for the development of the vegetation are presented: temperature conditions and precipitation regime, as well as climate-geographic characteristics - Lang's Rain Factor, as a base for the climate-vegetation classification of the climate. The climate type by using the method by Thornwhite and Lang was also determined.*

Spatial distribution of forest communites and climatic characteristics is shown on appropriate thematic maps using GIS technology.

The interdepence of the occurrence and survival of the forest vegetation in this area, its distribution and altitudinal differentiation, and the climate characteristics, is proved in this reseach as well. Each altitudinal forest zone are characterized by the specific microclimate conditions.

Key words: Goč, climate conditions, vegetation characteristics

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EFFECTS OF BIOFERTILIZATION ON SPRUCE (*PICEA ABIES L. KARST*) AND PINE SEEDLINGS (*PINUS SYLVESTRIS L.*) GROWTH IN DEPOSOL

Gujaničić, V.[1], Golubović-Ćurguz, V.[2], Raičević, V.[3], Spasojević, I.[3]

Abstract: *Biofertilizers are substances that contain living microorganisms which, promote plant growth by numerous direct and indirect mechanisms that make nutrients more available or increase plants access to nutrients. Bearing in mind the importance of PGPB in sustainable agricultural production, the goal of this paperwork was to test the possibility of using biofertilizers in forestry in aim to improve plant growth on anthropogenic, degraded soils.*

The effect of biofertilization on growth of spruce (Picea abies L. Karst) and pine (Pinus sylvestris L.) seedlings, grown in deposol of Kolubara basin (Serbia) were examined. Bacterial consortium was consisted of: Azotobacter chroococcum, Bacillus megaterium, B. circulans, B. licheniformis, B. pumilus,

B. amyloliquefaciens. The effects were recorded by growth parameters (shoot and root length, fresh and dry weight and total dry biomass, collar diameter, number of branches).

Biofertilization affected all observed growth parameters. Significant increase in root length and weight of spruce and pine were noticed. At spruce seedlings, the increase of root length was 63% compared to control, and weight was increased 30% compared to control. Root length was increased 20% compared to control, and weight was increased 23% compared to control, at pine seedlings.

These results indicate the validity of biofertilization use for forest species growing in deposol.

Key words: deposol, spruce, pine, biofertilization, PGPB

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EFFECTS OF ALLUVIAL SOIL PROPERTIES VARIABILITY ON GROWTH OF WHITE POPLAR (*POPULUS ALBA* L.) CL. L-12

Rončević S.[1], Andrašev S.[1], Ivanišević P.[1], Kovačević B.[1], Novčić Z.[1]

Abstract: *White poplar (Populus alba L.) naturally formed communities Populetum nigro - albae Slavn. 1952, Populetum albae Knopp, Jov. 1965 and Populeto albae - Quercetum roboris Job. Tom et. 1979. In addition to natural communities artificially plantations with white poplar and its clones are established on the alluvial soils with expressed sandy texture composition.*

Research of impact of changes in microrelief and the fraction of soil on a small area of cultivation of white poplar (Populus alba L.) cl. L-12 were performed at the experimental field of Institute of Lowland Forestry and Environment in the vicinity of Novi Sad (N: $45^0$16'57'' E: $19^0$52'40'') on the soil of fluvisol, sandy form.

The experiment was established in 1991 year with the seedlings type of 1/1 at planting distance 3 × 2 m (1666 trees·ha^{-1}) in the system of rectangular arrangement. After ten years of development of plantation selective thinning was performed and density has been reduced to 650-700 trees·ha^{-1}.

Diameters at breast height and heights for all trees were measured in order to determine the elements of growth caused by forms of microrelief and variability of soil in a small area (approximately 40m). Area of plantation is divided into two types of microrelief. In each repetition one mean tree was felled and analyzed by section method to determine the elements of growth and yield.

After twenty years of development of plantation white poplar showed significant differences between the sizes of trees and other parameters of growth depending on changes of soil properties in small spaces.

Thus, these results indicate that there are significant differences in all aspects of growth that are caused by changing microrelief and soil textural class.

Key words: Leuce poplar, clonal selection, the variability of soil

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THE MOST COMMON INSECTS AND DISEASES OF OAK SEEDS IN CENTRAL PART OF SERBIA

MladenovićK.[1], RadulovićZ.[1], Milanović S.[1]

Abstract: *Due to the increasing of oak forests dying it is necessary to ensure the production of quality acorns in order to obtain sufficient quantities of quality seedlings for reforestation. The causes of reduced germination and failure in planting material are mostly due to the presence of pathogenic fungi and insect pests. This article specifies the most damaging insects and fungi on the seeds of oak trees recognized during the six year study. Isolated fungus cause mummification (Stromatinia pseudotuberosa), as well as rot and anthracnose of acorns (Cytospora intermedia, Gloeosporium quercinum, Pestalotia glandicicola and Phomopsis quercella). In addition to these there are also fungi that develop their continued decreasing seed germination after sowing, leading to the lodging (sudden dying) of seedlings, blight and root rot (Fusarium, Pythium, Botrytis and Alternaria). Also noted was the presence of saprophytic species of the genus: Penicillium, Mucor, Aspergillus and Trichothecium. The most common insect pests recorded in acorns belong to the genera Curculio and Cydia.*

Key words: oak trees, seed, acorns, insect pests, pathogenic fungi

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MONITORING OF SITE CONDITIONS IN THE *QUERCETUM FRAINETTO-CERRIS* STANDS

Galić Z.[1], Stojanović D.[1], Klašnja B.[1], Pilipović A.[1]

Abstract: *Monitoring of site conditions is an important issue of research in science today. In research a special importance belongs to the climate zones vegetation types. In Serbia climate zones vegetation types are represented by typical association of Quercetum frainetto-cerris. The paper will shown data of site conditions for this vegetation type in 2009, 2010 and 2011. year.*

The average monthly air temperature and relative air humidity are shown for July and August (the period in year with the most prominent extremes). Thus, the average monthly temperature in July was the lowest in 2010. year (20.5ºC), and the highest in 2009. year (21.5ºC). Compared to the average air temperature in July, in August, the highest average monthly air temperatures recorded in 2011. year (22.5ºC), and the lowest in 2010. year (21.0ºC).

In the period of research the greatest anomaly was recorded in September 2011. The average mean monthly air temperature was 20.9ºC. This temperature was in comparison to 2009. and 2010. higher by 2,1 and 4.9ºC respectivily.

The average relative humidity in this period was low in August 2011. (61%). In other months it was recorded moderate average relative humidity.

The lowest values of soil moisture were recorded following the month with the lowest average humidity.

Key words: *Quercus frainetto, Quercus cerris,* monitoring, site conditions

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PHYSICAL CHARACTERISTICS AND POTENTIAL USE OF HUMOFLUVISOL IN THE PROTECTED AREA OF ALLUVIAL PLAIN

Pekeč S.[1], Ivanišević P.[1], Katanić M.[1], Galović V.[1], Stojnić S.[1]

Abstract: *Humofluvisol soils spread out in the central part of the alluvial plain, and have a distinctive morphological structure. In studied soil ratio of the total sand and total clay was 61.64% and 38.36% respectively. Textural class of this soil was clay in surface horizons and sandy loam to sand in deeper horizons. Total porosity of investigated humofluvisol was on average 52.21%, while the value of the water accessible to plants was from 9.05 to 31.11 vol.%. The vertical permeability had different values with the depth of the soil profile and ranged from $1.3x10^{-3}$ to $8.9x10^{-5}$ cm/sec. Capillary rise, tested under laboratory conditions related to different horizons, had values from 12.7 to 24.9 cm. Based on the content of pores studied soil has the largest share of medium pores represented with 19.25 vol.%, while the coarse and fine pores were presented with 16.25 vol.% and 16.72 vol.%. Good supply of groundwater, soil moisture and favorable water-air condition point out that this soil has high potential for growing of soft broadleaves, primarily poplar cultivars.*

Key words: humofluvisol, granulometric composition, water-air conditions, poplar cultivars

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THE ROLE OF LITTER QUANTITATIVE TRAITS ON DECOMPOSITION AND NUTRIENT CYCLING OF THE FOREST ECOSYSTEMS

Rahman M.[1, 2], Tokumoto Y.[3], Shuvo A.[4]

Abstract: *Decomposition of plant material is an important component in the study of forest ecosystem because of its critical role in nutrient cycling. Different tree species have different nutrient release patterns, which are related to litter quantitative traits and seasonal environmental factors. The quantitative traits of leaf litter are important predictors of decomposition and decomposition rates increase with greater nutrient availability in the forest ecosystems. At the ecosystem level, litter quantitative traits are most often related to the physical and chemical characteristics of the litter, for example leaf toughness and leaf mass per unit area, and lignin content tannin and total phenolics. Thus the analysis of litter quantitative traits and decomposition is highly important for the understanding of nutrient cycling in forest ecosystems. By studying the role of litter quantitative traits on decomposition and nutrient cycling in forest ecosystems will provide a valuable insight to how quantitative traits may influence ecosystem nutrient dynamics. Such knowledge will hopefully contribute to future forest management and conservation practices.*

Key words: Litter decomposition· Quantitative traits· Nutrient cycling· Forest ecosystems

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PHYTOCENOLOGICAL CHARACTERISTICS AND DIVERSITY OF GROUND FLORA IN ARTIFICIALLY ESTABLISHED STANDS OF WEYMOUTH PINE, DOUGLAS-FIR AND LARCH IN THE AREA OF BOGOVAĐA

Stajić S.[1], Čokeša V.[1], Miletić Z.[1], Babić V.[2]

Abstract: *The paper presents the results of phytocoenological research and diversity of ground flora in artificially established stands of Weymouth pine, Douglas-fir and larch in the area of Bogovađa, on the site of Hungarian Oak and Turkey Oak with hornbeam (Carpino betuli-Quercetum farnetto-cerris (Rud.1949) Jov.1979). In forest cultures, richness and heterogeneity of ground flora becomes lower. 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 site conditions, which is largely reflected in their floristic composition. Also, 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 species in the shrub storey, which stopped developing ground flora.*

Key words: Artificially established stands, conifers, ground flora, diversity.

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HYDROLOGICAL FUNCTION OF FOREST IN WATERSHED AREA OF PALJANSKA MILJACKA ON JAHORINA MOUNTAIN

Rajić-Bijelić B.[1], Čabaravdić A.[2], Čengić I.[2]

Abstract: *Forests role is recognized globally pronouncing year 2011 as International year of forests. Also particular global attention is paid on water resources assigning the period 2005-2015 as "Water for Life" decade (Calder et al. 2007). Interaction of these natural resources opened new era in forest and water management challenging harmonized approach useful for society as on local so on global level.*

Forest management prefers productive function of forests although recognize other forest functions too (protective, hydrological, social and others). Forest management plans consider hydrological function of forest and try to maintain water potentials on forested areas assuming complete environmental protection.

The aim of this paper is to examine if hydrological function of forest is preserved in Paljanska Miljacka watershed area on Jahorina mountain.

Here is applied GIS modeling according to adapted Slovenian methodology (Ferreira et al. 2007). GIS modeling is based on intersection of internal (forest stand structure, canopy, management regime) and external (soil, slope terrain) factors resulting with maps of hydrological needs and forest capacity to maintain hydrological function. Joint map presents areas with different degrees of hydrological conditions.

Resulting map for forested watershed area of Paljanska Miljacka showed large area with emphasized hydrological function while in neighborhood commercial forests several stands are assigned as areas of high risk in hydrological sense.

This research provides methodology adaptable for forest management plans which could strength environmental protection as integral part of sustainable forest management planning.

Key words: environmental protection, forest hydrology modeling

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CHANGES OF A LAND USE IN THE REGION OF VRANJSKA VALLEY IN THE PERIOD 1963-2010

Braunović S.[1], Ratknić M.[1], Kabiljo M.[1]

Abstract: *A land use pattern is the sole erosion factor that can be controlled and governed by man. Since an inadequate land use pattern can cause intensification of erosive processes, it is possible to reduce their intensity by its change.*
The paper presents the changes of land use patterns in the region of Vranjska valley in the period between 1963 and 2010 and the impact of the changes on the intensity of erosive processes. The identification of wooded land, arable land, meadows, pastures, orchards, vineyards and infertile land performed in 2010 was based on field works and the analysis of high resolution satellite images. The comparison of the obtained results with the data for 1963 proved that the categories of barren land, forest, meadow and pasture underwent most intensive changes. The above-mentioned changes, along with performance of biological and technical works, resulted in a reduction of intensity of erosive processes in the examined period. The mean erosion coefficient for the region of Vranjska valley in 1963 amounted to Zsr = 0.67 (medium intensity erosive processes), while in 2010 Zsr = 0.34 (low intensity erosive processes).

Key words: land use, erosive processes, erosion coefficient (Z)

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THE EFFECT OF THE PERFORMED BIOLOGICAL WORKS AND CHANGES IN LAND USE ON THE INTENSITY OF EROSION IN THE CATCHMENT OF THE RIVER GABROVNIČKE REKE

Bilibajkić, S.[1] Stefanović T.[1], Nevenić R.[1]

Abstract: *The subject of the investigation presented in this paper is the effect of the performed biological and biotechnical works and changes in land use on the intensity of erosion and sediment yield in the catchment of the river Gabrovnička reka.*
Biological works carried out in the catchment of the river Gabrovnička reka as well as changes in land use due to population migration in the period from 1955. to 2009. had a significant impact on mitigating erosion processes.
The results of conducted investigations show that in 2009 the intensity of erosion processes on the investigated area was reduced in comparison to the period before the erosion control works were performed.
This reduction is manifested in the assessed state of the erosion processes (mean erosion coefficient) and in the calculated sediment yield and transport, which are caused by erosion processes.
Apart from the erosion control works performed in the catchment Gabrovnička reka, a change in the catchment demography also significantly contributed to the mitigation of the erosion processes. In the period from 1955 to 2009, there was a constant decrease in the population number in the catchment area and deterioration of its age structure. Due to the effects of depopulation and population ageing, a great deal of arable land, which was left uncultivated, was in time covered with forests and grass, which also had beneficial effects on the reduction of erosion processes.

Key words: biological works, erosion processes, erosion coefficient, sediment yield, sediment transport

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PROPOSAL FOR SILVICULTURAL TREATMENTS IN THE BEECH COPPICE STANDS IN MOUNTAIN KUKAVICA

Milosavljević I.[1]

Abstract: *Large area under the beech coppices, aged 70 years, in south Serbia represents a major technical challenge for successful transformation into a high beech stands.The goal of management is fully use of site potentials and improvement of environmental conditions. In this paper recommendations are given, for carryng out silvicultural treatments in beech coppice stands in their transition into high stands in area of Mountain Kukavica, near Leskovac. In this area, sample area measured 20 X 25m, was set. Tree taxation elements for all trees were measured, and dendrometrical analysis of diameter and height of thickest trees were made. For the environmental site conditions, data were collected. For all stems it was also determined biological position, crown and stem quality, and health condition. Taking into account large number of trees per hectare, based on research results, high performance selective thinning operations up to 26.8 % by volume, were recommended.*

Key words: beech coppice stands, ecological factors, silvicultural measures, conversion, thinning

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EFFECTS OF DIFFERENT REGENERATION METHODS ON YIELD OF BLACK LOCUST (*ROBINIA PSEUDOACACIA* L.) STANDS: A CASE STUDY

Keserű Z.[1], Rédei K.[1], Csiha I.[1], Gál J.[2]

Abstract: *Black locust (Robinia pseudoacacia L.)* is one *of the most important stand-forming tree species in Hungary, covering approximately 23% of the forested land and providing 25% of the annual timber output of the country. One-third of these black locust stands are high forest (seed origin) and the remainder are of coppice origin. In Hungary according to the forestry regulations black locust stands can be regenerated by root suckers and with seedlings. The paper investigates the influence of different regeneration methods on wood production, the quality of stems and the health of trees. According to the reckoned data the professional and careful regeneration from root suckers produced higher yield at final cutting age than the regeneration carried out with seedlings. There was no considerable difference between the average quality of stems and the health of trees in stands regenerated by root suckers and seedlings.On the basis of the results of investigations and considering the economic requirements, regeneration of black locust stands from root suckers may be recommended on sites of yield classes I-III (Rédei, Gál,* 1985*) on a larger scale.*

Key words: *Robinia pseudoacacia* L.; regeneration methods; yield;

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SECTION VI

Forest protection

IMPACT OF THE PRINCIPAL CHARACTERISTICS OF SOIL ON THE ABUNDANCE AND DISTRIBUTION OF THE ENTOMOPHAGA MAIMAGA RESTING SPORES AND SOIL MICROORGANISMS

Tabaković-Tošić M.[1], Golubović Ćurguz V.[1], Miletić Z.[1], Pižurica R.[1]

Abstract: *Cadavers of older Lymatria dispar (gypsy moth) larvae (from L_4 to finish instar) killed by the fungal pathogen Entomophaga maimaiga predominantly contain resting spores (azygospores). These cadavers frequently remain attached to tree trunks for several weeks before they detach and fall to ground.*

In spring of 2011, in the culmination phase of the new outbreak of the gypsy moth in Serbia, the higher mortality rate of the older gypsy moth larval instars was reported in the forest complexes of Belgrade region. In two sample plots, located at the site of Hungairan Oak and Turkey Oak forest (Quercetum frainetto cerris) and at the site of montane beech forest (Fagetum montanum), the principal characteristics of soil – a natural development environment for certain stadia of entomopathogenic fungi E. maimaiga and other microorganisms, were analysed. Physical and chemical properties, as well as the abundance and distribution of fungal pathogen and principal physiological groups of soil microorganisms, were examined. The existence of similarity in soil physical properties was revealed at both sites, whereas the differences between chemical properties were far more significantly pronounced. The differences in chemical properties of the soil and the organic layer resulted in manifestation of differences with respect to abundance and relations among principal physiological groups of soil microorganisms, but not for Entomophaga maimaiga.

Key words: *Entomophaga maimaiga*, soil properties, soil microorganism abundance

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INFLUENCE OF GYPSY MOTH FOOD ON THE BIOLOGICAL EFFICACY OF THE TESTED INSECTICIDES

Tabaković-Tošić M.[1], Koprivica M.[1]

Abstract: *One of the steps on the path towards obtaining the permission for putting into circulation and for application of some insecticide is the study of the biological efficacy of it, i.e. of its ability to reduce a number of economically harmful insects to the normal level, which is considered to be safe. The study of the biological efficacy in forestry, by contrast to the same researches in agriculture, is faced up with many difficulties and problems, the biggest of which lies in the fact that in the natural conditions it is only possible to perform it when the outbreak of the target species occurs on a huge area of land. As a result, the study of the biological efficacy of the selected insecticide should be done simultaneously with the registration of it for this purpose and with the application in the suppression of the outbreak of the harmful insect. It is not possible to perform all of these activities simultaneously. The preliminary studies of biological efficacy are mainly conducted in the laboratory conditions, when the natural food of the gypsy moth larvae is not available, so prior to the experiment and during it the gypsy moth is fed on the synthetic food, specially adapted for the basic nutritional needs of this insect. Therefore, these studies are aimed at checking whether there are any statistically significant differences in the levels of the biological efficacy of the selected insecticides when they are applied on synthetic or natural food. In the experiments carried out in the semi-controlled laboratory conditions the levels of biological efficacy of some insecticides are mainly significantly different. In regard to the factor – type of food, i.e. nutrition by the natural or synthetic food, the maximum biological efficacy of all insecticides achieved when they applied on Pedunculate oak leaves can be explained by the tendency of larvae to prefer the natural food to the synthetic one, regardless of the fact whether it contains the feeding stimulators.*

Key words: gypsy moth, insecticides, laboratory, biological efficacy

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INVSTIGATION OF *CYDIA SPLENDANA* HÜBNER AND *CYDIA AMPLANA* HÜBNER AS PESTS OF PEDUNCULATE OAK ACORN

Drekić M.[1], Vasić V.[1]

Abstract: *In order to ensure sustainable management of penduculate oak forests it is necessary to provide enough supplies of high quality acorn for natural or artificial regeneration. In this purpose, at Forest estate Sremska Mitorvica were established two seed orchards of penduculate oak. In first mast years at seed orchard Banov Brod was observed that greatest share of acorns is deteriorated before ripening of acorns, where dominant cause is addressed to acorn feeding insects. Investigations showed significant share of damages caused by Cydia splendana and Cydia amplana what initiated study of their biology and damage intensity. Research was conducted at seed orchard Banov Brod and insectariums of the Institute of Lowland Forestry and Environment. Results showed that C. splendana swarming spreads from beginning of July until end of August, with highest intensity in first half of August. Swarming of C. amplana was recorded from start of July until end of August. First caterpillars bored into acorns was observed in July with maximum number recorded in August for C. splendana and in September for C. amplana. Start of emerging of caterpillars from acorns was recorded in September and for C. splendana it ended in mid October, while for C. amplana it lasted until the end of October. Both species hibernate in the form of cocoon. Damages made by C. splendana and C. amplana were relatively high and in 2003 affected was 29,4% of yield, and 26,6% in 2004. Most of the damage was done by C. splendana.*

Key word: pedunculate oak, acorn, *C. amplana, C. splendana*

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SAME PHISIOLOGICAL CHARACTERISTICS OF THE TWO PATHOGENIC FUNGI FROM *OPHIOSTOMA* GENUS

Golubović Ćurguz[1], V., Karadžić, D.[1]

Abstract: *This paper presents the results of the study of the same phisiological characteristics of the two species of pathogenic fungi from Ophiostoma genus (Ophiostoma piceae (Munch) Syd. & P.Syd., and Ophiostoma ulmi (Buisman)Nannf). We have tested the influence of different temperatures and different nutritive media to the mycelia growth of this fungus, than fungal fermenting activity, firstly, production of oxidase and reductase.*

In the laboratory conditions we tesed the effect of different temperatures (6℃, 10℃, 11℃, 17℃, 18℃, 20℃, 23℃, 24℃, 26℃, 27℃, 31℃) and three different media: Malt Extract Agar (MEA), selective media (MEA with actidion and streptomycin) and PDA (Potate Dextrose Agar) on the growth rate and morphological shape of mycelium of fungi. The fungal fermenting activity was analyzed by testing the influences of isolated fungi on the media oxidation degree.

According to the results of our test fungi exhibited physiological activity at temperatures ranging from 6℃ to 31℃, while the best conditions for growth of mycelium in the temperature range from 20℃ to 27℃.

Our results show that better daily and weekly mycelial growth of O. picea was recorded on MEA nutritive medium, while O. ulmi had better growth on a selective medium MEA.

On media with gallic and tannic acid isolates showed slower growth, but the recorded oxidation of these substrates in all the samples.

Key words: O. picea, O. ulmi, temperatures**,** nutritive medium, growth of mycelium, fermenting activity

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PRESENT STATE OF BEECH BARK DISEASE IN SERBIA

Karadžić D.[1], Milanović S.[2], Radulović Z.[2]

Abstract: *Beech (Fagus moesiaca /Domin. Maly/ Czeczott) is the most widely distrubuted tree species in Serbia. The significances of beech in Serbia's forest economy is great. However, wider use of Beech wood is limited by its durability. Beech wood is an excellent medium for ther development of meny parasite and saprophyte organisms primarly fungi. Karadžić et al. (2002) describe 147 fungi on beech.*

In the beech forests an specially great damage can be caused by the fungi causing bark necrosis and canker. „Beech bark disease" is currently regarded ae the most serious disease of beech. The cause is considered to be a combination of an insect known as the beech scale (Cryptococcus fagisuga Lind.) and a pathogenic fungus (Nectria coccinea /Pers.ex Fr./ Fries). „Beech bark disease" was first discovered in the beech forests of Serbia in 1983 (Marinković and Karadžić, 1985). Detailed surveys of the most beech stands in Serbia show that this disease is widely distributed. The disease occurs endemically and a greater damage was recorded on Majdanpečka domena, National park „Djerdap", National Park, „Fruška Gora", Mountain Goč, at several places in beech stands in the region Južni Kučaj (the sites: Igrište-Tekuća bara; Kločanica, Kapatanske livate itc.). The most greates damages are observed in the beech stands of copice orgin on locality G.J. Igrište- Tekuća Bara (Š.U. Paraćin).

Based on our observation in the field, it sems that Fagus moesiaca is more resistant to beech bark disease than Fagus sylvatica, and for this reason the damages in beech stands in Serbia are notably lower.

In cases of heavier infections silvicultural measure are recommended, consisting of felling and conversion of attacked trees especially at the beginning of the disease development.

The paper presents the distribution of „Beech bark disease" in Serbia, as well as the description of the disease symptoms and development.

Key words: Beech bark disease, distribution, Serbia

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USE AND EFFICIENCY OF SOIL HEBICIDES IN CONTROLLING AMBROSIA (*ABROSIA ARTEMISIIFOLIA* L.) IN SPRUCE SEEDLINGS PRODUCTION (*PICEA ABIES* L. KARST)

Milijević I.[1], Isajev V.[2], Mataruga M.[3], Janjić V.[4], Delić S.[5]

Abstract: *Ambrosia (Ambrosia artemisiifolia L.) is a weed species which is very difficult to suppress due to its aggressiveness, strength and high adaptability and in this respect it is one of the most dangerous weeds. The research was conducted during 2007 and 2008 on the sample plot set in the nursery (where two year-old spruce seedlings were transplanted), in the nursery "Stanovi", Doboj. The following herbicides were used: (1) Lasso-atrazine (a.m. alahlor+atrazin) with a dose of 5.3 +1.5 l/ha and a concentration of 0.83% (2) Goal (a.m. Oksifluorfen) with a dose of 3 l/ha and a concentration of 0.5% and (3) Racer (a.m. Flurohloridon) with a dose of 2.5 l/ha and a concentration of 0.31%. The number of plants was determined by counting the total plants on 75th day (in 2007) and on 60th day (in 2008), after the completion of the treatment. Based on the obtained data, the coefficient of efficiency (CE) of certain herbicides was calculated, representing the relative ratio between the damaged Ambrosia plants in relation to their number on the controlled plot. The total number of Ambrosia plants on the controlled plots in the first year of production was 108, whereas in the second year it was 72 per square meter. In experimental fields which received the treatment, the Lasso-atrazine efficiency ratio in the first year was 76%, while in the second it was 86%. On the plots where the Goal was used, the efficiency ratio was 77%, while in the second year it was 89%. On the plots where the Racer was used, the coefficient of efficiency was 94%, and in the second year it was 96%. According to the presented results, we can conclude that the treatment with Racer showed the highest efficiency against Ambrosia plants, equally high both in the first and in the second year of the study in the nursery, while the Lasso-atrazine treatment showed the lowest effects in both years.*

Key words: herbicides, Ambrosia control, spruce seedlings

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OCCURENCE OF PATHOGENS FROM THE PHYTOPHTHORA GENUS IN FLOODED FORESTS OF THE LOWER SREM

Milenković I.[1], Keča N.[1], Letić Lj.[1], Nikolić V.[1]

Abstract: *This paper presents the results of the investigation of occurrence of pathogens from the Phytophthora genus in hydrophilic forests, Fraxino angustifoliae - Quercetum roboris, in the manage unit "Grabovacko - Vitojevacko ostrvo". This area is under the impact of flooded water from Sava river, or under the impact of underground water in the no flooded period, and due to its habitat characteristics creates a favorable conditions for the development of pathogens from the Phytophthora genus.*

The study has been performed during the growing season in the year 2011, at five locations in alluvium of Sava river. The observation of the fluctuations of groundwater levels is the ongoing project at the same localities.

Numerous Phytophthora species are related with hosts from Quercus and Fraxinus genus, and the aim of this study was to determine the presence of these pathogens, as well as to contribute to better understanding of the impact of flood and groundwater for the presence of Phytophthora species in this area.

Over 40 Phytophthora spp. isolates were obtained during this work, and after a detail morphological and molecular identification of obtained isolates, several different Phytophthora species have been confirmed. In addition, many Pythium spp. isolates were obtained.

Key words: *Phytophthora*, oak stands, hydrophilic forests, water regime

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RELATIONSHIPS BETWEEN POWDERY OAK MILDEW AND WEATHER VARIABLES

Markovic M.[1], Rajkovic S.[1]

Abstract: *The occurrence of mass dieback in oak forests is a consequence of the presence of powdery mildew, caused by the pathogenic fungus Microsphaera alphitoides Griff. et Maubl., which particularly affects new, young foliage susceptible to infections. The occurrence and development of oak powdery mildew are closely related to weather conditions during the year. This paper presents the incidence of the disease in relation to outdoor temperature and humidity in Serbia from 2003 to 2009, with a forecast of potential focal centres of infection in the coming period in relation to weather conditions, which is important for the purpose of protection.*

Key words: oak powdery mildew, weather variables, GIS

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BOTRYOSPHAERIACEAE FOUND ON DECLINING WOODY HOSTS IN SERBIA

Zlatković M.[1], Keča N.[1]

Abstract: *Species of Botryosphaeriaceae have been isolated as endophytes and canker pathogens from numerous hosts in many parts of the world and have been implicated in the decline of* forest, plantation and some ornamental trees*. These fungi have been associated with different symptoms such as shoot blights, stem cankers and dieback that have also recently been observed in Serbia. In the present study, botryosphaeriaceous fungi were isolated from both healthy and diseased plant tissues and fruiting bodies of a wide variety of native and introduced woody plant species (Cedrus spp., Picea spp., Abies spp., Pinus spp., Aesculus hippocastanum, Fagus sylvatica, etc.) planted in urban forests, parks, along streets, poplar and pine plantations and natural forest stands.*

Widespread dieback of trees in the cities of Serbia from which Botryosphaeriaceae (Diplodia, Fusicoccum, Dothiorella, etc.) were isolated may be due to unsuitable environmental conditions such as high temperatures, drought stresses, flooding, frost and insect damage observed during the last years. Imported nursery stock may also be an important source of this pathogens. Impacts of Botryosphaeriaceae could be even greater because of a high concentration of possibly highly susceptible trees in urban forests, managed parks and monocultures along roads planted in stressful conditions.

Key words: Botryosphaeriaceae, dieback, urban forests, parks, monocultures

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MOST COMMON DISEASE OF HORSE CHESTNUT (*Aesculus hippocastanum* L.)

Radulović Z.[1], Karadžić D.[2], Milenković I.[2], Milanović S.[1]

Abstract: *Horse chestnut (Aesculus hippocastanum L.) is an endemic species of the southern part of the Balkan Peninsula, and grows naturally only in the basin of the River Drim. Because of its ecological and decoration characteristics is often used as a park tree and alley. Due to increased exposure to harmful factors in the urban environment horse chestnut becomes physiologically predisposed to attack harmful organisms. This paper presents the results of two years of research into diseases that occur in all stages of growth of horse chestnut. The paper presents first report of the species from the genus Phytophthora on horse chestnut in Serbia. The most common isolated fungus from the assimilation organs was Guignardia aesculi that causes leaf blotch. The greatest damage on adult trees is caused by wood-decay fungus. The most significant wood-decay fungus on horse chestnut were Inonotus hispidus, Ganoderma applanatum and Ganoderma adspersum.*

Key words: horse chestnut, pathogenic fungi, *Guignardia aesculi*, *Phytophthora sp*.

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THE PROSPECT OF A SHORT-TERM PRESERVATION OF THE OAK LOGS AT THE FOREST STORAGES USING ENVIRONMENTALLY FRIENDLY PRESERVATIVES

Mirić M.[1], Ivković S.[1], Vuković M.[1]

Abstract: *The problem of log-protection at the forest storage emerges instantly after the timber fall and is especially important for prolonged period of storing, due to the surrounding conditions. Numerous pests as xylofagous insects and decaying fungi attack trunks in order to provide nutrients for their growth. The possibility of short-term protection of Oak logs (Sessile Oak - Quercus petraea agg. and Pedunculate Oak - Quercus robur L.), has been tested at the three different geographical sites, using four wood preservatives based on chrome/copper/boron salts, chlorinepiriphos/dichlorinefluanid, Cu– naphthenate and antiseptic paste. Treated logs were artificially inoculated at the surface, using developed dicariotic mycelia of five Oak wood-rotting fungi. The separate control series of log-samples have been exposed to the spontaneous infection in the forest. The test results showed that those wood preservatives provided satisfactory protection of Oak trunks just for the short period of time (four weeks). The most frequent cause of log-sapwood deterioration has been spontaneous infection by sporas of fungus Stereum hirsutum at the forest sites. That was the outcome of the high level of Stereum hirsutum inoculum, as well as the microclimate conditions and pioneer character of fungus itself. Taking into consideration the unsatisfactory effects of the applied protection, recommended measures are of the organisational and technical issues. The proper transport of logs out of the forest is the most recommending one.*

Key words: *Stereum hirsutum*, CCB, chlorinepiriphos/dichlorinefluanid, Cu–naphthenate, log-preservation.

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ESTABLISHMENT OF HYMENOPTEROUS ENTOMOFAUNA ON INDIGO BUSH *AMORPHA FRUTICOSA* L. IN REPUBLIC OF SERBIA

Gagić Serdar R.[1], Mihajlović Lj.[2] , Mladenović K.[1], Bilibajkić S.[1]

Abstract*: During six years research studies of aggressive invasive host plant Amorpha fruticosa L. and its entomofauna, significant number of hymenopterous species had been recorded. Data analyses were done from statistically significant samples collected around the country. Primarily, the paper presents results of the parasitoid complex established on introduced monophagous indigo bush weevil Acanthoscelides pallidipennis Motschulsky. Coleoptera: Bruchidae: Bruchinae feeding in its pods. Special attention was on assessing and monitoring of new formed inter species relations between autochthons parasite wasps and herbaceous seed weevil beetle. As cosmopolitans, two subgenera species of Eupelmus and Anastatus (Chalcidoidea: Eupelmidae) were found commonly feeding on weevil larvae and pupa with ectoparasitoid status. The evidence of hyperparasitism existence as a phenomenon was established by specimens eclosion of Proctoptrupoidea: Diapriidae and species of genera Torymus (Chalcidoidea: Torymidae) and Tetrastichus (Chalcidodea: Eulophidae). One specimen from family Scelionidae (Hymenoptera: Proctoptrupoidea) appeared from pods sample, with status of fresh beetle egg parasite. Material was stored and exposed to outside weather conditions, and available to infestation. The most frequently insects found feeding on stem bark was scales. At least two scale species were recognized as A. fruticosa common pests. Mulberry scales, or Pseudaulacaspis pentagona Targ. Homoptera: Diaspididae and False plum scale Parthenolecanium corni Bouche. Homoptera: Coccidae were also monitored in different development stages. Adults of Chalcid wasps from families Aphelinidae, Eurytomidae, and Mymaridae (Hymenoptera: Chalcidoidea) and Braconidae (Hymenoptera: Ichneumoidea) appeared, living emergence holes after, on scale female mature shields. Leaves and branches material collecting in a goal of detecting damage caused by Metcalpha pruinosa Say (Hemiptera: Flatidae) on Indigo bush resulted with apterous specimens appearance-family Dryinidae (Hymenoptera: Chrysidoidea). Innitial hypoteses that genera Oedaule (Chalcidoidea:Pteromalidae) is zoophagous weevil larvae parasitoid, was rejected after studious laboratory work and confirmed as endophagous herbivore feeding in seeds also as the most common one.*

Key words: Pods, *Amorpha* , Weevil, Scales, parasitoids, parasitic wasps

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SURVIVAL OF FIVE WOOD DECAYING FUNGI TREATED WITH THE CERTAIN ENVIRONMENTALLY FRIENDLY WOOD-PRESERVATIVES *IN VITRO*

Mirić M.[1], Ivković S.[1], Vuković M.[1]

Abstract: *Wood preservatives based on the chrome/copper/boron (CCB) -salts, chlorinepiriphos/dichlorinefluanid and Cu-naphthenate were evaluated according to the effect on the following wood-decaying fungi: Stereum hirsutum, Chondrostereum purpureum, Stereum rugosum, Xylobolus frustulatus and Trametes versicolor. Fungal cultures were grown on the Malc-agar media containing 0.1, 0.5, 1, 5, 10, and 20% of the antiseptic. The lowest concentration with the lethal impact and the highest concentration with the fungistatic effect were estimated. Being time-depended, the impact of the different concentrations were analysed by exposing the mycelia directly to the antiseptic chemicals for 1, 3, 5, 10, and 15 minutes. This way, the toxical margin of the preservative was found and presented as a combination of two factors - the lowest concentration of the preservative and the shortest time of exposing, which had a lethal effect on fungi. With the Cu-naphthenate preparation the best results were achieved, while the other two were a little less effective. Wood-preservation at the forest storages can be based on these results. Nevertheless, lab-experiments (in vitro) can be used only as a start position for the experiments in a living environment (in vivo), because the outcomes do not correspond very often. That is, alteration of just one of the influential factors in the natural surrounding can cause entirely different micro-organisms reactions on the tested agents, comparing to the lab-originated results. The reason lies in the inevitable simplification of the experiments in vitro, comparing to the ones in vivo. Still, prior to a large-scale application of any wood-preservative stand lab-experiments. They are placed before the tests at the forest-storage, as to assess the area of outdoor application, especially for the freshly fallen stems, that are of the highest risk when it comes to the wood-decaying fungi.*

Key words: lethal concentration, Stereum, CCB-salts, chlorinepiriphos/dichlorinefluanid, Cu-naphthenate.

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NATURAL FOREST DYNAMICS FOLLOWING BARK BEETLE CALAMITIES IN THE ALPINE NATIONAL PARK BERCHTESGADEN (GERMANY)

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Abstract: *The last national forest report of the German federal government (Federal Ministry of Food, Agriculture and Consumer Protection 2009) attributes an important threat to German forests over the last decades to bark beetles. Higher amounts of unpremeditated harvests caused by bark beetles in middle Europe during the last century (Schelhaas et al. 2003, Engesser et al. 2008) reflect this development. Even elevated mountain forests face increasing risks of infestation by Ips typographus and Pityogenes chalcographus under mild spring and dry summer conditions (Krehan & Steyrer 2006). Moreover, the forest report highlights the danger of a further increase of bark beetle calamities driven by climate change in the future (Federal Ministry of Food, Agriculture and Consumer Protection 2009). This development rises the questions how the succession of affected stands will go and which changes may occur to plant and animal species in the forest ecosystems.*

Although already in the 1990s several bark beetle outbreaks occurred in the alpine national park Berchtesgaden, spruce bark beetles cause a significant die-off of spruce stands since the winter storm Kyrill in 2007. In contrast to managed forests where most often active control, harvest and regeneration measures are conducted no manipulation of natural dynamics takes place on approximately 6.000 ha of forest land in the national park.

During this three-year-study (2012-2014) approximately 200 survey plots will be installed in stands of different altitudes and aspects over the core zone of the national park within three categories – stands with no impact by bark beetles, stands influenced by bark beetle calamities in the 1990th and those recently attacked. Here, we present preliminary results regarding projections of medium term forest development and the influence of bark beetles on selected species groups (e.g. wood decaying fungi, arthropods).

Key words: forest succession, mountain forest, *Ips typographus*, regeneration, biodiversity

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CONTRIBUTION TO THE KNOWLEDGE OF THE FAMILY PHYTOSEIIDAE (ACARI) ON OAK TREES FROM AVALA MOUNTAIN

Mladenović K.[1], Gagić Serdar R.[1], Čokeša V.[1]

Abstract: *The diversity of the predatory epiphyllic mites from the family Phytoseiidae Berlese are the subject of numerous studies worldwide because of their increasing role in the integrated pests control of plant cultures. The species from family Phytoseiidae are natural enemies of epiphyllic micro-arthropods. They are common predators of phytophagous mites from superfamily Tetranychoidea and Eriophyoidea, but also usually these mites develop by feeding with small insect's species belong to Thysanoptera and Homoptera orders.*
Diversity of predatory mites from family Phytoseiidae has been partially investigated on cultivated plant species in forestry in Serbia. Forests are natural source of numerous populations of phytoseiid mites, because of the diversity of plant species and stability of its environmental conditions. Potential colonization of forests trees with these organisms comparing to same process in agro ecosystems depends on the proximity of natural vegetation cover (Tixier et al., 1998). Worldwide has been described over 2250 species of this family (Moraes et al., 2004) of which are more than 20 species commercially has been used in the biological control of phytophagous mites and certain insects. Until now, 28 species phytoseiid mites have been established in Serbia (Kropczynska & Petanovic, 1987; Petanovic & Stojnic, 1995; Stojnic et al., 2002; Mladenović at al., 2010). The paper presents the results of these mites diversity investigation in coppice, high and artificially established stands of oak forests on Avala Mountain. Examination included five native plant species of the genus Quercus: Q. cerris L., Q. robur L., Q. frainetto Ten., Q. petraea Liebl and Q. pubescens Willd. Mountin Avala was pronounced as „exceptional nature features area," in 2004. and it is represented with great wealth of both autochthonous and allochthonous species. Forest vegetation on Avala is largely consists of coppice oak forests with the following oak species: Turkey oak, English oak, Hungarian oak, Sessile oak and Downy oak in smaller scale.Research of epiphyilic fauna on oaks as host plants on Mount Avala, resulted in detection of the presence for only three species of mites of the family Phytoseidae. Species that were found are: Euseius finlandicus (Oudemans 1915), Amblyseius (Amblyseius) andersoni (Chant 1957) and Kampimodromus aberrans (Oudemans 1930). Predatory mites of the family Phytoseiidae were found on all five oak species. The area is rich with uncultivated plants, it represents a reservoir of these natural enemies of phytophagous arthropods, so it is imperative that further researches of predatory mites diversity in Serbia should be significantly focused on forest plant species.

Key words: Phytoseiidae, Quercus species, Avala mountain, Serbia

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DEGREE OF DEFOLIATION AND THICKNESS STRUCTURE OF TREE STANDS IN STARA PLANINA MT. (BALKAN RANGE), OBJECT OF LONG-TERM OBSERVATIONS

Tsakov H.[1], Delkov A.[1]

Abstract: *The degree of defoliation of the crown of beech, oak and pine forests was investigated in the Fore-Balkan, Central and Eastern Balkan Range. Best growth in thickness (diameter) show trees from defoliation degree "0" (healthy). Oak forests are in worse health stands compared to beech ones and with higher degree of decreasing of their foliar mass. Pine plantations (not typical for the region) are in worsened condition. The intensity of defoliation is connected with decreasing of the size of needles and with forming of crowns with 1- and 2-year-old needles.*

Key words: defoliation degree, stands structure, crown, growth thickness, health status

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DISTRIBUTION OF *ENTOMOPHAGA MAIMAIGA* HUMBER, SHIMAZU AND SOPER (ENTOMOPHTHORALES: ENTOMOPHTHORACEAE) ON BALKAN PENINSULA

Georgiev G.[1], Tabaković-Tošić M.[2], Pilarska D.[3,5], Mirchev P.[1], Georgieva M.[1], Petkov P.[1], Pilarski P.[4]

Abstract: *Entomopathogenic fungus Entomophaga maimaiga Humber, Shimazu and Soper (Entomophtorales) (Entomophtoraceae) was introduced in three populations of gypsy moth (Lymantria dispar L., Lepidoptera: Lymantriidae) in Bulgaria in the end of 20th century. After the first strong epizootics in 2005 the species increased its distribution by a natural range extension. Nowadays it is widespread in nearly all regions of the country in which L. dispar occurs. In 2011 the fungus depressed gypsy moth outbreaks in oak forests of Central Serbia (Belgrade and Valjevo regions). In the same year E. maimaiga was found also in two localities of European part of Turkey (Strandzha Mountain). In 2012 mortality of gypsy moth larvae caused by the pathogen was observed in forests of Avala hill near Belgrade. It is very likely that E. maimaiga is distributed in other Balkan countries (Greece and F.Y.R Macedonia), due to the fact that no outbreaks of the pest occur in this region.*

Key words: *Entomophaga maimaiga*, distribution, *Lymantria dispar*, epizootics, Balkan peninsula

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FLIGHT ACTIVITY AND BIOLOGY OF *IPS SEXDENTATUS* BOERNER IN BLACK PINE (*PINUS NIGRA* ARNOLD) FORESTS OF ISPARTA, TURKEY

Sarikaya O.[1]

Abstract: *Bark beetles cause serious losses by their damage in Black pine forest of Isparta region every year. Ips sexdentatus Boerner (Col.: Curculionidae: Scolytinae) is one of the important harmful bark beetle species in these stands. Ips sexdentatus adults are strong fliers capable of covering several kilometers for searching suitable host trees. In Isparta region, sometimes it has higher population and can make epidemic belonging to climatic conditions. By damage, it causes important economic losses in Anatolian black pine forests. This study was conducted to determine flight activity and biology of I. sexdentatus during 4 year between 2006 and 2010. For this aim, Black pine forest of Aksu province in Isparta was choose as research area and studies were conducted in two different stands of this area by using trap trees and pheromone traps. Scandinavian type funnel pheromone traps and pheromone dispensers and also trap trees are used for catching adults and monitoring of flight activity. Traps were checked weekly periodically and adults' numbers were recorded. Also, biology of I. sexdentatus was monitored by trap tree observations. It was observed that active flight period started when the average temperature was over 10°C in regional conditions. According to adult counting results, maximum population level of I.sexdentatus was occurred in 2009 in Black pine forest of Isparta region in Turkey.*

Key words: *Ips sexdentatus*, *Pinus nigra*, Turkey, flight activity, biology.

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TECHNIQUE DEVELOPMENT OF THE SENGON PROTECTION FROM *GANODERMA* INFECTION

Herliyana N.E. [1], Taniwiryono D. [2], Minarsih H. [2]

Abstract: *Sengon tree (*Paraserianthes *falcataria* (L.) Nielsen) currently becomes a major forest tree species widely *planted by smallholders in Indonesia. The wood of this is quick growing and relatively easy* to *sell. However, level of plant safety sengon between crop plantations and other forestry need to be assessed considering the sengon tree is alternative host of Ganoderma* spp. *Studies have been conducted to know the presence and diversity of Ganoderma* spp. *on the sengon tree and some ways inoculation on sengon plant in the nursery. The results showed that Ganoderma* lucidum *was found on the sengon* tree *and cacao plant, generally on the dead stump*. T*he test results of genetic diversity obtained genetic similarity between G. lucidum from sengon and cacao are quite close. The results of inoculation of G. lucidum testing on seedlings sengon showed that* both *isolate from cacao and sengon* tree *able to infect a sengon tree back.*

Key words: *Ganoderma*, *Paraserianthes falcataria*, genetic diversity

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SECTION VII

Forest policy

POSITIONING FOREST RESEARCH IN THE FUTURE – THE CONTRIBUTION OF IUFRO

Buck A.[1]

Abstract: *In 1992, the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil, established the concept of "sustainability" as a global norm for utilizing natural resources, including forests. Sustainability requires the reconciliation of environmental, social and economic demands on forests through appropriate management practices and policy frameworks. The role of the scientific community is to provide state-of-the-art information about the most effective approaches to forest management and policy.*
Twenty years after UNCED, the context for sustainable forest management and forest research has changed profoundly. An increasingly comprehensive set of international goals and priorities has emerged to steer forest use and conservation, accompanied by a diverse array of institutions, policies and mechanism. Many of these institutions, policies and mechanisms focus on broader sustainability issues, with forests being only part of their agenda. Against this background, it is important for the forest science community to demonstrate the contribution of its research to addressing these broader sustainability issues. As a member of the Collaborative Partnership on Forests (CPF), an arrangement among 14 leading international organizations with substantial programmes on forests, IUFRO plays a key role in promoting global cooperation in forest-related research and in disseminating scientific knowledge to stakeholders and decision-makers. IUFRO brings together about 650 member organizations with about 15,000 researchers in more than 120 countries, including in Southeast Europe. The IUFRO Strategy 2010-2014 with the theme "Reading the pulse of forest science for the benefit of forests and people" sets out six thematic areas that are meant to guide the science collaboration within the nine disciplinary Divisions of IUFRO and to provide entry points for collaboration with researchers from various other scientific disciplines in currently nine interdisciplinary Task Forces. The six themes are: forests for people; forests and climate change; forest bio-energy; forest biodiversity conservation and environmental services; forest and water interactions; and resources for the future. Each of these six themes constitutes a key aspect of sustainability. The presentation will provide information about how IUFRO addresses the above mentioned broader sustainability issues and associated risks and challenges through its global network of forest research and education institutions and scientists. Broader research for sustainability is also reflected in the on-going preparations for a new IUFRO Strategy 2015-2019.

Key words: sustainability, global science network, interdisciplinary, cooperation

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THE RISE AND DOWNFALL OF THE PRIVATE FORESTRY SECTOR INITIATIVE IN CROATIA

Kiš K.[1]

Abstract: *This paper shortly describes the development and failure of the private forestry sector initiative in Croatia regarded through the aspects of contemporary political situation and inherent sectors (agriculture, nature protection), giving a short history of the development of forest policy regarding private forests and describing how policy makers are still, to a very high extent, influenced by the general politics.*

It was not before the 3rd millennium that private forestry sector in Croatia started to develop. This changes were driven by the general transition process accompanied by the process of integration to the EU and, of course, personal interests of the parties involved (their leaders, to be more precise). In the period 2005-2007, two important forestry institutions were founded (Forestry Chamber and the Forestry Extension Service) as well as numerous PFO organizations. These organizations were later gathered under the umbrella organization of the Private Forest Owners' Union, which set an ambitious goal of joining the CEPF in near future.

As part of the anti-recession measures, the Government shut down the Forestry Extension Service by the end of 2010 and the Parliament amended the Forest Act in a way that declared the monopoly of the state forest company over all jurisdictions in private forests. The PFO Union ceased with all activities and was simply snuffed, which brings the question if it represented the interests of PFOs in the first place. These events by the end of 2010 definitely marked (hopefully, only temporarily) the failure of the private forestry initiative in Croatia.

In other words, the pre-requisites for the beginning of a sound forestry policy-making process in Croatia have not yet been acquired.

acronyms:
PFO - private forest owners
CEPF - (Confederation of European Private Forest Owners)

Key words: Forestry, private forestry sector, private forest owners' associations, Forest Extension Service, Forestry Chamber, Forest Act, stakeholders, parties, policy, politics

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PROTECTED AREA AND THEIR INTEGRATED MANAGEMENT – A CHALLENGES FOR IN THE FUTURE NATURE ECOSYSTEM MANGEMET

Haska, H.[1], Tabaku, V.[1], Metalia R.[1], Damo, R.[2]

Abstract: *Forest ecosystems are more important in establishing and maintaining the natural equilibrium. In the context of natural ecosystems in many countries of the world, Europe, the Mediterranean, but also and in Albania, are designated as so-called Protected Areas (PA).*

"PA considered a piece of land and / or sea, designated primarily for the protection of biodiversity, natural and cultural resources that accompany it and that way managed legal and / or other effective ways"(IUCN)

PA can be different; such as forest, water, wetland, agricultural, urban area,or can be a combination of them, but in fact more are represented by forest ecosystems.

Ecosystem-based management (EBM) is a promising new paradigm in the interdisciplinary fields of natural resource policy, planning and management. The ideas associated with EBM are now widely discussed in the scientific literature, the rhetoric of environmentalism, the policy of natural resource management, and even in courts of law. EBM can be an approach to guiding human activity using collaborative, interdisciplinary and adaptive methods with the long-term goal of sustaining desired future conditions of ecologically bounded areas that, in turn, support healthy, sustainable ecological and human communities.

Aim: *to examine current management of protected areas and to see him as a future perspective for a more complex and integrated management view it in the context of natural ecosystems management.*

Conclusions: *integrated management of Protected Areas, including in particular and national parks, can and should be realized in the framework of the management of ecosystems and natural resources, as a governance innovation Protected Areas, some of these issues will be addressed in this paper*

Key words: protected area, national park, integrate management, conflicts, using and proprietary right

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ADOPTION OF NEW FOREST POLICY IN ALBANIA IN RELATION WITH CURRENT FORMS OF OWNERSHIP IN THE FORESTS, FOR A THEIR GOOD GOVERNANCE

Haska, H.[1], Tabaku, Metaliaj R.[1], V.[1], Damo, R.[2]

Abstract: *As and in others country, and in Albania, in the past have existed different forms of ownership on forests. But, in fact, more evident were the forms and rights of use of forests (forest using rights). So from the Middle Ages and even in the Ottoman Empire have existed forms of public and private ownership, but the rights of use have been more in the form of community.Again, even after the declaration of independence (after 1912 year) continued to exist different forms of ownership and use of forests and pastures in Albania.*
In the communist period (1944 - 1990) was nationalized all forests and sawmill.After 1990 year , was recognized again by the law of the three forms of ownership; private, communal , and state. Enough forest areas are returned true owners. But in recent decades is done a greater decentralization, and more forests and pastures in the beginning are given in using and after in the property of the community and specifically Local Governemnet Units (LGU), thus communes and municipalities of the country.
Today we currently have a structure such as forest ownership in Albania: 60% communal forests, 37% state forests and 3% private forests. But the creation of this new structure of ownership on forests, without question that requires an adaptation and improvement of new policies in the management and governance of forests.
Aim: to examine current forest governance and evidences suggest tools / mechanisms in the future for a governance perspective as well and integrated view this in the context of current forms of ownership and use in the area of forest in Albania...
Material and methods: evidentation, collecting, classification and analysis some data from forest ownership and using rights in diverent period in Albania, as well as giving some suggestions for adaption of new forest policy in future forest development and governance.
Expected outcomes: will examine current forms of ownership and current forest governance and will evidences suggest tools / mechanisms for better governance and integrated in the future, in the area of forest in Albania,
Conclusions: forest governance in certain stages of time , see it in the proportions of ownership forms and their use, has been, and will have and in the future , a very significant character, and without doubt also requires an evidentation and after an adaptation to these developments in the context of governance as the best of these very important natural resources such as forest ecosystems, so, some of them issues will be treated in this paper.

Key words: forest policy, ownership, using and proprietary right, governance, adaption, legislation.

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FIRES IN FORESTS, SOME OF MAIN CAUSES THAT CAUSE THEM - A REVIEW CASE IN LAST YEARS FROM ALBANIA

Haska, H.[1], Metaliaj R.[1], Thoma H.[1], Kaci, A.[2], Habibi, B.[1]

Abstract: *Natural forests are a great asset around the globe. But they in many cases risk to be damaged for different reason and causes. In some cases, human interventions have causing enough damage to forests, such especially logging and deforestation without criteria. But in many other cases the damage are causing in forest and by attaced from various diseases and pests, but at any time colossal damage on forest ecosystems have been caused, by fires.*

So for example, we noticed that the global level during last years are burned a lot of forest surface, 1% of the total forest surface Worldwide damaged annually by fire but note that there are many countries that do not report correctly in forest firesand according ot the regions Europ were most affected.In the countries surrounding the Mediterranean Sea, fire is the main cause of destruction of the natural vegetation. Each year about 50,000 fires reduce to ashes 700,000-1,000,000 ha of forestlands, causing tremendous ecological and economical loss. For example last year have described broad enough colossal forest fires in Greece, Croatia, etc, and obviously also in Albania.In Albania, as results of its geographical position and very hot periods, but also for and other different reasons, there was in the past, but and in recent years a lot of episodes of the emergence of fires in forests and pastures.

Cases show that fires in forests and pastures in Albania are observed more during the hot periods of the year, mainly in springtime, at the end of it, and in the summer, and it reaches peak in the months June-July-August and begin decline curve in the months September-November, where after almost never appear at all in the months of the year end.

Causes of the fall of fires in forests and pastures are different. We can underline some of the main causes of the fall of the fires, and concretely: starting from the global warming, climate change and the consequences that come from those changes; property issues; inadequate sense of responsibility of forestry staff or local governmentetc.; problems with the use of the territory and conducting forest operations as higher benefits; lack of access to perennial entry in forests and pastures and with the appropriate tools; the lack of auto roads or tractor roads; tools and insufficient technical and non-effective in extinguishing them; irresponsible peoples or tourists, shepherds, workers, etc, which pass through forest and pasture areas; low budget allocated for their detection and extinguishing, or and other unknown reasons, as for example falling atmospheric lightning etc.

Some of these problems will be presented in our modest paper that we are presented with main aim to recognizing the situation, some of main the causes, and the trend for the future, as well as giving some recommendations.

Key words: forest fires, Albania, demage, conflicts, causes

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FRESHWATER RESOURCES IN ALBANIA AND THEIR IMPORTANCE FOR VEGETATION - ACTUAL SITUATION, PROBLEMS AND PERSPECTIVE

Canaj E.[1], Peculi V.[2]

Abstract: *Albania has a lot of water resources but often their quality is a problem due to pollution, especially in lowly field areas where live the most part of population and most industrial and agricultural activities are developed.*

General renewable water resources in Albania are about 13 300 m^3 per capita in one year.These resources are used for urban, industrial and agricultural,vegetation - included here and forestry purposes, as well as to provide electrical energy production by hydrocentrals .

Surface water also comprised a high rich for the economy of our country. Surface water are very important for good few uses such as electrical energy, agriculture and forestry or vegetation in general, fishery , tourism, industry as well drinking water supply.

Also Albania is rich with groundwater sources too, that are very important except of others and for the growth of trees. The renewable resource count to be 1 250 million m3 / year in main seven geological stratum.

There are a lot of cities and inhabited centres as well as enough industrial, agricultural and farming areas that influences in pollution of surface water and groundwater too.

Management and protection of water environment is one of the important activities in our country. To have a sustainable development, take a special importance the evidentation and the find of efficient roads and technologies for rational uses of natural resources as well as quality and quantity control of impact on environment.

What are states (S) and impacts (I) related to this theme, including impacts on the natural environment and human health/well-being, both at national level as well in transboundary terms?

Evaluation of real state of surface water in rivers and lakes and control of their pollution level is performed via monitoring in compliance with National Program on Environmental Monitoring Based on DCM no.103, dated 31.03.2002 "On environmental monitoring in Republic of Albania", the institutions contracted by Ministry of Environment, Forests and Water Administration monitore the quality of surface water, bathing water, groundwater and wastewater discharges.

There is a monitoring of wastewater discharges in main cities of Albania which measures the impact of wastewater discharges into surface waters (rivers, lakes, coastal seawaters). Monitoring on water quality is carried out for some cities in Albania in urban and rural areas, including here and some vegetation areas. Study on state of surface water quality is realized through information provided by expeditions carried out in 30 stations of national monitoring network of river water quality as well as monitoring expedition in 6 lake stations.

Key words*:* water reseources, Albania, groundwater, vegetation, forest, impact, rivers, lakes

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GOODS AND SERVİCES OF FOREST ECOSYSTEMS

Yeşil A.[1]

Abstract: *All forests provide significant goods and services. They serve as recreation sites, for example for hiking, hunting and orienteering. They contain considerable landscape aesthetic, natural history and cultural history values. They stabilize climate, regulate water, bind soil and sand, and reduce soil-, water-, air and noise pollution. They provide timber, clean water and climate amelioration. Furthermore people can be employed in Forestry.*
This paper deals with the new aproach for classification of goods and services of forest ecosystems. Actually, there are many definitions and many classifications, but there is no accepted definition or classification of ecosystem services. Millennium Ecosystem Assessment (MA) framed the idea but other initiatives have approached these problems differently and suggested alternative ways. MA divides the ecosystem services into four different classes: (1) Provisioning Services (2) Regulating Services (3) Cultural Services (4) Supporting Services. One of the other initiatives Common International Classification of Ecosystem Goods and Services has offered different classification.
Within the study it has been compared the two approaches and some conclusions for Turkish forestry applications.

Key words: Forest ecosystems, Forest functions, Goods and services

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LEVEL OF STAKEHOLDERS PARTICIPATION IN SPATIAL DECISION MAKING PROCESSES

Lovrić L.[1], Lovrić M.[1], Martinić I.[2]

Abstract: *This research aims to identify the stakeholders influence on the spatial planning processes for Nature Park Medvednica, trough assessment of their level of participation. Nature Park Medvednica is a mountainous protected area adjacent to Zagreb, the capital city of Croatia, and was taken as an example process, which spans onto tree decision making attempts. This Nature Park struggles for 30 year to hold back the pressure of urbanization. Because of the inexistence of spatial plan, which is required with the Croatian laws, its area was significantly decreased in 2009. The study was conducted in the framework of stakeholder analysis, for which a series of in-depth interviews with - stakeholders were performed, and documents concerning the spatial plan were analysed. The data gathered explains which are the disadvantages of the three processes of the formulation of the spatial plan and is providing a possible theoretical explanation or a model which can be implied in any decision making process involving stakeholders in natural resources management within a given political and cultural context. Description of the past and current spatial planning situation of the NP Medvednica was specified and issues and stakeholders concerning the creation of the spatial plan where identified. The key conflict areas that affect the formulation of spatial plan were methodologically detected and examined. The level of participation of stakeholders in the context of fulfilment of their own interests was assessed as well as the influence on participation processes of different stakeholder groups on the formulation of the spatial plan. In order to have proper citizens and stakeholders participation exercised some changes in the legislation and acts should take place.*

Key words: stakeholders, participation, decision making, spatial planning

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USE OF SOCIAL NETWORKS IN SE „SRBIJAŠUME"

Antić J.[1], Zelić M.[1], Jančić G.[1]

Abstract: *From the standpoint of scientific, technological and sociological Internet and social-networks have made a breakthrough in understanding the functioning and everyday life and work. Social-networks is one of the most democratic medium because it allows diffuse and two-way communication.*
The economy of every country is a driving force of society. Today's market environment requires increasing use of information technologies that companies need to ensure greater efficiency.
Environmental problems are complex and global. The current way of life is unsustainable. Common planetary home will be saved if the forest protection will be good.
For the survival of future generations, population of the Planet, every day, is informed and warned about these problems.
Online social networks Facebook, LinkedIn, Twitter, MySpace, LiveJournal are an integral part of modern business: marketing, PR, promotion of healthy lifestyles and environmental protection, and other business segments. It may be always online, today, wherever you are thanks to modern telecommunications infrastructure. It can be at any time surfing the Internet portals, to access e-mail, watch and listen to multimedia content HD format on YouTube.
Social-networks have become an integral part of our lives, we are often faced with the delicate problem of choosing the content set on the social network. Facebook, LinkedIn, Twitter as a communication media that have been accepted by a wide range of users. These networks allow the use of all types of content, including video-content information.
SE „Srbijašume" ready to confront the new challenges of modern communication and business communication is directed to a specific target group has included the application of social network Facebook. Social responsibility of „Srbijašume" requires a careful choice of professional content, as appropriate interactive communication with users.

Key words: Social networks, SE „Srbijašume"

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ROLE OF STAKEHOLDERS IN THE IMPLEMENTATION OF THE HABITATS DIRECTIVE IN CROATIA

Lovrić M.[1], Lovrić N.[2], Martinić I.[2], Landekić M.[2], Vuletić D.[1]

Abstract: *The Council Directive 92/73/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EC Habitats Directive) is, alongside the EC Birds Directive, the legislative basis upon which the EU-wide network of protected areas (Natura 2000) is built. The first step is the national proposal of Sites of Community Importance (pSCI), which should be based just on scientific criteria. Croatia is now in the process of designating pSCI's, and has formed a working group dealing with forestry section of Natura 2000 under the leadership of State Institute for Nature Protection. This working group is composed of representatives of many organizations coming from the nature protection and forestry sectors, which also have a task of setting management guidelines for the conservation of these species and habitats. The designation process is characterized by strong need for improvement of scientific knowledge on the consequences that different forest management regimes have on the conservation status of forestry species and habitats. Another momentum is a policy learning process on the legislative framework of Natura 2000 and on its implementation practices. Although primary based on science, the process is best characterized as a participatory policy negotiation process, in which the parties are getting closer and closer to a consensual decision.*

Two main variables that set the "position" of the decision in the process are the policy learning and the power relations among stakeholders, which are based on former cooperation, organizational interests, resource dependencies, and communication networks. These elements are structured into organizational network of resource dependencies and individual (members of the working group) network of communication and influence. The parameters of the communication and influence networks of individuals show similarities with the resource dependencies network of their organizations. The strength of the relations among organizations shows relation to the similarity of their interests. This indicates that the interorganizational relations are a reference framework in which the discussion of the working group is set. Such network model can facilitate the policy formulation process by giving new insights to all the parties, which would help them to assess the claims of other parties. This would also increase the "ease" of the implementation of the decision, since it would be more embedded in the context of the policy subsystem. However, disclosure of the parameters of these interorganizational relations during the policy formulation should be done with great prudence, as it would be an intervention to the process.

Key words: social network analysis, interorganizational relations, communication network, influence network, Natura 2000

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ORGANISATION OF FOREST ENTERPRISE AND IT S INFLUENCE ON CAPACITY TO MANAGE NATURE PROTECTED AREAS

Poduška Z.[1], Đorđević I.[1]

Abstract: *Nature conservation is of strategic importance for Serbia. Nature is protected in order to preserve the biological, geological and landscape diversity and the sustainable use of natural resources in accordance with human activities, social and economic needs and plans.*
This paper analyzes the state of organization in the forest enterprises and its capacity to manage in nature protected areas. The analysis included two protected areas: National park "Tara", managed by the Public Enterprise "National park Tara" and Nature park "Golija" managed by the public enterprise "Srbijašume".
The aim of this study was to determine the capacity for management of protected areas. The purpose of this research was to determine the most appropriate form of management of protected areas. The survey was conducted using case studies and survey.
It was found that the management of protected areas affecting state institutions and enterprises, local governments as well local residents and users and visitors. Competencies and needs of the parties involved in the management are often confronted toward expectations that natural resources should contribute to the successful management of the company and a better life for the population in the areas under protection, in the same time on the same place.

Key words: organization, improvement, state enterprise, diversification, services

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ECOLOGICAL AND ECONOMIC EVALUATION OF BELGRADE "URBAN TREES"

Maletić A.[1]

Abstract: *Trees that are growing in urban city areas are one of the most important natural resources of Belgrade.*
Without investment in tree management, the health and functionality of trees deteriorates.
As more and more people live in urban areas we need to raise awareness about natural capital in urban areas. Urban forests, rivers, and other green areas of cities can be considered as natural capital. Values of urban natural capital are improvement of water quality, air, providing habitat to many species of plants and animals, acceptance and retention of storm water, prevention of erosion,
reduction of temperature extremes, etc.
A large number of trees in Belgrade has reached its decrepit age. The functionality of these trees is very low, so their significance is reduced more to the psychological function. The cause of this is the old trees and poor investments in their proper maintenance.
The aim of this study was to determine the ecological and economic values of urban trees. Specific method was used as an example of calculating the value of trees growing in alley which is located in Partizanske avijacije street in the city of Belgrade. This was accomplished by the empirical analysis of the collected data and the valuation of urban trees using the CTLA method for calculating the monetary value of trees.
The results of evaluation of the urban street trees and their comparison with the funds that are invested in maintaining existing and planting new trees can provide the basis for a new approach to maintenance, protection and management of urban trees as part of urban natural capital of Belgrade
Value of urban trees, expressed in monetary value, is an additional and very strong argument for the systematic greening of city streets, the preservation of existing trees and improvement of their condition.

Key words: urban trees, evaluation, economic value

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ENTRANCE FEES AS REVENUE SOURCE FOR NATURE PROTECTION IN THE NATIONAL PARK KOPAONIK

Šumarac P.[1], Saković B.[1]

Abstract: *Although human civilization and the mankind continue to develop, protected areas as backbone of nature protection are still facing almost the same problems. Managements of protected areas around the globe reports the problem or issue of money deficiency for their proper functioning. This problem is more prominent in the countries whit preserved nature, rich biodiversity and distinguish transition process like Serbia is. Different models of protected areas financing are practiced among the countries but the same line underline all financing models - needs for further diversification of revenue sources in favor of accomplishment of sustainable financing strategies. Diversified funding portfolio is one among other four key principles or building blocks which define and determine sustainability of financing strategy for particular protected area. Protected areas are, as one of last existing wilderness areas, defined as public goods which establish, to the certain limits, responsibility of wider public to participate in their financing. After all resources that protected areas provide are from crucial significances for present and future generation.*
This paper will explore legal and formal prerequisites for establishing the system of entrance fees and valuate in monetary terms the potential of entrance fees as revenue source for future financing of management activities related to nature protection in the National park Kopaonik.

Key words: protected areas, financing, entrance fees

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NON-WOOD FOREST PRODUCTS-BASED ENTERPRISES IN WESTERN SERBIA: ORGANISATION OF EXTERNAL SUPPLY CHAIN

Nedeljković J.[1], Nonić D.[2], Ranković N.[3], Mandić V.[3]

Abstract: *The use of non-wood forest products (NWFPs) provides multi-functionality of forests, as natural resources. Also, it is an important opportunity for the development of entrepreneurship and gaining additional income for local people in rural areas, which are largely dependent on forest resources.*

The subject of this paper are NWFPs-based small and medium enterprises (SMEs) in the forest region Western Serbia, which includes 4 forest areas: Podrinjsko-kolubarsko, Tarsko-zlatiborsko, Limsko and Golijsko. The objective of this paper is the analysis of organisation, business and cooperation of SME within the external supply chain of NWFPs, as well as the analysis of questions regarding the cooperation with competent institutions. In the paper is given part of the results of the project "Research on entrepreneurship in private forestry sector in Serbia: NWFPs-based enterprises". The research was conducted in 2011 and included, in the forest region of Western Serbia, 28 NWFPs-based enterprises.

The questionnaire consisted of 65 questions, of which are 21 analysed in this paper. These questions refer to the basic characteristics of SMEs and its business, organization of purchase, processing and placement of NWFPs within the supply chain, as well as to the existence of cooperation between enterprises and with relevant ministries.

The research results show that enterprises are mainly located in urban areas and largely founded before 2000. Purchase stations are not, exclusively, located in the territory of the forest area in which enterprises operate, but the purchase is done at the neighbouring forest area, as well. The purchase manner depends on the size of the enterprise and processing capacities. Also, most enterprises do not perform direct sale to end consumer. Entrepreneurs pointed out that the main problems in business are lack of labour and unfair competition. It was noted that the cooperation between enterprises exists, but only on the level of information exchange.

Key words: organisation, small and medium enterprises, non-wood forest products, supply chain

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INSTITUTIONAL, LEGAL AND ORGANIZATIONAL FRAMEWORK OF NATURE PARK GOLIJA

Sakovic B.[1], Šumarac P.[1]

Abstract: *Protected natural area is a preserved part of nature, which is characterized by specific natural values and has multi level significance (ecological, scientific, cultural, education). Natural areas under protection are: national park, nature park, landscape of exceptional quality, nature reserves (general and special), natural monument and natural rarities. In Serbia, natural areas, which are characterized by great biological diversity, are protected whit different protection regime in order to preserve these special natural values. Protected areas are declared by a competent authority on the proposal of the Institute for Nature Protection of Serbia. State Enterprise for Forest Management "Srbijašume", Belgrade was founded in 1991 with the primary activity in management of state forests, promotion and utilization of all forest functions, including also and management of protected areas. In Serbia under certain level of protection is 5.86% of its territory and State Enterprise "Srbijašume" is responsible for managing 94 protected areas or almost 42% of the total protected areas in Serbia. The main objective of protected areas management is to preserve, protect and improve natural resources, biodiversity, quality of natural resources and landscapes and geo-heritage. This paper will present institutional and legislative framework of Natural Park "Golija" and its organizational and management model under the State Enterprise "Srbijašume".*

Key words: protected area, legislative and organisational framework

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THE POLICY OF FINANCING PUBLIC SERVICES IN FORESTRY

Petrášová V.[1]

Abstract: *The current period of economic crisis in Europe provokes problems of funding of ecosystem (public) services in forestry. National support in forestry of SR almost does not exist any longer. The Support from EU Structural Funds does not cover the costs associated with the protection of nature within the regulation adopted by Natura 2000. This paper consists of the analysis of current situation in EU support ecosystem services for society and the proposal for the support options at national level of policies at different levels of land management. It concerns the policy of the nature conservation in a specific fund, agriculture and regional policy.*

Key words: Public ecosystem service, forestry, support in forestry

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ANALYZING TRENDS IN THE ESTABLISHMENT OF PROTECTED AREAS ON THE TERITORY OF REPUBLIC OF SERBIA

Đorđević I.[1], Poduška Z.[1], Češljar G.[1], Stefanović T.[1], Nevenić R.[1]

Abstract: *Concept of nature protection on the territory of Republic of Serbia has long tradition, followed by numerous legislative norms, which were found in period from year 1930 till today. First regulative on nature protection starts from XIV century, while in recent history from 1930. Since then, it has been issued more than ten laws, which directly referred establishment of new protected areas and number of indirect legislation that encourage this activity.*

The main objective of this paper is to follow the trend of establishment of protected areas since 1948 till today, through several observed periods, in order to see how legislation in those periods affects establishment of new protected areas. In addition, the paper will analyze all indirect regulations established in these periods. Data for this study were gathered through non-reactive method. Research shows that the establishment of protected areas in the period since 1948 to this date has positive trend pushed by legislation from this period, with increasing interest of the institutions dealing with it as well as the presence of the growing need for specific areas to be managed in sustainable way and in accordance with the concept of nature protection.

Key words: protected areas, establishment, legislative framework

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BASIC PROJECTIONS OF THE ACTION PROGRAMME OF SUSTAINABLE DEVELOPMENT OF SERBIAN FORESTS

Aleksić P.[1], Tomović T.[2], Jović P.[3]

Abstract: *The Action Programme of Sustainable Development of Serbian Forests originated within the reform process of the forestry sector. According to the analysis of the present forest condition and the organization and functioning of forestry sector institutions, necessary measures, activities, processes and financing methods have been defined with the aim of meeting developmental objectives set in the Forest Strategy. Developmental processes are based on the following principles: (1) sustainability of forest and forestry development, (2) multifunctionality (by accepting all the forest functions, not only the economic, functions), (3) development of rural areas, (4) participation of stakeholders in the decision-making process, (5) publicity of information about forests and forestry, (6) increase of area covered by forests and their productivity, (7) commitment to accepted international obligations, (8) preservation of the forest health condition, (9) prevention of degradation and assessment of environmental influences, (10) enhanced research, education and staff training.*

Within the Action Programme, support has been defined to be necessary for the development of institutions of public forest management, inspection and public forestry services, as well as for the development and enhancement of forests, as follows: economic functions of forests, raising and tending of new forests, biological reproduction of existing forests, recovery of damaged stands, provision of forest seeds and planting material and preservation of the gene pool in forest trees, construction and maintenance of forest roads, marketing and the use of wood and non-wood forest products, sustainable development of wood industry and forestry planning.

Within the Programme, financial needs are represented, as well as the sources of funding of the projected development of forests and the forestry sector.

Key words: action programme, Serbian forests, susteinable developement

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SOME OF NON WOOD FOREST PRODUCTS IN THE LAKES DISTRICT REGION OF TURKEY AND THEIR USAGE FIELDS

Sarikaya A.[1]

Abstract: *Increasing of human interests were observed on natural resources by population rearing and developing of life quality. Turkey has three different floral region by geographical situation like a bridge between Asia and Europea. For this reason, it has approximately 10.000 plant species and 3500 of them are endemic. All vegatal and animal products which are growing up inside and edge of forests, are utilized by people for using or trading. These products are called "Non Wood Forest Products". The Lakes District Region of Turkey which is located in the south-western part of country and famous for having a lot of big lakes and watersheds, are very rich by non wood forest products. These products are used as food, medical, spice, natural herbal tea, dye, perfume, decorative articles and ornamental plants. In this study, some of considerable non wood forest products like cone of semen pine (Pinus pinea), linden (Tilia platyphyllos), carob tree (Ceratonia siliqua), sumac (Rhus coriaria), thyme (Thymus spp.), French lavander (Lavandula stoechas), kantaron (Hyperium montana), laurel (Laurus nobilis), hawthorn (Crateagus monogyna), chesnuts (Castanea sativa) etc. and information about their usage fields were put forwarded.*

Key words: Non wood forest product, the Lakes District, Turkey, usage

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SITUATION OF ILLEGAL GRAZING IN TURKISH FOREST FROM PAST TO PRESENT

Sarikaya O.[1], Babalik A.[1]

Abstract: *A total of 21.189.000 million hectares that constitute 27,7 % of the land in Turkey are forests. 54,4 % of the forests in Turkey are constituted by needled trees and 45,6 % are by broad-leaved trees. Forest fires are the main factor which threatens forest. Besides that, several abiotic and biotic factors affect Turkish forests. One of the most important factors of them is goat damage and illegal grazing. Goat is a natural element of the Mediterranean ecosystem in Turkey by vegetation, topography and climatic conditions. Especially, stony, sloping and uneven areas don't enable any animal except goat. Grazing is very important factor in shaping vegetation types in the Mediterranean ecosystem. Grazing of pastures cause reduced 2–3 times over their yields. For this reason, openings in the forests and maquis areas are preferred for grazing by shepherds. These stands are grazed mostly by hair goats and important damages occur on vegetation by this feding.*

Pastures consist 27,9 % of total area in Turkey and most of them are located on sloping and uneven stands and also 90 % of them are on degrade areas. It is esaily seen that pasture areas are becoming less year by year. Turkey had 44,3 million hectares pasture areas in 1935, it reduced to 21,7 million hectares were in 1980. Recently years, these ratio was estimated more less. Large forest stands are potantial for forest products, however insufficient of high quality pastures become an obstacle for stockbreeding in pastures. For this reason, overgrazing pressure occur in forest and maquis stands. Forest ecosystem and maquis areas are damaged by illegal grazing. According to official records, since 1937 till 2011 290.039 illegal grazing crime recorded and approximately 31 million animal were included related these crimes. It is seen that contrary to increasing of population, ovine (sheep or goat) number is decreasing year after year. Relating to this decreasing, number of crimes about illegal grazing is also becoming less. In this study, situation of illegal grazing and changes from past to present were defined by tables and figures.

Key words: Illegal grazing, hair goat, Turkish forests.

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RUSSIAN VIEW ON THE BOLOGNA PROCESS

Chubinsky A.[1], Chubinsky M.[1]

Abstract: *In 2010, the leading Russian Universities have been developed Federal State Educational Standards and the creation of which took into account the basic principles of the Bologna Declaration, including the competence-based approach to assessing the quality of specialist training, increased academic freedom of Universities for curriculum development, the presence in the educational program of disciplines at the student's choice, increase in self-study, taking into account labor discipline in credit units. From September 1 st 2011, all Russian universities switched to a two level system of training: Bachelor - Master.*

However, this time related to the Bologna process in the society has undergone several changes, including because most teachers do not see improvements in the life of the Universities, which have passed in the mid 90s of last century, on new system of training. Education funding was not enough for successful development. Employers are not on demand bachelors who have the competence and level of education lower than the engineers because of the reduced period of study, unsupported introduction of modern methods and teaching aids, including IT, that certainly require additional financies

Not interested in the promotion of education business community:

- *low interest of employers to the content of educational materials of bachelor's and master's degrees and their practical training in the workplace;*
- *virtually no sponsorship institutions of higher education;*
- *not received the system of continuing professional education, including Adult education.*
- *Analysis of the views of employees of higher education, public authorities, employers, shows a large spectrum of views on the Bologna process - from excellent to negative.*

Key words: Bologna process, education, bachelor's and master's degrees, Russia

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THE BASIC CHARACTERISTICS OF NTFP$_S$ - BASED ENTERPRISES' BUSINESS IN MACEDONIA AND SERBIA

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***Abstract**: The forests in South-eastern Europe (SEE) region are characterized by extremely high species richness. The wealth, in terms of biodiversity, is mirrored in the abundance of non-timber forest products (NTFPs) collected from the forests by local populations. Among the NTFPs in SEE region, mushrooms, medicinal herbs, berries and honey stand out as of particular importance - both in terms of subsistence value and potential for generating cash income at the village level.*

The main objective of the paper is to analyze basic characteristics of NTFPs - based enterprises' business in Serbia and Macedonia. In this paper is presented part of the results from the FOPER II CRRT project "Entrepreneurship, markets and marketing of non-timber forest products in SEE region". The methodology used for this research is quantitative analyses of collected data. Door-to-door survey, with 36 companies from Macedonia and 91 from Serbia was conducted. The questionnaire consisted of 51 questions, from which 17 are analyzed and presented in this paper.

The presented results refer to the basic characteristics of analyzed enterprises, theirs business and elements of marketing mix (product, price, promotion and place).

Key words: Non-timber forest products, small and medium enterprises, Macedonia, Serbia

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SECTION VIII

Environmental protection

BIOSPHERE RESERVE "GOLIJA-STUDENICA"

Aleksić P.[1], Jančić G.[1]

Abstract: *The area of the mountains Golija and Radočelo was designated by the Decree of the Republic of Serbia Government (2001) as the Nature Park "Golija"(75,183 ha) and PE "Srbijašume", as the trustee, performs the management. Nature Park "Golija", with its natural and man-made values, satisfies completely the criteria for the Biosphere Reserve nomination by the MAB (Man and Biosphere) programme.*

The base of the MAB programme, which was established in 1971 within the United Nations Educational, Scientific and Cultural Organization (UNESCO), is the harmony of man and nature.

As proposed by the Institute for Nature Conservation of Serbia, and in harmony with the objectives of the Spatial Plan of the Republic of Serbia (1996), supported by MAB National Committee, a part of the Nature Park "Golija", under the name "Golija-Studenica" (53,804 ha) was nominated as biosphere reserve. By the decision of the MAB International Co-ordinating Council (ICC) for UNESCO MAB programme, in September 2001, Biosphere Reserve "Golija-Studenica"was designated as the first biosphere reserve in Serbia and it became a part of the UNESCO's World Network of Biosphere Reserves (to date, 580 biosphere reserves in 180 countries have been included in the World Network of Biosphere Reserves - WNBR). The designation of the reserve was based on the well preserved nature with a great number of plant and animal species, among which there are many endemic and relic species. The area includes the Monastery Studenica which is on the World Heritage List since 1986.

Biosphere reserves are the sites of land and marine ecosystems which are internationally recognized by UNESCO MAB programme and they should solve one of the most important issues faced by the world today: how to reconcile the biodiversity conservation with the need for economic and social development and for the maintenance of pertinent cultural values. An efficient biosphere reserve denotes mutual actions by the professionals for natural and social sciences, groups for the protected area conservation and development, institutions responsible for the reserve management and local communities.

The effectiveness of the reserve organization was analysed in the First Report on the occasion of the tenth anniversary of the Biosphere Reserve "Golija-Studenica" (2001-2011).

Key words: biosphere reserve, Golija, management.

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CADMIUM ACCUMULATION IN *AILANTHUS ALTISSIMA* (MILL.) SWINGLE SEEDLINGS UNDER PHOSPHORUS AND IRON DEFICIENCY

Đunisijević-Bojović D.[1], Đukić M. [1], Belanović S.[1], Skočajić D.[1], Grbić M.[1], Bjedov I.[1], Obratov-Petković D.[1]

Abstract: *Potential plant nutritional disorders on carbonate soils are phosphorus or iron deficiency. Adapted calcicole plants, like Ailanthus altissima (Mill.) Swingle, have ability to change root microenvironment by increasing rhizosphere acidity and capacity of roots to uptake iron, zinc and phosphorus. Modified root microenvironment influences availability of toxic heavy metals, especially cadmium, which is among the most mobile in contaminated carbonate soils. Adaptation for efficient nutrients uptake also affects the process of Cd uptake into roots and translocation in shoots.*

To access influence of nutrients deficiency on Cd uptake and translocation hydroponic method was used to growth seedlings of Ailanthus altissima. Ten days after Cd contamination by adding $Cd(NO_3)_2$ at 20 ppm in growing medium, accumulation of Cd was detected in roots and leaves of Fe-deficient, P-deficient and control plants. Results indicate that roots of P-deficient plants accumulate significantly less Cd (152.6±29.12 ppm) than control, well supplied plants (632.7±67.12 ppm) and Fe-deficient plants (621.6±56.24 ppm). Concentrations of Cd in leaves of P-deficient plants were a little bit higher than in control and Fe-deficient plants, but statistically insignificant. The iron and phosphorus deficiency decreased root and shoot biomass production of Ailanthus altissima seedlings. Cadmium contamination decreased root and shoot growth in control and additionally, in iron deficient plants, but in phosphorus deficient plants Cd treatment did not influence growth.

From presented data it seems that P deficiency in growing media is more limiting factor for Cd accumulation than Fe deficiency. This study could be important for improvement of phytoextraction efficiency on polluted soils, which are poor in phosphorous an iron available forms.

Key words: *Ailanthus altissima*, phosphorus deficiency, Cd accumulation, phytoextraction, nutritional disorders

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MODERN APPROACH TO ENVIRONMENTAL PROTECTION IN FORESTRY PLAN DOCUMENTS

Baković Z.[1], Kisin B.[1]

Abstract: *One of the basic human rights is the right to life and development in a healthy living environment. Sustainable management of natural values, preservation of natural balance, diversity and increase in living environment quality are all an imperative of modern society. Natural values of Serbia are its natural riches, among which the forest holds one of the central positions. The ecosystemic connection among these natural riches is complex.*

Planning in Serbia's forestry has existed for the last two centuries. During this time period, the needs for productive functions offered by forest ecosystems have often been unsynchronized with their real capacities. In such conditions, planning has been exposed to constant changes, by following modern scientific achievements in forestry on one side and legal, inter-plan compatibility on the other side.

This study deals with contemporary planning approaches in relation to contemporary achievements in forestry science and forestry practice (international and national), international conventions ratified by the Republic of Serbia, valid national legal solutions, national strategies etc. This study has identified conflicts between commercial interests and priority objectives of forest management, defined for concrete, dedicated entireties and protection regimes. In addition, optimal objectives and measures for their fulfillment while drawing up strategic and operational forestry plan documents have been established, in conditions of specific protection regimes, with the aim of preserving and enhancing the quality of the living environment. In doing so, the following have been conciliated: feasible functional continuity, ecological balance, biological heritage and biodiversity, as well as sustainable forest management.

Key words: forest, planning, environmental protection, biodiversity

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EFFECT OF SUPPLEMENTS ON VITALITY OF BLACK LOCUST USED FOR RECULTIVATION OF COPPER MINE TAILINGS

Pilipović A.[1], Orlović S.[1], Stojnić S.[1], Vasić V.[1]

Abstract: *Mine tailings presents great ecological threat for the environment. Their chemical and physical properties, together with microclimate conditions, make them inhospitable for reestablishment of the vegetation. Experiences in recultivation of mine tailings in Serbia, especially in RTB Bor mines, showed great potential of black locust (Robinia pseudoacacia) as species for this purpose. In spring 2010, recultivation of mine tailing "Cerovo-cementacija" was conducted at area if cca 3 ha. Trial plot of different supplements for survival and vitality improval was established on the same site. Experiment consisted of following treatments: (i) control plot without supplements; (ii) application of polymer Hydrogel; (iii) application of azotobacter and polymer and (iv) application of Bactofil fertilizer. After establishment in August of 2011, following physiological parameters were investigated on treated plants: (i) net photosynthesis; (ii) transpiration; (iii) stomatal conductance; (iv) chlorophyll fluorescence and (v) pigments content.*

Results showed effect of treatments for some investigated parameters. Transpiration ranged from 0.979 mmolH_2O/m^2s for control to 1.368 mmol H_2O/m^2s for Bactofil treatment. Photosynthesis rate ranged from 3.106 mmolH_2O/m^2s for control to 5.777$\mu molO_2/m^2s$ for Bactofil treatment. Chlorophyll fluorescence did not show significant reponse to given treatments. Pigments content was affected by treatments, especially when it was expressed per units of dry leaf mass.

Key words: Black locust, mine tailings, recultivation, physiology

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CONSERVATION VALUE INDICATORS OF FORESTS AND FOREST-LIKE HABITATS IN HISTORIC AGRICULTURAL LANDSCAPES

Liira J.[1], Lõhmus K.[1]

Abstract: *The major challenge in forest biodiversity conservation lies in the loss of the high quality habitats. A solution can be in finding substitution habitats for forest-dwelling species. The cultural and aesthetic importance of old manor (castle) parks is widely known, but their biodiversity value is still insufficiently estimated. We explored whether densely wooded parks can be considered as forest-like habitats suitable for forest specific species. We surveyed 74 the densely wooded and closed canopy parts in old manor parks and compared the complex of structural and biodiversity indicators with neighbouring forest stands (93 stands) in central and southern Estonia. Studied indicators described stand structure, dead wood types and forest related biodiversity.*

We found that the studied park fragments do resemble old deciduous stands. In fact, park stands have higher estimates for various indicators and their compound indices except for dead wood index which is higher in forests. The latter can be expected due to the more intensive management of park stands. Forest management indicator plant species richness and the proportion of common forest species were almost the same in parks and forests.

We conclude that old closed canopy stands in parks can function as semi-natural forest habitats, but over-intensive management of these parks can jeopardize the existence their special biodiversity conservation value.

Key words: forest biodiversity; indicators; stand structure

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FUNCTIONAL TERRAIN CLASSIFICATION IN THE SPATIAL DECISION SUPPORT SYSTEM ENVIRONMENT

Tucek J.[1]

Abstract: *The differentiated forest management focused on the integrated forest functions and keeping principles of sustainability is based also on a rational (economically and environmentally appropriate) use of machinery - logging technology. For this purpose, we have developed a model for the selection of an optimal logging technology. The model is based on an evaluation of environmental, economic and ergonomic criteria for each technology. So far, it is possible to choose the optimal technology variant (machinery system) based on the evaluation of set of environmental and technological criteria (terrain accessibility, skidding distance, logging erosion, cutting method applicability, soil bearing capacity, structure and parameters of forest stand trees, the location of loading points). The inclusion of other economic, ergonomic and energetic criteria is in preparation. Appropriate or optimal technology for each forest stand shall be selected from a wide set of commonly used technologies and devices used in Slovakia as well as advanced technologies and equipment described in the literature. Knowledge on environmental and technological evaluation criteria and parameters of technology and machinery from various sources (literature, own research results) are converted into formalized knowledge base using fuzzyfication and object approach. Created networks of dependencies are applied to the content of relevant information layers and databases stored in GIS and database system. For their construction, we used NetWeaver software environment directly linked to the EMDS system, which is a technological extension of the ArcGIS. The functionality of the proposed solutions we have verified on large areas in forest practice conditions of the Krivan enterprise, an organization branch of Slovak State Forests. From the technological point of view, we have developed a specific information system based on GIS, mobile geo-information technologies and spatial decision support system. Ensure we adapt and integrate useful data sources, which we have developed special-purpose geographic database. This consists of several groups of thematic layers describing natural conditions, forest cover and forest road network in the experimental area (forest stands boundaries delineation, forest soil types, forest types, forest roads, loadings, digital elevation model and others). Based on the contents of this database, we then performed extensive analyses based on the overlaying of information layers, map algebra, distance analysis and surface analysis, which are necessary for the opening-up the forest, functional terrain classification and logging technology selection and optimization in the GIS environment.*

Key words: Functional terrain classification, decision support system, knowledge base, network of dependencies

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SPATIAL PLANNING OF ECOREMEDIATION POTENTIALS FOR ASH DUMP SITES THROUGH AGRO - ENERGY CROPS CULTIVATION

Dražić G.[1], Radojević U.[1], Milovanović J.[1], Gavrić M.[2], Vukotić Lj.[2]

Abstract: *Public enterprise "Elektroprivreda Srbije - EPS" is managing an area of about 1.500 hectares of ash dump sites with an average annual production of ash of about 6.500.000 tones. Such large areas and mining and industrial facilities have a significant negative impact on environment by contaminating soil, water and air resources. Therefore, PE EPS is making great efforts to minimize these pressures. National Strategy of Energy Development gives advantages to the development of renewable energy sources, among which the most recognized is the potential of biomass. Currently available biomass sources are insufficient in quantity and unsatisfactory in quality, and it is necessary to intensively explore possibilities of its production. The most interesting energy crops are short rotation willows and poplars, as well as perennial grasses. Production of these crops, in addition of providing renewable energy sources, undoubtedly has environmental benefits, primarily through the carbon sequestration as well as soil and water remediation. According to these characteristics, Miscanthus giganteus is the most promising perennial grass. The main aim of this paper is exploring of possibilities for miscanthus biomass production at degraded ash dump sites managed by PE EPS in Serbia, as well as spatial planning for the best use of available areas for the most productive miscanthus cultivation and the most efficient soil remediation by establishing miscanthus plantations. Miscanthus is presented through its eco-physiological traits from the point of degraded soil usage. Potential assessment of ash dump sites has been done and related to possibilities for miscanthus plantation development. The maximum productivity achieved in previously established field trials and calculated calorific value of this crop were used to estimate the potential production of annually renewable domestic energy source to produce electricity and fuel. Research results show that this production is possible, but with number of limitations which should be overcome.*

Key words: ash dump sites, perennial grass, potentials, mapping

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RESEARCH OF DEFOLIATION ON ICP FORESTS SAMPLE PLOTS IN THE REPUBLIC OF SERBIA

Stefanović T.[1], Poduška Z.[1], Đorđević I.[1], Češljar G.[1], Nevenić R.[1]

Abstract: *Initial symptoms of forest stands drying are defoliation and discolouration of tree crowns. Therefore, the defoliation, with the changing of tree crowns color are accepted as the main parameters which estimate crown condition within forests state monitoring. This paper analyzes data for defoliation as part of the results of the monitoring of forests on ICP sample plots. Rating of defoliation is done regardless of the cause of leaves loss, and the results are not aimed at determining the cause-effect relationship. They are only represent the state of defoliation on sample plots processed in the period. Connecting these results with other indicators of environmental conditions will provide more specific information, and make conclusions about the vitality of plants depending on environmental conditions.*

Key words: defoliation, ICP sample plots, crown condition monitoring, Serbia

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FORESTS AS A BIOLOGICAL BASIS FOR TOURISM VALORISATION OF VELIKI JASTREBAC

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Abstract: *Forest ecosystems represent the most important ecological potential, whose considerable significance for human life arises from their resources and numerous functions. In recent years, preserved and protected nature and safe food received a particular worldwide attention, while regions able to provide such conditions have a particular importance in terms of tourism. The Republic of Serbia Spatial Plan for the period 2010-2014-2021 envisages a formation of spatial-functional complexes of mountain, spa, ecological, hunting and other forms of commercial tourism. The preference in the Serbian tourism offering is given to facilities whose construction has already been completed or initiated, or to centres that offer complex tourism services. One such complex is the region of Veliki Jastrebac. The paper outlines natural characteristics and specificities of this region, which, along with additional, created values, represent a tourism potential that can be subject to valorisation on various grounds.*

Key words: forests, Veliki Jastebac, multi-functional valorisation, tourism

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MONITORING OF HEAVY METALS CONCENTRATIONS IN FOREST ECOSYSTEMS OF THE NATIONAL PARK "FRUŠKA GORA"

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Abstract: *Forest ecosystems have never been influenced by so mach stresses, which leads to deforestation, both individually and cumulative, and therefore to loss of forest area, which, in the far distance, can lead to ecological disaster. Monitoring of polutants concentrations, and comparison of results from surveys that were conducted during 2004/05 in this area, primarily aimed at a clearer and more exact assessment of the state of the National Park "Fruška Gora", and load by heavy metals (Pb, Ni). In regard to the fact that the area of Fruška Gora is very diverse, both floristic and vegetal, 7 species of the plants (5 woody and 2 herbaceous) were selected on four localities, in these researches. One of these localities is control locality. Localities are:*

Locality 1: Entrance from Hopovo (locality 1 in previous researches);

Locality 2: Venac (locality 3 in previous researches);

Locality 3: crossroads of entrance road and dawnward road M21 in Paragovo (locality 6 in previous researches);

Locality 4: control locality – private road (locality 7 in previous researches).

Monitoring of heavy metals concentrations in plants during 2011 have shown very similar situation as in previous research period (2004/2005). Results in 2011 have shown fol lowing results:

- *Herbaceous plants are better heavy metals accumulators than woody plants,*
- *Lime tree (Tillia tomentosa) had higher values of heavy metals in comparison with other woody plants, during the research period (2011.).*

Key words: heavy metals, Fruška Gora, monitoring, polutants.

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MONITORING OF MANGANESE CONCENTRATIONS IN THE AREA OF THE NATIONAL PARK "FRUŠKA GORA"

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Abstract: *Although manganese represents essential element in plants development, higher concentration of this element leads to long term harmful effects. Aim of this paper is monitoring of manganese concentration and its accumulation in plants in four localities in National Park "Fruška Gora". For the research of manganese concentration 7 plants species were chosen, which, during last period of researches (2005.) showed as good accumulator. Content of manganese in vegetative parts of five plant species in four localities were analyzed. Outcomes showed that manganese concentration in leaves of analyzed plants differed depending on the localities as well as plant species. Derived data were processed by using statistical method of analyze of variance, by LSD – test for level of significance p=0.05. Testing of mean values significance was determined by using of Duncan test.*

Key words: Manganese, monitoring, plants, Fruška Gora

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CONSERVATION PLANNING AND IMPROVEMENT OF THE DAMAGED LANDSCAPE IN THE CITY MUNICIPAL LAZAREVAC

Cvejić M.[1], Tomićević J.[2]

Abstract: *The area of the City Municipal Lazarevac which consists of flood plain of the lower and middle river Kolubara and Kolubara coal basin, was once a forested area whith extensive farming. As a result of a coal mining, Kolubara coal basin the largest coal deposit of lignite in Central part of Serbia, has undergone drastic changes with serious environmental consenquences that caused a complete change of character of the landscape.*
Analysis of secondary data and other study and tehnical documentation, relevant to the area municipality Lazarevac based on assesment of character and stability of the analyzed part of the landscape, showed the need for proposing a plan to preserve and improve the degraded image features and landscapes.
Shows the estimated value of the character of the landscape. They are the instrument by which the walue of inegrating landscape planning in the area. The proposed network is disrupted and renaturalised landscape elements , to recover their stability in the therritory of the Municipal Lazarevac.

Key words: planning documents, the character of landscape, conservation and enhancement of landscape character

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AGE IMPACT ON VESSELS WIDTH OF *TAXODIUM DISTICHUM* (L.) RICH. FROM "VELIKO RATNO OSTRVO" AREA IN BELGRADE

Jokanović D.[1], Vilotić D.[1], Nonić M.[1], Popović, V.[2], Ćirković-Mitrović T.[2], Petrović J.[1]

Abstract: *Baldcypress, who originates from North America, belongs to Taxodiaceae family and it isn't researched in anatomic way in Serbia. Samples for this research are taken from a protected area of nature called "Veliko ratno ostrvo" and it's located between 1169 and 1172 km of the river Danube close to Belgrade.*
Results of macroscopic-microscopic analyze of Taxodium distichum (L.) Rich., which are introduced in this paper, are related to this area.
Baldcypress, has no heartwood, and it's without resin canals, as well. Growth rings are visible, and a zone of late wood is darker than a zone of early wood. Radial parenchyma is not visible by an eye.
Various researches showed that there are some differences in the vessels lumen width and in number of vessels per mm square, as well, between different aged trees.
As for these trees, there are some differences between vessels lumens and a number of vessels between early and late wood zone.
As the tree gets older, the width of vessels lumens are becoming increased, but their number per mm square are becoming decreased.
The final result of macroscopic-microscopic analyze of Taxodium distichum (L.) Rich. shows that it has good technical characteristics, so it's recommended to establish plantations with these species in our country. It can be well-reproduced in a generative way (from seed), has a big resistance to low temperatures, air-pollution, and grows very quickly, as well, so there are many reasons to start with establishing cultures of it in Serbia.

Key words: Baldcypress, vessels, growth rings, radial parenchyma

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REVITALIZATION OF LANDSCAPES DEGRADED BY SURFACE MINE EXPLOITATION - CASE STUDY OF LANDSCAPE PLANNING AROUND FOOTBALL FIELDS IN CVETOVAC

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Abstract: *Surface mine exploitation of coal as a technological process cannot be completed without a significant impact on the environment and the landscape where the works are carried out. Vast disturbed landscapes are left upon finished exploitation. These areas then require extreme care, caution and a great complexity in the planning and carrying of work on the revitalization of the area. The landscape can never return to its original state because of the great loss of land mass by coal exploitation, geological disturbance and mixing of different layers of sedimentary formations and thus changing the groundwater regime. However, past experiences have shown that it is possible to plan degraded post mining landscapes in way to provide similar facilities of multifunction value, with modifications dictated by the emerging environmental conditions, method of exploitation, equipment and other moments. This paper presents an example of revitalization of areas degraded by surface mining. The area intended for landscape planning is located in surface mine pit „Tamnava – Istočno polje", near "Strelište" in Cvetovac. The football fields have already been built in this area. The main goals of landscape planning were prevention of all types of erosion by forming plant cover, improving the visual appeal of the area and increase of forest cover percentage of Belgrade. The entire area includes two parts, which are planned differently. The green space around football fields is designed by free landscaping using trees, shrubs, climbers and lawn areas. The green windbreak in planned on slops toward surface mine pit. More appealing landscape was achieved by creating different types of plantings using a large number of deciduous, coniferous and fruit trees species which change the coloring of area when going through different phenophases. And a relatively stable forest ecosystem is established by a reforestation of slopes of surface mine pit thus creation of green windbreak will protect surrounding area from air pollution and erosion.*

Key words: surface mine exploitation of coal, degraded landscape, revitalization, green windbreaks

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LAND DEGRADATION AND INCREASING POVERTY IN RURAL AREAS OF SERBIA

Marčeta M.[1], Keča Lj.[1], Jelić S.[2]

Abstract: *Land is one of the basic elements of the environment and multi-functional versatile resource, which is particularly threatened by natural processes, and actions of human activities. Although it is difficult to assess the extent of land degradation problems, there is no doubt that people around the world feel the consequences of its effects. Loss of productive land has a direct impact on agriculture in rural communities, primarily in the form of reduced yields and revenues are based on this exercise. Serbia has recorded a significant reduction of arable land, primarily because of damage to land and conversion of the most fertile agricultural land into construction and other non-agricultural purposes. Socially marginalized population groups directly affect the decline in soil quality and reducing the fertile fields. The aim of this article is point to a direct causal link between living standards and population and environmental quality, as well as finding possible solutions in the form of preventive action, and "healing" environmentally degraded areas. As one possible alternative to the revitalization of environmentally damaged areas of Serbia forestation "vulnerable" land and the terrain. The purpose of this study is evaluation of the current state of land in Serbia, and the formulation of possible solutions of action to improve, then revitalized and use of land resources for economic development, primarily in agriculture, where the most pronounced effects of soil degradation. The case of the demographics of rural areas, in terms of population, their share in total population, data regarding the standard of living and the number of households. In addition, it has been analyzed data on the level of land degradation, its prevalence and forms of manifestation in the surveyed areas.*

Key words: land degradation, poverty, Serbia, rural areas

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EVALUATION OF THE FACTORS OF RELIEF FOR FOREST RECREATION BY NATURAL INDICATORS: FOREST KOŠUTNJAK EXAMPLE

Cvejić M.[1], Tomićević J.[2]

Abstract: *The current study presents a method for establishing a complex recreation resource within a territorial system for recreation areas within the period of 2007 to 2010, using quantitative-qualitative forest stand indicators. Use of the methodology for direct assesment of forest relief with recreational functions on the basis of natural indicators. The assesment is tied to performance of pre made „biocllimatical analysis" and requirements of recreational ergonomics of the site.*
*The phases adhered includes **I**-Classifying the results from the conducted studies on plant succession and forest types. **II**-Inventory and assessment of stand recreation suitability by category, **III**-Tipe and class of recreation occurring in the forest, **IV**- Calculation of the average coefficients of recreation suitability under various scenarious. The present study primarily targets to efficient forest management approach in order to help planners to make the optimal decision for recreation activities in forests.*

Key words: relief, forest recreation planning, suitability, Košutnjak forest

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SECTION IX

Biomass and carbon of forest ecosystems

BIOMASS PRODUCTION IN CULTIVATED WETLAND ECOSYSTEMS

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Abstract: *The investigations of biomass production were conducted at wetland ecosystem near protected natural reserve of Zasavica in Srem region, near Nocaj vilage. A part of natural wetland ecosystem was used for agricultural production (crop farming) , and a part stayed in natural condition. In 2010 field experiment was established with fast growing crop Misacathus gigantheus in two variations: application of basic agrotechnical measures and application of complete agrotechnical measures. Biomass production (kg/m2) was measured in terms of maximal production, in October 2011 and recommended harvest time in February 2012 for miscanthus I (with complete agrotechnical measures), miscanthus II (just basic treatment), natural vegetation common reed (Phragmites communis) and natural vegetation of willow (Salix sp.). Energy values were determined after preparation of pellets. Maximal heating value was determined for salix (18,51 MJ/Kg), for other around 17,6 MJ/Kg with low moisture and ash contents. Maximal production of dry biomass were salix>miscanthus I>reed>miscanthus II, but in early spring harvest the order was miscanthus I> salix>miscanhus II>reed. Yield energy was calculated per m^2 based on technologically dry biomass (with 15% of moisture) and based on dry biomass. Potential energy yield per unit of soil surface was calculated based on determined parameters with requirement of similar weather conditions. The results show that miscanthus production with the application of complete agrotechnical measures is similar to willow production and that it is bigger than natural reed production. The results were discussed from the aspect of preservation and improvement by wetland production of energy crops*.

Key words: wetland ecosystems, biomass production, energy values, potential energy yield

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FOREST RESIDUE UTILIZATION IN BEECH STANDS THINNING

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Abstract: *This article presents results of the research concerning implementation of the partial tree length method in thinning. Research took place in management unit "Zeljin" on the territory of forest administration "Aleksandrovac", forest holding "Rasina", Krusevac. The goal was to research the possibilities of implementing the partial tree length method as one of the harvesting methods by which the issue of greater forest residue utilization in mountainous conditions would be solved. The base of this method is utilization of the total volume of roundwood and its extraction with a tractor equipped with a winch to a temporary landing without the use of towing horses.*

All operations were subjected to the preservation of residual trees, and the goal was to research the occurrence and sizes of damages that occurred by the implementation of this method. Damages were quantified by their size on residual trees during the extraction of roundwood.

Felled tree was cross cut into trunk segments of optimal lengths for skidding from the aspect of maximum qualitative utilization of wood mass by applying national quality standards for roundwood.

Partial cutting of thicker limb bases on trunk segments with branches was conducted in order to decrease the width of the load and damages on residual trees in the stand.

Quantity of damaged trees per winching cycle decreases by the increase of number of cycles.

Felling direction was especially important and the direction that causes the least damages on residual trees should be chosen. Besides that, the length of assortments should be in accordance with the direction of skidding and terrain inclination, since the number of damages on residual trees increases with the increase of assortment length and the angle between felling and skidding direction.

The use of towing horses is not necessary in these working conditions since it is possible to extract the total wood volume thicker than 3 cm at the thinner end with bark, and simultaneously keep the damages of residual trees to a minimum.

Key words: thinning, damages on residual trees, assortment skidding, adapted agricultural tractor, partial tree length segments

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THE INFLUENCE OF FERTILISING ON GROWTH OF SEEDLINGS *PAULOWNIA* SPP.

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Abstract: *Demand for wood biomass is increasing each year. This imposes the need to introduce the production of new species, characterized by rapid growth, short rotation and high energy value. The calorific value of Paulownia biomass is little over half that of coal same as is other forest biomass. But the lower content of pollutants such as sulphur, lower in Paulownia than most other biomass and the fact that Paulownia is a readily renewable resource clearly points to its environmental benefit. Relying on previous experience, the species of the genus Paulownia Sieb. et Zucc. stand out as one of the alternatives, among willows and poplars, which are mostly grown for this purpose in Serbia.*
Research conducted within these plantations are intended to contribute to determining the adaptive and productive potential of this species in Serbia. The paper presents the results of the development of annual seedlings of Paulownia fortunei on the experimental field Pambukovica – Ub, Serbia. The results obtained in the first year after planting indicate that the fertilizing affected seedling development.

Key words: planting, dendro biomass, productive potential

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APPLICATION OF CARBON CYCLE MODELING IN SUSTAINABLE MANAGEMENT OF FOREST ECOSYSTEMS

Radojević U.[1], Milovanović J.[1], Šijačić-Nikolić M.[2]

Abstract: *Research on carbon cycle in forest ecosystems are becoming more frequent, specially related to the connection with climate change. However, this is not the case in Serbia, where there is little available data on carbon stored in forest ecosystems and its dynamics. An important tool in studying this phenomenon is environmental modeling through which we can simulate forest ecosystems and forest carbon cycle for longer periods of time. In this paper for modeling the forest carbon cycle we used CO2FIX program for management unit Semegnjevska gora which is located in Western Serbia. CO2FIX is a stand level simulation model which quantifies carbon stocks and fluxes in forest biomass, soil organic matter, wood products and atmosphere, and can be used to estimate the amount of carbon credits for CDM A/R projects. Two cases were modeled and they simulate different ways of management and realization of the CDM A/R project. Results of the first case show that different management of forest ecosystems leads to differences in amount of stored carbon, with a difference of 109,73 Mg C/ha between two scenarios. Simulated afforestation in the second case obviously leads to more carbon storage then if there was no forest, but the amount of carbon credits that could be obtained depends on the beginning of the crediting period.*

Key words: environmental modeling, carbon cycle, forest ecosystems, carbon credits

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ECONOMIC AND SOCIAL CHALLENGES OF BIOMASS PRODUCTION SUSTAINABILITY IN SERBIA

Spasić S.[1], Jovanović B.[2]

Abstract: *In view of a growing energy demand – expected doubling of the world energy demand till 2050 - alternative forms of energy, in particular renewable ones, have to be developed and strengthened. Thanks to its geographical and geological preconditions, Serbia is predestined as a supplier for energy processed from biomass sources. Worldwide, the volume of agricultural waste is estimated 10 to 14km, equal to a yearly average 42.5t of new biomass per ha. Only the biomass produced yearly in forests contains the 25fold of the energy from extracted petrol. The leftovers of the food production, which cannot be consumed by the human organism, such as stipes, husks and similar, are mostly burnt (worldwide yearly about 2gt). According to FAO, there are 3.5billion hectares of degraded surface which could come into question for the cultivation of bioenergy plants, while the cultivated area for biofuels in 2007 worldwide was only 30million hectares. This means that, together with biogenic residues, half of the world's energy demand can be covered with bio-energy without endangering with nature preservation or food supply. SEE region is abundant in wood biomass, which is far cheaper than biomass in EU (10-20€/t). Biomass industry obtaines significant social potentials for developing countries such as Serbia, to name a few: new jobs creation, rural exodus reducing, rural areas strengthening, agricultural small and medium business/entrepreneurship expansion. But how all these resources and challenges work in conjuction with Forestry Development Strategy of Republic of Serbia? This paper will examine a number of economic (e.g. establishment of an important and future-oriented economic sector, creation of long-term market outlet of agricultural and forest industry by-products) and social advantages and risks of using biomass for energy purposes, with Serbia as a focal point, and in comparison to present obstacles for biomass usage for energy production.*

Key words: biomass potentials, economic benefits, social advantages, energy production, market sustainability.

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ABOVEGROUND PHYTOMASS MENSURATION OF HORNBEAM TREES IN THE STANDS OF CENTRAL PART OF THE RIGHT-BANK FOREST-STEPPE ZONE.

Andrii Z.[1]

Abstract: *Within the global climate change the research of bioproductivity of Ukrainian forests as a whole and its individual regions is a crucial scientific problem. At this time during forestry management it is limited mainly by assessment of stems part of stands. Using this approach in future work to forest management deprives foresters and researchers the opportunity to fully solve issues related to the ecological monitoring of forests and does not allow to meet information needs that arise during the solution of many environmental problems.Oxygen-making ability of forests and in the same time their potential for carbon sequestration and storage of carbon dioxide pollution is directly proportional to forest productivity and longevity of saving them as living natural ingredients.The objective of this research is to assess the aboveground phytomass of hornbeam trees in the stands of central part of the Right-Bank Forest-Steppe zone of Ukraine. A terminology and basic definitions of bioproductivity processes in forest are pointed, research trends of bioproductivity of forests are shown, methods of experimental evaluation components of phytomass of trees used by scientists in the world are described, and features of the studied tree species in the forest area are presented.Methodological principles for collecting and processing experimental data are described. Its forest assessment characteristics, experimental evaluation and analysis of qualitative features of phytomass components' hornbeam trees are made. The dependence on mathematical equations from the main features of the assessed trees is found. The determination of homogeneity of the collected research data, identification of the distribution patterns of the studied parameters, and insurance of the adequacy and reliability of mathematical models' connections to assess the parameters of fractions of hornbeam phytomass were done to conduct the statistical analysis of the general data set.There are described theoretical and methodological approaches to modeling the change of components' phytomass depending on taxation parameters of model trees. The correlation of main phytomass parameters between other assessed indicators, that are easily determined in the field, was found. Based on these correlations, the adequate models were found. Standard assessment of biotic components of phytomass productivity of trees in a completely dry state in mass units allows using the conversion factor to determine the content of carbon deposited in it. For practical use the complex of mathematical models and tables of hornbeam phytomass components for evaluating phytomass of hornbeam trees in central part of the Right-Bank Forest-Steppe are proposed.*

Key words: Forest-steppe, hornbeam, assessment indicators, bioproductivity, phytomass components, density, modeling.

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POTENCIAL OF BIOMASS FROM SERBIAN FORESTS FOR COMBINE HEAT AND POWER COGENERATION

Dedić A.[1], Matić V.[1], Salemović D.[2]

Abstract: *In 2007, Serbia ratified the Kyoto Protocol, taking over the responsibility to increase the amount of energy produced from renewable energy sources. The annual wood biomass energy potential in Serbia is approximately 1Mtoe As the total annual consumption of primary energy in Serbia in 2011 was about 15.3Mtoe; from this it is clear that biomass derived from forestry can cover even 6.53% of primary energy in Serbia, if it is rational and adequately used. Also, wood biomass is favourable fuel as it is rich in carbon and having in mind environmental protection issues, due to closed circle of carbon-dioxide (CO_2 produced in combustion processes are used for oxygen production in photo-synthesis). In addition to that, in a system with natural air circulation in gasification process of wood biomass, there is no emission of NO_x components which is great advance in compare with classic combustion of biomass*

The regions in Serbia, the largest producers of wood waste after forest harvesting are presented in the paper. The structure of wood waste, its characteristics, as well as machines for obtaining wood chips are analyzed. In the conclusion the estimation of amounts of wood chips is given for a demo CHP plant with 200kW of electric power which is under construction.

Key words: wood waste, structure, characteristic, estimation.

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REVITALIZATION OF BEECH STANDS - ECOLOGICAL NECESSITY AND POTENTIAL OF BIOMASS UTILISATION

Bobinac M.[1], Andrašev S.[2]

Abstract: *The structure and growth of beech trees was analysed in the unmanaged beech stand with admixtures of sessile oak, lime and hornbeam on Fruška Gora, based on two periodic measurements. The first measurement was performed at the stand age of 97 years, and the second at the age of 105 years. The 97-year old stand was characterised by significant sizes of growth elements per hectare (N=208, G=32.64 $m^2 \cdot ha^{-1}$, V=467.62 $m^3 \cdot ha^{-1}$), and the volume increased by 105.61 $m^3 \cdot ha^{-1}$ till the age of 105.*

In both measurements, there were 153 beech trees per hectare, which in total structure accounts for 75% per tree number, 82% per volume and 85% per current volume increment. The spontaneous stand development resulted in the increased phyto-sociological weakening of trees which was, during the study period, reflected in the following features of beech trees. In both measurements, upper storey beech trees accounted for 94 % per tree number and for 98% of volume. During the first measurement, the trees with freely formed and reduced crown by less than 25% of the crown perimeter, accounted for 22% and 32% of volume, and during the second measurement, they accounted for 8.5% per tree number and for 14.3% of volume. The trees with multiply reduced crowns, during the first measurement accounted for 26 % and for 16% of volume, and during the second measurement they accounted for 50% and 35% of volume.

During the study period, the average annual increase in basal area, volume, above-ground oven-dry biomass and carbon quantity in beech trees with freely formed and reduced crowns by less than 25% of the crown perimeter, was increased by 88-94%, and in the most prosperous trees in the silvicultural sense by 49-55%, compared to the stand average. Compared to the stand average, lower average annual increase in the above increments by 32-33% were achieved by the unprosperous trees in the silvicultural sense, which justifies their removal from the stand in the aim of the higher increment potential of the most prosperous trees in the silvicultural sense.

Key words: beech, growth elements, internal structure, revitalization, Fruška Gora.

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THE CONCEPT OF OBTAINING DRIED BIOMASS FROM COMBUSTION PROCESS AND ITS USE FOR BRIQUETTES PRODUCTION

Topić R.[1], Cuprić N.[2], Dedić A.[2]

Abstract: *The paper describes the plant for combustion of sawdust and briquette production. Wood waste which is obtained after forest harvesting and primary processing of wood is first fired in furnace and the burning products used for drying oter wood waste in a drum dryer. The amount of dried wood waste is used like the fuel for the combustion process and the other part for the briquettes production. In that way, the full energy efficiency is achived.*

In the process of substitution of fossil fuels with renewable energy based on biomass, the drying process has an important role, as an important phase of preparing biomass for energy use. The drying process in the high temperature pneumatic drum dryers is complex, nonlinear thermodynamic process, with complex energy transfer and movement of particulate materials, thereby change their condition, along the drying chamber. In order to allow as much as possible intense drying and shorten the time of the drying process, using the minimum of environmentally friendly fuels, it is necessary to increase the value of initial temperature of the drying agent and to increase the agent throughput and velocity.

The general layout of plant for briquettes production consists of: cyclonic furnace, pneumatic drum drier and the device for briquettes production is explained and it is developed by coauthors of this paper. The energy generated by burning 2 kg of briquettes is equivalent to the energy generated by burning 1 liters of heating oil, with very low sulfur content.

The suggested plant satisfied the strong demands of environmental protection and enabled energy savings.

Key words: biomass, combustion, dryer drum, briquettes.

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PRIMARY PRODUCTION OF CALORIFIC VALUE OF POPLAR CLONES IN SLOVAKIA

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Abstract: *Poplar clones are characterized by very fast growth rate, a high volume of wood production and a short rotation period compared to other wood species. The greatest portion of they area is the crop land, where the forests are man-made with the poplar clones representing the stand-forming tree species. The study presents results of the calorific values on biomass of Robusta and I214 (Populus x euramericana) clones in Slovak territory. The average calorific value of all biomass fractions (wood, bark, small-wood with bark) is approximately in the range of 17.8-18.4 MJ kg^{-1} or 6.86-8.73 GJ m^{-3}. Standard deviations were in the range of only 2.4-2.8%. The calorific value production of whole stands was calculated from their volume production according to yield tables [m^3 ha^{-1}]. The mean annual production of calorific value for site indexes 40-20 culminated at the age of 17-26 years with values of 320-80 GJ ha^{-1}. The culmination for the I-214 clone occurred 2-3 years earlier than for the Robusta clone. This age is optimal for total stands felling. Robusta and I-214 poplar clones have not only fast growth, large biomass and calorific value production, but also have the high energy use efficiency in comparison to other wood species. Most of the poplar stands accumulated more than 1% heat, which originated in the solar energy.*

Key words: biomass, calorific values, energy use efficiency, poplar clones

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RELATIONSHIP BETWEEN THE FOREST STAND ENERGY BALANCE AND FOREST CARBON STORAGE

Marková I.[2], Marek M.[2]

Abstract: *Trees productional activity is conditioned by the input of short-wave solar energy and long-wave (thermal) radiation. Finally, the amount of solar radiation absorbed by the forest stand is the sum of incoming and outgoing short/long-wave radiation and is designated as the "net radiation" (R_N). The ratio H/LE is known as the Bowen ratio β - the useful measure of the form of the stand energy dissipation. Deeper investigation of the relations between R_N , and carbon storage in a forest stand brings description of the strength of connection between the daily course of stand energy balance and carbon fluxes and evaluation of the impact of the prevailing form of energy dissipation on the carbon flux. Some differences between s coniferous and broadleaf forest stands are presented.*

Key words: energy balance, Bowen ratio energy dissipation, carbon capture

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WOOD BIOMASS AND DIFFERENT WAYS OF ITS UTILIZATION IN CHP PLANTS

Dedić A.[1]

Abstract: *The substitution of conventional fossil fuels with biomass for energy production results both in a net reduction of greenhouse gases emissions and in the replacement of non-renewable energy sources. However, at present, generating energy from biomass is rather expensive due to both technological limits related to lower conversion efficiencies, and logistic constraints.*
In this paper the stages of the biomass gasification were described as far as the final effects of CHP plant which can work with or without organic Rankine-Clausise (ORC) thermodynamic cycle. Also, one of possible utilizations of CHP plant in sawmills and producing pellets and briquettes were given. The basic principals of small-scale CHP plant based on Stirling engine were explained. At the end, it was discussed the energy efficiency of CHP using Grossmann diagram.
The paper presents the research work in frame of the project "Development of CHP Facility with Biomass Gasification", TR33049, supported by The Ministry of Education and Science of the Republic of Serbia.

Key words: gasification stages**,** ORC cycle, Stirling engine, Grossmann diagram.

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MORFO-PHYSIOLOGICAL CHARACTERISTICS OF MISCANTHUS X GIGANTEUS IN THE FIRST TWO YEARS OF DEVELOPMENT

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Abstract: *Miscanthus giganteus (elephant grass, Chinese grass) is a rapidly growing hybrid crop that produces a high annual yield of biomass and achieves a high energy value during insineration. It is grown as an energy source for combustion in thermal power sistems, 1 ha of planted miscanthus replaces 6t of coal or 75 000 kWh of electricity. Miscanthus growing season starts in the first half of April, while the maximum biological yield is established at the beginning of October. Because of the high moisture content and lower biomass quality at the time of maximum biological yield, harvest is done in February, when the moisture content decreases to 20%.*

Field trials with treatments that include planting density (1, 2 and 3 plants/m2), increasing doses of mineral fertilizers (0, 50 and 100 kg/ha NPK) and irrigation (with and without irrigation), were used for the study of morpho-fizological features and determination of optimal agroecological conditions, necessary to achieve the maximum yield of biomass. In the first year of development and with the treatment of 100 kg N/ha and the density of three planted rhizomes / m ², the high estyield of 0.58 t/ha drymatter, was achieve. The maximum yield of 6.1 t/ha dry matter was achieved in the second year with treatments that include 2 rhizomes / m ² , application of 50 kg N /ha of mineral fertilizers and irrigation. It has a wide ecological valence, the possibility of growing on poor quality soils with unfavorable conditions for the cultivation of annual crops and food production.

Key words: miscanthus, morpho-physiological features, biomass yield, degraded areas.

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SECTION X

Wildlife management

BIOLOGICAL CARRYING CAPACITY OF FOREST VEGETATION FOR THE RED DEER RE-INTRODUCTION IN THE AREA OF HUNTING GROUND HOMOLJE NEAR ŽAGUBICA

Marinović Lj.[1], Lavadinović M.V.[2], Cvjetićanin R.[3]

Abstract: *Although natural conditions in Serbia are favourable for red deer (Cervus elaphus), their abundance is at an unsatisfactory level. The unfavourable red deer abundance is demonstrated by a nonuniform distribution of populations per individual regions in Serbia. The increase in red deer abundance is required not only from the ecological aspect, but also because of the economic component of sustainable hunting and rural development in Serbia. The process of red deer re-introduction to its natural habitat is complex, therefore it has to be conditioned by scientific and research activities and by the adequate preparations.*
The assessment of habitat biological carrying capacity is one of the preconditions for the correct red deer re-introduction. The purpose of the research is to enable a more objective and reliable estimation of the hunting site quality for red deer, as well as the base for etiological study of red deer migrations. This paper analysed the conditions for red deer re-introduction to natural habitats in the area of Beljanica – Crni Vrh in the hunting ground Homolje near Žagubica. Taking into account the high diversity of forest vegetation, hunting ground Homolje is a suitable area for red deer growing..

Key words: red deer, forest vegetation, biological carrying capacity, Homolje

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CORRELATION BETWEEN THE EGG SHELL COLOR AND PHEASANT EGG INCUBATION

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Abstract: *Based on research conducted in 2011 year, regarding the impact of genetic factors on the hatching and vitality of pheasant chicks and young, authors came to conclusion which indicates a strong causal relation between the egg shell color and certain production parameters such as the percentage of died embryos. A model was based on determining egg shell color for 420 eggs of the Phasianus mongolikus. Shell color of eggs obtained in aviaries is very versatile and can be expressed in almost 25 tones of colors. All these nuances are embedded in the 7 basic tones. The result shows that percent of died embryos is 85% for lime skim eggs, 50% for lime spots eggs, 50% for green eggs, 30% for blue-green eggs, 25% for dark grey eggs, 25% for brown eggs and 20% for light brown eggs. Achieved results of the research were applied to one of the biggest pheasant farm in Serbia „Šumadija"form Kragujevac. The total number of eggs was 216,188 from which 191,240 were fertilized eggs, and 24,948 were eggs with died embryos. So, the total number of hatched pheasant chicken was 155,690. When total number of eggs (216,188) is used with above mentioned parameters, almost same results are obtained (155,763) which confirm the correctness of the obtained results.*

Key words: pheasant egg shell color, egg fertility, died embryos

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COMPARATIVE ANALYSIS OF HUNTING GROUNDS IN THE AREA OF BELGRADE

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Abstract: *Sustainable utilisation and protection of natural resources are some of the leading objectives of the present and future economic development of Serbia. In the area of Belgrade, there are 15 hunting grounds with total area reaching about 316,000 ha. The largest number is managed by the Hunting association of Serbia through its members - Hunting Associations (10 hunting grounds with total area about 300,000 ha), while the others are managed by the Public Enterprises "Srbijašume"and Serbian Army. These hunting grounds support some of our autochthonous and biologically and economically most valuable species of big game (e.g. roe deer and wild boar), as well as our principal species of small game (brown hare, pheasant, and partridge). The above game species are a significant (but not also a high) economic potential, however they are much more significant as the best bio-indicators of environmental quality. The Afforestation Strategy of Belgrade area (Official Gazette of the City of Belgrade, 20/2011) defines many goals and measures aiming at the rational utilisation of forest resources, biodiversity conservation and environmental protection. Also, the subject of the Afforestation Strategy is to improve the state of natural forests and artificially established stands, as well as the establishment of new forests and green spaces of all categories and their integration into one functional entity. For this reason, this study presents the results obtained by the comparative analysis of the Afforestation Strategy and the state of hunting grounds in Belgrade area, with the emphasis on the main threats and protection measures of raised game species and their forest habitats.*

Key words: game, hunting ground, forest, management, Belgrade

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WILDLIFE RESERVES, MANAGEMENT PLANS AND PLANNING EFFORTS IN TURKEY

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Abstract: *Protected areas are least affected by humans and provide protection to the wildlife the most. Allocation of some areas for preservation of natural values is a common practice, which dates back almost to the beginning of the history of humanity. Wildlife reserves are one of the efficient instruments of protecting natural areas. According to the Turkish 4915 numbered Law of Land Hunting "Wildlife reserves are the areas in which game, wild animals and wildlife are protected and improved and also are introduced to there and habitat improvements practices are taken and when it is necessary hunting is released with the framework of special hunting plan." In Turkey, there are 79 wildlife reserves, covered 1.218.838 ha. 56 of these wildlife reserves were declared on 07.09 2005 and 23 of these were declared as wildlife reserves on 16.08.2006 with Cabinet Degree. The general purpose of declaring as these wildlife reserves are for protecting of Red deer, Fallow deer, Roe deer, Gazelles, Chamois, Wild goat, Wild sheep, Grouse, Pheasant, Great bustard, Hyena and Waterfowls in Turkey. Although it is seemed to protect one species in wildlife reserves, wildlife management and improvement plans are prepared to manage considering whole ecosystems, resource values of protected area such as biodiversity and the beauty of landscape etc, which take into account administration, social, economic and technical dimensions.*

Despite 79 wildlife reserves were declared to establish in 2005 and 2006, 49 of their management plans have not finished for 9 years yet. Wildlife management and improvement plans are tried to complete for future in six years in Turkey.

Key words: Wildlife reserves, Wildlife management plan

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FOREST CERTIFICATION AND PROTECTION OF THE BIRD FAUNA IN SERBIA

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Abstract: *In Serbia, introduction of certification in the forestry sector has significantly improved the environmental approach in forest management. This has resulted in the reduction of conflict of interest between economic management and the need to preserve biodiversity in forests. Despite certain isolated antagonisms towards the introduction of certification in the forestry sector, that process has been successfully implemented in the territory of AP Vojvodina within PC "Vojvodinašume", as well as some holdings within PC "Srbijašume". Significant progress has been made in environmental education of employees in forestry companies. The improvement is the most evident in development of monitoring of certain bird fauna representatives and regular informing of the general public. Measures have been undertaken to map the nests of some rare species of diurnal birds of prey and black storks, including the reduction of disturbances during the reproduction period. Areas which are being regenerated as part of forest activities, are left with individual autochthonous trees and shrubs, as an assistance in preservation of biodiversity and landscape features of the area. Notwithstanding the obvious progress, there are also evident problems which are reflected in excessive use of chemicals in forestry which are harmful to biodiversity, as well as in intensified use of machinery in forest activities, in unified classification of natural forests by age, composition pattern and coverage area, while planting monocultures of allochthonous species and clones. The paper also analyses the advantages of introducing forest certification and existing problems, particularly in protected areas, including some proposals of appropriate measures for reaching compromise, particularly with regards to protection and improvement of the condition of the forest bird fauna.*

Key words: Bird fauna, forest certification, biodiversity, protected areas, harmonisation

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MORPHOLOGICAL CHARACTERISTICS OF PHEASANT EGGS AND THEIR INFLUENCE ON THE EMBRYONIC AND NEONATAL DEVELOPMENT OF PHEASANT CHICKENS

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Abstract: *According to the biological constraints (short period of reproduction and exceptional variability of hatching in relation to the quality and color of the eggshell), scientific knowledge about biological mechanisms and the biological potential of pheasant embryos is essential, in order to define the optimal conditions of incubation and increased hatching of pheasant chicks, their viability and meat quality, and therefore the economic validity of farm production of pheasant game. Role of morphological characteristics of pheasant eggs (weight, color of eggshells, calcification of eggshell) on incubation, and particularly on the postnatal development and production characteristics has not been sufficiently determinated. In order to obtain answers to questions and current biological limitations, this paper presents the examinations of distribution, weight, conception, hatching and vitality of pheasant eggs where eggs were visually classified into 4 groups (A / dark brown; B / light brown; C / brown-green and D / greenish-blue) and incubated under standard production conditions. Based on the monitoring and analysis of these parameters, it can be concluded that based on the criteria of the color of eggshells it can be expected indirect reflections on some of the production characteristics: the quality of the shell, conception of eggs, hatching and morphological characteristics of muscle tissue*.

Key words: pheasants, eggshell color, incubation, morphological characteristics

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IMPROVEMENT OF VETERINARY LEGISLATION IN HUNTING IN ACCORDANCE WITH EU STANDARDS

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Abstract: *In hunting are used scientific knowledge from life sciences, forestry, veterinary medicine, agriculture, law and others. Within the hunting economy in European Union, a significant place take legislation of veterinary medicine. Considering that Serbia has become a candidate country for EU membership, is obligated to harmonize regulations in the veterinary profession in hunting with legislation in the EU. This is also an important step when applying with co-financing projects to the funds of European Union.*

This paper analyzes the regulations concerning the health status of wildlife populations and game meat hygiene in Republic Serbia: Law on Game and Hunting ("Off. Gazette of RS" no. 18/2010) Veterinary medicine law ("Off. Gazette of RS" no. 91/2005) and the Law on Food Safety ("Off. Gazette of RS", No. . 41/2009) and other subsidiary legal acts. Are discussed in particular EU regulations on the inspection of game meat: Laying down specific rules on official controls for Trichinella in meat, EC-Commission Regulation No 2075/2005 in accordance to Regulation (EC) No 854/2004 of the European parliament and of the council: „Laying down specific rules for the organization of official controls on products of animal origin intended for human consumption". Are described also examples of projects about education on these regulations in previous years granted for co-financing by the European Commission in Brussels.

Having in mind differences in subsidiary legal acts which are applicable in Serbia in relation to the European Union, we believe that their adaptation is necessary in order for protection the health of game animals, and prevent the appearance of zoonotic diseases in humans. With compliance to EU legislation we can increase the level of food safety and condition for export of game meat to the European Union, as well as, encourage the arrival of larger number of foreign hunters in our country.

Key words: hunting, veterinary, regulations, European Union, Serbia

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HUNTING AND HUNTING TOURISM IN TURKEY

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Abstract: *Hunting was first regulated 3167 numbered The Law of Land Hunting in 1937 in Turkey. This law was amended to 4915 numbered on 01.07.2003 in accordance with requirements of current conditions. This law aims to sustain hunting and wildlife management, to protect and improve game animals with their natural habitats, to control and manage the hunting in the country. Depending on The Law of 4915 numbered, The Central Hunting Commission was established. This commission chaired by Minister of the Forest and Water Affairs, meets every year in May. In addition, The Central Hunting Commission decides to be harvested game animal' bag limits, quotas and the areas which are closed or opened to hunting for the following year.*

In Turkey, hunting season begins in the middle of the August along with quails, turtledoves, wild boar and jackal's hunting. Foreign hunters can hunt under game tourism. Wild goat (Ibex), chamois, red deer, roe deer, wild boar, Anatolian wild sheep, gazelle, hybrid ibex, fox and jackal are hunted according to game tourism regulations.

In Turkey, the number of game animals except wild boar is far below the carrying capacity of the country. Because of this, the quota given for hunting including the hunting season of 2011-2012 was very low. For example, General and State hunting areas in Turkey, the quota for ibex 289, chamois 17, red deer 54, Anatolian wild sheep 6, gazelles 10 and roe deer 52 was given. However, the wild boar's quota given was around 3850.

Key words: Hunting in Turkey, Hunting tourism

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