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BIODIVERSITY OF FOREST ECOSYSTEMS AND CLIMATE CHANGES

SEASONAL VARIABILITY OF ANTIOXIDANT ENZYMES AND METABOLITES IN NEEDLES OF SERBIAN SPRUCE

Jelena BOGDANOVIĆ PRISTOV[1],
Dragosav MUTAVDŽIĆ[1], Olivera PRODANOVIĆ[1],
Vuk MAKSIMOVIĆ[1], Ksenija RADOTIĆ[1]

Abstract: *We studied variation in the activity and isoenzyme patterns of soluble and cell wall bound peroxidase, catechol oxidase, β-glucosidase, as well as catalase, superoxide dismutase and invertase, in needles of the Balkan endemic conifer Serbian spruce, Picea omorika (Panč.) Purkinye. We also studied content of glucose, fructose, lignin and simple phenols bound to the cell walls. The samples were collected from Mount Tara, the species' natural habitat. Seasonal changes were found to affect enzymatic activities and isoenzyme profiles. Total protein content was significantly lower in the summer than in other seasons. Several isoforms of peroxidase, catechol oxidase and superoxide dismutase, as well as two catalase isoenzymes were detected. During vegetative season there was the highest number of soluble peroxidase isoenzymes. The annual change in activities of both ionic and covalent POD isoforms quantified from zymogram showed high individual diversity. Catalase and catechol oxidase peaked in summer and spring, respectively. Both total SOD and Mn-SOD activities were significantly higher in the winter samples than the summer ones. β-glucosidase showed maximum activity in spring and summer. Significantly lower invertase activity was found in spring. Glucose and fructose exhibited clear seasonal changes, reaching highest concentration in autumn. Total antioxidant activity and total soluble phenol content in P. omorika needles were significantly higher in summer in comparison with the other seasons. Catechine was the most abundant low-molecular mass phenol in omorika needles, followed by coniferyl alcohol and chlorogenic acid. The highest catechine and chlorogenic acid content was observed in spring. The highest lignin content was found in spring, being in correlation with the activities of some individual covalent POD isoforms. Content of cell wall bound coniferyl alcohol, p-coumaric acid and ferulic acid showed a significantly lower value in spring in comparison with the other seasons, being in correlation with some individual ionic POD isoforms.*

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THE INVASIVE AND POTENTIALLY INVASIVE WOODY SPECIES IN THE FORESTS OF BELGRADE

Biljana NIKOLIĆ[1], Branislava BATOS[1], Dragana DRAŽIĆ[1],
Milorad VESELINOVIĆ[1], Đorđe JOVIĆ[1],
Vesna GOLUBOVIĆ-ĆURGUZ[1]

Abstract: *On the list of one hundred globally principal invasive species (Global Invasive Species Database), along with the house mouse (Mus musculus L.), originates from India, or gypsy moth (Lymanthria dispar L.), of Eurasian-African origins, etc. there are even 34 plant species, and almost 50% of them originate from America. The invasion is most frequently caused by the favourable bio-ecological characteristics of the sites and the lack of natural enemies, as well as the biological properties of the species which enable the fast spread of them (secretion of growth inhibitors, hairy or sticky seeds, small seeds, bird-dispersed edible seeds, ability to form adventitious root, etc.). Frequently, there is a significant number of the invasive species within the same family, which is attributed to the similar bio-ecological characteristics or phylogenetic relations, but also relating species, and all other ones, which show the tendency to invasiveness, should be treated as potentially invasive.*

With the exception of weeds, there are no clearly defined methods for control of many species, and their degree of invasiveness has not been defined. In regard to woody species, it can refer to the autochthonous species which spread in an uncontrolled way due to leaving of the arable areas, but also owning to the altered site conditions (by drainage, deforestation, wildfires, creation of waste disposal sites, etc.). These plants are often competitive with allochthonous (exotic) trees and bush, which were introduced in the aim of reforestation or establishment of green areas in the inhabited places. Generally speaking, all the invasive species are also the indicators of the site degradation, gene pool of autochthonous species, plant communities, and of the environment, in general.

Forests and forest land cover an area of 26,000 hectares of Belgrade (10% of total city area). About 90 woody and over 200 herbaceous species from about 40 phytocenoenosis (mainly in alliance of white willow forests, Salicion albae), as well as natural and artifically established plantations of forest trees, cover an area of 15,000 hectares of city area. The degrees of invasiveness (principal invasive, moderat invasive, or minor invasive) were determined for many of these species.

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Key words: aliens, principal invasive, moderate invasive, minor invasive, trees, shrubs, herbs, natural sites

METHOD FOR EVALUATION OF MACROFUNGAL COMMUNITIES IN HIGH DIVERSITY FOREST ECOSYSTEMS

Žaklina MARJANOVIĆ[1], Branko KARADŽIĆ[2]

Abstract: *Estimation of fungal communities with forest ecosystems is extremely hard topic, as the fungi develop within the substrates and the only way to record them macroscopically is recording of sporocarp appearance. However, abundance and sporocarp biomass cannot be used for quantification of ecological role of certain fungal species, due to the very diverse fruiting habits of different macrofungal species. Indeed, the only reliable information that can be used in community investigation is presence of sporocarp, or recording of fungal DNA in the forest soils.*

In this work we are reporting on the reliable method to estimate and compare macrofungal communities of different forest ecosystems. The data used in presented method could be sporocarp presence, or presence of the species recorded by molecular analyses. The method is very suitable for a long term monitoring of macrofungal community change due to the climatic changes.

Key words: macrofungi, biodiversity, forest ecosystems

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CONSERVATION OF FOREST SITES WITH RARE TREE SPECIES AS A PART OF SUSTAINABLE FOREST MANAGEMENT (UPM, TIKHVIN, RUSSIA)

A. DOROSHIN[1], E. RUMJANTSEVA[2]

Abstract: *Identification and conservation of forests with tree species rare for local area and especially grown on its natural geographic range border is one of the most important conditions for biodiversity protection at logging operations on the territory of any region. For the eastern districts of the Leningrad region, such valuable tree species are lime, elm, oak, hazel and common alder. They can be consid-ered as cladotypes of the warmest periods of the Holocene age in Northwest Russia, therefore they are most sensitive to any changes in climate and ground conditions.*

The international concern UPM makes a lot of efforts for safeguarding and promoting biodiversity in its own forests and forests it manages. The UPM approach is based on the methods which allow to safeguard structural and specific variety of forest ecosystems and to imitate the processes of the natural forest dynamics. The forests of Tikhvin lespromkhoz with the area of about 200 thou ha are typically commercial of secondary origin. Following the UPM concept, one of the main ways of biodiversity maintenance in such for-ests during logging operations is leaving valuable habitats (key biotopes). Such method allows to conserve not only valuable forests with official logging restrictions but also forests identified during the planning and logging. It gives possibility to safeguard small forest sites with rare tree species of various age and single big trees.

To instructs the staff contemporary methods of biodiversity conservation at harvesting in the Tikhvin lespromkhos two model sites have been established. Both sites have high level of flora and fauna species diversity, habitats of officially protected species and sites with relict broadleaved trees.

Key words: biodiversity, cladotypes, forest management, key biotopes

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CLIMATE CHANGE AND RESTORATION OF MANGROVES IN NORTHERN ANDAMAN ISLANDS, INDIA

Sahana Bose[1]

Abstract: *The massive tsunami which swept through the Indian Ocean Region in 2004 has tilted the tectonic plate on which Andaman and Nicobar Islands of India are situated, leaving the southern Andaman submerged and uplift of its northern group of islands. The coastal trip of land along its northern island has been detached and elevated to a few meters from the original sea level. As a result mangrove forests found here are now drying up and depleting severely, leaving the area more vulnerable to climate change. This paper points out the immediate need for mangrove restoration along the northern coastal belts of Andaman Islands which not only protect the islands from severe natural calamities but also acts as a carbon sinks to remove carbon dioxide from atmosphere. It studies the present and future consequences of such depletion and its effects on rural communities which thrive on mangrove plantation for fuel woods, thatching and timber. It highlights the need for community participation and decentralized planning in Indian context to restore the mangrove vegetation along the tsunami affected areas. The natural regeneration of mangroves will take at least 10 to 15 years. No proper stock mapping has been done yet. Drying up of mangroves puts the island in a fragile state and made it more vulnerable to climate change and global warming. It has reduced the fuel-wood production and increased the shoreline erosion. It has disturbed the biodiversity and timber industries dependent on mangrove trees.*

Andaman situation is a classic example of unplanned natural resource exploitation disregarding basic ecological principles. Restoration of degraded and critical mangrove areas by planting of suitable species and preparation of coastal vulnerability map to access the areas which are vulnerable to coastal disaster is the need of the hour.

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CRITERIA FOR CHOSING RETENTION TREES OF EUROPEAN ASPEN (POPULUS TREMULA) IN MIXED SPRUCE FORESTS: ESTIMATION OF BIOLOGICAL AND ECONOMIC VALUE OF INDIVIDUAL ASPEN TREES CASE STUDY OF TIKHVIN REGION, LENINGRAD PROVINCE, NORTH-WEST RUSSIA

Denis POPOV[1], Anton DOROSHIN[2]

Abstract: *Retention trees of European aspen (Populus tremula) are very important for biodiversity maintenance during clearcuts in boreal forests. Admixture of aspen in mixed spruce forests of North-West Russia is abundant. Biodiversity conservation at a stand level is a new technique in Russia and has no official regulations. There is a lack of guidelines for selection of aspen trees for retention. Simple, but reliable criteria for estimation of aspens' biological value are missing. Most of aspens are non-profitable for utilization because of lack of demand for its low quality timber. Compromise between biological and economic values of aspen trees is important. A list of visual features characterizing aspens' biological and economic value was designed, 193 aspens were described and measured for the typical spruce dominant forest with aspen admixture. Relevance of each visual feature to a biological value was evaluated based on subjective opinions of experts and then importance of each aspen for biodiversity maintenance was estimated based of the set of these features. Economic value of trees was calculated based on assortment prices and average logging costs. Occurrence of visual features and changes of aspens' economic and biological values were described relating to trees' diameters. Research shows that the use of visual features is rather reliable for evaluation of importance of single aspen trees for biodiversity maintenance. Old aspen trees are the most biologically valuable and the least economically feasible. Diameter at a breast height can be used as a good criterion for retention of aspen trees.*

Key words: Populus tremula, retention tree, biodiversity, evaluation criteria.

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A REVIEW OF WOOD DENSITY VARIATION AND ITS ECOLOGICAL IMPLICATION

Jian WU[1]

Abstract: *Wood density is an important parameter for defining wood quality and providing scientific information for various researches. As the major component of carbon storage is in the woody stem, wood density is an important variable in estimating biomass and consequently, the carbon balance. Considering the physiological process of the wood formation and the complexity behind the environment impacts on wood structure, information obtained from the wood density variation has the great potential to restructure the past climate change and project future scenarios. In this article, wood density in the radial direction at different scales will be firstly discussed, ranging from the material level through tissue level to the cell level. The main focus is initially placed on the physical property of the wood with special questions such as what physical elements causes the wood density variation. Secondly, based on review of the current knowledge, main factors influencing those physical wood density variations would be summarized and classified into different categories. Based on the summary, a conceptual map of the factors affecting wood density variation would be proposed afterwards.*

Key words: Porosity, cell structure, Carbon budget

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CLIMATE CHANGE IMPACT ON FOREST VEGETATION IN REPUBLIC OF SRPSKA

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Marijana KAPOVIĆ[1], Zorana HRKIĆ[1]

Abstract: *The aim of this work is determination and assessment of climate change intensity on Republic of Srpska's territory, based on analyzed data. Besides, it is necessary to determine the impact of these changes on forest vegetation zoning in researching area. For purpose of these researches, following meteorological elements (air temperature and precipitation amount) for the meteorological station in Doboj, Trebinje and Sokolac in the period 1951-2005, were analyzed. The results were compared with the applicable reference period (1961 to 1990). Based on estimation, a values change of these elements to the end of 21 century is predicted. Climate change, depending on its intensity and geographical areas, to a significant extent, may affect the advancing vegetation forest belts in both the horizontal and in vertical sense. This research included the most important areas in the Republic of Srpska in climatological terms.*

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ECOLOGICAL INDEXES OF THE COMMUNITIES IN SOUTHWESTERN SERBIA

Mihailo RATKNIĆ[1], Ljubinko RAKONJAC[1],
Aleksandar VASILJEVIĆ[2]

Abstract: *This paper presents the results of the researches of the ecological indexes of the forest communities in southwest Serbia. The ecological indexes for the humidity, chemical soil reaction, nutrients, light and temperature were determined. The following forests were researched, on the total of 93 samples: the sessile oak and Turkey oak forests, silver birch forests, European poplar and silver beech forests, beech forests, beech and fir forests, black alder forests, grey alder forests, grey willow forests, Austrian pine forests, Scots pine forests, Balkan sessile oak forests, beech-fir and spruce forests, mountain maple and spruce forests, and spruce forests. The studied sites are located at the altitudes ranging grom 1,010 meters to 1,500 meters above the sea level. The communities were registered on the dystric ranker, dystric cambisol, eutric ranker, eutric cambisol, fluvisol, gley, colluvium, limestone cernozem, luvisol, pseudogley, and brown limestone soil. The ecological indexes for the humidity ranged from 2.13 to 3.47, for the chemical soil reaction from 2.23 to 3.45, for the nutrients from 2.11 to 2.99, for the light from 2.11 to 3.39, and for the temperatures from 2.96 to 3.42.*

Key words: ecological indexes, forest communities, humidity, chemical reaction, nutrients, light, temperature.

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SOME OBSERVATIONS ON THE EFFECT OF SUMMER DROUGHT IN THE FOREST OF HUNGARIAN OAK AND TURKEY OAK IN SERBIA

Anka DINIĆ[1], Martin BOBINAC[2]

Abstract: *Forest of Hungarian oak and Turkey oak (Quercetum frainetto-cerris Rudski/1940/1949 s.l.) is the best in reflecting the climate conditions (macroclimate) of the greatest part of the submontane oak belt in Serbia and it represents a climatogenic community. The community of Hungarian oak and Turkey oak occupies predominantly the lands of an undulated hilly relief, over the Tertiary sediments rich in bases (sandstones, marls, clays, calcareous loams, etc.). The soil types are eutric cambisol and smonitza. In the area of the community of Hungarian oak and Turkey oak, the climate is temperate continental, characterised by summer drought periods, predominantly in July and August. Drought period in Serbia is characterised by high summer temperatures, low relative air humidity and, in some parts, by frequent occurrences of dry warm winds. During summer drought periods, the surface layers of the soil are desiccated and the relative air humidity in the storey of herbaceous plants and shrubs is low. In some cases, summer drought can even lead to physiological drought. In such circumstances, the excessive and uncontrolled transpiration causes the death of herbaceous plants. For this reason, many plant species in the storey of herbaceous plants in the community of Hungarian oak and Turkey oak flower and fructify in May and June, before the summer drought.*

The main edifiers of the community, Hungarian oak (Quercus frainetto Ten.) and Turkey oak (Quercus cerris L.), are adapted to summer drought conditions. During summer droughts, these species succeed in retainin water to some extent, which is confirmed by low variations in transpiration over summer months. Hungarian oak thrives best on brown forest soil over siliceous bedrock, and Turkey oak has a greater ecological-coenological scope and grows on limestones and siliceous bedrocks. The effect of anthropogenic factors on stand canopy closure in the range of the community of Hungarian oak and Turkey oak is significant. This effect is especially reflected on the floristic composition, seasonal dynamics and the species regeneration in this community during the summer drought period.

Key words: summer drought, forest of Hungarian oak and Turkey oak, references, Serbia

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INFLUENCE OF HETEROGENEOUS LIGHT CONDITIONS ON REGENERATION DYNAMICS IN THE SILVER FIR – NORWAY SPRUCE FOREST AT DNOLUCKA PLANINA, BIH

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Srđan KEREN[3], Ivan BJELANOVIĆ[1]

Abstract: *This article presents results of the research relating to the influence of light regime on seedling regeneration in the mixed silver fir – Norway spruce forest at Dnolucka planina, Bosnia and Herzegovina. For the purpose of assessing the influence of heterogeneous light environments on density and ADR (apical dominance ratio) of fir and spruce seedlings, our study was conducted in experimental canopy gaps ranging from 50 m2 to 300 m2 in size. Microsite suitability for seedling establishment under dense crown canopy was assessed, as well as the survival ability of seedlings up to 2 m in height. Processing of the hemispherical photographs was performed by using the software application Gap Light Analyzer 2.0 in order to evaluate light regime on the chosen sample plots. The results suggest that ADR for both species changes with gap size, that is, with different levels of shading. Seedling density was correlated with gap size and canopy structure. It was determined that very small gaps (up to 50 m2 in size) have on average about 12,9 % light transmission and provide fourfold higher density of fir seedlings in relation to spruce (1,12:0,31 N/m2); in small gaps ranging from 50 m2 to 150 m2 in size, light transmission reaches 19,5 % and these microsites provide slightly higher density of fir seedlings than that of spruce (0,52:0,43 N/m2); on the other hand, middle-sized gaps ranging from 150 m2 to 300 m2 in size, transmit about 34,1 % of full light and enable threefold higher density of spruce seedling compared to silver fir (0,62:0,22 N/m2). The results obtained from the field have applicable character in forestry business practice since drawn models representing statistical dependence of seedling density and ADR on forest canopy cover and light regime provide specific ecological implications.*

Key words: mixed fir-spruce forest, canopy gaps, light regime, hemispherical photographs, seedling establishment.

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CONTRIBUTION TO THE LIGHT REGIME COGNIZANCE IN SESSILE OAK STANDS ON FRUŠKA GORA MOUNTAIN

Violeta BABIĆ[1]

Abstract: *results of light regime research in pure sessile oak stands located in the area of National park "Fruška Gora", are shown in this paper. Pure sessile oak stands in this area cover 3960.73 ha, i.e. 17.6%. Reserched stands belong to the most frequent sessile oak forest type (Quercetum montanum typicum Čer. et Jov. 1953) on acidic brown soils and ilimerised acidic brown soils. Stands are even aged, origin is vegetative, between 100 and 105 years of age. Data collecting was done in the summer of 2008, on two different aspects. The stand on southeastern aspect is located at 350 m a.s.l, inclination is 25°, canopy is sparse to complete (0.6 to 0.7). The stand on northwestern exposure is located at 345 m a.s.l, inclination is 15°, canopy is sparse (0.5 to 0.6). The Stationary isohel method is used for the ascertaining of stands light regime. Isohel maps were drawn, the average light intensity and light permeability indices were calculated for the areas between isohels, based on average light intensity values on monitoring spots. Significant differences in light regime were established in researched stands which have different canopy and aspects.*

Key words: Fruška Gora, sessile oak, canopy, light regime

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THE IMPACT OF CLIMATE FACTORS ON VIEW AND COMPOSITION OF PLANT COMMUNITIES IN THE SUBALPINE BELT ON KOPAONIK

Blagoje PEJIĆ[1]

Abstract: *Norway spruce and dwarf juniperi in subalpine belt on Kopaonik build a very sensitive plant communities (Ass. Piceo subalpinae-Vaccinio-Juniperetum Mišić et Popović 1954). The research results confirm that minimal changes in climate caused obvious changes in the composition of plant communities, especially in areas of contact between two different plant communities. From the relevant research can draw the conclusion that the increase in mean values of temperature, as a result of global warming and the greenhouse effect, its first manifestations had in contact zones of sensitive plant communities in unfavorable environmental conditions.*

Key words: climate changes, subalpine belt, Kopaonik

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ADAPTATION OF SCOTS PINE (PINUS SYLVESTRIS L.) ECOTYPES OF THE ILLYRIAN REGION IN THE AFFORESTATION IN SOUTH-EASTERN SERBIA

Ljubinko RAKONJAC[1], Vasilije ISAJEV[2], Mihailo RATKNIĆ[1], Vera LAVADINOVIĆ[1], Aleksandar LUČIĆ[1]

Abstract: *The methodological approach to Scots pine ecotype differentiation was studied. It was presented that the specific site conditions of the wider ecological range of Scots pine in Bosnia could have affected the processes of the reproductive isolation of this species, despite the small geographic distance of the study populations. The study of Scots pine ecotype differentiation shows that there is a regular interdependence between Scots pine morphological-anatomical and eco-physiological properties and the characters of¬ the sites. It is the defined regularities of the distribution of the researched elements by the study groups that actually represent the adopted parameters of Scots pine ecotype differentiation. Based on the analysis of all differential characters, the populations are grouped into 5 Scots pine ecotypes.*

The planting stock applied in the afforestation with Scots pine in the conditions of south-eastern Serbia should originate from the phenogroup B1 (after Tošić's classification of the sites very close to Scots pine natural sites - regarding the altitude).

Key words: Scots pine, ecotype, afforestation, different sites.

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STATUS OF FOREST REGENERATION IN DIEBACK AFFECTED ABIES DENSA (EASTERN HIMALAYAN FIR) STANDS OF CHAMGANG-HELELA REGION (THIMPHU), WESTERN BHUTAN

Sonam Tobgay[1]

Abstract: *In the sub-alpine, natural mono-specific Abies densa forests in Chamgang-Helela region, Thimphu (Western Bhutan), almost all trees in the upper ridges were killed by drought triggered massive fir dieback in the late 1970s and early 80s. There is lack of information regarding the regeneration and vegetation dynamics of these affected fir stands. We investigated tree regeneration in 20 20x20m randomly established permanent plots spread across the study area with a distance of 50m between each plot. Inside each plot 5 1x1m mini-plots were nested. The working hypothesis was that ultimately die-back affected stands would be replaced again by mono-specific Abies densa stands, because fir, with the exception of Juniperus recurva, is the only dominant, long lived tree species at this elevation. Some advanced tree regeneration was present in the vicinity of the mini-plots but not inside the mini-plots. Since the dieback Abies seeds have been deposited and germinated, although recruitment during the initial years after the dieback was discontinuous. At present an average density of 0.6 seedlings of fir per m¬² exists. The fact that only 26 percent of the mini-plots showed regeneration indicates patchiness of the regeneration which will result in a mosaic of dense and open forest. Different site factors and other factors like micro-site (moss, leaf litter, mineral soil and organic matter), grazing, shade, slope, altitude, competing ground vegetation have influence on Abies densa germination and survival. The mortality of Abies densa germinants could not be observed. The seedling density of other tree and shrub species like Juniperus recurva (0.1 m-²), Acer sp. (0.18 m-²), Rhododendron arboreum (0.13 m-²), R. cinnabarinum (0.11 m-²), R. lepidotum (0.18 m-²), R barbatum (0.02 m-²), Viburnum nervosum (0.01 m-²) and Rosa sericea (0.29 m m-²), were much lower compared to Abies densa (0.6 m-²). These low numbers indicate that it is unlikely that a closed pioneer, Juniper or Acer stand will be formed, displacing the previous fir stands. For some time, the forest stands will be a mosaic of dense and wide spaced fir trees. We anticipate that over time, mono-specific Abies densa forest will eventually once again*

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replace the present stand composition of the dieback affected fir stands.

Key words: Forest regeneration, disturbance, forest dieback, biodiversity, dynamics, micro-sites, Abies densa, replacement.

AIR POLLUTION EFFECTS ON STOMATAL DENSITY OF HORSE CHESTNUT AND LIME IN BANJALUKA CONDITIONS

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Zoran GOVEDAR[1], Zorana HRKIĆ[1]

Abstract: *The aim of this paper is to determine the air pollution impact on the stomatal density of investigated woody species horse chestnut and lime in the tested conditions of air pollution of the Banja Luka city. City of Banja Luka is a city known for the greenness and famous green alleys. There were tested listed species because they are in the alleys and parks in the city. Tests were conducted in the West transit, where a daily flow of cars was 23 750 in May 2008. and in Šeher where it is estimated a lower half flow of cars.*

Key words: Stomatal density, horse chestnut, lime, air pollution.

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FOREST GENETICS, NURSERY PRODUCTION, PLANT BREEDING AND CLIMATE CHANGES

ASSESSMENT OF THE ADAPTABILITY OF NORWAY SPRUCE, SILVER FIR AND COMMON BEECH IN PROVENANCE EXPERIMENTS

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Abstract: *Climate change is expected to have largely unpredictable effects on forest ecosystems. Reliable information about adaptability of forest tree species are therefore critically important for planning any mitigation and adaptation measures. Provenance experiments comprised of samples (provenances) from different source populations, make it possible to study reaction of forest tree species to changed sites, along with intraspecific variation and role of genetic factors in their reactions. If a bigger set of provenances is tested at more plots in different environments, a general reference about the species´climatic adaptability and plasticity can even be obtained.*

Our study focused on 3 main species of the mountain forests of Central European: In Norway spruce, we evaluated growth and survival of 49 provenances on a series of 5 plots established along an altitudinal gradient covering its whole cultivation range in Slovakia. In European silver fir, we compared 45 provenances at 2 plots in Central Slovakia. In common beech, growth, survival and vegetative phenology of 100 and 32 provenances were studied at 2 provenance plots, respectively, established on typical beech sites in Slovakia.

To assess the reactions of provenances to transfer, we used the regression approach of Rehfeldt et al. (1999). Optimum transfer rates were derived from quadratic regressions between the survival, growth and phenology of individual provenances and/or species and ecodistances (differences in geographical coordinates or ecological variables between source populations and locations of trials). The emphasis was on the effects of climatic parameters including temperature, precipitation and vegetation period.

All three species tended to grow and survive better when their provenances are transferred to somewhat lower altitudes, where the positive effect of longer vegetation was more important than increasingly deficient precipitation. The altitudinal interval with positive responses was broader in common beech than Norway spruce. Within species, local provenances were not

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necessarily the best responding to changed site conditions regarding the growth (Norway spruce, silver fir), survival (all species), and vegetative phenology (common beech).

Key words: provenance experiments, adaptability, Picea abies, Abies alba, Fagus sylvatica

EFFECT OF THE SITE CLIMATE CHARACTERISTICS ON MORPHOMETRIC PARAMETERS OF SCOTS PINE (PINUS SYLVESTRIS L.) REPRODUCTIVE ORGANS

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Abstract: *The effects of the site climate characteristics site on morphometric parameters of Scots pine (Pinus sylvestris L.) reproductive organs were researched. Scots pine was selected for the study because it is one of the most significant species irreplaceable in afforestation processes on dry, degraded and eroded sites. The research includes seven Scots pine populations in Serbia in which there were significant differences in the site climatic parameters. The analysis included the shape (cone width and length), average number of seeds per cone, extraction coefficient, absolute seed mass, as well as germination quality. Also, the basic climate parameters were analysed: average annual temperature, average t. during the vegetation period, absolute minimum and maximum, annual precipitation and precipitation during the vegetation period.*

Key words: Scots pine, climate change, morphometric parameters

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GROWTH VARIABILITY OF BEECH IN INTERNATIONAL PROVENANCE TRIALS IN SERBIA

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Saša ORLOVIĆ[1]

Abstract: *The paper presents research of growth elements (diametars and heights) of five and six years old beech plants (Fagus sylvatica L.) in international provenance trials established at Fruska gora Mountain and Debeli Lug. Provenance trials are consists of 25 provenances, where each provenance is represented by 50 plants, planted in 5 rows with 2x1 m spacing.*

Resoults showed significant variability of growth elements values, both between and within the provenances. In general, provenances located at Mt Fruska Gora had higher values of diametars and heights than the same provenances located at Debeli Lug. Also, resoults indicate that domestic provenances did not have highest values of growth parametars, as well as that the growth parameters of the farthest provenance from Germany were not the lowest.

Key words: beech, provenance test, diametar, height.

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THE IMPORTANCE OF GENETIC MELIORATION OF OAK SEED STANDS (QUERCUS PETRAEA / MATT / LIEBL) IN THE LIGHT OF CLIMATE CHANGE

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Abstract: *Climate changes that occur are obvious, and the consequences of their effects are already present in different ecosystems and human everyday life. Particularly affected are forest ecosystems where, for several decades, the attention of the forestry science and profession has been focused on the oak forests, especially on the Sessile oak forest (Quercus petraea /Mat/Liebl). Maintaining high-quality stands of this type has multiple significance. Besides the economic and ecological importance of the oak forests, the need for improving the seed and nursery production is particularly important. Technological procedures in the production of seeds and seedlings should be focused on the production of seedlings with morpho-physiological characteristics which will correspond to the climate conditions predicted for the next 50-100 years.*

The paper presents the results of activities conducted in genetic-melioration in seed stands of a 100-year-old oak in the area of Forest Enterprise "Banja Luka"-B&H. We have analyzed the works done in the previous period, conducted the first thinning with the aim of genetic melioration, collected data in the field, tested the quality of fructification and proposed the measures which will be used in the future. Starting from the bio-ecological characteristics of the analyzed species, complexity of oak stands, as well as their sensitivity and response to climate change, the implementation of genetic melioration in seed stands aims at improving the production of the seeds of this species through the targeted use of the genetic potential of seed stands.

Key words: *Quercus petraea*, seed stands, genetic melioration, climate change

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ANALYSIS OF MORPHOLOGICAL PARAMETERS OF THE LEAF OF WILD CHERRY (PRUNUS AVIUM L.) FROM BOSNIA AND HERZEGOVINA

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Abstract: *The objective of this investigation has been to obtain a clear insight into the individual and population variability of the leaf of wild cherry (Prunus avium L.) by means of statistical analyses. Attempts have been made to avoid the pitfalls observed in the works of other authors and those encountered in the course of the preliminary investigation.*

Based on the conducted investigation, recommendations have been made for selection of trees and a methodology has been designed for collecting leaf samples for further analyses.

The collected materials (20 populations, 571 trees, 115.998 leaves, 95.988 measured characteristics and 95.988 derived characteristics) were subjected to multivariate, univariate and descriptive analyses in order to obtain a clear insight into the variability of wild cherry on the territory of Bosnia and Herzegovina.

Multivariate analysis was found to be most convenient for data processing. The UPGMA method of clustering exhibited the best fit with the original matrix of distances (r0 = 0.43). This method showed that the 15 clusters may be divided into 3 groups and 3 subgroups. The cluster analysis indicated that individual groups comprised geographically distant populations. Site and vegetation analyses showed that the clusters contained elements that characterized them as thermophilous phytocoenoses. The first and third cluster contained mesophilous floristic elements.

The descriptive analyses exhibited similarities with the multivariate analysis. The PCA method turned out to be unsuitable for this kind of research since the analyzed populations could not be classified on the basis of the analyzed characteristics.

The purpose of this investigation is to provide a better insight into the genetic diversity of the local wild cherry populations in order to make plans relative the establishment of seed bases and maintenance of the wild cherry gene fund of Bosnia and Herzegovina.

Key words: wild cherry, population, leaf, gene fund, seed basis

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TECHNICAL GUIDELINES FOR SESSILE OAK GENETIC CONSERVATION STRATEGIC PRIORITIES IMPLEMENTATION IN SERBIA

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Abstract: *Sessile oak (Quercus petraea agg. Ehrendorfer 1967) and its populations have significant economic importance in the forestry of Serbia, but also high level of endanger because of forest drying effects caused by acid rains influence. Multidisciplinary approach of the species variability assessment has been applied in this research and considered as a complex of two categories: adaptive variability, affected by environmental factors, and neutral variability, which is not affected. The species genetic variability was estimated applying cpDNA universal primer pairs and five different haplotypes were detected in the analyzed sample material from populations in Serbia. The baseline for genetic conservation strategic priorities programming and implementation has been established by defining of Sessile oak genecological zones, specific genecological regions and high variability level populations with rare haplotypes appearance. The areas in West and Southwest Serbia, with all their specificities, represent an exceptional potential for the conservation of Sessile oak variability, which can have a very significant role for the enhancement of the species adaptability to global climate changes, which are apparently unavoidable. According to the Sessile oak (Quercus petraea agg. Ehrendorfer 1967) Genetic Conservation Strategy general and specific goals, presented in previous researches, Technical guidelines for the species genetic conservation strategic priorities implementation have been established. These Technical Guidelines are intended to assist those who cherish the valuable Sessile oak genepool and its inheritance, through conserving valuable seed sources or use in practical forestry. The focus is on conserving the genetic diversity and rare haplotypes of the species, especially within specific populations for genetic conservation purposes, selected according to cpDNA variability research results. The Guidelines are based on the available knowledge of the species variability and on widely accepted methods for the conservation of forest genetic resources.*

Key words: Sessile oak, Conservation strategy, Technical guidelines

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PRODUCTION OF NURSERY PLANTING MATERIAL FOR THE PURPOSE OF REALIZATION OF THE STRATEGY OF AFFORESTATION BELGRADE AREA

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Abstract: *The Strategy of afforestation Belgrade area provides 100,000 ha of potential surface. The first phase of the implementation of the strategy is the activation of productive capacity, which should provide the required range of planting materials. The paper presents the results of the current research state and potential of the nursery plant production in the Belgrade area.*

Nursery plant production in the area of Belgrade has a long tradition. One of the oldest nursery in Serbia was formed even at the end of the nineteenth century at the bottom of Avala. Now at the Belgrade area there are 34 registered nurseries. The anual production is about 1,350,000 seedlings. Nurseries are unequally distributed. Some marginal Municipalities do not have the organized production of planting material, although there are favorable conditions. Forest complexes at the area of Belgrade, mostly from deciduous trees are great, but they are poorly used as sources of forest seeds. Existing Index of seed-stands of forest trees is poor as the number of structure in the area of Belgrade (22) as well as the number of trees species (14). Seed stands occupy an area of 835.35 hectares which is only 2.32% of total forest covered land area. Seeds production in the Belgrade area is not balanced, so that from about 18 000 kg of seeds annually, 99% is the acorn. According to conducted surveys nursery production covered only 29 species. Of the 13 needed, the main species, now is produces only 6 species, while for the remaining species still do not have organized the production in the Belgrade area.

In order to realize the Strategy as well as to preserve the diversity collection of forests seed, technology developing and production of high quality planting material has to be done. In addition to main species, it is necessary to produce seedlings following species from second layer of indigenous forest communities, because they are in the existing nurseries very poorly represented.

Key words: afforestation, nursery production, strategy

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CHARACTERISTICS OF BIOLOGICAL REPRODUCTION IN TREE SEED SOURVES

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Abstract: *Tree and shrub reproduction is not a simple property, it is an integral process of internal and external conditions. Reproduction includes both the processes that determine the variability and the processes that ensure the genotype stability. The balance between these two processes is designated as the recombination system. The tree and shrub species are characterised by the open and restricted open type of this system. The characteristics of the combination system and the goals of production create the essential differences in the organisation of seed and nursery production in forestry and landscape architecture. The analysis of the hierarchical levels and regulative factors in recombination systems in forest seed sources contributes to further enhancement of cultivated tree communities. The principles of tree and shrub breeding should be carried out at all levels of biological integration in the sense of planting stock resistance to the attacks of harmful fungi, viruses, insects and other extremely unfavourable environmental factors.*

Key words: tree reproduction, seed sources, recombination system

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A COMPARISON BETWEEN AESCULUS FLAVA ANTHER AND MICROSPORE SUSPENSION CULTURE

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Branka VINTERHALTER[1]

Abstract: *Anthers of A. flava were isolated from disinfected flower buds and cultivated on solid callus induction medium (CIM), containing Murashige and Skoog's (MS) mineral solution and 1 mg/l each 2,4-dichlorophenoxyacetic acid (2,4-D) and 6-furfurylaminopurine (Kin). A half of anthers was kept on solid CIM medium and the other half was macerated 3-5 days later, to create microspore suspension cultures. The microspores released from anthers were suspended in liquid CIM medium, sieved through a 50 micrometer mesh and shaken on a platform shaker. Eight weeks later, anthers were transferred to regeneration induction medium (RIM) containing MS salts, 0.01 mg/l 2,4-D and 1 mg/l Kin. Microspore suspensions were mixed with equal volumes of cooled RIM and the mixture was dispensed in Petri dishes. Embryo emergence from both types of cultures was monitored over a 2-month period. The difference in embryogenic potential of anthers isolated from different parts of inflorescence axis was observed. Anthers isolated from basal third of inflorescence (A-anthers) exhibited the highest frequency of embryo formation (36.6%), comparing to anthers from the middle third of inflorescence (B-anthers) and particularly the top third anthers (C-anthers). The embryo average number per anther did not differed significantly between A- and B-anthers, whereas it was significantly lower in C-anthers. The same tendency was observed in microspore suspension cultures. Microspore suspension culture was more efficient method for embryo induction, as it yielded twice more embryos then anther culture. Androgenic embryos obtained by both techniques were maintained and multiplied by repetitive somatic embryogenesis on solid RIM medium.*

Key words: androgenesis, anther culture, microspore suspension, yellow buckeye

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MATURATION OF AESCULUS FLAVA (MARSHALL) ANDROGENIC EMBRYOS

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Abstract: *Yellow buckeye (Aesculus flava Marshall) is an ornamental species originating from North America. Nevertheless, cultivated A. flava tree, about 15 years old, growing in the Botanical Garden "Jevremovac" of the Belgrade University. Closed flower buds (4-5 mm long) with premature anthers were harvested from A. flava tree.*

Androgenesis was induced in anther culture on solid MS (Murashige and Skoog, 1962) medium with 2,4-dichlorophenoxyacetic acid (2,4-D) and kinetin (1.0 mg l-1of each). Globular androgenic embryos were noticed after two months. However, after globular embryos, heart, torpedo-like and cotyledonal embryos were appeared.

Feature development and multiplication of androgenic embryos proceed on a solid medium with reduced concentration of 2,4-D (0.01 mg l-1) and same concentration of kinetin. After medium for multiplication, embryos were cultured on media for embryo maturation supplemented with various concentrations (0.1, 0.5 and 1%) of activated charcoal.

The effect of activated charcoal has been attributed to the absorption of inhibitory substances, such as phenolic compounds which are produced embryos, from the medium.

The best results of germination and maturation of A. flava androgenic embryos were obtained on medium supplemented with 1 % activated charcoal. Also, the greatest number of secondary somatic embryos and the lowest number of albino embryos were noticed on the same medium.

This is the first report about induction and maturation androgenic embryos originating from A. flava anther culture.

Key words: anther culture, androgenesis, germination, maturation, yellow buckeye

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CHEMICAL-ANATOMICAL CHARACTERISTICS OF FRAXINUS ANGUSTIFOLIA VAHL. SSP. PANNONICA SOO & SIMON IN THE REGION OF MOROVIĆ

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Abstract: *Anatomical and chemical characteristics of a tree depend on various factors, first of all on the kind of tree and within the kind on conditions of site, that is climate factors as well as soil quality. These differences which are the results of natural factors combination- genetic characteristics, the influence of the enviroment and the age of ksylem are shown in the form of type, quantity and kind of cells that forms a tree, and in the base of all are the differences regarding chemical constituents of a tree, both structural and secondary.*

This study shows the results of the research of anatomical and chemical structure of the subspecies Fraxinus angustifolia Vahl. ssp. Pannonica Soo & Simon in the ash three and common oak forest type (Fraxineto-Quercetum typicum) on moderately moist fertile soil in swampy area in Morović region.

Key words: cellulose, lignin, Mean numerical fibre lenght, Mean mass fibre lenght, Runkel's number

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A RAPID PROTOCOL FOR IN VITRO PROPAGATION OF WHITE POPLAR (POPULUS ALBA L.)

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Abstract: *Poplars have been planted widely in temperate zone because of their fast growth and utilisation for biomass production. Poplars also serve as a material for reforestration of destroyed infertile lands. Collection of species and varieties of poplar could be a start in sellecting clones resistant to different environmental stresses, while micropropagation provides rapid production and maintenance of selected clones. We present rapid protocol for micropropagation and ex vitro aclimatization of two clones of P. alba. Shoot induction medium consisted of MS medium suplemented with BAP (2.25 mg/L), NAA (0.186 mg/L). For shoot multiplication BAP (0.1 mg/L) and NAA (0.1 mg/L) were used, while rooting of produced shoots were performed on hormone free half strength MS medium. Two clones differed in both, shoot lengt (39.9 ±1.8 and 26.1 ± 2.3) and multiplication index (5.4 ± 0.4 and 2.7 ± 0.3), while rooting was 100%. Acclimatization for both clones was 70 - 80%, the time period from initiation of shoot buds to ex vitro acclimatized plantlets being 4 months.*

Key words: in vitro, micropropagation, Populus alba.

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THE EFFECT OF GENOTYPE ON ANDROGENESIS INDUCTION OF AESCULUS HIPPOCASTANUM L.

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Abstract: *Influence of different genotype, age of trees and environmental temperature on induction of androgenesis and apperance albino horse chestnut embryos were studied. Efficiency of in vitro androgenesis via anther and microspore culture were investigated using the same closed flower bud material. Androgenic response of different genotypes was measured and compared. Anther induction rates were from 5 % to 37.6 % depending of genotype. Under optimal conditions, the number of embryos per isolated anther varied between 0.5 to 5.0 embryos in anther culture, while in microspore culture varied between 3.0 to 27 embryos, depending of genotype. A microspore culture was 5-6 times efficiency than anther culture for same genotype.*

Age of the trees had no influence on androgenesis induction. Temperature of about 4-5°C was optimal for androgenic embryo induction.

Flow cytometric analysis of embryos and regenerated plants showed that the most of the androgenic embryos were haploid, corresponding to their microspore origin, while a half of these were diploid, after 6 months in culture.

Key words: horse chestnut, genotype, androgenic embryos, ploidy stability.

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AFFORESTATION, SILVICULTURE, FOREST ECOLOGY AND CLIMATE CHANGES

FACILITATION PROCESS AND SPROUTING ABILITY AS SILVICULTURAL TOOLS IN THE FRAME OF CLIMATE CHANGE

Elias MILIOS[1]

Abstract: *As a result of global warming foresters are to face a new ecological reality. A great sift of forest types will be observed in southern Europe. Many species and forest types will move north, while in mountainous areas forest zones are expected to shift upward. Moreover, many ecosystems will be either degraded or collapse. In the frame of climate change, silviculture has to develop practices in order a) to facilitate the gradual transition from one forest type to another, b) to preserve ecosystems and forest types and c) to restore degraded ecosystems as a result of global warming. The imitation of species and ecosystems responses against disturbances and abiotic stress will reinforce this effort. Modified silvicultural systems, in which species spouting ability and seedling sprouts are incorporated in regeneration procedure, have to be developed and applied to forests where species are in danger of extinction or the abiotic conditions are harsh. In addition, sprouting has to be used in the restoration of degraded ecosystems. Another process that can be incorporated in restoration and reforestation activities is facilitation among plants by creating specific microhabitats with a favorable microclimate. Moreover, facilitation during the stand regeneration in shelterwood systems may be used in more cases and in more species than in the present. More research is needed in south Europe regarding: a) species sprouting ability and b) the role of facilitation in the establishment of many species in various environments. In addition, practices that use facilitation or sprouting in silvicultural systems or restoration activities must be checked in both silvicultural p*ractice and research trials.

Key words: Sprouting ability, facilitation, ecosystem preservation, restoration, global warming

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CLOSE TO NATURE ARTIFICIAL REGENERATION OF EXTENSIVE CALAMITY CLEARINGS

Anna TUČEKOVÁ[1]

Abstract: *Results of research on close to nature technological procedure of artificial regeneration in form of sowing to "vegetation cells" are presented in the paper. In the time of crisis it is one of possible cheaper procedures of artificial regeneration of extensive clearings, especially in case of the lack of high quality planting stock. In Slovakia we have been verifying this technology in 12 localities of calamity and extreme clearings being affected by climatic changes. Success of sowing to „vegetation cells" has been tested for 11 tree species as Norway spruce, European larch, Scots pine, silver fir, European beech, Sycamore maple, pedunculate oak, black alder, black locust, common ash, and Swiss stone pine. In case of high quality seed with good germination energy, the seed of tested tree species germinated with 85-100% success. Germinated seedlings survive without any greater problems, damage, mostly in good health condition. They have favourable conditions in the „cells" during vegetation period, which is affected by climatic changes, without any greater temperature or moisture fluctuations. Some of them already during the first vegetation period reach the height of plastic cover (conifers), while broadleaves exceed by their heights plastic cover by about 5-15 cm. After the fourth year some broadleaves reach height of 60 cm up to 200 cm (beech, oak, alder) and conifers 50 cm up to 75 cm (pine, larch).*

Key words: extensive calamity clearing, sowing, "vegetation cells"

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PATTERNS OF FOREST REGROWTH FOLLOWING CLEAR CUTTING ON LANDSAT WINTER IMAGES

Anton KARDAKOV[1]

Abstract: *The objective of this research was to analyze the influence of stand variables such as time passed since clearcut logging, pre-commercial thinning in young stands, site index class, site type, dominating tree species in young stand composition on radiance changes during early secondary succession on a difference image made in seasonal snow cover conditions. Radiance differences were derived from a difference image of a two-date Landsat Thematic Mapper (TM) image pair.*

The results of the study show that, there is a significant effect of time passed since disturbance of clearcut logging, on the radiance difference of regenerating patches on a difference image. The effect of pre-commercial thinning on radiance in young stands was significant if the treatment was performed within three years before the second image was taken.

Key words: Remote sensing, forest change detection, Landsat Thematic Mapper, winter images, clearcut regeneration

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THE MOST IMPORTANT PROBLEMS OF HUNGARIAN AND TURKEY OAK FOREST RECLAMATION ON THE TERRITORY OF BELGRADE

Milun KRSTIĆ[1], Marina VUKIN[1], Ivan BJELANOVIĆ[1]

Abstract: *The total area of forests on the territory of Belgrade is 38.853 ha, with wood volume of 4.8 million cubic meters and annual increment of 229.870 cubic meters. The forest cover percentage in Belgrade amounts to 11.8%. The stands of the climatic communities of Hungarian and Turkey oak (Quercetum frainetto-cerris Rud. 1949), which belong to the special purpose forest category, account for a significant part of Belgrade forest fund. These forest complexes are characterized by the following: a considerably high portion of coppice stands (90%); unfavorable age class proportions (more than 80% of these stands are in the same age class, i.e. 60-70 years); unfavourable composition of tree species, with a big proportion of Turkey oak and a small proportion of Hungarian oak; a certain portion of degraded and at some places devastated stands etc. All these factors, together with the negative succession of vegetation and inadequate introduction of autochthonous and allochthonous woody species, have lead to both decreased utilization of production capacities and inadequate provision of multiple benefit forest functions. Conducted research projects present a synthesis of all past analyses of stand condition and silvicultural aims on certain pilot objects in the stands of Hungarian oak and Turkey oak on the territory of Belgrade. The findings are particularly demonstrative of the need for strategic planning of future development and for defining measures for successful acclimatization of these forests to markedly negative factors of abiotic and biotic nature in the urban conditions and to particularly negative climatic changes. In order to improve the state of these forest complexes which are of great importance for Belgrade, suitable reclamation operations have been proposed as the basis for comprehensive models of solutions.*

Key words: Hungarian oak, Turkey oak, special purpose forests, reclamation, climatic changes

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THE CREATION OF THE SITE INDEXES OF THE FOLLOWING AUTOCHTONOUS CONIFER SPECIES: AUSTRIAN PINE, SCOTS PINE AND SPRUCE

Mihailo RATKNIĆ[1]

Abstract: *The created site indexes for the Austrian pine were marked as following: 10, 12, 14, 16, 18, 20 and 22, for the Scots pine: 14, 16, 18, 20, 22, 24 and 26, and for the spruce: 15, 17, 19, 21, 23, 25 and 27. This classification of the site productivity by the site indexes is a result of the fact that the previous researches showed that there was a great disharmony between the developmental-productive characteristics of the cultures in Serbia with the increment-yield tables. The heights, diameters, basal area, volume and volume increment of the Austrian pine are significantly greater than the data from the tables by Nedjalkov (1962). The similar situation is typical for the Scots pine (in comparison with the tables by Wiedemann) and spruce (in comparison with the tables by Schwapach and Wiedemann). It points to the absolute uselessness of the current increment-yield tables for the conifer cultures in Serbia, which is partly caused by the fact that these tables were based on the models of the development of the natural stands. Their uselessness is particularly emphasized in the cultures established with 2,000-2,500 seedlings per a hectare. The model of the development of the trees enables the easy parametarization or reparameterization of the models, under the conditions of the climate change. The paper presents the dependance of the site indexes on the ecological and stand conditions.*

Key words: site indexes, Austrian pine, Scots pine, spruce, cultures

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MODELS OF BEECH HEIGHT GROWTH IN DIFFERENT ECOLOGICAL CONDITIONS

Mihailo RATKNIĆ[1]

Abstract: *Numerous associations, sub-associations and facies indicate the wide range of beech, which results in different production potentials of beech, but also the need of planning different silvicultural and management measures. Models of dominant tree height growth are a strong foundation of site class assessment, projection of silvicultural and management measures, evaluation of the actual state and the forecast of the future state. The models of beech height growth are based on the data of analysed trees in 13 ecological units (strata) with five repetitions in each ecological unit (65 trees). The subjects of analysis were the trees which were not shaded for a longer time during their development. The differences in dominant tree height per ecological units were tested by the analysis of variance, and the correlation between height and age was described by Todorovic's function. Ecological units were singled out based on geological, soil and phytocoenological studies. The analysis of variance shows that in all study years, there are statistically significant differences in tree heights of the dominant layer. The differentiation of ecological units in the attained tree heights starts already from the age of 10 years. The order of ecological units according to the attained heights is variable till the age of 70 years. After that, there are almost no changes in the order of ecological units according to heights, meaning that the site effect on the attained maximum height becomes evident only after the age of 70 years. Based on a series of heights of all ecological units, in order to generalise the characteristics of height growth, we formed the site indices for beech. Altogether eight SIs for the age of 150 years were formed. Growth models were applied for soil class assessment and for the determination of terms for silvicultural and management operations in the stands. The beginning of the silvicultural operations and their periodicity depends on the site productivity and they should differ.*

Key words: site index, beach stands, growing model, climate change

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THE CREATION OF SITE THE INDEXES OF THE ALLOCHTHNOUS CONIFER TREES: DOUGLAS FIR, COMMON JUNIPER AND EUROPEAN LARCH

Mihailo RATKNIĆ[1]

Abstract: *This paper presents the results of the creation of the models of the determination of the site productivity classes by the use of the site indexes. The site indexes are the models of the development of the dominant trees. The growth rates are not in the harmony with our views and models which were created, and the goal of the complete adaption to the new circumstances in the forests ecosystems, mainly to the change of the climate conditions, is still far from being achieved. The satisfactory results cannot be achieved by the transformation of the current models by the use of the correction factors, or the creation of the new tables of the increment and yield based on the old principles. As a result, there is a great risk that the tables after the creation, which is very complex, long-lasting and expensive, can be shortly outdated, due to the change of the growth conditions. Therefore, the models of the growth which enable the incorporation of the new pieces of information on the increment, without the construction of the whole model, will be used in the future. These models enable the creation of the different scenarios of the impact of the stimulating and distrubing factors, based on the principles "if-then": if there are certain growth conditions, then the following growth dynamics is anticipated. These models are focused on the single trees, which enables the creation of the yield tables for the pure and mixed stands based on the new principles. In order to achieve this goal, the rich and reliable database on the conditions and yield characteristics of the most important species of the forest trees is needed. The construction of the models based on the new principles is enabled by the creation of the site indexes. The created site indexes for Douglas fir and common juniper are: 18, 20, 22, 24, 26, 28 and 30, and for the European larch: 14, 16, 18, 20, 22 and 26.*

Key words: site indexes, Douglas fir, common juniper, European larch, cultures

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THE CHANGES OF THE WAYS IN WHICH THE LAND IN GRDELIČKA GORGE AND VRANJSKA BASIN IS USED

Sonja BRAUNOVIĆ[1], Mihailo RATKNIĆ[1]

Abstract: *By the use of satellite photos of the high resolution the areas covered by forests, arable land, meadows and pastures, orchards, vineyards and barren soil in Grdelica gorge and Vranje basin were singled out. These data serve as a base for the creation of the erosion map of the researched area and at the same time enable the creation of the model of the adequate use of the space and the protection of it.*

Based on the condition of the ways in which the land was used dated from 1953 it was reported that the forests account for 31.09 %, arable fields account for 29.68 %, and the pastures account for 22.21 %. The barren soil account for 7.71 %, meadows account for 7.00 %, vineyards account for 1.29 %, and orchards account for 1.03 %. Based on the condition dated from 2008 the dramatic change of the way in which the soil is used was reported in comparison with the base period.

Key words: satellite photos, the way in which land is used, erosion processes

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THE SATELLITE PHOTOS OF THE HIGH RESOLUTION IN THE DEFINION OF THE CHANGES IN THE ECOSYSTEMS USING THE HILLY-MOUNTAIN ROGOZNA AREA AS AN EXAMPLE

Mihailo RATKNIĆ[1], Svetlana BILIBAJKIĆ[1],
Sonja BRAUNOVIĆ[1]

Abstract: *The adequate biodiversity protection at the species and genetic level is not possible without the adequate site protection. The climate change causes the increase in the air temperature (increased evapotranspiration), decrease in the quantity of precipitation, as well as the deterioration of the soil physical characteristics. The deterioration of the water-air soil characteristics will lead to the deterioration of the structure caused by the decrease of the nutrient content. The protective role of the vegetation will be reduced, the soil erodibility will increase, as well as the number of the wildfires, whereas the site conditions will deteriorate drastically. The global changes also affect the smaller regions, owning to which the monitoring of them is of a particular importance for the changes in the ecosystems. For this purpose we use the satellite photos of the high resolution, and by the use of GIS technology the method of the monitoring of the periodical changes in the ecosystems was developed. The collected data will enable the creation of the model which contain the dynamics of changes in the natural ecosystems. This paper analyzes the hilly-mountain Rogozna area. The classification based on EUNIS sistem of the site classification was applied. By the use of the satellite photos of the high resolution (pixel size 1m) for Rogozna area the spacial distribution of the sites was defined. By the periodical recording of the characteristic areas in Serbia the spacial distribution of the ecosystems, as well as the changes in their composition and structure, will be monitored.*

Key words: ecosystem, biodiversity, climate change, site, GIS

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SATELLITE IMAGES INTERPRETATION AS A BASIC FORM IN THE LAND COVER DETERMINATION FOR THE NATIONAL FOREST INVENTORY

Milorad JANIĆ[1], Dragomir GRUJOVIĆ[1],
Kristian ARNT[2], Branko MIŠIĆ[1]

Abstract: *The most actual question in the science belongs to the many circumstances such as climate change. The forestry is becoming highly significant for the human life in the all world. Therefore, it is very important to share the knowledge and information among the scientists from different countries without any boundary.*

One of the most important project for our country and belongs resources, was a Forest land inventory. During the realization of that project, in the same time Forestry Faculty start the investigation and cooperation with colleges from Norway. Our cooperation has a special base on the field of remote sensing. According to the basic Logic, in the right time we make a parallel link between those two activities. Now we are in the position to evocate a generally way of ours researches.

In this text are presented the results of classification and interpretation of forest and forest land for National Forest Inventory purposes. For this exploration we have used LANDSAT 7 image for eastern Serbia region, National Forest Inventory data and topographic maps scale 1: 25000. The accuracy of applied methodology is approximately 95 % which is acceptable not even for National Forest Inventory.

Kay words: remote sensing, land cover, forest land, satellite images, classification, Landsat images, Erdas imagin, forest inventory

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REMOTE SENSING USED AS THE RATIONALIZATION FOR THE LAND COVER DETERMINATION

Dragomir GRUJOVIĆ[1], Milorad JANIĆ[1],
Kristian ARNT[2], Branko MIŠIĆ[1]

Abstract: *Global change-challenges for all civilization. All of us have as a priority to think and to tray to find the best answers on the way from degradation, through conservation to sustainable natural resources management. One of the basic question, of course, is the question of the land cover determination. The special aspect of that question, today is the aspect of modern and rational technology for monitoring and control all of those so dynamic changes in the land cover. Remote sensing today present one of the most actual technology, not even in the spaces of those questions about land cover determination. During the cooperation with the colleges from Norway, wee are in the position to inform you about some results from ours investigations witch are special dedicated to the forest land.*

On this text are presented the results of three classification methods: Vegetation Index (VI), Normalized Difference Vegetation Index (NDVI) and Transformed Normalized Difference Vegetation Index (TNDVI) for land cover determination for rationalization of National Forest Inventory project. For this exploration we have used LANDSAT 7 image for Vojvodina region, aero photographs, topographic maps scale 1: 25000 and software ERDAS Imagine. In this case the VI and NDVI methods have shown better compatibility.

Kay words: land cover, forest land, remote sensing, satellite images, Erdas imagin, Vegetation Index, classification, forest inventory, rationalization

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THE ANALYSIS OF THE DELIBLATO SANDY TERRAIN BY MEANS OF THE LANSAT IMAGES

Dragomir GRUJOVIĆ[1], Dragan STEVIĆ[2]

Abstract: *Deliblato sandy terrain spreads across the southeastern part of Panonia plain. The sandy terrain vegetation is an important factor which has impact on the climate of this region, since at this spot the climates of Panonia plain and Carpathians are interwoven. The multi-spectral analysis of the Landsat7 satellite images from the mid-summer period image taking of this region has been carried out. By using the K Means classification, a number of classes have been obtained representing the forest vegetation diversity. As a basis for isolating the vegetation cover the vegetation map has been used, at the scale of 1:25000.*

Key words: Deliblato sandy terrain (Deliblato Pescara), forest vegetation, climate, Landsat7, K Means classification

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THE ANALYSIS OF CLASSIFICATION OF THE PHOTOGRAMMETRIC AND SATELLITE IMAGES CLASSIFICATION BY MEANS OF ISODATA METHOD

Dragomir GRUJOVIĆ[1], Dragan STEVIĆ[2]

Abstract: *The unsupervised classification ISODATA gives the representative data and the wide range of the application in the forest vegetation classification. In this paper the photogrammetric color images have been used, at the scale of 1:14500, the mid-summer period image taking as well as the Landsat7 satellite channels of the Golubac area. The above-mentioned method enables a new approach in the isolating of the homogenous areas in terms of the sustainable forest management, as an important factor in the forming of this area climate. By the image comparative analysis, on the basis of the spectral analysis, with the analytical approach and indicated classification the difference of the accuracy levels and the quality of the forest vegetation isolation classification has been obtained. Depending on the requirements of the sustainable management of forest areas we have chosen the special resolution of the photogrammertic and satellite images*.

Key words: ISODATA method, forest vegetation, climate, photogrammetric images, Landsat7, multispectral analysis.

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SPECTRAL ENHANCEMENT OF THE SATELLITE IMAGES IN THE CLASSIFICATION OF FOREST VEGETATION IN THE REGION OF VRSAC HILL

Dragan STEVIĆ[1], Dragomir GRUJOVIĆ[2]

Abstract: *Forest vegetation is one of the important factors in determining the climate of the local and global character. The spectral Landsat7 satellite channels have a significant application in the vegetation classification. The channels of the visible and near infrared part of the EM specter have been used, the period of taking images was mid-summer, and these images cover the north-eastern part of Serbia (the area of Vrsac Hill). The multi-spectral processing of the satellite image has been carried out by means of unsupervised classification process (ISODAT method), and the spectral enhancement by means of: the vegetation index, normalized difference of vegetation index (NDVI), as well as the transformed NDVI (TNDVI).*

Key words: forest vegetation, climate, Landsat7, multispectral, ISODATA classification

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THE APPLICATION OF FUZZY C MEANS CLASSIFICATION OF THE VEGETATION ON THE PHOTOGRAMMETRIC IMAGES

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Abstract: *The unsupervised Fuzzy C Means classification method, gives the representative data and wide range of applications in the vegetation classification. In the paper the photogrammetric color images covering the area of Kosmaj mountain in the visible part of EM specter (400-700nm) at the scale of 1:15000, in mid-summer period, have been used. The spectral analysis of the images, with the analytical approach and indicated classification enables an accurate isolation of the forest vegetation. The above-mentioned method enables a new approach in the isolation of the homogenous areas for the sustainable forest management requirements as an important factor in the formation of this area climate.*

Key words: Fuzzy C Means classification, vegetation classification, photogrammetric color images, spectral analysis, climate.

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PASSIVE TERRESTRIAL OPTICAL MEASUREMENTS FOR ASSESSING CLIMATE CHANGE IMPACTS ON FOREST CANOPIES

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Abstract: *Influence from environmental factors and growth in forest ecosystems expresses through constant changes in forest structure. Assessment of the driving factor(s) can be based on only on high quality information about forest structure and its changes. Plot based monitoring systems coupled with database analysis and remote sensing tools provides a good system for handling with large areas. However, regular forest inventory systems do not include usually information on two very important variables of forest canopies- leaf area index and canopy cover. Among different methods for leaf area index assessment on the ground hemispherical cameras and similar optical tools are widely being used. Obtaining a true green leaf area index estimate is, however, not a trivial procedure and can not be successful without having unbiased and precise measurement data and objective methods.*

A new method is presented for processing digital hemispherical images to estimate leaf area index. The method does not include thresholding by subjective brightness level (which introduces a great degree of uncertainty), handles changes in illumination variability, can be applied on single below canopy images (avoiding two sensor issues) and is easy to implement. Outcome of the method is angular dependence of forest canopy transmittance which is used in leaf area index calculation algorithms. Results from three different stands from Järvselja, Estonia are presented.

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INVESTIGATION OF ARTIFICIALLY ESTABLISHED BROADLEAVED STANDS ON THE TERRITORY OF STEPIN LUG

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Abstract: *Introduction of autochthonous and allochthonous broadleaved species into oak habitats, categorized as special purpose forests, in different microclimatic conditions presents one of several reclamation operations in these specific forest complexes in central Serbia. The study comprises investigations of environmental conditions (particularly of climatic factors) and stand condition in artificially established stands of Norway Maple (Acer platanoides L.), Narrow-leaved Ash (Fraxinus angustifolia Vahl.), Hazeltree (Corylus colurna L.), Plane (Platanus acerifolia Wild.) and White Linden (Tilia tomentosa Moench.) in the forest complex Stepin Lug on the territory of Belgrade. These valuable stands are about 50 years old. The total number of individual trees and wood volume, for each tree species are as follows: Norway Maple - 650 trees per hectare and 371,13 m3/ha; Narrow-leaved Ash. - 587 trees per hectare and 439,56 m3/ha; Hazeltree - 1559 trees per hectare and 598,24 m3/ha; Plane - 807 trees per hectare and 445,89 m3/ha and White Linden - 982 trees per hectare and 497,05 m3/ha. The stands are even-aged with a sufficient number of good quality trees which can be selected as function bearing trees. On the basis of research results, bearing in mind climatic and microclimatic changes of particular habitat conditions, basic bioecological characteristics of the species and specific features of the functions which these stands have to perform, we have suggested tree species suitable for the introduction into investigated habitats. The selection of these species should ensure stability and durability of the investigated stands, as especially significant forests as well as fulfillment of all multiple benefit forest functions.*

Key words: Introduction of broadleaved trees, oak habitats, microclimatic conditions, especially significant forests

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MONITORING THE IMPACTS OF SILVICULTURAL MEASURES IN THE PROCESS OF RESTORATION OF TREE DEVITALISATION IN COMMON OAK MIDDLE-AGED STAND

Martin BOBINAC[1], Siniša ANDRAŠEV[2]

Abstract: *The impacts of different silvicultural measures on the restoration of tree devitalisation consequences occurring at the stand age of 42 years, were analysed in two permanent sample plots (O.P.-1 and O.P.-2) in artificially established middle-aged stand of common oak, in the age period between 42 and 57 years.*

The stand was established on the noncalcareous chernozem soil type. The site is characterised by the plant community: Tilio-Carpino-Quercetum robori-cerris. During the study period, thinning and sanitation cutting were carried out in O.P.-1 at the ages of 42 and 48 years, and in O.P.-2 only the dead trees were removed.

At the age of 42, there were 832 trees per hectare and volume 194.2 m3•ha-1 in O.P.-1, and in O.P.-2 there were 804 trees per hectare and volume 220.8 m^3•ha^{-1}. Under the similar silvicultural treatment in the stand before the establishment of sample plots, till the age of 52 years, in O.P.-1 altogether 160.5 m^3•ha^{-1} were felled, and on O.P.-2 the felling amounted to 106.1 m^3•ha^{-1}. Over the period 43-52 in OP-2 current volume increment of 8.49 m3•ha^{-1}•yr^{-1} was attained by 612 trees per hectare, and in OP-1 current volume increment of 8.06m3•ha^{-1}•yr^{-1} was attained by 404 trees per hectare. As the result of the applied silvicultural measures at the age of 52 years, the volume per hectare was greater in O.P.-2 (267.4 m^3•ha^{-1}) compared to O.P.-1 (181.9 m^3•ha^{-1}).

After the age of 52, the process of tree devitalisation continued in OP-2, which conditioned the change in silvicultural strategy. 33% of volume was removed by thinning and sanitation cutting at the age of 52 years in O.P.-2, and in O.P.-1 thinning was postponed till the age of 57. With approximately the same values of basal area and volume per hectare in both sample plots at the age of 57, during the period from 53 to 57 years, current volume increment of 7,56 m^3•ha^{-1}•yr^{-1} was attained by 380 trees per hectare in OP-2, and in OP-1 current volume increment of 7.17 m^3•ha^{-1}•yr^{-1} was attained by 404 trees per hectare.

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The study results indicate that the character and intensity of silvicultural measures have a direct impact on common oak rehabilitation from unfavourable effects.

Key words: *Q. robur* L., permanent sample plots, devitalisation, monitoring, impacts of silvicultural measures

UTILIZATION POSSIBILITY OF ALKALIZED SOILS AIMED AT INCREASING FORESTED AREA OF BANAT

Saša PEKEČ[1], Petar IVANIŠEVIĆ[1], Zoran GALIĆ[1]

Abstract: *In Vojvodina, the land affected salts (salt-affected soils) occupy an area of 233.927 ha, of which the "true salty soil" waste 148.000 ha, and 85.927 ha of salty soil land. Within the saline in Vojvodina, class alcalized soil (class salty soils, type solonetz: morphological structure A/E-Bt,na-C-CG, or AE-Bt,na-C-CG) covers an area of 115.593 ha, of which the most in the Banat, areas of 89.249 ha. The results of studying the properties of solonetz soil on examined sites indicate medium deep to deep physiologically active depth profiles (rhizosphere depth). Rhizosphere depth causes position Bt,na horizon, which is explored in the sections located at a depth of 12 to 64 cm. Texture of the land is within the limits from sandy-clayish loam to claysh loam. Iluvial horizon of soil (Bt,na horizon), the texture is always of claysh loam, with colloidal clay content over 38%. Regarding the heavy mechanical composition, this soil has a negative water-air properties. Unfavorable water-air properties are in Bt,na horizon. Carbonate content in depth profile indicates the move (flushing) carbonate in the deeper horizons. The reaction of soil solution in surfice horizon is slightly acid to neutral and in the deeper parts of the profile alkaline. Arrange the content of organic matter is humus accumulative type (1,97-4,29%). Total salt content is highest in Bt,na horizon and ranges from 0,12-0,43%. This soil because of their properties are not used in intensive production. Using the production potential of these lands requires a variety of ameliorative actions. Habitats with alkalized soils was inhabited pedunculate oak-ash forests (Querceto-Fraxinetum angustifoliae) in the past. Now these habitats are degraded, with the remnants of the bush formations of hawthorn or sloe, or individual trees of wild pear, wild apple and wild roses. Therefore, tree species for afforestation of these habitats should be chosen within the above mentioned species of trees, among which are the most appropriate: Quercus robur, Fraxinus angustifolia, Fraxinus americana, Juglans nigra, Populus alba, Prunus sp., Pirus piraster and Eleagnus angustia.*

Key words: solonetz, reforestation, Banat

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THE MICROORGANISMS POPULATION SIZE OF THE SOIL ORGANIC LAYER AND CHARACTERISTICS OF THE BLACK LOCUST LITTERFALL (ROBINIA PSEUDOACACIA L.) ON THE RECLAIMED MINE SOIL OF THE ENERGY-INDUSTRIAL COMPLEX "KOLUBARA"

Zoran MILETIĆ[1], Snežana STAJIĆ[1],
Vesna GOLUBOVIĆ-ĆURGUZ[1]

Abstract: *The researches were conducted on the reclaimed mine soil formed by the deposition of the waste-rock from the open-pits of the lignite mines in three black locust monocultures. The total annual yield of the litterfall, organic carbon and nitrogen, as well as phosphorous and potassium, calcium and magnesium, was studied. The C/N ratio and hydrolized forms of nitrogen were determined. In the soil organic layer under the black locust culture the seasonal dynamics of the population size of the saprophytic mircroorganisms, which perfom the important function in the nitrogen cycle in the forest ecosystems, was studied. Along with the black locust litterfall in the monocultures of these species, the native species has an important role in the formation of the soil organic layer, which provides the various energy material for the saprophytic microorganisms and create favourable conditions for the humus synthesis. The extremely high quantities of nitrogen, which is basic missing nutrient in the studied reclaimed soil, are present in the black locust litter. The products of the decomposion of the black locust leaves are the important source of the nutrients for the native species. Because of the characheristics of the black locust litter and light regime in the black locust stands, this species is very favourable for the use in the thick mixed plantations of the short rotation intended for the production of timber for the energy purposes. The products of the decomposition of the black locust litter and humus in the mixed plantations can improve the nutrition of the other species.*

Key words: black locust, litterfall, soil organic layer, saprophytic microorganisms, nutrients

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THE IMPACT OF THE AUSTRIAN AND SCOTS PINE ON THE ORGANIC FORMS OF PHOSPHOROUS AND THE FORMS OF PHOSPHOROUS AVAILABLE TO THE PLANTS IN THE RECLAIMED MINE SOIL OF THE ENERGY-INDUSTRIAL COMPLEX KOLUBARA

Zoran MILETIĆ[1], Snežana STAJIĆ[1],
Zlatan RADULOVIĆ[1], Katarina MLADENOVIĆ[1]

Abstract: *The impact of the monocultures of the acidifying species (Austrian and Scots pines) on the content of the organic forms of phosphorous and the forms of phosphorous which are available to the plants in the mine soils recultivated by the reforestation was studied. The researches were conducted in the Energy-Industrial Complex "Kolubara". The total annual yield of this element on the area of soil by the litterfall was determined. Under the influence of the cultures of the Austrian and Scots pines in the surface layers of the studied reclaimed soils the content of the organic forms of phosphorous increased in comparison with the deeper layers, whereas the content of the forms which are available to the plants decreased in comparison with the deeper layers.*

Key words: Reclaimed mine soils, Austrian pine, Scots pine, phosphorous

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THE IMPACT OF THE AUSTRIAN AND SCOTS PINE MONOCULTURES ON THE FORMS OF POTASSIUM WHICH ARE AVAILABLE TO THE PLANTS IN THE RECLAIMED MINE SOILS OF THE ENERGY-INDUSTRIAL COMPLEX KOLUBARA

Zoran MILETIĆ[1], Snežana STAJIĆ[1], Vlado ČOKEŠA[1]

Abstract: *The impact of the monocultures of the acidifying species (Austrian and Scots pines) on the content of the forms of potassium which are available to the plants, absorbed and water-soluble, in the mine soils recultivated by the reforestation was studied. The researches were conducted in the Energy-Industrial Complex "Kolubara". The total annual yield of this element on the area of soil by the litterfall was determined. Under the influence of the cultures of the Austrian and Scots pines, as well as under the influence of the products of decomposition of their leaf litter, in the surface layers of the studied reclaimed mine soils, the content of the forms of potassium which are available to the plants increased in comparison with the deeper layers.*

Key words: Reclaimed soils, Austrian pine, Scots pine, potassium

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THE INFLUENCE OF THE SILVICULTURAL TREATMENTS ON THE CHANGE OF QUALITY OF THE ARTIFICALLY ESTABLISHED JAPANESE LARCH STANDS

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Ljiljana BRAŠANAC-BOSANAC[1]

Abstract: *This paper presents the results of the research of the quality of the artificial Japanese larch stands established on the site of the mountain beech forests in Čemernik. On the selected sample plots, based on the studied stand condition, environmental conditions and analysis of the development of trees and silvicultural needs, the low selective thinning of high and moderate weight was suggested as the silvicultural measure. In addition, the trees were classified based on the biological location, as well as on the quality of stems and crowns. The three-degree classification was applied, which means that the trees were classified as dominant, codominant, or depressed trees, and at the same time the quality of stem and crown of each tree on the sample plots was estimated. By analysing the obtained results of the quality and biological position of the trees, the quality of the stand was evaluated prior and after the marking for thinning. The stable stand of the better quality has a greater influence on the creation of the more favourable microclimate of the vicinity, on the mitigation of the temperature extremes, and it enables the increase of the relative air humidity by the evapotranspiration, as well as the reduction of the concentration of the air pollutants, etc.*

Key words: artificially established stand, Japanese larch, the quality of stand, silvicultural treatment, microclimate

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ANALYSIS OF TREE GROWTH ELEMENTS AS A CRITERION FOR STAND CLASSIFICATION BY REGENERATION PRIORITY

Vlado ČOKEŠA[1], Snežana STAJIĆ[1], Zoran MILETIĆ[1]

Abstract: *Felling and dendrometric analysis of altogether 18 mean stand trees and 18 mean dominant trees was performed in different ecological conditions of sessile oak coppice stands in the area of Mt. Cer, North-Eastern Serbia. The subject of the research were the stands in the mature stage which are prevalent absolutely throughout the area, which points to an unfavourable age structure. Although these are coppice stands, formed by clear cutting during the Second World War, there were also individual trees of different ages, of seed origin. This paper, based on growth and increment lines of trees of both vegetative and seed origin, points to the duration periods of certain stand development phases, as well as on silvicultural measures which were carried out, i.e. which were absent at a given time. Based on tree development, i.e. the analysis of growth elements and their trend, as one of the criteria, stand classification was performed by the priority for regeneration, aiming at the establishment of as good as possible age structure.*

Key words: sessile oak, coppice stand, development phases, growth elements, rotation length

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THE SITE CHARACTERISTICS OF THE GRDELIČKA GORGE AND VRANJSKA BASIN AREAS

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Abstract: *This paper presents the analysis of the orographic, geological, pedological and vegetational characteristics of Grdelica gorge and Vranje basin areas. This area is located at the altitudes ranging from 252 to 1,874 meters above the sea level. In the altitudinal zone ranging from 700 to 1,000 meters above the sea level 26.75 % of the area is located, in zone above 1,000 above the sea level 24.97 % of the area is located, in the zone ranging from 500 to 700 meters above the sea level 24.42 %, of the area is located, in the zone ranging from 300 to 500 meters above the sea level 23.29 % of the area is located, and in zone up to 300 above the sea level 0.57% of the area is located. The metamorphic rocks account for 41.1 %, sedimentary rocks for 32.5 %, and igneous rocks for 26.4 % of the area. The acid brown soils account for 58.54 %, eutric brown soils for 10.37 %, vertisols for 8.57 %, alluvial soils for 6.16 %, etc. The oak and beech forests are the most common. Based on the model the changes in the forest ecosystems caused by the moderate increase of the air temperature (average increase of the temperature by 2.6–3°C) were determined.*

Key words: climate model, changes of the ecosystems, vegetation, soil, site

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THE CONDITIONS OF THE FORESTS AND FOREST ECOSYSTEMS IN GRDELIČKA GORGE AND VRANJSKA BASIN

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Tatjana ĆIRKOVIĆ-MITROVIĆ[1],
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Abstract: *This paper presents the results of the researches of the conditions of Grdelička gorge and Vranjska basin areas, which belong to the southeast Serbia region, Južna Morava and Jablanica forest areas. This region covers an area of 263, 888. 82 ha (44.6 % is state-owned, and 55.4% is privately-owned). Forests and forest land of Grdelička gorge and Vranje basin, managed by the State Enterprise "Srbijašume", covers an area of 45,675.12 ha, which accounts for 17.3% of the total area. The greatest part of the forests, 86.4%, is managed by the forest management unit "Vranje" from Vranje, whereas 13.6 % of the forests is managed by the forest management unit "Suma" from Leskovac.*

Based on the global purpose, the forests of the researched areas have been divided into three categories: the forests with the productive-protective function (the most common), with the primary protective function and the special nature reserve. The forests with the main purpose of the production of the technical timber covers the greatest area. The forests with the primary protective function are also present – the soil protection of the I degree. The harmonisation of the plans, measures and activities with the defined needs and forest condition determined at Grdelička gorge and Vranjska gorge areas, opens the possibility of the improving of the forest ecosystems.

Key words: forest conditions, forest functions, soil protection, natural environment.

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PRODUCTION EFFECTS OF THE RECONSTRUCTION OF BEECH COPPICE FORESTS IN THE AREA OF BUKOVI

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Abstract: *This paper shows research results which refer to development of dominant trees in the coppice beech stands, as well as man made stands of Douglas fir, spruce and Austrian pine, artificially established in the process of reconstruction on the site of beech mountain forest. The comparing analasis between coppice beech trees alongside artificially grown Douglas fir, Norway spruce and Austrian pine trees was carried out by testing the significance of differences in development of diamteres (dbh) and heights. In the oldest common age (40 years) dbh shows statistically significant differences among analyzed species. Beech reaches the lowest values (100%), than Austrian pine (123%), and the highest values have Norway spruce (150%) and Douglas fir (160%) among which there is no significant difference. All species have maximum increment values between 10 and 15 years of age. Culmination values for beech with 6,2 mm to 7,3 mm are significantly lesser, in statistical term, compared to conifer species. At time of culmination, Austrian pine has the highest increment with 14,1 mm, than Douglas fir with 13,1 mm and Norway spruce with 12,2 mm. Douglas fir has the greatest total height which makes it significantly different, in statistical sense, in relation to other species. The second total height has Norway spruce, than come Austrian pine and beech that do not differ significantly in total height. If beech height is marked as 100%, than Austrian pine achieves 96%, Norway spruce 141% and Douglas fir 165%. Douglas fir and Austrian pine have maximum increment between 10 and 15 years of age, while Norway spruce is similar to beech reaching maximum increment between 15 and 20 years of age. Douglas fir has the most biggest culmination value of 1,07 m, and is followed by Norway spruce (0,77 m), beech (0,62–0,65 m) and Austrian pine (0,54 m). Research results were used to define silvicultural goals and to select the most suitable silvicultural measures with the aim of improving the present state of the sites and better use of their production capacities.*

Key words: beech coppice forests, artificially established conifer stands, reconstruction, tree development.

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PROPOSAL OF SILVICULTURAL OPERATIONS IN COPPICE SESSILE OAK AND BEECH FOREST OF THE MANAGE UNIT „TRSTENIČKE ŠUME“

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Abstract: *Influenced by many different factors, there was a creation of coppice forests in large areas, so that their current situation is not satisfactory in terms stand status, quality, stability, vitality and health. The paper points out the problem of large representation of coppice forests, unsatisfactory situation and the need to repair and improve the current situation. Adversely state is caught in studied manage unit "Trstenicke forests", the Trstenik area, whose covered surface is: 2018.58 ha. Of this number, 81.6% consists of coppice forest by area and by volume, of which 78.8% are preserved. The results of studying the situation and proposed of silvicultural interventions in coppice sessile oak and beech stands, which is located on the sessile and Turkey oak habitat (Querceto petreae-ceriss), aged about 50 years, have been presented. Taking into account the origin and that this forest is in the age when she needed care, according to study site conditions and stand state, corresponding cultivated procedures are proposed.*

Key words: Coppice sessile oak forests, stand state, silvicultural operations, conversion

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FOREST MANAGEMENT AND CLIMATE CHANGES

IMPACTS OF CLIMATE CHANGE ON THE ESTABLISHMENT, DISTRIBUTION, GROWTH AND MORTALITY OF SWISS STONE PINE (PINUS CEMBRA L.)

Simon BODEN[1,2], Patrick PYTTEL[3],
Christopher Stuart EASTAUGH[4]

Abstract: *Anticipated future climate changes are expected to significantly influence forest ecosystems, particularly in treeline ecotones. Climate change will have both direct and indirect effects on the future distribution of alpine tree species, some of which will be positive and others negative. Although the climatic conditions for species' growth can often be determined with some confidence, several other climate-related factors impact the realised niche of species, and these must be accounted for in any realistic consideration of the potential impacts of climate change. In particular, climate influences on pathogens and seed dispersal mechanisms play an important role. This study reviews those factors that determine the growth and distribution of Swiss stone pine, including the importance of the European nutcracker bird (Nucifraga caryocatactes L.) in seed dispersal, climatic influences on growth, and insect and fungal determinants of tree mortality. Although increased temperatures are on the whole likely to have a positive physical impact on growth and distribution of Swiss stone pine, indirect effects that influence seed dispersal or pathogen occurrence may threaten local population viability of the species in some areas. The complexity of the interrelations between direct, indirect, climatic and non-climatic factors makes management of treeline species under a changing climate a 'wicked' problem, without clear solutions. A better understanding of all of the interrelationships between the impacting factors is needed, and will be greatly assisted by long-term ecological monitoring. A fuller understanding of all the factors that influence the distribution of Swiss stone pine will allow management of this species to be better adapted to an uncertain climate future.*

Key words: Treeline, distribution, bioclimatic envelope, monitoring

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GROWTH IN DIAMETER OF SCOTS PINE PLANTATIONS IN CENTRAL BALKAN RANGE IN PERIOD OF CLIMATIC ANOMALIES

Hristo TSAKOV[1], Alexander DELKOV[1], Hristina HRISTOVA[1]

Abstract: *Object of investigation is growth in diameter of Scots pine plantations, which are part of monitoring network for forest ecosystems observation in Central Balkan Range in the period 1998-2007. Dynamics of annual radial growth has been followed, as well as the time of its increment as 1, 2 and 3 cm. Growth has been best in 2001 and 2002, and with lower rate and less intensity of formation of the first centimetre of timber – in the period 2003-2004. Years 2005 and 2007 were most favourable for the growth and formation of 2 and 3 cm radial growth. Variation curves were made for the share of number of trees according to natural diameter degrees, and the rank of average tree according to diameter was determined. The investigation has methodological pattern and will help forest management and forestry practices in forecasting growth and productivity of Scots pine plantations in the region.*

Key words: radial growth, diameter degrees, rank of average tree according to diameter, climatic anomalies, Scots pine plantations

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RESEARCH RESULTS OF THE EFFECT OF CLIMATIC FACTORS ON THE DIAMETER INCREMENT OF TREES IN SLOVAKIA

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Abstract: *Correlation dependence of increment indexes on climactic factors was studied on annual rings orders of 455 trees of spruce, oak and beech. Average monthly temperatures are presented for the years 1931-2005, and total monthly precipitation for the years 1901-2005. Estimated correlation coefficients with values 0.2-0.5 are statistically significant. Examined trees react positively, in particular to precipitation in June and July. Reaction of spruce is strongest. Precipitation from second half of vegetation period of previous year has important influence too. The influence of higher temperatures during vegetation period on increment changes is mostly negative and statistically insignificant.*

Key words: climatic effects, annual rings, spruce, oak, beech

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WINDS OF CHANGE – MANAGEMENT OF EVEN-AGED PEDUNCULATE OAK FORESTS IN INCREASINGLY WINDIER CLIMATE

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Abstract: *Current scenarios of climate change predict increase of the annual mean temperature, changes in the precipitation regime, and increase in the frequency and intensity of extreme weather events, e.g. forest fires and wind storms. While the effects of changing temperature and precipitation on forest ecosystems are less evident, negative impact of the strong wind is clearly evident from storms like Vivian (1990) or Lothar (1999). The aim of our contribution is to analyze the data on wind damage inflicted by two recent wind storms that occurred in one of the world's largest forest complexes of pedunculate oak – "Spačva" forest basin. The vulnerability of pedunculate oak stands is assessed with regard to stand age and stand structure.*

The "Spačva" forest basin covers ca. 43 000 ha in Croatia and ca. 18 000 ha in Serbia. The current silvicultural system applied to these forests is even-aged management with shelterwood regeneration in three cuts. During the last decade, the Croatian part of the forest basin was hit twice by severe wind storms, in 1998 and 2008, with the amount of wind-thrown wood of 170 000 m3 and 107 000 m3, respectively. The results of the analysis indicate increase in the risk of wind damage with increasing stand age. The highest intensity of wind damage was recorded in the stands where the seed cut was performed and only small number of large pedunculate oak trees were left for the final felling. In these stands, wind has uprooted or broken over 70% of the trees.

Based on these results, it is evident that the current management system of shelterwood regeneration on large areas should be reconsidered in the view of higher probability of occurrence of severe wind storms in the future.

Key words: "Spačva" forest basin, pedunculate oak stands, severe wind storms, even-aged management, shelterwood regeneration method

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STAND AGE AS ONE OF THE PREDISPOSING FACTORS IN THE DECLINE OF PEDUNCULATE OAK IN THE STANDS OF THE "SPAČVA" FOREST BASIN

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Abstract: *Decline of pedunculate oak trees and stands is a phenomena first recorded in Croatia as early as 1909. Since then, vast volume of literature was produced dealing with the problem indicating that the process of oak decline results from the interaction of multiple predisposing, inciting and contributing factors. One of the predisposing factors frequently discussed is the stand age, where older stands, or trees, are more susceptible to dieback. Aim of this contribution is to asses importance of the stand age as one of the predisposing factors in the decline of pedunculate oak in the "Spačva" forest basin. We will quantify incidence of dieback according to stand age in terms of amount of harvested dead oak trees per unit area (m3/ha) and the share of standing volume removed from the stand trough the harvest of dead oak trees (%).*

We have selected 962 stands of pedunculate oak with total area of 20 671 ha for the analysis. Stand age ranged from 14 up to 120 years, with most of the stands being older than 80 years. Data on stand structure and record of harvested volume per tree species and type of harvest for the period of 11 years (1996-2006) was taken from the Management Plans. Average intensity of decline increased with the increase in stand age, with highest values of 35 m3/ha recorded in the stands of sixth age class. However, the variability of the decline intensity was very pronounced among the stands of the same age class. Thus, it is impossible to arrive at the general conclusion about the role of the stand age in the process of oak decline, because stand age most likely only amplifies negative factors already present in the stand.

Key words: "Spačva" forest basin, pedunculate oak, decline, stand age

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VOLUME MODELS OF BEECH HIGH STANDS IN THE AREA OF SERBIA

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Abstract: *The problem of defining the reliable regression models for volume assessment in beech high stands was researched. To date, there have been no similar models or tables for natural stands of principal tree species in Serbia. The study models were based on the data collected in six forest areas, i.e. eleven high all-aged beech stands. Altogether 241 sample plots were established using the square design, circular sample plots of 500 m^2, spacing 100 m. All trees above 10 cm in diameter were measured in all sample plots and site characteristics were defined. The data were processed using the application programme constructed to this purpose. In each sample plot, taxation elements were measured to get the average values (diameter, height, canopy) and aggregate values per hectare (number of trees, basal area, volume, volume increment), as well as site characteristics (tariff series, altitude, slope, aspect). The stepwise multiple regression method was applied. It was hypothesised that the characteristics of sample plots could simultaneously be the characteristics of hypothetical stands, and it was proved to be right. Two regression models were constructed: Model 1 and Model 2. Model 1 has more theoretical significance and Model 2 has a practical significance. All the parameters in regression models are statistically significant at the risk level $p < 0.001$. Standard error of regression in Model 1 is +/-11.58 m^3/ha, and the coefficient of multiple determination is 99.51%. In Model 2, standard error of regression is +/-16.74 m^3/ha, and the coefficient of multiple determination is 98.97%. Using Model 2, beech stand volume per hectare (V) is estimated based on mean stand height (H_L) and stand basal area per hectare (G). The deviation of stand volume by this Model from stand volume estimated based on sample plots established in the stand is from -2.8% to +3.5%, i.e. from -9.3 m^3/ha to +10.2 m^3/ha. Almost completely, the residuals are distributed by the probability law of normal distribution. The conclusion on the true reliability and efficacy of the regression models can be brought more reliably only after their practical implementation.*

Key words: Serbia, beech stand, stand volume, regression models

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THE RESOURCES OF THE BEECH FORESTS IN THE PEŠTER PLATEAU

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Abstract: *The beech forests in the Peshter plateau are located at the altitudes ranging from 1,200 to 1,600 meters above the sea level. In the beech community on the limestones the total of 136 plants were reported, whereas 78 plants were reported on the silicates. In the spectre of the life forms in the beech forests on the limestones and silicates, the lower presence of the hemicryptophytes was observed (46.32%, i.e. 44.87%) in comparison with the other communities of this region. The high percentage of the geophytes (22.06%, i.e. 21.79%) points to the more humid climate and edaphic conditions, since the stands are located at the colder exposures, or at the greater altitudes, since the soil humidity and the relative air humidity are great. The presence of the phanerophytes and nanophanerophytes is significant, and they account for more than 23%. The chamaephytes account for 4.41% on the limestone, i.e. for 7.70% on the silicates. There is a highest percentage of the Mid-European floral elements (32.35%), and there is a significant percentage of the Eurasian floral elements (22.79%). The group of the circumpolar and cosmopolitan elements (8.82%), together with the floristic elements of the northen regions, accounts for 14.70%. The Submediterranean floristic elements account for 16.18%, Pontic-Centrasian and Subatlantic floristic elements for 6.62%, whereas endemic floristic elements for only 0.74%. In the beech communities on the silicate there is the highest percentage of the Mid-European and European floristic elements (29.49%). The group of the circumpolar and cosmopolitan floristic elements accounts for 11.54%, whereas floristic elements of the northen regions for 7.69%. The Submediterranean floristic elements account for 14.10%. The Pontic-Centralasian floristic elements for 3.85%, Subatlantic floristic elements for 2.85%, and the endemites for 1.28%. In the beech forests the total of 66 medicinal plants, i.e. 40.7% was reported. In the first category of the healing rate, the total of 10 species were determined, in the second category of the healing rate the total of 4 species were reported, in the third category of the healing rate the total of 20 species, in the fourth category of the healing rate the total of 15 species, and in the fifth category of the healing rate the total of 17 species. By the analysis done in the beech forests 63 honey plants, out of which 10*

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woody, 21 bushy, and 32 herbaceous, were reported. The average honey yield of the communities is 2.98. The beech forests were reported on 2,027.03 hectares. The high even-aged forest stands account for, 17.4%, high multi-aged forest stands for 7.7%, coppice forests for 49.6%, coppice even-aged forests for 3.0%, shrubs for 3.4%, high beech and sessile oak forests for 4.0%, high (even-aged) beech and hornbeam for 3.6%, coppice beech and hornbeam forests for 5.8%. The trees with the diameter up to 30 cm account for 61.3%.

Key words: beech forests, sustainable use, natural resources

QUANTIFICATION OF BEECH STAND STRUCTURE AS THE BASE FOR THE DEFINITION OF ECOSYSTEM DIVERSITY

Bratislav MATOVIĆ[1]

Abstract: *In natural forests, structure is the basic and most often the only measurable indicator in the determination of ecosystem diversity. The quantification of high beech stand structure in the area of Eastern Serbia was performed using different structural indices, aiming at the definition of ecosystem alpha diversity. To quantify the simple structure, we applied the Lorenz index, and to quantify the spatial structure, we applied the aggregation index (Clark- Evans), and the parameters of individual trees based on the relations of neighbouring trees for the description of the structure on small areas (uniform angle index, Gadow et al.; mean directional index, Corral-Rivas, et al.; Füldner's diameter differentiation index; and dominance index, Hui, et al.). Lorenz index and diameter differentiation index show that it is the case of a clearly structured stand both over a small area and at the level of the entire stand. Aggregation index, uniform angle index, and mean directional index show that the trees in the stand are randomly distributed with a mild tendency to normal distribution. Dominance index shows that 50 % of the nearest neighbours of an observed tree have a larger diameter. The greatest advantage of the application of modern indices for structure quantification is that the different aspects of stand structure can be expressed numerically, as opposed to classical presentations of structure with a descriptive character. Also, a great advantage of structure quantification is that the changes of stand structure can be monitored over a longer time period.*

Key words: simple structure, spatial structure, ecosystem diversity, beech, indices.

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DEPENDENCE OF BEECH TREE VOLUME INCREMENTON CROWN STRUCTURE

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Abstract: *The effect of crown structure on tree volume increment was researched in a beech high stand in the area of Severni Kučaj, Eastern Serbia. Taxation elements of all trees above 10cm were measured on sample plots sized 500m². Volume increment of individual trees was estimated based on their diameter increment using regression model. Also, the elements of crown structure were measured. The relation between the elements of crown structure (length, width and basal area) as dependent variables and tree diameter and height as independent variables was assessed by simple regression analysis. The analysis was performed for all trees, for unmarked trees, for trees of different crown classes, and for 20% of trees with the greatest volume increment. The relation between tree volume increment as dependent variable and elements of crown structure (length, width, volume, basal area), as independent variables for the same tree categories was determined by multiple regression analysis. The effects of the elements of crown structure on beech volume increment were assessed based on the presented relations.*

Key words: beech, tree, volume increment, crown

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THE DEVELOPMENTAL-PRODUCTIVE CHARACTERISTICS OF THE DOUGLAS FIR CULTURES ESTABLISHED IN THE PROCESS OF AMELIORATION OF THE COPPICE AND DEGRADED FORESTS

Mihailo RATKNIĆ[1], Ljubinko RAKONJAC[1]

Abstract: *In the amelioration of the degraded coppice forests by the biological reconstruction typically the current broadleaf species were substituted by the mainly ecologically suitable conifer species which grow in this region, such as Austrian and Scots pine, spruce, common fir, and to a significantly lesser extent Bosnian pine or Macedonian pine in the high mountain regions, and from the foreign – allochthonous species, Coast Douglas fir, and Blue Douglas fir, Eastern white pine, and to a lesser extent Nordmann fir, white fir, common larch (European, Sudetic and other variances), bull pine ((Pinus ponderosa), cedar, and other species, the percentage of which is irrelevant. The Convention on Biological Diversity prohibits the introduction of the allochtonous species in the natural ecosystems, and the use of them (if they are not on the list of the invasive species) is permitted in the intensive plantations with the targeted timber production, as well as in the public urban green areas. As Douglas fir is the species which is characterized by the high productivity, the use of it in the intensive plantations is undoubted. However, there are no comparative reseaches on the productive characteristics of the Douglas fir cultures established on the different sites. Based on the comparison of the current and average volume increment, it can be concluded that the cultures reached the stage of the high productivity (in spite of the fact that the average increment have not culminated yet). Since the period of the high productive lasts for a relatively long time, in the case of the long rotations Douglas fir is able to use the productive capacity of the site, if the apppropriate care measures are applied. The results of the reseaches will enable the anticipation of the production in the intensive plantations in the dependence on the site conditions.*

Key words: Douglas fir, productivity, intensive plantations, biological diversity

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ECOLOGICALLY ASPECT OF WOOD PRODUCTION AND CO_2 ABSORPTION IN AUSTRIAN PINE PLANTATIONS IN SERBIA

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Abstract: *The main aim of this study was to investigate characteristic and ecologically aspect of wood production and CO_2 absorption in Austrian Pine plantations in Serbia. Material for analysis contains 34 sample plots on characteristic geologically substrates (limestone, serpentine and granite). In the paper we also present the main growth characteristics of Austrian Pine plantations.*

Key words: Austrian pine, plantations, wood production, CO_2 absorption

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ESTIMATED EMISSIONS OF GREENHOUSE GASSES DURING FOREST ROAD CONSTRUCTION

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Predrag VASILJEVIĆ

Abstract: *Forest roads present infrastructural basis for the most of all of forestry operations. That is the main reason why the importance of forest road construction and research in that domain is significant. Civil engineering mechanization that is used in our conditions is powered with technologically aged motors. This influences the greater emission of greenhouse gasses into the atmosphere other than it is proposed by present day standards. Until now, researches in the domain of greenhouse gasses emissions during forest road construction are insufficient. This paper presents an estimation of emission of different groups of gasses, N_2O, CO_2, CH_4, which are the main causing factors of greenhouse effect, in comparison to volume of excavated earth during construction of a forest road and compared to references from literature. The road was built in forest complex Mala Albina near Kucevo, a town in Eastern Serbia. The road length was 856m and the total excavation of earth was 8911 m^3. The volume of excavated earth compared to the road length indicates specific conditions of construction. Caterpillar CAT D6 was used for excavating the earth in extreme conditions.*

Key words: forest roads, construction, CAT D6, greenhouse gasses

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CHAMOIS (RUPICAPRA RUPICAPRA BALCANICA) MANAGEMENT IN THE NATIONAL PARK "TARA"

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Abstract: *Balkan chamois (Rupicapra rupicapra balcanica) is an insufficiently researched species/subspecies of wild ungulates in Serbia, despite the fact that it is autochthonous and rare in our region. There is an absence of more complete data on its population density and other demographic parameters, range, feeding, and also on the achieved results in the previous management. There are many factors (e.g. diseases, avalanches, predators, illegal hunting, isolation, and low abundance of some populations) which endanger chamois in its natural habitats all over Europe. The status of the species/subspecies at the national level (territory of Serbia) is defined as VU (vulnerable), according to a partly modified IUCN classification. It is additionally protected by the Hunting Law (1993), i.e. by the prohibition of hunting over the definite periods - males (February 1st – July 31st), females and kids (Februar1st – August 31st). At present, it exists only in a few hunting grounds. One of the best known is the hunting ground "Tara" within the National Park of the same name, where the spring abundance in 2009 was estimated to 354 individuals. In the past five years, the realised hunting was much lower than the planned one, and ranged from 4 to 20 individuals. This paper, for the first time in Serbia, analyses some morphological characters of chamois horns (length, height and span) on the sample of 56 individuals, hunted in the NP "Tara" over the period 2006-2009. The present population abundance in this hunting ground is explained, first of all, by the suitability of the general habitat conditions and by the prevention of illegal hunting, and also by the adequate management.*

The comparative analysis of habitat conditions and all planned and realised measures in the management of chamois population in the National Park "Tara" enables the identification of the main factors of chamois hazards and protection measures throughout Serbia. By all means, it is only by the analysis of a greater number of factors significant for the survival and development of populations of this susceptible species, that we can start the activities aiming at the increase of chamois abundance

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and distribution in Serbia, including also the reintroduction to the localities from which it disappeared (e.g. Kopaonik, Stolovi).

Key words: chamois, *Rupicapra rupicapra*, management, Tara, Serbia

ANALYSIS OF LEGISLATIONS AND HUNTING ORGANIZATIONS IN SERBIA, ETHIOPIA AND CHINA AS THE TOOL FOR PREVENTING NEGATIVE EFFECTS OF THE CLIMATE CHANGE ON THE WILDLIFE TROUGH THE SUSTAINABLE MANAGEMENT

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Abstract: *The Climate changes are reality, which will affect the biodiversity at the global level. Therefore a mitigation and adaptation of ecosystems are necessary. Forest ecosystem is highly vulnerable, due to negative impact of human pressure, pests, calamities and forest fires, which are strengthening under favor of the Climate changes. Since the forests are natural habitat for the most of ungulate and carnivore species, providing shelter and food source, its devastation will affect this species too. It is expected that the Climate changes will affect the distribution of a wildlife, which will respond with migrations, crossing the national borders and shifting towards higher altitudes or latitudes, becoming the new part of ecosystems. Unexpected should be expected, why the wildlife managers should be prepared to support game's adaptive strategy. At the same time the negative impacts should be reduced, such as a strong hunting pressure is. The easiest way to track consequences of the Climate changes on the wildlife is the monitoring. Therefore it is important to define a long term monitoring strategy of animals' seasonal activities. Also a behavior of a migratory species is important for estimating negative impacts on the wildlife.*

Three countries – Serbia, Ethiopia and China have been analyzed trough their hunting organization and legislation which influence the wildlife management. The diversity of sustainable developments between these countries is present, since the each country has its own wildlife management tradition and characteristics. Each country is facing different challenges, since Serbia has to adopt its management to the EU criteria, Ethiopia is experiencing the direct influence of the Climate change, while the China has to find the balance in achieving integral wildlife management goals. Therefore analysis of the domestic legislation, international conventions and the activities of stakeholders'

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participation is necessary toward achieving sustainable management.

Key words: Climate changes, wildlife, sustainability, legislation

FOREST PROTECTION AND CLIMATE CHANGES

SOME CLIMATE CHANGE IMPACTS ON FOREST PROTECTION IN RUSSIA

Yu. I. GNINENKO[1]

Abstract: *Last years it was found in Russian forests that mass outbreaks of some forest pests occur in more northern regions than earlier. Earlier pine web-spinning sawfly Acantholyda posticalis Mats. outbreaks usually occurred in pine forests in south-east European Russia and south West Siberia. However in late XX century they were found in Tverskaya region and Mary El Republic which are around 1.000 km north of their usual occurrence.*

Melolontha hippocastani L. outbreaks that earlier occurred only in south west Siberia and Volga area in late XX century were identified and are functional in Khanty-Mansiysky Autonomous District (northern West Siberia).

Dutch elm disease epiphitotics (Ophiostoma ulmi and O. novo-ulmi agents) evolved in Russian elm forests in XX century and resulted in their mortality. However recently Dutch elm disease moved over 1000 km to the north and resulted in elm mortality in landscape and protective plantations of Moscow, Saint Petersburg, Vologda and other cities in north European Russia.

We found that American white moth (Hyphantria cunea) that infested Russian forests and agro-landscapes in the 60-es of the last century earlier was harmful just in North Caucasus region began to damage in more northern areas. Now in particular its outbreaks became common in Belgorodskaya and Voronezhskaya regions.

Climate change processes may be very dangerous in north Siberia and Far East forests. North shift of these harmful phytophages habitats such as Lymantria dispar and Dendrolimus sibiricus may result in their infestation of Kamchatka forests.

Key words: climate change, forest pests.

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CLIMATE CHANGE AND FOREST DISEASES

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Abstract: *The analyses of relationships between climate and forest diseases and the potential effects of predicted climate change on forest pathogens, hosts and their interaction are presented. The effects of climate change could have positive, negative or no impact on individual pathogens and the diseases they cause. Climate change could alter patterns of disturbance from pathogens through: direct effects of the development and survival of pathogens, physiological changes in tree defences, and indirect effects from changes in the abundance of insect vectors of tree pathogens, superparasites and antagonists.*

Multiple effects on the epidemiology of forest diseases are expected, including the survival of primary inoculum, the rate of disease progress during a growing season, disease transmission and the duration of epidemics. Because of their short life cycles, mobility, reproductive potential and physiological sensitivity to temperature and moisture, even modest climate change could have rapid impacts on the distribution and abundance of many forest pathogens (Phytophthora spp., Ophiostoma spp., Spheropsis sapinea, etc). Climate change could alter stages and rates of the development of the pathogen, reproduction rates, modify host defences and susceptibility, and results in changes in the physiology of host-pathogen interactions. The most likely consequences are shifts in the geographical distribution of host and pathogen, resulting in the ability of pathogens to infect new host tree species; greater or reduced overwintering success of pathogens, increased number of insect vectors, changes in type, amount, and relative importance of certain pathogens.

Some scenarios are beneficial for the forest (e.g. increased winter cover may increase winter mortality of some pathogens), but many are detrimental (e.g. warming tends to accelerate pathogen development rate and facilitate rage expansions of pathogens). Climate change could favour some highly damaging pathogens and have considerable and widespread impact on forest health. Some illustrative examples of potential disease effects with predicted climate change are presented.

Key words: Climate change, forest pathogens, fungi, host-pathogen interaction, scenario

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FOREST FIRES AND CLIMATE CHANGES

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Abstract: *Forest fires are a global problem and require the engagement of all the institutions and subjects of the society in the prevention and suppression of forest fires and in the reclamation of burnt areas, both at the local and at the international levels.*

Forest fires are a great ecological and economic problem, because they destroy large areas of forests and thus reduce the multiple-use forest functions. Worldwide, more than 50,000 forest fires are registered on average annually and they destroy about 400,000 hectares of forests.

In the forest area managed by the State Enterprise for Forest Management "Srbijašume", over the period 2000-2009, there were 893 forest fires, with the burned area amounting to 17,294 hectares.

Human activities, first of all the combustion of fossil fuels, have affected and still affect the climate changes.

Climate changes are classified as the greatest global ecological problem of the modern civilisation which, unless the appropriate and urgent measures are undertaken, can result in the further increase of air temperature between 1.40C and 5.8 0C till the end of the 21st century, compared to 1990.

Forest ecosystems are exposed to unfavourable influences of climate changes, they are a significant reservoir of carbon and a significant potential for the mitigation of the global warming, because of which they require a special method of management which includes the protection, the improvement of the existing state and the establishment of new forests.

Forest protection against forest fires, especially in the extreme climate conditions, is one of the most important goals not only of SE "Srbijašume", but also of the entire society, taking into account the forest significance and the functions.

Key words: forest fires, climate changes, forest protection

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ACID DEPOSITION MEASUREMENT IN CROATIA IN FRAMEWORK OF ICP FORESTS

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Abstract: *The Integrated Cooperative Programme on Assesment and Monitoring of Air Pollution Effects on Forests (ICP Forests) and EU regulation aim to conduct intensive and continuous monitoring of forest ecosystems in Europe as means of evaluating the damage caused by atmosferic pollution, acid loads, climate change and other factors influencing forest condition. Climate change could influence the levels of acidity and nitrogen in forests therefore continous measurements are needed.In order to detect the influence of various stress factors the monitoring is carried out in the permanent plots located in 31 European countries. Croatia is participating with 7 plots.The aim of this research is following the ICP Forests methodology to determinate loads of acid deposition in the lowland forest ecosystem of Quercus robur L. (Pedunculate oak) on yearly basis. The results are put in the correlatation with the results of actual loads on other European ICP plots, in order to assess the condition in Croatia. Results have showed that calculated nitrogen loads in the bulk open field and the throughfall are lower than the critical load. High content of sulphate sulphur (19.84 kg ha-1 y-1) is caused of seaspey input and an antropogenic origin. On the examened plot the value of nitrate nitrogen is relatively low (3.64 kg ha-1 y-1) but the mean annual deposition of ammonium nitrogen is high. The reason of high N-NH4+ deposition (10.64 kg ha-1 y-1) could be due to clossness of agricultural area. The throughfall deposition of the nitrogen compounds, for the majority of the plots is indicating the importance of dry deposition filtered from the air and washed off the leaves.*

New chalanges arising from air pollution, biodiversity loss and climate change effects on forest ecosystems give the efforts necessary to maintain the programme and enhance it for future needs.

Key words: acid deposition, bulk open field, critical load, ICP forests, throughfall

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MONITORING THE FOREST HEALTH STATUS IN THE DIFFERENT CLIMATE CONDITIONS

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Abstract: *In the last few decades, significant increase in withering of pedunculate oak forests has been recorded throughout their natural areal in Croatia. According to previous researches, the cause of trees' degradation (withering) is a synergetic adverse effect of many different factors (changes in climate, climatic excesses, polluted precipitation, biotic factors etc.). Monitoring of forest conditions can be conducted through terrestrial observations, but also by using remote sensing methods.*

Forest stands conditions in the researched area were estimated by interpreting CIR aerial photographs. Infrared digital ortophoto (DOP 1:5000) was created and intersected with a systematic sample (grid point 100x100 m) for the entire researched area (5500 ha). Degree of damage was determined for 19 582 trees in total and damage indicators (damage - D , mean damage - MD, damage index - DI, mean damage index - MD1) were calculated for individual tree species and all interpreted species combined. Besides the results of the forest degradation inventory, which were based on aerial photographs, comparison to the CIR aerial photographs interpretation data, created 20 years ago, was also made. Comparison of the photo interpretation results from the afore-mentioned period clearly shows the increase of all damage indicators in all of the interpreted species. Factors that have adverse influence on stability of the pedunculate oak ecosystem (decrease of precipitation amount during the vegetation period, rising of the air temperature) was also analyzed. Trends and aberrations of climatic factors (average annual and vegetation precipitation amounts, average air temperatures) from the reference model, as well as their connection to the degradation of penduculate oak in two micro-relief types, were also determined.

Key words: colour infrared (CIR) aerial photographs, pedunculate oak, forest damage, monitoring, micro-relief, air temperature, precipitation amount, Croatia.

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COMPARATIVE ANALYSIS OF FOREST VITALITY IN THE REPUBLIC OF SERBIA IN THE PERIOD 2004-2009

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Abstract: *An insight into the health state of forests for making conclusions about the necessary improvement measures, it is possible to determine through monitoring of condition of forests. Subject of ICP Forests is monitoring of anthropogenic (primarily air pollution) and biotic factors harmful to the state and development of European forest ecosystems. Determining the status of forest ecosystems requires detailed ecological, socio-economic research to explain consequences of forest deterioration and analysis of the impact of global climate change on forest communities.*

The paper gives a comparative overview of monitoring forest condition on sample plots the Republic of Serbia. International Cooperating Program for the monitoring of forests is carried out continuously since 2003, and was done at Level I of this program. In the period 2004/ 2009 the observation were performed on 130 points and collected the data necessary for further analysis. Plots are systematically located in network of 16x16 km, and the 4x 4 km. On experimental fields was done evaluation of degree for defoliation, discoloration and recorded damages by class.

Comparative analysis of the data in this period will be provided access to the previous situation of forests in Serbia as well as some trends defoliation and discoloration of broadleaf and evergreen species.

Key words: biomonitoring, ICP Forests, climate change, Serbia

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DEVELOPMENT OF PATHOGEN PHAEOCRYPTOPUS GAEUMANNII (ROHDE) PETRAK ON DOUGLAS FIR (PSEUDOTSUGAE MENZIESII (MIRB.) FRANCO) PROVENANCES IN BULGARIA

Margarita GEORGIEVA[1]

Abstract: *Douglas fir (Pseudotsuga menziesii (Mirb.) Franco) is a valuable exotic tree species used in Bulgarian forestation practice. The resistance of different provenances to pathogenic organisms is one of the main problems in the future introduction and cultivation of the species in Bulgaria.*

Swiss needle cast caused by the needle-infecting ascomycete Phaeocryptopus gaeumannii is responsible for substantial growth loss in many Douglas fir plantations. Some specific biological peculiarities and ecological requirements of the species were determined as well as the effect of certain climatic factors on their development.

Fifty five provenances from the Douglas fir natural area of distribution were examined in the period 2004–2007 for their resistance to Swiss needle cast disease. Distinct differences between the provenances concerning their resistance were observed. It was established that the provenances from the western and eastern areas of Cascade Range and from Pacific Coast Range are the most resistant to Swiss needle cast. The provenances from the area of northern interior – Greenwood (Washington), Keremeos (Washington), Whitefish (Montana), Bates (Oregon) and Canyon City (Oregon) and two provenances from the southern interior – Flagstaff (Arizona) and Alamogordo (New Mexico) were most susceptible. Two provenances from the southern interior – Flagstaff (Arizona) and Alamogordo (New Mexico) were the most susceptible. On the basis of the results obtained, a selection of resistant provenances to be used in the forestation practice in Bulgaria was suggested. Provenances from Coast Range (Washington and Oregon) were recommended for that purpose.

Key words: Douglas fir, provenances, Swiss needle cast, Phaeocryptopus gaeumannii

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THE RESEARCH OF SOME PHYSIOLOGICAL CHARACTERISTICS OF FUNGUS CRYPHONECTRIA PARASITICA (MURR.) BARR

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Katarina MLADENOVIĆ[1]

Abstract: *One of the preconditions for the effective fight against the plant diseases is the knowledge of the bioecology of pathogens. This paper presents the results of the impact of temperature, light, different media on the growth and characteristics of the mycelium of fungus C. parasitica. The researches of these characteristics of C. parasitica were conducted with three different isolates. The impact of the temperature was studied in the interval 0-400 C. The optimal temperature for its growth, as well as the interval in which the fungus is physiologically active was determined. The influence of light was studied in the 18-hour photoperiod, and the growth and the characteristics of mycelium were studied on three different media. The obtained results point to the conclusion that the optimal temperature for the growth of mycelium is 250 C, that the mycelium grows at a slower rate at the daily light, and that PDA is the most favourable medium for the growth of mycelium.*

Key words: C. parasitica, growth of mycelium, temperature, nutritional media, light

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THE INTERACTIONS OF SOME ANTAGONISTIC FUNGI AND THE FUNGUS CRYPHONECTRIA PARASITICA (MURR.) BARR

Zlatan RADULOVIĆ[1], Dragan KARADŽIĆ[2]

Abstract: *The decay of the sweet chestnut is mainly caused by the fungus Cryphonectria parasitica (Murrill) Barr, the agent of the chestnut blight. In the fight against this fungus, along with the use of its hypovirulent strains, the possibilities of the application of some antagonists to a greater extent are studied. This paper presents the results of the laboratory studies of the interactions of the fungus C. parasitica and the antagonistic fungi Trichoderma viride, Trichotechium roseum, Penicillium sp. and Aspergillus sp. The interactions wee studied at three different temperatures. The indexes of sensitivity were determined for each fungus, based on which the types of reaction of the antagonistic fungi in the mixed cultures were determined.*

Key words: Cryphonectria parasitica, mixed cultures, type of reaction, index of sensitivity

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CONTRIBUTION FOR RESEARCH ON CYTOSPORA FUNGI ON WILLOWS (SALIX SP.)

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Abstract: *This paper presents results of 3 year mycology research on species of genus Cytospora that causes necrosis and bark canker on willows Salix sp. at the area of Srednje Podunavlje (situated between $45^0 08' 18''$ and $45^0 42' 50''$ N, and between $17^0 10' 10''$ and $17^0 58' 50''$ E). During of research, at the field was collected dendro-material with symptoms of illness and damage, same material was stored in herbarium and bring to the laboratory for further identification with standard methodology.*

During research on willows was noted 6 fungi form genus Cytospora (C. ambiens Sacc., C. chrysosperma (Pers.)Fr., C. fertilis Sacc., C. nivea Sacc., C. salicis Rab. and C. translucens Sacc.) causes necrosis and bark canker on willows Salix sp. On collected samples was also determined presence of Leucostoma nivea (Pers. ex Fr.) Hoh. and Valsa salicina Fr. (telemorph stage C. nivea and C. salicis).

Key words: willow, Salix sp., bark, fungus, Srednje Podunavlje

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SEEDLINGS MYCORRHIZATION UNDER THE TREAT OF CLIMATE CHANGES

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Abstract: *Under the treat of climate changes, question of seedling production, as a one of the most important areas concerning forestry techniques in a whole, became more important, since both the successful forestation and quick development have been highly depending on the seedling quality.*

Mycorrhiza provides many benefits to both the seedlings and the adult trees. Ectomycorhhiza, formed with important coniferous species of Pinaceae and hardwood species of Fagaceae and Betulaceae, are prevailing inside forest ecosystems. Several thousand fungal species are thought to form ectomycorrhizas on the global scale, and more than 250 have been recorded in Montenegro until now.

Differences, expressed on ecological and functional significance of such diversity, are evident. Hence the value of individual species in seedling mycorrization is different.

In 2005-2009, collection containing 45 isolates of ectomycorrhizal fungi from Montenegro territory was formed. Based on literature data, and on hither experience in manipulation with these fungi, preliminary evaluation of individual fungi isolates for seedling mycorrization during nursery plant production were made.

The aim of the paper is not only to emphasize the importance of seedling mycorrhization in forthcoming period, through the explanation of benefits which this treatment enables, but also to note the necessity of examination of ectomicorrhizal fungi isolates - characteristics from autochthonous populations.

Key words: ectomycorrhiza, seedling production, isolates of ectomycorrhizal fungi, autochthonous

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HETEROBASIDION ANNOSUM (FR.) BREF. AND THE HEALTH CONDITION OF SCOTS PINE STANDS IN WEST BULGARIA

Boyan ROSSNEV[1], Peter PETKOV[1]

Abstract: *Studies on the health condition of Scots pine stands have been performed in the period 1995-2009. The findings demonstrate a chronic process of defoliation and drying, including trees dying by groups. The action of Heterobasidion annosum in this process has been closely followed and observed. The dynamics of infection foci increasing has been established. H. annosum has destroyed some stands.*

Key words: Scots pine, Heterobasidion annosum, drying

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BIOFUNGICIDE CONTROL DISEASE IN FOREST – FSC WAY

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Abstract: *Forests provide us with clean water, fresh air and they even help combat global warming. They also provide food, medicine and important natural resources, such as timber and paper. If managed responsibly, forests and plantations benefit people – both people dependent on forests and the global community at large. FSC is a certification system that provides internationally recognized standard-setting, trademark assurance and accreditation services to companies, organizations, and communities interested in responsible forestry.FSC certification offers forest managers rewards for managing their forests the FSC way – following the highest social and environmental criteria there are. Powdery mildew on oak is caused by the fungus Microsphaera alphitoides Griff. et Maubl The pathogen may retard the growth of young plants and may kill tree seedlings. The biggest damage is to the young oak, that in cases of strong attacks, must be used chemical protection (treatment by fungicides). In Serbia fungicides for control of pathogenes in forest ecosystems are not registered. Therefore, it is necessary to select ecotoxicologically favourable fungicides registered in this region and obey FSC policy in application of pesticides. Because of the desire for reducing the negative consequences of applying chemicals, biological control is becoming increasingly important. For biological control of plant disease causing fungi used biofungicides. AQ-10 is a new biofungicide that contains fungal spores of Ampelomyces qisqualis for the control of powdery mildew by parasiting and killing the fungal organisms that cause the disease. AQ-10 is approved for the efficient and biotical use of Powdery Mildew. Aim of this work is to verify the independently effect of biofungicide AQ10 and in combination with polymer Nu-film 17 in controlling powdery mildews oak. Preliminary examination were performed by standard OEPP methods PP1/69 (2) (OEPP/EPPO, 1997) on the oak seedlings infected by parasitic fungus M. alphitoides. Treatments were carried out in 4 repetitions, in the vegetation period in the 2009.*

Key words: FSC, powdery mildew, biofungicides, efficacy

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CELLULOLITIC AND XYLANOLITIC ACTIVITY OF SOME WOOD – DECAYING FUNGI OF OAK WOOD IN VITRO

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Abstract: *It has been investigated cellulolitic as well as xylanolitic activity of four wood decaying fungi of Oak wood: Stereum hirsutum, Chondrostereum purpureum, Stereum rugosum and Xylobolus frustulatus in vitro. Wood decaying fungi with its' enzymatic complex decompose basic constituants of wooden cell wals – cellulose, chemicelluloses and lignin, in different ammount. As a consequence, it appears a few types of decay, so that mechanical properties depending of certain constituants are beeing lost. Cellulose in the wood use to build an scelet – substance and is being responsible for bending strength, while its' decomposition cause decrease or loss of this mechanical propertie of the wood. Decomposition of cellulose is forced if the chemicelluloses are previously removed from the wood. Only wood decaying fungi are capable to deteriorate chemicelluloses inside wooden cell wals. As a group of polysacharides built from great number of molecules of different sugars (50 – 200) they represent the main constituants of primary and seccundary walls. Cellulolitic activity has been investigated by "Clearing" and "Remazol – Avicel" method, while xylanolitic activity according to method of "Reduced Xylan". Result showed that the highest cellulolitic activity had Ch. purpureum. All tested fungi have had simmilar xylanolitic activity. Results gained in laboratorial conditions in vitro does not represent totaly situation in nature where it happens that on enzymatic activity of fungi a numerous of factors have an simultanuos effect, so they should represent just an orientation.*

Key words: Stereum hirsutum; Chondrostereum purpureum; Stereum rugosum; Xylobolus frustulatus; enzymatic activity

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SPEED OF PENETRATION OF WOOD - DECAYING FUNGI THREW MECHANICAL INJURIES ON STEMS OF SESSILE OAK (QUERCUS PETRAEA AGG.) IN VIVO

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Abstract: *Speed of penetration of four wood - decaying fungi of Oak threw mechanical injuries on sound healthy trees have been investigated as follows: Stereum hirsutum, Chondrostereum purpureum, Stereum rugosum and Xylobolus frustulatus. Artificial inoculations with mycelia have been provoked in vital standing trees of Sessile oak (Quercus petraea agg.) in stands (in vivo) and appearance of dying back symptoms, the rate of mycelia spread through the stem, speed of wound callusing and appearance of fruit bodies or decay symphtoms, have been observed. The results of investigation show that decaying fungi spread faster in axial than in tangential direction, what is probably in connection with anathomical structure of wood and direction of spreading of vessel elements inside the wood. During experiment all tested fungi have been reisolated from the sapwood zone except X. frustulatus which have been detected in the zone of heartwood. On the major number of stems the appearance of callusing in zone near by places of mechanical injury, ie. inoculations, has been detected. Indexes of dieback of inoculated stems on Goč showed more changes than it was the case on the location of Slačina, but the changes on leafs haven't been detected neither here. Appearance of dry branches and leaf chlorosis have been detected just on a few stems at the end of the test, but it couldn't be directly conected with presence of tested fungi inside the wood, regarding that they have had an saprophytic way of nutrition, or appeared as weakened parasites, while for this test we had chosen sound healthy trees of Sessile Oak. Among five control stems which haven't been artificially inoculated, two stems changed indexes of dieback, what use to proove the state that artificial inoculation is not the causer of chlorosis. Indexes of dieback of inoculated stems on Goč showed more changes than it was the case on the location of Slačina, but the changes on leafs haven't been detected neither here. In this test, as like in major experiments in vivo, much more factors use to have influence on results than during the tests in vitro, what is often not possible to notifie or to have under control.*

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Key words: Stereum hirsutum; Chondrostereum purpureum; Stereum rugosum; Xylobolus frustulatus; Quercus petraea; wood biodeterioration

RESISTANCE OF THERMICALLY MODIFIED BEECH WOOD – FAGUS MOESIACA (DOMIN, MALLY/ CZECZOTT.) AGAINST SOME WOOD DECAYING FUNGI

Snežana IVKOVIĆ[1], Miroslava MARKOVIĆ[2], Vladan JELKIĆ

Abstract: *Resistance of the beech wood – Fagus moesiaca (Domin, Mally, Czeczott.) exposed to different temperature treatments, against wood decaying fungi, has been investigated using samples dim. 25 x 15 x 5 mm³. Thermical treatment has been performed according to method reccomended by Welbacher (2007.). Samples have been exposed to the temperatures of 100, 140, 170 and 200 ºC , during 5 hours. After thermicaly treatment samples have been exposed to the impact of wood decaying fungi: Coniophora puteana (Schum.:Fr.) Karst. and Trametes versicolor (Fr.) Pil. in Petri dishes (D = 90 mm) in duration of 8, 12 and 16 weeks. Mass loss of beech wood due to impact of decaying fungi has been estimated as a difference of masses of samples in absolutely dried condition before and after exposition to fungal attack and calculated in percentage. By this investigation it has been confirmed that thermically modified wood (TMW) use to be more resistant against impact of fungi causing brown- and white rot in comparison to unthreated- or threated wood at lower temperatures. Nevertheless, gained results are obtaining that thermically modified wood as material is not resistant against impact of decaying fungi, especially against the causers of white rot.*

Key words: Thermically modified wood, Fagus moesiaca, mass loss, Coniophora puteana, Trametes versicolor.

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THE DIVERSITY OF HARMFUL MOTHS OF NATIONAL PARK "ĐERDAP"

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Abstract: *The paper shows that in the National Park "Đerdap" about 250 species of the family Noctuidae were recorded, of which 50 species of moths (Noctuidae, Lepidoptera) potentially harmful in forestry. Research period was during 2007 and 2008, when we collected the moths (Noctuidae) in the National Park at different sites; Pantheidae, Nolinae, Chloephorinae and Eariadinae were treated as the subfamilies (Nowacki, 1998 and Rakosy, 1996). Collected and identified specimens were systematized by nomenclature (Nowacki & Fibiger, 1996 from Karsholt & Razowski, 1997).*

National Park "Đerdap" as a special area in Serbia, determined by specific abiotic and biotic environment factors: geological, climatic, hydrological, geomorphologic, geographic, petrographic, edaphic, floristic, vegetational and faunistic. Most forests of National park Đerdap, as well as the most canyons in Eastern Serbia are considered as a "protective forest" because the forests at higher slopes have enormous importance for the protection of soil from erosion. National Park "Đerdap" area is very complex and it is characterized by diverse forest and bush vegetation: a total of 50 vegetation communities were allocated here (Mišić 1981).

Harmful moths occur each year, and the difference is only in the intensity of harmful phenomena, because it causes different amount of damage in certain forest stands, or in certain forest units. Damages caused by harmful moths can refer to individual forest units or to the larger forest areas (Kovacevic and Franjević-Ostrc 1978). Climatic subfield where National Park "Đerdap" belongs covers the zone of younger mountains that extend continuously from the Danube to the north and to low valley in the south. The annual temperatures are lower than 10°C.

Monitoring of harmful moths in forestry has potentially great importance, in light of global climate change. It is difficult to predict behavior of potentially harmful moths in forestry in the changed climate conditions. However, this research with permanent monitoring may point to a change of behavior, the area extension, acclimatization to the new environment and new conditions, as well as to potential damage in our forest ecosystem.

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Key words: Noctuidae, harmful moths, Lepidoptera, National Park “Đerdap”

TWO NEW SPECIES FROM THE GENUS DUBININELLUS WAINSTEIN (ACARI, PHYTOSEIIDAE) IN THE SERBIAN FAUNA

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Abstract: *The diversity of the predatory epiphyllic mites from the family Phytoseiidae Berlese is only partly studied in our country. Over the last two decades the phytoseiid mites in the agro-biocoenoses have been more intensively researched, mainly in the harmony with their role in the biological controle of the phytophagous mites, as the bioindicators of the effects of chemicals in the plant production. Therefore, these studies were conducted in a great detail, at the level of the complex of the predatory mites and the trophic groups of the prey. By contrast, the research of the biodiversity and zoogeographic aspects of the mites in other ecosystems has been neglected. Due to these circumstances, by 2002 only 25 species of phytoseiid mites were reported in Serbia, out of which five species from the genus Dubininellus Wainstein: D. canadensis (Chant), D. echinus (Wainstein & Arutunjan), D. juvenis (Wainstein & Arutunjan), D. macropilis (Banks) and D. spoofi (Ouds.).*

Thus, the researches of phytoseiid mites fauna have recently begun in numerous natural, mainly forest, and the unexplored anthropogenic sites. The paper presents some of the results of the research of the diversity of the phytoseiid mites of the subfamily Phytoseiinae Berlese in the artifically established stand of Alnus glutinosa, Pinus nigra, P. silvestris and Larix leptolepis on the reclaimed mine soil of the Mining-Energy Complex Kolubara. The species from 13 plant genera were studied: Acer, Alnus, Amorpha, Cerasus, Crataegus, Fragaria, Juglans, Morus, Populus, Quercus, Robinia, Rubus and Salix.

The phytoseiin mites were reported only on the plant species from the genera Rubus and Fragaria. The different types of blackberries and plums are more frequently inhabited by the different species of the genus Dubininellus, which is also proved by our previous researches. Their presence on the other plant genera is proportionally less frequent, and these species were not reported during these latest researches, although by the processes of eterisation and shaking numerous and proportionally big samples with 300-400 leaves were controlled.

Three species from the genus Dubininellus were reported: D. juvenis and D. maltshenkovae (Wainstein) on R. ceasius i R.

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fruticosus agg., as well as D. ribagai (Athias-Henriot) on F. vesca. The latter two species are new in the fauna of Serbia. As a result, the number of the reported species of the subfamily Phytoseiinae in our country increased to seven. This fact is is important since the biodiversity of this subfamily, according to the different sources, is proportionally small within the European fauna, with only about fifteen registered species from two genera, whereas about 190 species from three genera are known in the world. Therefore, the results obtained in our researches will enable the adding of the new faunal and zoogeographic data on the European phytoseiin mites.

Key words: Phytoseiidae, Dubininellus, Rubus, New records, Serbia

FEEDING PREFERENCE OF CHRYSOMELA POPULI L.

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Saša ORLOVIĆ, Branislav KOVAČEVIĆ, Verica VASIĆ

Abstract: *Chrysomela populi is very important pest in willow nurseries and young plantations and causes damages both in a form of larvae and adult by eating leaves. As consequence to defoliation losses in growth, insufficient lignifications of stem and in extreme cases dying of plants are present. Selection of genotypes resistant or less susceptible could be one of the solutions in solving this problem, especially considering the alternative in use of pesticides.*

Multiannual researches and selection programs conducted at the Institute of Lowland Forestry and Environment showed different intensities of leaf damage on different clones. These results indicates the presence of predilection of Chrysomela populi towards some clones of willow. Investigation of predilection to candidate genotypes can improve selection process in order to gain superior genotypes for aforestation in which clones toward whom predilection is not present would be favored.

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THE GYPSY MOTH OUTBREAKS IN SERBIA IN THE PERIOD FROM 1945 TO 2010

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Abstract: *In the period from 1945 to 2010 there were five gypsy moth outbreaks, which covered the great forest areas. In the same period there were two gypsy moth outbreaks as well, which basically occurred at the local level. In the autumn 2009 the increase of the number of gypsy moths was reported in some parts of Serbia.*

This paper presents the available facts on the forest areas attacked by the gypsy moth in Serbia during five great outbreaks. It must be emphasized that the gypsy moth at the same time caused the great damages by defoliating the millions of fruit trees.

During the first after-war gypsy moth outbreak (1946-1950) the forests covering an area of 358,421 ha were attacked as early as in 1948. By comparison, in the same year the forests covering an area of 838,130 ha were attacked by the gypsy moth in the Federal National Republic of Yugoslavia. During the second gypsy moth outbreak (1953-1957), the forest covering an area of 909,400 ha were attacked by the gypsy moth in 1957. In the same year in the former country the forests covering an area of 1,326.687 ha were attacked by the gypsy moth. Although there are no separate literature data on the attacked areas in Serbia during the third gypsy moth outbreak (1961-1966), only in two former counties in 1965 the gypsy moth was reported in the forests covering an area of 454,579 ha. At the same time, in the Federal National Republic of Yugoslavia, the gypsy moth was reported in the forests covering an area of 2,309.395 ha. Around 500,000 ha were attacked only in 1997, during the gypsy moth outbreak 1995-1999 in Serbia. During the latest great gypsy moth outbreak (2003-2006) the record attack in Serbia without Kosovo was reported in 2005, when the forests covering an area of 360,000 ha were attacked.

Key words: Gypsy moth, outbreaks in Serbia

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Note: The research is financed by the Ministry of Science and Technological Development of the Republic of Serbia (TR 20052).

CLIMATE CHANGE, GYPSY MOTH OUTBREAK AND CHEMICAL INSECTICIDES

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Abstract: *In forest ecosystems in Serbia, biological insecticides based on Bacillus thuringiensis ssp. kurstaki (Btk) have been generally accepted and lately most applied pesticides in the suppression of the gypsy moth (Lymantria dispar L), i.e. during its progradation phase, when the density is relatively small. During the culmination phase, when the density of the target insect is maximal, if biological preparations are applied even with the excellent efficacy, the part of the population which remains alive often causes the damage of such proportions that, at the first glance, it makes the efficacy of the preparation doubtful.*

Also, Btk insecticides show the best efficacy on the younger larval instars. The older instars require higher lethal doses, so very often the applied rates of the preparation cause sublethal effects and the loss is even greater than that caused by the larvae in the untreated areas, because one of the consequences of sublethal doses is the prolonged larval development. This fact is especially emphasised during the unfavourable meteorological conditions which lead to prolonged hatching and to washing down of a part of the applied preparation. As a consequence, the age structure of the treated population larvae is most often from L1 to L4, and the rate of the active ingredient is reduced so that it does not have the lethal potency.

When number is greater, it is assumed that so-called "soft" ecotoxicologically favourable preparations Avaunt®, Alverde®, Coragen®, registered for application in agriculture, but not in forestry, can be used for inhibition of multiplication.

Results of laboratory studies of biological efficiency of above preparations showed that they have preconditions for application in forest ecosystems. The 100% biologic efficiency, mechanism of rapid inhibition of larvae feeding, and thereby inhibition of leaf mass damage, resistance to water rinsing, high selectivity, and small quantities of application, anticipated a bright future for them.

Key words: biological efficiency, Avaunt®, Alverde®, Coragen®, laboratory studies.

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ENTOMOPHAGA MAIMAIGA – A FACTOR FOR STABILITY INCREASING AND BIODIVERSITY ENHANCING IN OAK FORESTS ON BALKAN PENINSULA

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Abstract: *Entomophaga maimaiga Humber, Shimauzu & Soper (Entomophtorales: Entomophtoraceae) is a natural enemy of Lymantria dispar L. in Asia, and was successfully introduced in USA and Bulgaria. In Bulgaria, the first epizootics caused by this fungus occurred in 2005. Investigations on the distribution and impact of the pathogen on gypsy moth populations were performed in 2009, although no massive L. dispar outbreaks have been observed recently in the country. Due to the fact that two of the E. maimaiga epizootics we observed occurred in the immediate vicinity of Bulgaria's borders with Serbia and Greece (10-15 km), it can be assumed that the fungal pathogen has spread naturally to the two neighbouring countries. We believe that it is desirable to initiate a monitoring program and to augmentatively expand the range of E. maimaiga as an alternative to the use of chemical and B.t. insecticides, which are a threat for the stability and biological diversity in oak forests of the Balkan Peninsula.*

Key words: *Lymantria dispar*, *Entomophaga maimaiga*, *Quercus*, biodiversity conservation

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ENTOMOPATHOGENIC FUNGI ASSOCIATED WITH THE GYPSY MOTH EGGS

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Abstract: *Along with the predatores and parasitoids, the microorganisms, such as microsporodia and entomopathogenic fungi have the important role in the regulation of the gypsy moth population abundance (Lymantria dispar L.). This paper presents the research results of the entomopathogenic fungi associated with the gypsy moth eggs, which are the potential agents in the biological control.*

By the laboratory tests of the gypsy moth eggs, which originate from Bagremara (Forest Management Unit Novi Sad, Forest Administration Backa Palanka), the presence of the dead eggs with the symptoms of mycosis was reported. Several fungi, out of which three were singled out as the potentially entomopathogenic, were isolated from these eggs. By the determination of the fungi, which were later used in the experiment, it was determined that the first one belong to Penicillium genus, the second one to Trichothecium genus, and that the third one is the species Engyodontium aranearum (Cavara) Gams et al. All these fungi belong to Deuteromycota (= Fungi imperfecti) class. The gypsy moth is known to be the host for the species of the first two gena (CARROLL,1987), whereas it was found in the third species for the first time.

The entomopathogenic characteristics of the isolated fungi were studied by the experiment in which the spore and mycelial suspensions were applied to the vital gypsy moth eggs, which prior to the application were divided into four experimental groups (one for each fungi species and one as control). In the petri dishes 200 eggs were set, which after five repetitions and four treatments implies the total of 400 eggs in the experiment. Prior to the hatching the eggs were preserved at 20 0C, and the moisture necessary for the infection was provided by the everyday drenching of the cotton wool tampons in the petri dishes. Thirty days after the setting of the experiment, and after the hatching, the number of the non-hatched eggs was determined in each dish.

By the analysis of variance and LSD test, the significant differences among the group treated by the spore and mycelial suspensions of Engyodontium aranearum (Cavara) GAMS ET AL.

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fungus, other experimental groups, as well as the control one, in the percentage of the non-hatched eggs were determined.

Key words: Gypsy moth, eggs, pathogenic fungy

INFLUENCE OF TEMPERATURE AND CONCENTRATION H – IONS TO THE GROWTH AND PRODUCTION MASS OF MYCELIUM FOMITOPSIS PINICOLA (SW.:FR.) P. KARST. ISOLATED FROM BEECH AND FIR

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Abstract: *Knowledge of basic physiological characteristics causers of the destruction of wood is a rational basis in order to fight against the factors of destruction. Special importance is the impact of research more destructive fungi that cause a form of corruption - prismatic brown rot. Among these species, in our climate is one of the most common fungus Fomitopsis pinicola (Sw.: Fr.) P. Karst, which attack broadleaf and larch wood, and is being developed as a parasite and a saprophyte.*

Testing was done on influence of temperature and concentration of H - ions on the growth and mass production of mycelium and pH substrate change under the influence of this fungy. The trials were made with dicarion mycelium F. pinicola isolated from the mushroom body taken from fir and beech trees, from the Tara National Park. It was found that the range of development of both strain F. pinicola from 5 to 340C, while the optimum for its development is 290C, which coincides with the literature data. At constant pH values of the substrate mycelium of both strains F. pinicola had a maximum increase of the weaker acid substrate (pH 4.8). Tests on unpufered substrates showed that the mycelium F. pinicola weighing pH 2.3, where it recorded the largest weight of dry mass of mycelium.

The aim of this study was to determine if they are and how many extent environmental factors influence the successful colonization of nutritive surfaces in natural conditions by F. pinicola, compared to competitive destructor fungy.

Key words: temperature, pH, wood decay ing fungi, beech, fir

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EXPANSION OF THAUMATOPOEA PITYOCAMPA SCHIFF. (LEPIDOPTERA THAUMATOPOEIDAE) AN URTICATING PEST WITH REGARD TO CLIMATE CHANGE IN SERBIA AND MONTENEGRO

Milka M. GLAVENDEKIĆ[1]

Abstract: *An urticating forest pest pine processionary moth (PPM), has been so far distributed only in the vicinity of town Peć, Kosovo and Metohija. In other parts of the country no caterpillar nests have been so far observed. The first data on T. pityocampa on the territory of P.E. "Srbijašume", Forest Department Bujanovac were obtained by pheromone monitoring. Mail moths were captured on the following localities: Trnovačka reka (V. Trnovac), Rajince (Preševo), Crnotince (Preševo) and Rujan (F.E. Bujanovac). Monitoring was performed in pine plantations growing on the altitude from 482 to 646 m.*

In Montenegro there are data from literature (Mijušković, 1961) about outbreak of PPM in 1959/1960. It was found on all pine species and also on Cedrus atlantica. PPM was also observed on coast in Meljine, Budva, Petrovac and Bar. In the continental part of Montenegro PPM outbreaks were recorded in the vicinity of Nikšić and in Forest Department Danilovgrad. In F.D. Danilovgrad there was recent outbreak in 2005 on the locality Topolovo. During the research in 2009, on the base of pheromone traps, mail moths of pine processionary moth were recorded on the following localities Bzo, Studeno, Udraž katuništa, Ivanj Uba and Zmino brdo on the altitude from 1024 to 1540 m. Natural enemies of PPM were studied and egg parasitoid Ooencyrtus pityocampae Mercet was found.

PPM as urticating insect to humans and animals is expanding its populations with climate change from Mediterranean region to the continental part of Europe, as well as on the Balkan peninsula.

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FOREST POLITICS AND CLIMATE CHANGES

REFLECTION OF CLIMATE CHANGE ISSUES IN ROMANIAN FOREST POLICY, LEGISLATION AND PRACTICE

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Abstract: *The paper assesses the impact of the last twenty years international dialogue and resolutions on climate changes on the Romanian forest policy, legislation and practice, based on the analysis of the national forest policy and strategy, main forest legislation and current forest practice. Despite the fact that there are only few direct references to climate change impacts and adaptation, several objectives of the National Forest Policy and Strategy (2001-2010) enhance the CO_2 sink capacity of Romania by (a) ensuring the integrity and development of the forest area as well as the extension of the area with forest vegetation; (b) extending of the forest area and of other categories of forest vegetation, including on the degraded lands, (c) supporting the establishment of forest plantations on lands taken out of the agricultural land use, and (d) supporting the actions of establishment of forest shelterbelts, tree alignments along roads and of other categories of forest plantations. None of the articles of the recently adopted Forest Code (March, 2008) or relevant forest legislation mention the climate changes, their impacts or adaptation measures. However, several chapters of the 3rd Title of Forest Code (Sustainable management of forests) are referring to measures that prevent or reduce the impact of climate change: biodiversity conservation, ecological reconstruction, forest regeneration and tending, forest fires preventing and fighting, maintaining the integrity of the forest area etc. The current forest practices continues the tradition of the pre-1990 forestry as they are based on technical norms and guidelines developed in that period, with non-significant influences of the last decades change in forest ownership and socio-economic development. As a conclusion, there were no relevant changes in Romanian forest policy, legislation and practice in the last decades as a direct result of the international debates and initiatives on climate changes, and most of the measures regarding the adaptation to climate changes are based on the traditional forestry principles and practice.*

Key words: forest policy, legislation, climate change, Romania.

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THE ROLE OF FOREST POLICY IN FIGHTING CLIMATE CHANGE IN R. MACEDONIA

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Abstract: *This paper analyzes existing forest policy with concern to fighting climate change issues in R. Macedonia.*

Forestry in general has not been adequately incorporated into current mitigation efforts – neither in terms of fossil fuel substitution nor in terms of carbon sequestration potential for forests. Moreover, adaptation of forestry to climate change has been almost entirely neglected in R. Macedonia. The many benefits that society and environment gain from forests, just to mention wood, non-wood forest products, soil protection, water regulation, conservation of natural habitats and biodiversity, recreational functions, might be seriously jeopardized. That is the main purpose of this paper to analyze the existing regulations and measures taken towards mitigation climate change concerning forestry and produce recommendations for further development of this issue.

The method used here is qualitative analysis of secondary data related to forestry and climate change.

The results have shown that there are number of law regulations and measures taken by the appropriate institutions concerning climate changes. It has to be stressed that MOEPP is more active in this area and most of activities and measures taken during last decade were initiated by the environmentalists. Moreover, forestry has introduced international policy related to mitigation of climate change afterword. Still, it is very important that first steps are made and forest policy is going into right direction.

This paper has huge importance and will be a basis for further analyses regarding climate changes policy development processes in Macedonia.

Key words: forests, climate change, forest policy.

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BARRIERS AND OPPORTUNITIES OF SUPPORTIVE POLICY – NATURA 2000 OF FOREST ENTERPRISES IN THE SLOVAK REPUBLIC UNDER THE CONDITIONS THE EU

Viera PETRÁŠOVÁ[1]

Abstract: *Analysis of the results of supportive policy – NATURA 2000 impact on the economics of forest enterprises in pre-accession period and after the accession into EU demonstrates mainly for small agrarian enterprises their efforts to diversify own activities. This trend has been possible also by adoption of current supportive forest policy. The paper presents an overview of current supportive policy of forest sector in the framework of whole agrarian sector as well as other sectors of the national economy. Problems connected with the implementation of this policy are described. They are mainly barriers in enterprising in forestry and related activities. Overview of supportive policy is compared with the results of expert questionnaires survey. The overview presents also prediction of the needs of supportive forest policy by state forest sector and non-state forest sector according to present leaders of interest groups in forest sector. Barriers and opportunities of supportive policy with considering changed conditions due to economic and financial crisis as well as chances for forest enterprises to use opportunities of adopted tools of economic policy, which solve current unfavourable situation, are given in the paper.*

Key words: support policy, NATURA 2000, SWOT analysis, forest enterprises, activities, diversification

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NATURE PROTECTION AND FORESTRY LEGISLATIVE CONFLICTS – NP FRUŠKA GORA STATEMENT

Radovan NEVENIĆ[1], Zoran PODUŠKA[1],
Renata GAGIĆ[1], Ilija ĐORĐEVIĆ[1]

Abstract: *There are 3 institutions at same area who are involved in conflict and not able to find out solution for managing the meadow, which is under jurisdiction and use of all involved in conflict.*

The different attitudes of conflict actors who has to be in charge for meadow maintenance, different attitudes regarding nature protection and parts of area maintenance which is under nature protection legislative and rules, leads, that independent parties indentified overlapping and unclear legislation as a main cause of conflict.

It is evident that there is a great number of laws and regulations which are related with the same area. Investigation and research action was leading in direction to find out what are the main collisions between two legislatives and what will be the conflict management strategies, focused on improvement of communication and collaboration as prevention of conflict.

Case Study preformed in frame of the national and regional research by FOPER project – Forest Policy and Economics Education and Research, a project for strengthening the capacities of education, training and research of forest policy and forest economics in South-Eastern Europe region.

Key words: forest policy, conflict, legislative, nature, protection, management

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BARRIERS AND OPPORTUNITIES FOR CONSERVATION AND MANAGEMENT OF DEHESAS

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Abstract: *Dehesa is an agroforestry system of the western part of the Iberian Peninsula where an open oak forest is combined with livestock raising in order to provide a wide range of functions. Dehesa system is nowadays subject of an intense debate regarding its actual situation and sustainability. The lack of regeneration, out-aged stands and pest outbreaks are considered to be symptoms of a holistic process where social and environmental factors take part. This paper reviews the main aspects of traditional dehesas concerning their historical development, EU policy and climate change. The analysis has revealed that dehesas have suffered important changes due to socioeconomic and political factors. Moreover, these factors can become both barriers and opportunities for future development depending on the management decisions. Contrarily, climate change seems to be a barrier for management as only negative impacts are predicted.*

Key words: agroforestry, climate change, policy, montados, Mediterranean

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CASE STUDIES OF CORPORATE SOCIAL RESPONSIBILITY (CSR) IN FOREST PRODUCTS COMPANIES - AND CUSTOMER'S PERSPECTIVES

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Abstract: *The concepts and practices of Corporate Social Responsibility (CSR) in forest products industry have been evolving since the 1970's, initially promoted by stakeholder criticism. The researcher selected four forest products companies: Stora Enso, Korsnäs, Arctic Paper, and Sappi. In addition, the customer's perspectives were gathered from three selected customer-firms: Tetra Pak, Jernström, and Color Print. The following CSR processes were identified in the selected forest products companies: community development and communication, corporate governance and law compliance, code of ethics and business conduct, environmental management, health and safety programs, human resources process, human rights, supply chain management, products and services quality, arts and culture programs, independent CSR organization, anti corruption policy, and CSR report.*

In practicing their CSR programs, the selected companies were driven by different predominant factors such as the values, performance, and stakeholders of the companies. The results also show that there are similarities, such as starting to work actively to control climate change. In addition, there are also different approaches in the profile of CSR processes. The differences in approaches are affected by the size of the company and the geographical position of operations; in which it is strongly correlated with different socio cultural condition and economic development of the given area.

Regarding the customer-firms, they perceive that there are more interests in their suppliers' CSR programs, specifically about environmental issues. The customers mention that quality is the major driving factor in selecting their suppliers. In addition, the organizational scale of direct customers; whether they are local or Multinational Corporation, also affect their purchasing behaviour.

Key words: CSR, sustainability, ethics, forest products companies, climate changes, customer's perspectives.

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GEOMATICS IN FORESTRY. SOME ASPECTS OF THE LITERATURE ANALYSIS

Małgorzata GAJOS[1]

Abstract: *The development of every field of knowledge is related to the appearance of bibliographical sources registering the literature of a given field. Thanks to them it is possible to research the development of interests of professional groups and of the researchers related to a specific field, the directions of its development and diversification of subject matters of their works.*

Base on the characteristics of the profile of a magazine and its impact factor three foreign magazines from the scope of geomatics (International Journal of Geographical Information Science, Geoinformatica, Photogrammetric Engineering & Remote Sensing) were selected. Next, the articles included in them were analyzed in relation to the application of geomatics in the forestry, and especially using the geoinformation technology in exploring forest ecosystems.

Analysis comprises the period of 3 years (2007-2009).

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PARTICIPATION OF LOCAL COMMUNITY AND LOCAL GOVERNMENT UNIT (LGU) IN MANAGEMENT AND GOVERNMENT OF FORESTS IN KORCA QARK AND ALBANIA – A CHALLENGES BUT AND A PERSPECTIVE ON THE FUTURE

Hajri HASKA[1], Etleva CANAJ[2], Flora MERKO[3], Janaq MALE[4], Manjola SALLA[5]

Abstract: *The deep decentralization reform undertaken by Albania Goverment since 1996 was finalized in 2008 by transfering of about 60% of forest areas in properties to local goverment units.*

This deep reform in Albania is a real opportunity to reduce poverty in remote areas through participatory management, establish of mechanisms on forest and pasture use, reduction of erosion, improve water quality and environmental stability.

The participatory process has the added value also on exposing the community to ideas of sustainable management practices. As a result of this, in Korça region are functioning 27 associations of communal forest and pastures users representing about 100,000 farmers in the region.

The transfer of forests and pastures in properties to communes has led to improved management of degraded forests by increasing the interest and participation of communities and local government. One key problem encountered in this process that still needs to be resolved is the sharing of responsibilities and cooperation between the district forest service, local government and community.

Over the 10 years of experience and work in Communal Forest and Pastures Management, all actors involved and donors that support the communal forest and pasture management process have used following principals:

-The focus should be more on people rather on trees.

-Comunal Forest Management (CFM) is not just a method for natural resources management, but it is also part of local empowerment and capacity building process.

-CFM is successful where forest users participate in decision making and also take part in the responsibilities that comes with it.

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-Management should be based on a relationship with the forest, rather the activities done to the forests.
-Local communities support sustainable natural resources management only when their minimum daily needs and well-being have been met.

Key words: Albania, Korça, participation, forests, sustainable, local community, Local Government units, management, communal forests, reform, natural resources, challenges.....

IMPLEMENTATION OF EFFICIENT POLICY AND MANAGEMENT METHODS IN RELATION OF PROPERTIES AND USER RIGHTS ON FORESTS IN ALBANIA

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Abstract: *At the Balkan Peninsula, in the south eastern part of Europe is located Albania, a small, but very beautiful country. It has a population of about 4.1 million inhabitants, and capital is Tirana.*

Albania enclosed from terrestrial, sea, rivers and lakes border. Total length of Albania border is about 1094 km; from them 657 km terrestrial, 316 km sea border, 43 km rivers border and 73 km lake border.

Mediterranean shrubs, broad-leaves forests, conifer forests, mixed forests, alpine a sub-alpine pasture ecosystems, meadows, rocks area, marine ecosystems, coastal, lagoons and other wetland area, lakes, rivers, but of course and agricultural area, - are some of main natural habitats and ecosystems in Albania.

So, around 36 % of total area of Albania is covered by the forests or 1,043,158 ha with a total standing volume of 81,334,000 m3. In Albania are 361,568.7 ha (12.58 % against of total Albania surface), protected Areas, according to IUCN criteria.

But, in Albania development of forestry sector have represented different aspects as and management, policy reforms, property forms, social-economics aspects, organizational forms etc... But, more significant have been forest property and using rights aspects of forests.

In Albania, before 1945 year have been existed three property forms: private, state and communes or villages property. But, after 1946, all the forests are nationalized and till 1991 have had only one property form: state property and the policy that have been implemented in forestry sector was that centralized planing and management. After 1992 are authorized three property forms in forests: private, state and communes properties (in the first phase it was transfered in use to communes). Similar problems have exist in the past and in Korca district, but the new

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decentralization proces will develop forest sector in Korça district as well as in all Albania.

So, for implementation of new and efficient policy, Albanian government have applied decentralization of property forms in forestry sector, as well as management and governance of forest sector in a way that user rights in forest sector, have to bee more and more for different actors that acting in forest sector.

Key words: Albania, propriety, using rights, forest, decentralization.

ENVIRONMENTAL PROTECTION AND CLIMATE CHANGES

THROUGH SUSTAINABLE AND UNSUSTAINABLE DEVELOPMENT FROM STOCKHOLM TO COPENHAGEN

Goran TRIVAN[1], Dragica STANKOVIĆ[2],
Đorđe JOVIĆ[3], Tatjana ĆIRKOVIĆ-MITROVIĆ[3]

Abstract: *Stockholm Conference on environment held in 1972, revived conscience of mankind and started "Ecological era". World Summit on Sustainable Development held in 1992 in Rio de Janeiro represented outset in world response on climate change and global warming in our planet.*

Almost 150 world leaders signed agreement called „Framework United Nation's Convention on climate changes". Objective of the Convention was the reduction of emissions and stabilization amounts of gases in the atmosphere that cause the effect of greenhouse, to a level that would prevent harmful impact on climate that changes caused by human activity can have.

After 17 years, 15th United Nations Climate Change Conference, was supposed to be the most important chapter of story called climate change.

The aim of the conference in Copenhagen is to achieve a new global agreement on combating climate change, which would replace the current Kyoto Protocol which expires in 2012.

Key words: Conference, Copenhagen, environmental protection, sustainable development, climate change

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FOREST RESOURCE AND SPATIAL IMPACT ANALYSES

Radovan NEVENIĆ[1]

Abstract: *Island forest coverage – former island Ada Ciganlija has 265,5 ha. The research area of the island forest coverage impact lower part of the Ada plate, position where just now Belgrade Sava bridge is in construction. The spectacular bridge over the Sava will be 929 m long and 45 m wide. It will have a distinctive 200 m pylon erected on the lower tip of the Sava island, with a fan of steel cables on both sides of the pylon holding the structure together. There will be six lanes for vehicles, two tracks underneath for the planned underground railway, and two lanes for bicycles and pedestrians.*

In this paper, second phase of previous investigation, research of possible impact on forest coverage is done only at corridor where the bridge route is wriggled over Ada lower part, which comprise forest, vegetation coverage close to the bridge. Overview and global recognizing of the imperiled vegetation coverage as a part of recreation zone, urban forests, will be analyzing issue as well as comparing previous vegetation condition with present area in construction.

Key words: spatial data, forest, impact, GIS…

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CLIMATE CHANGES IMPACTS ON FORESTS IN MONTENEGRO – MITIGATION AND ADAPTATION

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Abstract: *On the basis of available data on Montenegrin forests, as well as undertaken silviculture activities, the possible impacts of climate change on forests in Montenegro are considered as well as measures to minimize these impacts and measures for better adaptability of these ecosystems.*

In addition the paper are presented the data from base inventory of gases with greenhouse efects for Montenegrin forests by the IPCC methodology prescribed in the revised manual from 1996.

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THE MEASURES SUGGESTED FOR MITIGATION OF NEGATIVE IMPACT OF CLIMATE CHANGE ON FOREST ECOSYSTEMS

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Abstract: *The environmental pollution causes many ecological problems, climate changes and global warming, with adverse effect on forest ecosystems in the whole world, and Serbia also. Forest plants tend to release carbon instead of natural process of absorbing it because of global warming. Thus forests instead of being lungs of the Earth become one of the sources of pollution. Numerous studies about global warming and potential changes in temperature and humidity, point to wide spectrum of effects both on the forests ecosystems on the whole and on the single tree. Even though climate and other environmental conditions, especially negative ones have the most direct influence on the forest vegetation and its structure the forest itself can also modify these conditions to a great extend. To mitigate negative effects and to exceed expected consequences the adaptive measures should be taken into account in the forest management. These measures will help forests to acclimatize to new environmental conditions. If new regulations and other polices regarding forest adaptation would be provided and acknowledged one will have the actual indication for taking different actions in state and private forests, all in aim of sustainable forest management even under changed climate conditions. The paper presents negative effect of climate change, consequences and disturbances in forest ecosystems and the modified framework of adaptable forest management. The potential strategic and operational methods for forest ecosystems adaptation to negative climate changes are also suggested.*

Key words: forest ecosystems, climate changes, strategic measures, adaptable forest management

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POTENTIALS OF SUPER ABSORBENT POLYMER APPLICATION IN FORESTRY

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Abstract: *During the eighties of the twentieth century, to intensify the agricultural production, the American scientists developed the substance called Super Absorbent Polymer based on polymers (non toxic acrylamide), today known under different names (superabsorbent, hydrogel, water-absorbing crystals), and trade names (Horta-Sorb®, Super-Hydro-Grow, etc.), depending on the type and the manufacturer. The positive experience refers to the application of polymers: as an addition to soil mixtures for plant production and cultivation (Henderson & Hensley, 1986; Kjelgren et al., 1994; Kahl et al., 2000; Vilotić et al., 2006; Kresović et al., 2008; Dragičević et al., 2008), stimulators of seed germination (Henderson & Hensley, 1987, 1987a), for immersing the bare-root seedlings in long transport, for soil stabilisation (Aly & Letey 1989, 1990; El-Hady et al., 1981, 1991; Barvenik, 1994; Bouranius et al., 1995), for the stimulation of plant survival and growth in the establishment of tree rows, shelterbelts, and in the reforestation of difficult and degraded terrains in climatically modified environmental conditions (Cook & Nelson, 1986; Callaghan et al., 1989; Huttermann et al., 1990 Vilotić & Šijačić-Nikolić, 2008, 2009; Šijačić-Nikolić et al., 2008).*

To test the superabsorbent polymer potentials and methods of application in Scots pine and Austrian pine seedling production, the experiments were established in the conditions of laboratory, greenhouse, and nursery. To analyse the superabsorbent polymer effect on the development of Scots pine and Austrian pine seedlings in the first years after afforestation, two experiments were established in the spring 2008. The first experiment was established on the burnt area of the Sands Deliblatska Peščara, with Scots pine seedlings (Pinus silvestris L.) aged 2+1, produced in Nisula rolls. The second experiment was established at the locality Kremin, with containerised seedlings of Austrian pine (Pinus nigra Arn.), aged 2+0. The following polymers were tested: Water Retainer/Polymers - Hydro Absorption Rate between 250 and 350 (Manufacturer Super Absorbent Company, 10 Chrysler, Suite B, Irvine, CA 92618, Website: www.SuperAbsorbent.com), in powder state.

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The study results justify the application of polymers in Scots pine and Austrian pine seedling production in nursery conditions. The positive effect of polymers is accumulated and intensified with the increasing seedling age. Also, polymer application affects the higher seedling survival and their better and more intensive growth over the first years after transplanting.

Key words: Super Absorbent Polymer, Scots pine, Austrian pine, Deliblatska Peščara

FOREST ECOSYSTEM PROTECTION PLANNING IN THE REPUBLIC OF SERBIA

Milijana CVEJIĆ[1]

Abstract: *Endangerment of forest ecosystems due to climate changes is up-to-date problem. We are witnesses of influence of climate changes on environment and forest ecosystem as a part of it.*

Climate changes threatening forest health and stability. Increasement of air pollution and number of periods of extremely high temperatures resulting in depredating phenomena such as acid rains, drought and storm. Result of such a phenomena that influence forest is land erosion, increasement of land acidity as well as degeneration of forest ecosystems (severe wood regeneration, increasement in damage of forest fire, foul weather, pest and plant disease). Those phenomena restraining natural regeneration growth and biological diversity of forest.

One of the available instruments to protect forest ecosystem within process of protection of environment is production and application of legal act, planning documents and incorporation in international conventions.

Objective of the text will be research of strategic and plan aspects of forest ecosystem protection through the current plans documentation. Methodical concept of environment protection by means of predicted factors and terms define sustainable conduction of natural values and anticipate arrestment, control, decrease and recovery of all aspects of degradation.

By analyzing current plan documentation understanding of plan concept of forest ecosystem protection will be developed.

Intention of text is to propose effort on base of researched documentation for plan and strategic protection and improvement of forest ecosystems in condition of global climate change.

Key word: Environment, Forest ecosystem, Climate changes, Protection

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BIOLOGICAL SYSTEMS FOR WASTEWATER TREATMENT AND RAINWATER HARVESTING IN THE VILLAGE ZAGORA, MONTENEGRO

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Abstract: *The paper presents research results related to the construction of the biological system for wastewater treatment and the design of the integrated system for the rainwater harvesting and purification in touristic village Zagora. The village does not have conventional water supply and sewerage systems. The water is supplied by water desalinization system. Seventeen houses and one reception facility will be built according to the plan. Houses vary in size and they can accommodate one hundred visitors. In regard to climatic conditions and type of housing project the intent is to construct an integrated biological system for wastewater collection and treatment. The system comprises pretreatment compartment, constructed wetland and restorer. The technical water supplied at the inlet returns back to the reception and all houses. The composting toilets are installed in all houses and reception for the purpose of saving water and unburdening biological system for wastewater treatment by microorganisms and aquatic plants. The restoration of old water reservoirs, called bistjerne and ubla, is planed in the aim of rainwater harvesting and treatment. The construction of the new system for rainwater harvesting from roofs, all kinds of eaves and ground is suggested for the purpose of gathering more rainwater. In this way sustainable management of present water resources will be enabled in village Zagora.*

Key words: waste water, constructed wetland, restorer, rainwater harvesting, Zagora

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SOIL EROSION IN THE DRAINAGE BASIN OF THE RIVER RASINA UPSTREAM OF THE RESERVOIR "ĆELIJE"

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Abstract: *The dam and the reservoir "Ćelije" is located on the river Rasina about 33 km from its confluence in the river Zapadna Morava. The river Rasina drains the slopes of the mountains Jastrebac, Kopaonik and Goč, which attain the altitudes of up to 1500 m i.e. 1900 m. The lowest elevation of the Rasina at the confluence to the Zapadna Morava is about 200 m, and the elevation of the Rasina bed in the profile of the dam "Ćelije" is about 239 m. The drainage basin is elongated, curved, with a developed drainage pattern,The drainage basin area to the dam profile amounts to 609.15 km2.*

The reservoir "Ćelije" is a strategic part of the Rasinsko-Pomoravski regional water-supply system which includes the downstream part of the Zapadna Morava and the upstream part of the Velika Morava. It is planned that the sub-system "Ćelije" should be the regional system which provides full supply of water to the municipalities: Kruševac, Aleksndrovac, Varvarin, Ćićevac, Trstenik and Vrnjačka Banja and partial supply to the municipalities: Ražanj, Paraćin, Ćuprija, Jagodina and Despotovac.

Taking into account the increasing demands of clean water, it is important to protect the reservoir "Ćelije" against erosion in the catchment and the resulting damage.

This paper presents the results of the study of the catchment natural characteristics significant for the development of soil erosion process and the present state of erosion in the drainage basin upstream of the reservoir "Ćelije", as the indicator of its erosion and sediment risks. The research was carried out over 2008 and 2009.

Key words: erosion, reservoir, risk, state.

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THE MIGRATION TRENDS AND SOIL PROTECTION FROM THE EROSION IN GRDELIČKA GORGE AND VRANJSKA BASIN

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Ljiljana BRAŠANAC-BOSANAC[1],
Tatjana ĆIRKOVIĆ-MITROVIĆ[1]

Abstract: *This paper presents the results of the researches and analysis of the trends of the population, the number of households, and residential density according to the censuses from 1948, 1953, 1961, 1971, 1981, 1991 and 2002, based on the data for the municipalities (parts of municipalities) which belong to the researched area: Leskovac, Vladicin Han, Crna Trava, Surdulica, Vranje, and Bujanovac. The data were collected and analyzed for the total of 221 inhabited places. The decrease in the population of the rural inhabited places is the result of the decrease of the total population growth rate and migrations. The increase in the population of the Grdelicka gorge and Vranjska basin was typical for all the inter-census intervals until 1991, since the decline of the population in all parts of the area was typical for the latest inter-census period 1991-2002. The decrease in the population in the latest census-interval was reported in Bujanovac, Surdulica, as well as in the areas which belongs to Leskovac and Crna Trava. The decline was also reported in Vladicin Han, whereas the increase in the population was reported only in Vranje. In this area, as well as in the greatest part of Serbia, the population migrated from the mountain to the lowland areas, and from the rural to the urban centers. The analyzed demographic and socio-economic changes in the researched area affected the decrease of the intensity of the erosional processes.*

Key words: population, migrations, number of households, residential density, erosion.

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THE ANALYSIS OF THE IMPACT OF THE WAY IN WHICH THE LAND IS USED ON THE EROSION CONDITION IN THE TRGOVIŠKA RIVER DRAINAGE BASIN

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Abstract: *This paper analyzes the changes of the condition of the erosion processes and bedload production in the Trgoviska river drainage area, formed after the application of the erosion control methods in the drainage basin. The condition of the erosion processes and determined bedload production (in 2009) were compared with the respective values from the period prior to the appplication of the control methods. This paper is based at the determination of the causes of the reported changes of the intensity of the erosion processes and bedload production in the researched area. The area in which the researches were conducted is defined by the border of the Trgoviska river drainage basin. The results of the researches showed that the intensity of the erosion procees in the studied area in 2009 decreased in the comparison with the condition in the drainage area before the application of the control methods. It was reflected in the estimated condition of the erosion processes as well (mean coefficient of erosion for the studied area), and in the estimated bedload production, caused by the erosion processes, i.e. by the final impact of the numerous factors of erosion. Although the condition of the erosion processes in some area is the result of the conditions in this region, i.e. of the impact of the numerous factors, it was concluded that the changes of the condition of the erosion processes in the studied area were almost solely caused by the change of a small number of the erosion factors, mainly referred as the "way in which the land is used". The establishment of the forest cultures resulted in the positive changes in the intensity of the erosion processes as well as in the decreased bedload production.*

Key words: the way in which the land is used, erosion control methods, erosion process, bedload production

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THE CONDITION OF EROSION AND EFFECTS OF THE EROSION CONTROL ACTIVITIES PERFORMED IN THE KRPEJSKI POTOK DRAINAGE BASIN

Sonja BRAUNOVIĆ[1], Mihailo RATKNIĆ[1]

Abstract: *Krpejski potok drainage basin sis a part of the Juzna Morava drainage basin, and in the recent past was the strong erosion area, which endangered the international communication lines and inhabited places in the Grdelicka gorge. This paper presents the results of the intensity of erosion in 1953, 1970, and 2008. The intensity of the erosion process in 2008 was determined by the use of the satellite photos of the high resolutions. By the comparative analysis of the obtained results the positive effect of the erosion control activities performed in the basin, as well as the influence of the socio-demographic factors were determined.*

Key words: erosion map, intensity of erosion, satellite photo, Krpejski drainage basin

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THE ANALYSIS OF FORMULAE FOR THE ESTIMATION OF THE FLOODPLAIN SLOPE IN MELO TORRENTIAL FLOOD

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Abstract: *The creation of the transversal objects in the torrential bed is aimed at the prevention of the deep and lateral erosion. By the creation of the barriers the steep torrential beds turn into the stepped torrential beds with the flattened slope of the torrential bed bottom and the reduced water depth and velocity, by which the bank erosion is prevented, as well the transportability of the flow. In order to maximize the effectiveness of the projected barreiers in the control of the erosion processes it is important to determine correctly the distance between them, which depends on the barrier height, slope of the torrential bed bottom, and the slope of the floodplain. The barrier height and the slope of the torrential bed bottom are the known values, whereas the slope of the floodplain should be anticipated and calculated. There are several formulae for the calculation of the slope of the floodplains, which are essentially the formulae for the determination of the slope of the equalization of the torrential bed with the created barriers in the specific circumstances. This paper compares the values of the slope of the floodplains obtained by the estimation by the formulae by the different authors, mainly used in the practice, with the values obtained by the geodesic surveying of the longitudinal profile of the slope of floodplain of the barrier number 1 in Melo torrential flood. The smallest deviation from the calculated values of the slope of floodplains was obtained by the use of Thiery's formula, and it is followed by the use of Velikanov's formula, and the regional analytic dependences (Biocev, Kostadinov and Velojevic). In order to anticipate the slope of the floodplains the regional analytical dependences, based on the field researches of the already formed floodplains, and which besides the slope of the torrential beds would include the independent variables, by which the bedload would be characterized, should be used.*

Key words: barrier, slope of the floodplain, slope of the torrential bed, bedload.

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CLIMATE CHANGES AND MANAGEMENT PROTECTED NATURAL WITH SPECIAL EMPHASIS ON NATIONAL PARK KOPAONIK

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Abstract: *Climate changes as global warming have global consequences, which are inevitable migration of plant species to the north and in mountainous areas above the climatic belts, as the existing plant community in the highest part of Kopaonik is particularly vulnerable. Previous experiences in strictly protected areas in the National park Kopaonik are mostly negative and impose the need for changing the approach in the implementation of activities on the preservation of plant communities and species in the first degree of protection and the most sensitive areas to climate changes. This will be achieved through the active joint participation of experts of different disciplines in the ongoing monitoring and early detection of changes in the most sensitive plant communities and species (indicators of changes), as well as designing plans and actions to prevent harmful consequences of global warming.*

Key words: warming, sensitive species, reserves, Kopaonik

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CHARACTERISTICS OF PRECIPITATION AND SURFACE YELD IN DECIDUOUS FORESTS AT THE PETROCHAN SCIENTIFIC EXPERIMENTAL FORESTRY STATION OVER THE PERIOD 1998-2008

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Abstract: *Climatic factors impact on the surface yield significantly. The impact of precipitations is the most tangible. In order to perform monitoring of the impact a hydrologic station was established in the scientific experimental forestry station Petrochan on the river Gavaneshtitsa. An on-going monitoring process started in 1998. The results of precipitations and surface yield measurement over the period 1998-2008 are presented in the article. The results are tentative due to the short term period of monitoring.*

Key words: climatic factors, hydrologic station, rainfall, runoff

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INFLUENCE OF ANTHROPOGENIC FACTORS ON ENVIRONMENT IN THE RASINA WATERSHED

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Abstract: *This paper presents the influence of demographic trends on the environment of the Rasina river watershed. Thanks to migrations from this hilly region, nowadays in the villages of researched watershed prevail older-age household members where the number of active population is continually being lessened. As the consequence of the decrease of active agriculture population and increase of their average age, many arable lands are no more plowed and converted to weeds. The significant impact to the decrease of erosion processes has been exerted also by smaller number of livestock in the researched region, especially sheep and goats, which is the result of administrative measures.*

Key words: environment, natural factors, anthropogenic factors, migrations, degradation

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BIOMASS – POTENTIAL FOR FUTURE

ANALYSIS OF FOREST BIOMASS RESOURCES FOR ENERGY PRODUCTION

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Ján ILAVSKÝ[2], Mária ŽIAKOVÁ[3]

Abstract: *The paper presents the overview of methodology for identification of forest biomass resources for energy production and its transportation to heating plant. The potential volume of wooded biomass was calculated from detailed description of forest stands. The evaluation includes several factors: the growing stock, planned fellings and felling types, assortments structure, forest age structure, ownership. Ecological limiting factors were evaluated including protected forests, level 5 of nature protection, sensitive and poor soils, regions with slope over 50%. Biomass production from ecologically sensitive regions was strongly restricted. Consequently transportation distances were analyzed and distance zones constructed. Finally the amount of exploitable wooded biomass and its costs were estimated. The results were summarized in report and presented in maps, tables and graphs.*

Key words: forest biomass, GIS, energy production

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THE POSSIBILITY OF PAULOWNIA SP. UTILIZATION IN THE RECLAMATION OF DEGRADED LAND

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Abstract: *At present stage of technological development fossil fuels still have the dominant role. Open pit exploitation of coal and its use for the purpose of production of heat and electricity are drastically disturbs the environment.*

The obligation of the human collectivity, as well as a condition of his continued survival is to mitigate the negative effects caused by these activities. Reclamation of the mechanically damaged soil as a consequence of exploitation of opencast mining and ash disposals of thermal power plants are the challenges which require urgent resolution.

The paper presents the potential of Paulownia sp. in the process of biological recultivation. The species is tolerant to the environmental conditions. Produce a large amount of leaf biomass each year. It is rapidly growing species with high quality wood. Paulownia tree is the species which is devoted great attention in the world. Results of previous research indicate that this species is suitable for use in reclamation by afforestation in Serbia.

Key words: recultivation, afforestation, deposol, ash disposals

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THE VARIABILITY OF THE QUANTITY OF ESSENTIAL OIL EXTRACTED FROM THE BOSNIAN PINE NEEDLES

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Abstract: *On the list of one hundred globally principal invasive species (Global Invasive Species Database), along with the house mouse (Mus musculus L.), originates from India, or gypsy moth (Lymanthria dispar L.), of Eurasian-African origins, etc. there are even 34 plant species, and almost 50% of them originate from America. The invasion is most frequently caused by the favourable bio-ecological characteristics of the sites and the lack of natural enemies, as well as the biological properties of the species which enable the fast spread of them (secretion of growth inhibitors, hairy or sticky seeds, small seeds, bird-dispersed edible seeds, ability to form adventitious root, etc.). Frequently, there is a significant number of the invasive species within the same family, which is attributed to the similar bio-ecological characteristics or phylogenetic relations, but also relating species, and all other ones, which show the tendency to invasiveness, should be treated as potentially invasive.*

With the exception of weeds, there are no clearly defined methods for control of many species, and their degree of invasiveness has not been defined. In regard to woody species, it can refer to the autochthonous species which spread in an uncontrolled way due to leaving of the arable areas, but also owning to the altered site conditions (by drainage, deforestation, wildfires, creation of waste disposal sites, etc.). These plants are often competitive with allochthonous (exotic) trees and bush, which were introduced in the aim of reforestation or establishment of green areas in the inhabited places. Generally speaking, all the invasive species are also the indicators of the site degradation, gene pool of autochthonous species, plant communities, and of the environment, in general.

Forests and forest land cover an area of 26,000 hectares of Belgrade (10% of total city area). About 90 woody and over 200 herbaceous species from about 40 phytocenoenosis (mainly in alliance of white willow forests, Salicion albae), as well as natural and artifically established plantations of forest trees, cover an area of 15,000 hectares of city area. The degrees of invasiveness

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(principal invasive, moderat invasive, or minor invasive) were determined for many of these species.

Key words: aliens, principal invasive, moderate invasive, minor invasive, trees, shrubs, herbs, natural sites

FOREST LANDS VALORIZATION POSSIBILITY THROUGH FAST GROWING ENERGY CROP MISCANTHUS GIGANTEUS CULTIVATION

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Abstract: *Status of fuel and energy base in the world requires a radical intervention in the energy sector, notably by changing the fuel base and the use of additional resources in the form of renewable energy. Renewable energy sources are based on sophisticated and environmentally friendly technologies and contribute to strengthening and diversifying the structure of industry, agriculture and forestry. Biomass energy use has a multifaceted meaning. When the energy biomass is grown specifically on the agro - forest land, it contributes to maintaining the landscape, its biodiversity, to the economy of enterprises, which produce this biomass, especially in areas less suitable for intensive agricultural and forestry production. Energy crops are often grown in marginal areas, respectively in soils contaminated with heavy metals or organic pollutants. It would be optimal for these soils cultivated species, which would also apply its eco-renovation capability and consequently their use of biomass for energy purposes. From this point of view, plants of the genus Miscanthus are extremely promising. Miscanthus giganteus high level biomass production, noticed in previous researches in the field sample plot established in Serbia, and possibility of cultivation on less quality soil make this crop very suitable as annual renewable raw material for bio-fuel production on uncovered, low quality or withdrawn forest lands for other purposes (power level lines, telecommunications etc.). Possibility of this energy crop cultivation on forest lands and production of pellets and briquettes in Serbia is considered in this paper as a way of economic valorization of uncovered, withdrawn or low quality forest lands.*

Key words: energy crop, forest lands, economic valorization

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NEW TECHNOLOGIES IN THE FORESTRY SECTOR IN SERBIA – CASE STUDY HARVESTER –

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Abstract: *Improvement of forest ecosystems involves the use of new technologies. If we look at cutting trees as a way of use, protection and improvement of forest ecosystems, applying harvester is a new method in the contemporary forest use. In Serbia harvester is used to cut the poplar plantation. Cutting is performed on large areas afterwards the conditions for the establishment of new poplar plantations is about to be set. Intensive cultivation of poplar contributes to recultivation of degraded soils, Carbon sequestration, giving a great contribution to the mitigation of climate change. Uses of harvester in poplar plantations provide a strong backbone of forest enterprise to economically and environmentally sustainable managed forests.*

In this paper identify the fostering and impending factors for the introduction and application of new technologies in the process of utilisation of poplar plantations in JP "Vojvodinašume". Modern methodological approach applied based on qualitative research methods.

Key words: new technologies, harvester, forest ecosystems, case study

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USING FOREST RESIDUES FOR CLEAN UP METAL POLLUTED WATER

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Dragana DRAŽIĆ[2], Nevena ČULE[2]

Abstract: *The increased amount of heavy metal in various forms, in the environment, causes a severe threat to the ecological system due its negative impact on most life forms. In contrast to organic pollutants, that can be metabolically degraded or transformed, the remediation of heavy metals needs their total removal or conversion into biologically less active or inactive species. The conventional methods for the removal of heavy metals from aqueous solution are very expensive and in some cases left new, undesired waste. There is a need to develop rapid, economical and environmentally friendly technology for the removal of these pollutants from different liquid effluents. It is knew that different biomaterials absorbs passively heavy metals and this process called biosorption could be a potential alternative to the existing physicochemical technologies to clean up wastewaters. Many biomaterials are used for this purpose such as algae, ferns, moss, fungi and different residues from agriculture and forestry industries. This biomass is available in large quantities and can form a good basis for the development of bio sorbent materials. Moreover, the use of dead biomass has the some advantages as follow: it is abundant and very cheap; the process does not require a continuous nutrient supply for maintaining the cells in good physiological conditions etc. This paper presents a review of the data on potential cheap cellulose-containing natural materials such as wood sawdust, bark and other forest resides for adsorption of ions of heavy metals and dye from wastewaters.*

Key words: heavy metal, biomaterials, biomass, forest residues

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