

FIRST SERBIAN FORESTRY CONGRESS
under slogan:
- FUTURE WITH FOREST -

11-13 November 2010
Belgrade, Republic of Serbia

**ON THE OCCASION OF JUBILEE MARKING 90 YEARS OF ITS EDUCATIONAL,
SCIENTIFIC AND PROFESSIONAL ENGAGEMENT, FACULTY OF FORESTRY
ORGANISES THE INTERNATIONAL SCIENTIFIC CONGRESS**

Congress Abstracts

Editors:
Ratko Ristić
Milan Medarević
Zdravko Popović

Belgrade, 2010

FIRST SERBIAN FORESTRY CONGRESS

under slogan:

- FUTURE WITH FOREST -

11-13 November 2010:
Belgrade, Republic of Serbia

Congress Abstract

- Publisher: University of Belgrade, Faculty of Forestry
- Editors: Ratko Ristić
Milan Medarević
Zdravko Popović
- Organiser: University of Belgrade, Faculty of Forestry, Belgrade
Co-organisers: Institute for Nature Conservation of Serbia
- Congress is supported by: Serbian Ministry of Science and Technological Development
The International Union of Forest Research Organizations (IUFRO)
World Association for Soil and Water Conservation (WASWC)
International Federation for Landscape Architecture (EFLA)
International Organization for Biological Control of Noxious Animals
and Plants – Palaearctic Regional Section
WITASEK, Austria
- Editorial Office: University of Belgrade, Faculty of Forestry, Kneza Višeslava 1, 11030
Belgrade
Telephones: +381 11 3053 988, +381 11 3053 871,
Fax: +381 11 2 545 485
E-mail: conference.office@sfb.rs
Home page: <http://www.sfb.rs>
- Lecture: Katarina Lazić
- Cover design: Boris Radić
- Technical Editor: Saša Sofijanić
- Circulation: 300 copies
- Printing: Planeta print, Belgrade
- ISBN: 978-86-7299-066-9

Contents

Topic A : Forestry Papers

H.Hulusi ACAR, Dilek ERBAS, Saliha UNVER, M.Sinan OZKAYA, Nedim TUYLU THE INVESTIGATION OF APPROXIMATE COST AND PROGRESS PAYMENT FOR FOREST ROADS TO BE BUILT IN THE ARTVIN REGION OF TURKEY.....	29
Jelena M. ALEKSIĆ, Thomas GEBUREK HIGH GENETIC DIVERSITY AND CRYPTIC GENETIC STRUCTURE IN A STENOENDEMIC SERBIAN SPRUCE PRESENT IN THE BALKANS OVER A LONG TIME: IMPLICATIONS FOR CONSERVATION	30
Predrag ALEKSIĆ, Gordana JANČIĆ PROTECTION REGIMES AND FOREST MANAGEMENT IN PROTECTED AREAS MANAGED BY THE STATE ENTERPRISE “SRBIJAŠUME”	31
Predrag ALEKSIĆ, Bratislav KISIN THE HISTORY OF PRIVATE FORESTS IN SERBIA	32
Predrag ALEKSIĆ, Milun KRSTIĆ, Srboljub MILIĆ SILVICULTURAL NEEDS AND MEASURES AIMED AT THE REALIZATION OF THE NA- TIONAL FOREST ACTION PROGRAM OF THE REPUBLIC OF SERBIA	33
Ahmad Alijanpour EFFECT OF ASPECTS ON QUANTITATIVE FACTORS OF CORNUS MAS - A CASE STUDY: ARASBARAN FORESTS, NW IRAN	34
Esmail ALIZADEH, Mohamad Reza ZARGARAN INTRODUCED SPECIES OF THE GENEUS NEUROTERUS AND THEIR DISTRIBUTION IN OAK FORESTS OF THE WEST AZARBAIJAN PROVINCE (IRAN).	35
Milosav ANDJELIĆ IMPACT OF PARASITE FUNGI ON DRYING OF FIR TREES (Abies alba Mill.) IN THE TERRITORY OF THE “DURMITOR” NATIONAL PARK	36
Siniša ANDRAŠEV, Milivoj VUČKOVIĆ, Savo RONČEVIĆ, Petar IVANIŠEVIĆ, Martin BOBINAC, THE SELECTION OF GROWTH FUNCTION USED TO MODEL THE VOLUME OF BLACK POPLAR TREE	37
Jovana ANTIĆ, Milka ZELIĆ, Gordana JANČIĆ INTERNET COMMUNICATIONS AND PR PROMOTION OF TOURISM IN PROTECTED AREAS IN THE PUBLIC ENTERPRISE “SRBIJAŠUME“ BELGRADE	38
Hüseyin AYZAZ, Cantürk GÜMÜŞ, Sevim İNANÇ FORESTATION WORKS IN TURKEY	39
Violeta BABIĆ, Zoran GALIĆ, Ljubinko RAKONJAC, Snežana STAJIĆ	

MICROCLIMATE CONDITIONS IN THE STANDS OF SESSILE OAK ON ACID BROWN AND LESSIVE ACID BROWN SOILS IN FRUSKA GORA	40
Violeta BABIĆ, Milun KRSTIĆ, Milan KNEŽEVIĆ, Zoran GALIĆ, Olivera KOŠANIN	
CONTRIBUTION TO THE DEFINING OF STAND CHARACTERISTICS AND SITE CONDITIONS IN THE SESSILE OAK FOREST IN FRUSKA GORA	41
Vojislav BAJIĆ	
SORTIMENT TABLES FOR COPPICE BEECH FORESTS IN SERBIA	42
Vojislav BAJIĆ	
POTENTIAL TECHNOLOGICAL STRUCTURE IN SEED-GROWN BEECH FORESTS IN SERBIA	43
Reza Basiri	
THE ANALYTICAL BASIS OF SIMPLE LINEAR REGRESSION IN FORESTRY STUDIES (CASE STUDY: RELATIONSHIP BETWEEN BASAL AREA AND TREE COVERAGE OF QUERCUS BRANTII LINDL. IN ABSARDEH, CHAHAR MAHALE AND BAKHTIARI ,IRAN	44
Branislava BATOS, Nevena ČULE	
VARIABILITY OF GROWTH PARAMETERS OF HALF-SIB LINES OF SERBIAN SPRUCE (<i>Picea omorika</i> /Pančić/ Purkyne) IN THE JUVENILE PHASE	45
Branislava BATOS, Zoran MILETIĆ, Danijela MILJKOVIĆ, Saša ORLOVIĆ	
COMPARISON OF MACROELEMENTS CONCENTRATION IN QUERCUS ROBUR L. LEAF WITHIN FIVE DIFFERENT POPULATIONS: A MULTIVARIATE APPROACH. . .	46
Branislava BATOS, Dragica VILOTIĆ, Danijela MILJKOVIĆ, Saša ORLOVIĆ	
INTER-POPULATION VARIABILITY OF STOMATAL CHARACTERISTICS OF QUERCUS ROBUR L. LEAVES IN FIVE POPULATIONS IN SERBIA	47
MAHMUT M. BAYRAMOĞLU, DEVLET TOKSOY	
METHODS OF ESTIMATING THE ECONOMICAL VALUE OF CARBON AND THE EVALUATION OF TURKISH FORESTRY REGARDING THIS.	48
María Catalina BECERRA LEAL	
INFLUENCE OF ARBUSCULAR MYCORRHIZAL FUNGI ON GROWTH OF SEEDLINGS OF CITHAREXYLUM SUBFLAVESCENS SF BLAKE, IN NURSERY PHASE	49
Martin BOBINAC, Siniša ANDRAŠEV, Miloš SIMIĆ	
RETROSPECTIVE ON THE STRUCTURE OF DYING TREES IN THE ARTIFICIALLY ESTABLISHED RIPENING OAK STANDS IN THE AREA OF THE UPPER DANUBE BASIN IN SERBIA	50
Gregor BOZIC, Berthold Heinze, Davorin KAJBA, Vedhu KRYSTUFEK, An Vanden BROECK	
GENETIC DIVERSITY AND GENETIC DIFFERENTIATION OF EUROPEAN BLACK POPLAR POPULATIONS IN THE SUB-ALPINE REGION	51

Jugoslav BRUJIĆ, Boris MARKOVIĆ, Vladimir STUPAR, Jovan TRAVAR, Drago PETKOVIĆ, Đorđije MILANOVIĆ	
DIGITAL-BASED GREENERY CADASTRE OF THE CITY OF TREBINJE.	52
Serdar CARUS	
RADIAL, HEIGHT AND VOLUME GROWTH OF CALABRIAN PINE (<i>Pinus brutia</i> T.) FIVE YEARS AFTER DEFOLIATION BY THE PINE PROCESSIONARY MOTH IN TURKEY ...	53
Song CHENG, Li ZHANG, Jiyue LI, Hui YU, Gang YANG	
RESPONSES OF FOREST ECOSYSTEM TO THE WENCHUAN EARTHQUAKE, CHINA.	54
Pavle CIKOVAC	
DISTRIBUTION AND ECOLOGY OF DINARIC CALCAREOUS FIR FORESTS IN THE HIGH-KARST ZONE	55
Milijana CVEJIĆ	
METHODICAL PROCEDURE FOR DETERMINATION OF NATURAL WEALTH OF THE URBAN FOREST FOR RECREATIONAL FUNCTION	56
Vladimir ČORBIĆ	
MECHANICAL DAMAGES ON THE REMAINING TREES OF PEDUNCULATE OAK ON THE TERRITORY OF SREM DURING THE FIRST PHASE OF TRANSPORT	57
Milić ČUROVIĆ, Milan MEDAREVIĆ	
MAJOR CHARACTERISTICS OF THE MIXED FIR AND BEECH VIRGIN FORESTS IN THE “BIOGRADSKA GORA” NATIONAL PARK IN MONTENEGRO.....	58
Milorad DANILOVIĆ, Nenad ĆUPRIĆ	
THE STATE OF FORESTS IN SERBIA IN TERMS OF THEIR UTILIZATION	59
Vasileios C. DROSOS, Vasileios J. GIANNOULAS, Sarantis - Angelos G. LIAMPAS	
EVALUATION OF THE COMPATIBILITY BETWEEN THE FOREST OPENING-UP WORKS AND THE NATURAL ENVIRONMENT.....	60
Vasileios C. DROSOS, Kiriaki KITIKIDOU, Chrisovaladis MALESIOS	
SPATIAL ACCURACY OF MEASUREMENTS USED IN CARTOGRAPHY	61
Tomislav DUBRAVAC, Stjepan DEKANIĆ	
STRUCTURAL FEATURES AND REGENERATION PROCESSES OF BEECH AND FIR FORESTS IN „RISNJAK”NATIONAL PARK	62
Murat ERTEKİN, Ö. Lütfü ÇORBACI, M. Ertuğrul YAZGAN	
ROLE OF SOME PRE-TREATMENTS ON SEED GERMINATION OF EASTERN STRAWBERRY TREE (<i>ARBUTUS ANDRACHNE</i> L.)	63
Murat ERTEKİN, Halil Barış ÖZEL	
GENETIC VARIATION IN CONE PRODUCTION IN AN ANATOLIAN BLACK PINE SEED ORCHARD IN TURKEY.....	64
Javad ESHAGHI RAD	
SOIL PROPERTIES UNDER THREE HYRCANIAN FOREST TYPES	65

Sattar EZATTI, Akrab NAJAFI, Tarbiat MODARRES, Tarbiat MODARRES LONG-TERM MECHANICAL DISTURBANCE IMPACTS ON SOIL PHYSICAL PROPERTIES AND ECOLOGICAL RESPONSE OF HARDWOOD SPECIES IN THE HYRCANIAN FORESTS, IRAN	66
Dragan GAČIĆ, Vladan BJEDOV, Jadranka DELIĆ EFFECT OF LINEAR TRAFFIC OBJECTS ON WILD ANIMALS IN SERBIAN NATIONAL PARKS	67
Vladislav GALOVIĆ, Saša ORLOVIĆ, A. PILIPOVIĆ, Bojana KLASNJA, S. STOJNIC APPLICATION OF MOLECULAR METHODS IN FORESTRY	68
Vasileios J. GIANNOULAS, Vasileios C. DROSOS, Orestis Ath. GIOVANNOPOULOS THE EFFECT OF CONSTRUCTION AND OPERATION OF AN ASPHALTED FOREST ROAD ON THE ENVIRONMENT	69
Predrag GLAVONJIĆ, Dragan NONIĆ, Nenad RANKOVIĆ, Vojislav MILIJIĆ, Dragan JANKOV ANALYSIS OF LEGISLATIVE AND INSTITUTIONAL FRAMEWORK OF THE RESTITUTION PROCESS IN FORESTRY OF SERBIA AND THE COUNTRIES OF SOUTHEASTERN EUROPE	70
Govedar ZORAN, Milun KRSTIĆ STATE AND SILVICULTURAL PROBLEMS IN UNEVEN-AGED FORESTS OF BEECH, FIR AND SPRUCE IN THE REPUBLIC OF SRPSKA	71
Dragomir GRUJOVIĆ, Milorad JANIĆ, Kristian ARTN, Branko MIŠIĆ RATIONALIZATION OF LAND COVER DETERMINATION USING REMOTE SENSING.	72
Cantürk GÜMÜŞ, Gökhan ŞEN, Devlet TOKSOY, Hüseyin AYAZ, Betül BAHAT NATURE CONSERVATION AND NATIONAL PARKS IN TURKEY	73
Seyed Mohammad HOSSEINI, Alois SKPOUPY FOREST HARVESTING AND ECOLOGICAL ASPECTS IN THE HYRCANIAN FORESTS OF IRAN	74
Vasilije ISAJEV, Milan MATARUGA, Vladan IVETIĆ, Aleksandar LUČIĆ EX SITU CONSERVING, TESTING AND UTILIZATION OF GENE POOL OF ENDEMIC-RELICTREE SPECIES IN SERBIA	75
Vasilije ISAJEV, Milan MATARUGA, K. KONSTATINOV, S. MLADENOVIĆ-DRINIĆ, Vladan IVETIĆ, Aleksandar LUČIĆ APPLIED BIOTECHNIQUES FOR IMPROVEMENT OF SOME SPECIES OF THE GENUS Pinus L. AND Picea L. IN SERBIA	76
Petar IVANIŠEVIĆ, Zoran GALIĆ, Saša PEKEČ, Savo RONČEVIĆ, Siniša ANDRAŠEV, Nenad RADOSAVLJEVIĆ MODELING METHOD FOR SOIL DATA IN ALLUVIAL HYDROPHILIC FORESTS OF VOJVODINA FOR BASIC DATA BASE FORMATION IN GIS	77

Petar IVANIŠEVIĆ, Zoran GALIĆ, Saša PEKEČ, Savo RONČEVIĆ, Siniša ANDRAŠEV, Branislav KOVAČEVIĆ	
THE INFLUENCE OF FLOODING AND DRAINING DURATION OF PHYSIOLOGICALLY ACTIVE LAYER OF FLUVISOL SOIL ON DYNAMICS OF GROWTH OF CLONE I-214 IN INUNDATION OF THE RIVER DANUBE IN THE AREA OF SOUTHERN BAČKA	78
Mladen IVANKOVIĆ, Maja POPOVIĆ, Ida KATIČIĆ, Saša BOGDAN	
FLUSHING PHENOLOGY VARIATION OF THE EUROPEAN BEECH (Fagus sylvatica L.) PROVENANCES FROM THE BALKAN REGION	79
Abolfazl Jaafari, Akbar Najafia, Seyed Khalagh Mirnia	
NATURAL RECOVERY OF SOIL CHEMICAL PROPERTIES FROM TIMBER SKIDDING DAMAGE IN HYRCANIAN FORESTS NORTH OF IRAN	80
Milorad JANIĆ, Dragomir GRUJOVIĆ, Kristian ARNT, Branko MIŠIĆ	
INTERPRETATION OF SATELLITE IMAGES AS A BASIC FORM IN LAND COVER DETERMINATION FOR THE NATIONAL FOREST INVENTORY	81
Petronije JEVTIĆ, Ljiljana S. MIHAJLOVIĆ	
MARKETING AND MANAGEMENT IN THE ROLE OF RENEWABLE DEVELOPMENT OF FORESTRY AND WOOD CONVERSION	82
Marijana KAPOVIĆ, Milan KNEŽEVIĆ	
CHARACTERISTICS OF BLACK SOIL ON JAVOR MOUNTAIN LIMESTONES IN THE REPUBLIC OF SRPSKA	83
Dragan KARADŽIĆ, Slobodan MILANOVIĆ, Tanja MILIJAŠEVIĆ, Milan MILENKOVIĆ	
THE OCCURRENCE OF PARASITIC AND SAPROPHYTIC FUNGI AFTER FOREST FIRES.	84
Dragan KARADŽIĆ, Tanja MILIJAŠEVIĆ, Ljubodrag MIHAJLOVIĆ, Zoran STANIVUKOVIĆ	
INFLUENCE OF EXTREME HAIL ON EPIDEMIC OCCURRENCE OF FUNGUS SPHAEROPSIS SAPINEA Dyco et Sutton IN PLANTATIONS AUSTRIAN PINE IN THE VICINITY OF DOBRUN	85
M.R. KAVOSI, F. FARIDI	
INVESTIGATING OF THE EFFICIENCY OF ROUNDUP, BASAGRAN, AND GRAMAXON HERBICIDES ON ARCEUTHOBIUM OXYCEDRI IN JUNIPER FOREST IN CHAHARBAGH (GORGAN)	86
M. KEBERT, M. KARAMAN, S. ORLOVIĆ, S. STOJNIĆ, B. KLASNJA	
ANTIOXIDANT SCREENING OF SOME LIGNICOLOUS FUNGI	87
Géza Kelemen	
TREE RISK ASSESSMENTS IN THREE DIMENSIONS	88
Milan KNEŽEVIĆ, Olivera KOŠANIN	
SOILS IN HYGROPHILOUS FORESTS OF NARROW-LEAVED ASH IN RAVNI SREM . .	89
Tadej KOGOVŠEK, Gregor DANEV, Darij KRAJČIČ	

NATURE CONSERVATION MEASURES IN SLOVENIAN FORESTS	90
Panagiotis KOULELIS	
A SUGGESTED DEVELOPMENT MODEL FOR THE GREEK FOREST SECTOR POLICY AND ECONOMICAL MEASURES	91
Branislav KOVAČEVIĆ, Sasa ORLOVIĆ, Marina KATANIĆ, Savo RONČEVIĆ, Ivanišević PE- TAR, Saša PEKEČ	
ROOTING CHARACTERISTICS OF ONE-YEAR OLD BLACK POPLAR (Aigeiros Duby) PLANTING MATERIAL TYPES	92
Branislav KOVAČEVIĆ, Saša ORLOVIĆ, Saša PEKEČ, Marina KATANIĆ, Srđan STOJNIĆ	
THE EFFECT OF GENOTYPE AND DATE OF PREPARATION ON THE ROOTING OF WHITE POPLAR CUTTINGS	93
Marina VUKIN, Ivan BJELANOVIĆ	
THE STUDY OF STAND STATE AND THE PROPOSAL OF RECLAMATION OPERATIONS IN THE FORESTS OF HUNGARIAN OAK AND TURKEY OAK IN THE TERRITORY OF LIPOVICA – BELGRADE	94
Yalçın KUVAN	
THE NEGATIVE IMPACTS OF TOURISM ON FORESTS: THE CASE OF TURKEY	95
Vera LAVADINOVIĆ, Vasilije ISAJEV, Zoran MILETIĆ	
ECOLOGICAL ADAPTABILITY OF DOUGLAS - FIR PROVENANCES IN SERBIA	96
Vukan LAVADINOVIĆ	
THE USAGE OF CAPTURE-MARK-RECAPTURE/RESIGHT METHODS IN ESTIMATING POPULATION ABUNDANCE	97
Jelena LAZAREVIĆ	
MYCORRHIZATION OF CONTAINERIZED PINUS NIGRA SEEDLINGS WITH AUTOCH- THONOUS PISOLITHUS ARRHZIZUS	98
Majid LOTFALIAN, Nastaran ZARE	
FOREST ENGINEERING IN IRAN: BACKGROUND, EDUCATION AND LOOKING TEN YEARS FORWARD	99
Marko LOVRIĆ, Ivan MARTINIĆ, Nataša LOVRIĆ, Matija LANDEKIĆ, Mario ŠPORČIĆ	
ASSESSMENT OF PROGRESS TOWARDS SUSTAINABLE FOREST MANAGEMENT IN CROATIA THROUGH USAGE OF QUANTITATIVE IMPROVED PAN-EUROPEAN CRITERIA AND INDICATORS	100
Nataša LOVRIĆ, Marko LOVRIĆ	
ASSOCIATIONS OF PRIVATE FOREST OWNERS AS A TOOL FOR SUSTAINABLE DEVEL- OPMENT OF FORESTRY – A CASE STUDY OF THE R. MACEDONIA	101
Richard LUKWETE BISHA	
FOREST UTILIZATION, HUNTING AND PROTECTION OF HUNTING FAUNA	102
B. M. Lushaj, S. Woodward, N. Keča , M. Intini	

DISTRIBUTION, ECOLOGY AND HOST RANGE OF ARMILLARIA SPECIES IN ALBANIA	103
Darko LJUBOJEVIĆ, Milorad DANILOVIĆ	
FOREST ROAD NETWORK LAYING USING GIS THROUGH THE IMPLEMENTATION OF THE MULTI-CRITERION EVALUATION MODEL IN THE FOREST MANAGEMENT UNIT “KOZARA-MLJEČANICA”	104
Aleksander MARINŠEK, Andraž ČARNI, Petra KOŠIR, Urban ŠILC	
FOREST TYPES AND ECOLOGICAL GRADIENTS IN FLOODPLAIN FORESTS IN THE SUBPANNONIAN REGION OF SLOVENIA	105
Miroslav MARKOVIĆ, Dragan KARADŽIĆ, Saša ORLOVIĆ	
MYCOLOGICAL COMPLEX ON WILD CHERRY (<i>Prunus avium</i> L.).....	106
Milan MATARUGA, Vasilije ISAJEV, Pero BALOTIĆ, Čedomir BURLICA, Branislav CVJETKOVIĆ	
PROGENY TESTS OF NORWAY SPRUCE (<i>Picea abies</i> Karst) IN BOSNIA AND HERZEGOVINA - CONTRIBUTION TO THE EUROPEAN EX SITU CONSERVATION .	107
Elena I. MAYOROVA, Elena V. TEMNOVA	
FORESTRY POLICY IN THE CONTEXT OF GLOBALISATION	108
Milan MEDAREVIĆ, Staniša BANKOVIĆ, Damjan PANTIĆ, Biljana ŠLJUKIĆ, Nenad PETROVIĆ, Snežana OBRADOVIĆ, Biljana PEŠIĆ	
PROTECTIVE FORESTS IN SERBIA: POSSIBILITIES FOR BRINGING NATIONAL REGULATIONS INTO CONFORMITY WITH MCPFE ASSESSMENT GUIDELINES	109
Mirjam MILAD	
CLIMATE CHANGE AND NATURE CONSERVATION IN FORESTS: CHALLENGES FOR CONSERVATION CONCEPTS AND PRACTICE IN CENTRAL EUROPE.	110
Đordije MILANOVIĆ, Vladimir STUPAR, Jugoslav BRUJIĆ, Davor NIKIĆ	
DISTRIBUTION OF AUTOCHTHONOUS DENDRO SPECIES IN THE MANAGEMENT UNIT „OZREN“-PETROVO – IMPLEMENTATION OF GIS TECHNOLOGY	111
Ivan MILENKOVIĆ, Nenad KEČA	
ROLE OF PHYTOPHTHORA SPECIES IN DECLINING OF OAK FORESTS IN SERBIA .	112
Tanja MILIJAŠEVIĆ, Milan MILENKOVIĆ	
BIOLOGY AND CONTROL OF PATHOGENIC FUNGUS <i>Sphaeropsis sapinea</i>	113
Vojislav MILIJIĆ, Nenad RANKOVIĆ, Dragan NONIĆ, Nikola STAMENKOVSKI, Marko MARINKOVIĆ	
CHARACTERISTICS OF SMALL AND MEDIUM FOREST ENTERPRISES IN TIMOK FOREST AREA AND THEIR PROPENSITY FOR CLUSTER ESTABLISHMENT.	114
Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ, Željko MALJEVIĆ	
THE MOST COMMON TYPES OF ACIDOFIL BEECH FORESTS IN SERBIA AND	

THEIR ECOLOGICAL – PRODUCTION CHARACTERISTICS	115
Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ, Željko MALJEVIĆ	
THE MOST COMMON TYPES OF BEECH – FIR FORESTS IN SERBIA AND ECOLOGICAL – PRODUCTION CHARACTERISTICS OF THESE FORESTS	116
Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ	
THE TYPES OF MONODOMINANT MONTANE BEECH FORESTS WITH THE HIGHEST PERCENTAGE IN SERBIA AND THEIR ECOLOGICAL - PRODUCTION CHARACTERISTICS	117
Rostam Mousavi	
TIME CONSUMPTION, PRODUCTIVITY AND COST ANALYSIS OF THE SHORT-LOG AND LONG-LOG SKIDDING IN THE HYRCANIAN FOREST IN IRAN	118
Irum MUKHTAR, Rukhsana BAJWA	
INCIDENCE OF SHISHAM (DALBERGIA SISSOO ROXB.) DIEBACK IN VARIOUS AGRO ECOLOGICAL ZONES OF PUNJAB	119
Jelena NEDELJKOVIĆ, Dragan NONIĆ, Ljiljana KEČA, Nenad RANKOVIĆ	
LEGAL FRAMEWORK OF NON-WOOD FOREST PRODUCTS IN WESTERN BALKAN COUNTRIES	120
Biljana NIKOLIC, Mihailo RATKNIC, Milorad VESELINOVIC, Dragana DRAZIC, Ljubinko RAKONJAC	
FOREST FRUIT TREE SPECIES IN SERBIA – STATE AND DIVERSITY	121
Nikooy, M. Barzkohi, H. Firozan, A. Hemmati, V. Ershadifar, Moona	
A TIME STUDY OF FELLING OF BROAD LEAF TREES IN THE CASPIAN FOREST OF IRAN	122
Zahra NOURI, Seyed JALILALAVI, Jahangir FEGHHI, Ghavamaldin ZAHEDI, Ramin RAHMANI	
ESTIMATION OF SPECIES DIVERSITY IN DIFFERENT STORIES OF FOREST AREA (CASE STUDY: HYRCANIAN FOREST OF IRAN)	123
Marijana NOVAKOVIĆ, Rade CVJETIĆANIN, Sead VOJNIKOVIC	
ANALYSIS OF THE FLORA AND DIVERSITY OF PLANTS OF BEECH AND FIR FORESTS ON SERPENTINE IN BOSNIA AND SERBIA	124
Nenad NOVAKOVIĆ, Gordana JANČIĆ, Petar NEĆAK	
FISHERY AND WILDLIFE MANAGEMENT IN PROTECTED AREAS MANAGED BY PUBLIC ENTERPRISE FOR FOREST MANAGEMENT SRBIJAŠUME, BELGRADE ...	125
Rodoljub OLJAČA, Vladimir PETKOVIĆ, Zorana HRKIĆ, Zoran GOVEDAR	
MORPHOPHYSIOLOGICAL CHARACTERISTICS OF BEECH (<i>Fagus silvatica</i> L.) SEEDLINGS LEAVES IN THE AREA OF MANAGEMENT UNIT VRBANJA.	126
Dragana OSTOJIĆ	
FOREST RESERVES OF SERBIA CONDITION, DISTRIBUTION AND SYNECOLOGY .	127

Dragana OSTOJIĆ, Biljana JOVANOVIĆ ECOLOGICAL CHARACTERISTICS AND CONDITION OF FOREST ECOSYSTEMS IN THE NATURE PARK “SARGAN-MOKRA GORA”	128
Halil Barış ÖZEL, Murat ERTEKİN, Erol KIRDAR THE FACTORS AFFECTING THE SUCCESS OF GROUP NATURAL REGENERATION PRACTICES IN ORIENTAL BEECH (<i>Fagus orientalis</i> Lipsky.) FORESTS IN TURKEY (BARTIN AND DEVREK CASE STUDY)	129
Sanja PAJIĆ, Ljiljana KEČA AUCTION OF FINISHED WOOD ASSORTMENTS IN PUBLIC ENTERPRISES IN SERBIA FOR THE PERIOD 2001-2009.	130
Andrej PAUŠIĆ, Andraž ČARNI RECONSTRUCTION OF PAST FOREST ASSOCIATIONS IN SW SLOVENIA WITH THE HELP OF REMOTE SENSED DATA AND HISTORICAL CADASTRAL LAYERS ..	131
Davide PETTENELLA, Dragana STOJKOVIĆ FINANCIAL INSTRUMENTS FOR SUPPORTING RESPONSIBLE FOREST INVESTMENTS: A REVIEW OF INTERNATIONAL EXPERIENCES	132
Slaviša POPOVIĆ, Miroљjub MITIĆ, Jovana DŽOLJIĆ ANALYSIS OF FORESTLAND INDICATORS OBTAINED BY CORINE LAND COVER METHODOLOGY	133
Igor POTOČNIK USE OF VARIOUS GEODETIC METHODS IN FOREST ENGINEERING	134
Nahid RIAHIFAR, Majid LOTFALIAN, Mohamad HOJATY, Asghar FALLAH, Nastaran ZARE IMPACT OF FOREST ROAD ON TREE REGENERATION ON ROAD SIDES A CASE STUDY IN ZALEMROOD TEMPERATE FOREST IN SARI- IRAN	135
Savo RONČEVIĆ, Siniša ANDRAŠEV, Petar IVANIŠEVIĆ, Branislav KOVAČEVIĆ THE EFFECT OF THE TYPE OF PLANTING MATERIAL AND TIME OF PLANTING ON PLANT SURVIVAL IN EASTERN COTTONWOOD (<i>POPULUS DELTOIDES</i> BARTR.) ..	136
Mattias RUPP „OPEN WOODLANDS THROUGH PASTURE: GENESIS, RELEVANCE AS BIOTOPES, VALUE IN THE LAND-SCAPE AND IN NATURE CONSERVATION IN SOUTHWEST-GERMANY”	137
Marko SABOVLJEVIĆ, Milorad VUJIĆIĆ*, Aneta SABOVLJEVIĆ BRYOPHYTES AS SIGNAL-SPECIES OF FOREST STANDS IN SERBIA.	138
Hossein SARDABI EFFECTS OF DIFFERENT EUCALYPT SPECIES ON FOREST SOIL PROPERTIES IN THE GUILAN PROVINCE	139
Hossein SARDABI FOREST SOIL FERTILITY VARIATION UNDER EUCALYPT PLANTATION	140

C.B. SCHMITT, S. ENTENMANN, D. BENICK, T. PISTORIUS PROMOTING SYNERGIES FOR FOREST CONSERVATION UNDER GLOBAL BIODIVERSITY AND CLIMATE POLICY	141
Noraddin SHAYESTEHE, Esmaeil ALIZADEH, Mohamad Reza ZARGARAN A COMPARATIVE STUDY OF THE STRUCTURE OF GALLS PRODUCED BY OAK GALL WASPS OF GENUS ANDRICUS SP. (CYNIPIDAE) ACTIVITY IN THE WEST AZARBAIJAN PROVINCE	142
Malvina Shehi, Gazmend Zeneli POTENTIAL OF BIOMASS AND WAYS OF USING IT IN THE DISTRICT OF DIBRA ..	143
Reza SHEIKHPOORA, Seyed GHOLAMALIJALALIB, Ali YAKHKESHIC, Shamsollah SHARIATNEJAD LOCAL FORESTRY, A COMPREHENSIVE METHOD FOR SOLVING ECONOMIC–SOCIAL PROBLEMS OF WOODSMEN	144
Shrivastava Ajit Kumar MITIGATING THE GAP IN DEMAND AND AVAILABILITY OF BAMBOO IN THE STATE OF MADHYA PRADESH IN CENTRAL INDIA	145
Edmundo SOUSA, Luís BONIFÁCIO, Pedro NAVES PINE WILT DISEASE IN PORTUGAL TEN YEARS AFTER THE FIRST REPORT: THE TRÓIA PENINSULA CASE STUDY	146
Edmundo SOUSA, Pedro NAVES, Luís BONIFÁCIO, DISPERSION OF THE INTRODUCED PINE WOOD NEMATODE IN PORTUGAL	147
Branko STAJIĆ, Milivoj VUČKOVIĆ, Marko SMILJANIĆ STAND STRUCTURE AND DIVERSITY IN THE NATURE RESERVES IN THE KOPAONIK NATIONAL PARK.	148
Branko STAJIĆ, Milivoj VUČKOVIĆ, Marko SMILJANIĆ DENDROCHRONOLOGICAL STUDIES IN NORWAY SPRUCE (PICEA ABIES (L.) KARST.) STANDS FROM NP KOPAONIK	149
Zoran STANIVUKOVIĆ, Milan MILENKOVIĆ, Dragan KARADŽIĆ, Ljubodrag MIHAJLOVIĆ THE MISTLETOE (VISCUM ALBUM L.) – A PROBLEM IN FIR (ABIES ALBA MILL.) FORESTS IN SERBIA AND THE REPUBLIC OF SRPSKA	150
Dragica STANKOVIC, Milan KNEZEVIC, Borivoj KRSTIC, Mirjana SIJACIC NIKOLIC , Dragica VILOTIC NICKEL CONTENTS IN PLANTS AND SOIL IN THE AREA OF THE PROTECTED NATURAL RESOURCE „AVALA” – BELGRADE	151
Bogdan Stefanović DESIGN OF SERPENTINE ON FOREST ROADS BY THE INTERNAL CIRCULAR CURVE METHOD	152
Milena Stefanović, Dragica Obratov-Petković, Srđan Bojović	

ANALYSIS OF SCIENTIFIC INFORMATION: STUDIES OF SYCAMORE MAPLE	153
Mirjana STEVANOV, Max KROTT	
SHAPING FUTURE WITH FORESTS THROUGH STATE FOREST INSTITUTIONS POTENTIALS FOR USING BENCHMARKING MODEL AS DECISION-MAKING SUPPORT . . .	154
M. STOJANOVSKA, V. STOJANOVSKI, M. MIOVSKA	
POSSIBILITIES FOR ADDITIONAL FINANCIAL SOURCES OF THE MAVROVO NATIONAL PARK IN R. MACEDONIA	155
Dragan STOJICIC, Milan MATARUGA, Vasilije ISAJEV	
EFFECTS OF DIFFERENT MINERAL FERTILIZERS ON THE GROWTH AND DEVELOPMENT OF ONE YEAR OLD SEEDLINGS OF NORWAY SPRUCE (Picea abies /L/Karst) WITH BARE ROOT	156
Vladimir STUPAR , Jugoslav BRUJIC , Đordije MILANOVIĆ, Rade CVJETIĆANIN	
ASSOCIATION OF BEECH, FIR AND SPRUCE IN KLEKOVAČA MT. – MANAGEMENT EFFECTS ON ITS FORM AND COMPOSITION	156
Mirjana ŠIJAČIĆ-NIKOLIĆ, Jelena MILOVANOVIĆ, Radmila KNEŽEVIĆ	
VARIABILITY OF CONE MORPHOMETRICAL TRAITS AND SEED QUALITY PARAMETERS OF NORWAY SPRUCE SAMPLE GENOTYPES FROM KOPAONIK MOUNTAIN	157
Mirjana ŠIJAČIĆ-NIKOLIĆ , Dragica VILOTIĆ, Radmila KNEŽEVIĆ , Suzana MITROVIĆ	
ESTIMATION OF PAULOWNIA ADAPTABILITY IN SERBIA	158
Predrag ŠUMARAC, Biljana SAKOVIĆ	
THE MOST PROMINENT MANAGEMENT PROBLEMS IN THE KOPAONIK NATIONAL PARK	159
Masoud TABARI, Alireza Ali ARAB	
EFFECT OF SEED SIZE, FENCING AND PROTECTIVE TREATMENT ON GROWTH AND ESTABLISHMENT OF QUERCUS CASTANEIFOLIA (C. A. MEY.) SEEDLING . . .	160
Todorov VOISLAV	
POSITIVE AND NEGATIVE EFFECTS OF NEW FOREST LEGISLATION ON SUSTAINABLE FOREST MANAGEMENT PRACTICES AND OWNERSHIP RIGHTS OF FORESTS IN MACEDONIA	161
Dimitrios TSALAGKAS, Vassilios VASSILIOU	
EFFECTS OF CURING TIME ON BENDING STRENGTH OF THE FINGER-JOINED BLACK PINE AND MACEDONIAN FIR LUMBER	162
Katalin TUBA, Géza KELEMEN	
TRAPPING POSSIBILITIES AND RESULTS OF DUSKY CLEARWING	163
S. Tykkä, , J. Nedeljković	
INNOVATION AND SUSTAINABILITY IN FORESTRY IN CENTRAL AND EASTERN EUROPE: CHALLENGES AND PERSPECTIVES	164

Nevena VASILJEVIĆ, Ratko RISTIĆ, Milan MEDAREVIĆ, Biljana ŠLJUKIĆ, Boris RADIĆ THE IMPLEMENTATION OF THE EUROPEAN LANDSCAPE CONVENTION (ELC): THE ENGLAND FORESTRY ACTION PLAN AS A MODEL FOR THE IMPLEMENTATION ELC IN SERBIA FORESTRY SECTOR	165
Dragica VILOTIĆ, Mirjana ŠIJAČIĆ-NIKOLIĆ, Milorad VESELINOVIĆ, Milan REBIC, Dušan JOKANOVIĆ COMPARATIVE RESEARCH ON CIRCULATORY VESSELS WITHIN GROWTH RINGS OF GYMNOCLADUS CANADENSIS LAM. FROM SRPSKA CRNJA	166
Gazmend Zeneli, Abdulla Diku CAPACITY DEVELOPMENT IN ALBANIAN FORESTRY: MARKET ACTORS, TRENDS, REGULATORS, AND ENABLING ENVIRONMENT	167
Chunhua ZHANG, Atsushi KATO, Katsushi KURODA, Hisashi ABE ANATOMICAL STRUCTURE OF EXTRAFLORAL NECTARY OF ACACIA MANGIUM. 168 Milica ZLATKOVIĆ, Nenad KEČA, Tanja MILIJAŠEVIĆ SYMPTOMS OF BOTRYOSPHERACEAE ON FOREST AND SHADE TREES IN SERBIA	169
Jana Zurc CONNECTIONS BETWEEN PROTECTED AREAS, TOURISM AND DEVELOPMENT OF THE COUNTRYSIDE	170
Gninenko Y.I., Cheelakhsaeva E. A., Klukin M. S. NEW RISK FOR EUROPEAN FORESTS – USSURYJSKY BARK BEETLE POLYGRAPHUS PROXIMUS	171
O. Sidorenko, F. Kleshkanov PLANT-MICROBE RELATIONSHIPS USING BACTERIAL PREPARATIONS	172
Marko MARINKOVIĆ, Marina JOVANOVIĆ, Todor GRASIĆ CLUSTERS IN HORTICULTURE AND FORESTRY IN SERBIA: SIGNIFICANCE AND POSSIBILITIES OF ORGANIZING	173
Topic B : Ecological Engineering in Protection of Soil and Water Resources Papers	
Ratko KADOVIĆ, Stanimir KOSTADINOV, Ratko RISTIĆ, Tatjana SUBAŠIĆ-NIKOLIĆ HIGHER EDUCATION IN THE FIELD OF ECOLOGICAL ENGINEERING FOR SOIL AND WATER RESOURCES PROTECTION	177
M. CHIARI, G. ANGELMAIER, H. HÜBL URBAN TORRENTS - THE INFLUENCE OF SETTLEMENTS ON RUNOFF AND FLOOD PROPAGATION	178
Zoran MILETIĆ, Vesna GOLUBOVIĆ-ČURGUZ, Zlatan RADULOVIĆ, Snežana STAJIĆ, Vlado ČOKEŠA ACCUMULATION OF ORGANIC CARBON AND NITROGEN IN RECLAIMED	

LIGNITE MINE SOILS UNDER THE INFLUENCE OF AUSTRIAN PINE CULTURES . . .	179
Sevim INANC, Huseyin AYAZ, Canturk GUMUS	
AFFORESTATION WORK IN TURKEY	180
Daniela IROTOVA-LAZAREVA, Ivan BLINKOV, Tatjana KOJCEVSKA, Aleksandar TRENDAFILOV	
AN OVERVIEW OF THE NATURAL DISASTER WHICH HAPPENED ON DECEMBER 4TH 2008 IN THE MUNICIPALITY OF RADOVIS	181
Irina MILOVANOVIĆ, Jelena ČOTRIĆ, Milutin STEFANOVIĆ	
ANALYSIS OF THE IMPACT OF APPLIED ANTIEROSION WORKS ON REDUCING SILTATION IN THE RESERVOIR „ČELIJE“	182
S.H.R. SADEGHI, A. NAJAFI	
APPLICABLE BMPS FOR ALLEVIATING SOIL EROSION IN NORTHERN IRANIAN FOREST WATERSHEDS	183
Radica LELOVA, Ivan BLINKOV	
APPLICATION OF INSPIRE DIRECTIVE ON MUNICIPALITY LEVEL – CASE STUDY: MUNICIPALITY OF KAVADARCI (an extract from BSc diploma thesis)	184
J. NYSSSEN, J. PONTZEELE, P. BILLI	
BEAVER DAMS AND THE HYDROLOGY OF SMALL MOUNTAIN STREAMS OF THE ARDENNES, BELGIUM	185
Reza BASIRI	
DETERMINATION OF ECOLOGICAL SPECIES GROUPS BY ANGLO-AMERICAN APPROACH (Case study in West Azarbaijan, Iran)	186
Slobodan PETKOVIĆ, Mileta MILOJEVIĆ	
DIFFERENT ASPECTS OF THE BENEFIT OF EROSION AND TORRENT CONTROL IN SERBIA	187
Radica LELOVA, Ivan BLINKOV	
DIGITAL CADASTRE OF URBAN GREENERY – CASE STUDY MUNICIPALITY OF KAVADARCI (an extract from BSc diploma thesis)	188
Snezana BELANOVIĆ, Renate WENDLER, Charles SHAND	
DISTRIBUTION OF MERCURY AND LEAD IN PEATY SOIL AT GLENSAUGH RESEARCH STATION, SCOTLAND	189
Stanimir KOSTADINOV, Vukašin MILČANOVIĆ, Slavoljub DRAGIĆEVIĆ, Irina MILOVANOVIĆ, Ivan NOVKOVIĆ	
EFFECT OF EROSION CONTROL WORKS ON THE STATE OF EROSION AND SEDIMENT TRANSPORT IN THE ŽUNJSKA REKA CATCHMENT UPSTREAM OF THE STORAGE “ČELIJE“	190
Svetlana NIKOLIĆ	
EROSION IN THE BISTRICA RIVER WATERSHED	191

Nikolco VELKOVSKI, Ivan MINCEV, Kole VASILEVSKI	
EXPANSION OF AREAS WITH FOREST TREE SPECIES THROUGH NATURAL REGENERATION ON THE LOCALITY "VRTUSKA" WITHIN THE NATIONAL PARK "PELISTER"	191
Sara LUKIĆ, Snežana BELANOVIĆ, Milan KNEŽEVIĆ, Milorad DANILOVIĆ	
FALCE ACACIA AMELIORATIVE AFFORESTATION EFFECT ON CARBON ACCUMULATION IN SOIL	192
Vojislav ĐEKOVIĆ, Ljubomir LETIĆ, Radovan SAVIĆ, Vesna NIKOLIĆ, Nedo MILOŠEVIĆ.	
FRESHWATER FISH FARMING POSSIBILITIES IN THE HILLY-MOUNTAIN AREA OF SERBIA	193
Zoran GAVRILOVIĆ, Sonja JURIŠIĆ, Renata PUZOVIĆ	
IMPACT OF HEPP "ĐERDAP I" BACKWATER ON FORELAND FORESTS AND REVITALIZATION	193
Biljana TACEVSKA-RADOVIC, Aleksandar TRENDAFILOV, Ivan BLINKOV	
INTRODUCTION IN THE PROCESS OF RECLAMATION OF THE GOVRLEVO PIT-MINE	194
Ratko RISTIĆ, Boris RADIĆ, Nevena VASILJEVIĆ, Zoran NIKIĆ	
LAND USE CHANGES AND FLOOD PROTECTION - CASE STUDY OF RIVER JELAŠNICA	195
Jan NYSSSEN, Jeroen VAN DEN BRANDEN, Velibor SPALEVIĆ, Milić ĆUROVIĆ, Miodrag ZLATIĆ, Amaury FRANKL, Koen GILLIJNS, Lisa VANDEVELDE, Paolo BILLI	
LAND USE CHANGES IN MONTENEGRO SINCE THE EARLY 20TH CENTURY AND IMPACTS ON HYDROLOGY	196
Mirjana TODOSIJEVIĆ, Snežana BELANOVIĆ, Stanimir KOSTADINOV, Ratko KADOVIĆ, Nada DRAGOVIĆ	
LAND USE EFFECTS ON EROSION INTENSITY AND LOSS OF CARBON IN SOILS OF WEST AND SOUTHEAST SERBIA	197
Danica ZUPANSKI	
LEGAL ASPECTS OF ENVIRONMENTAL PROTECTION FROM MUNICIPAL SOLID WASTE IN SERBIA	198
S. PEKEČ, S. ORLOVIĆ, P. IVANIŠEVIĆ, Z. GALIĆ, B. KOVAČEVIĆ	
MOISTURE AND AIR CHARACTERISTICS AND THE REGIME OF UNDERGROUND WATER OF EUGLEY SOILS	198
Borce BOJCOVSKI, Aleksandar TRENDAFILOV, Bozin TRENDAFILOV, Ivan BLINKOV	
MONITORING OF EROSION ON A BURNED FOREST AREA	199
Lidija TRPENOSKA-SIMONOVIK, Ivan BLINKOV, Dusica TRPCEVSKA-ANGELKOVIK, Aleksandar TRENDAFILOV	
MULTIHAZARD MAPPING FOR BETTER PLANNING	200
Miodrag ZLATIĆ, Tijana ANDRIJANIĆ, Mirjana TODOSIJEVIĆ, Stanimir KOSTADINOV,	

Vladimir ŠUŠNJEVIĆ	
NATURAL AND ECONOMIC EFFECTS AND ASSESSMENT OF RISK AND UNCERTAINTY OF SUSTAINABLE SOIL MANAGEMENT IN THE PARIGUZ WATERSHED	201
Radovan SAVIĆ, Ljubomir LETIĆ, Gabrijel ONDRASEK, Vesna NIKOLIĆ	
NUTRIENTS ACCUMULATION IN DRAINAGE CHANNEL SEDIMENTS	202
Saso PETROVSKI	
OPPORTUNITIES FOR LAND CONSOLIDATION IN FORESTRY	203
Vjačeslava MATIĆ	
PHYTOENGINEERING EROSION CONTROL MATERIALS	204
Zoran NIKIĆ, Ratko RISTIĆ, Danica SREĆKOVIĆ-BATOĆANIN, Ivica RISTOVIĆ	
QUALITY OF WATER IN STORAGE RESERVOIRS RELATED TO CATCHMENT LITHOLOGY.....	204
Zoran GAVRILOVIĆ, Mileta MILOJEVIĆ, Sonja JURIŠIĆ	
RAIN GENERATORS - IMPORTANT EQUIPMENT IN THE FIELD OF EROSION SCIENCE	205
S. JOVIČIĆ, Z. MARKOV	
RED LIST OF SPECIES THREATENED BY AVALANCHES AND LANDSLIDES	206
Dragica STANKOVIĆ, Borivoj KRSTIĆ, Dragica VILOTIĆ, Mirjana ŠIJAIĆ-NIKOLIĆ, Milan KNEŽEVIĆ	
RESEARCH CONCENTRATION OF POLLUTANTS IN FOREST ECOSYSTEMS OF THE PROTECTED NATURAL PROPERTIES „AVALA”	206
Nasrollah BASSIRANI	
ROLE OF PLANTED TREES AND FOREST PLANTATIONS IN LOW FOREST COVER COUNTRIES (LFCC) - CASE STUDY OF IRAN.....	207
Mileta MILOJEVIĆ, Zoran GAVRILOVIĆ, Milutin STEFANOVIĆ	
SEGMENT OF REMOTE SENSING APPLICATION IN SOIL AND WATER CONSERVATION	208
Svetlana BILIBAJKIĆ, Tomislav STEFANOVIĆ, Renata GAGIĆ SERDAR, Zoran PODUŠKA	
SLOPE OF SILTATION IN TORRENT CHANNELS OF THE TRGOVIŠKI TIMOK CATCHMENT.....	209
Stevan DOŽIĆ, Matilda ĐUKIĆ, Sara LUKIĆ	
THE STATE OF FOREST SHELTERBELTS IN SERBIA	209
Božin TRENDABILOV, Ivan MINČEV, Bojan SIMOVSKI, Nikolčo VELKOVSKI	
SUITABILITY FOR TREE SPECIES AFFORESTATION USING GIS AIDED LANDSCAPE MODEL IN THE REPUBLIC OF MACEDONIA.....	210
Yahya KOOCH, Seyed Mohsen HOSSEINI, Jahangard MOHAMMADI, Seyed Mohammad HODJATI	
THE ECOLOGICAL EFFECTS OF WIND ON SOIL NUTRITION ELEMENTS STATUS	

IN THE HYRCANIAN FORESTS OF IRAN	211
Aleksandar TRENDAFILOV, Ivan BLINKOV, Bozin TRENDAFILOV	
THE SELECTION OF TREE AND SHRUB SPECIES AS AN IMPORTANT FACTOR IN THE PROCESS OF SUCCESSFUL BIOLOGICAL RECLAMATION	212
Vojislav ĐEKOVIĆ, Grozdana GAJIĆ, Aleksandar ANĐELKOVIĆ, Nedo MILOŠEVIĆ, Jelena KERNALIS	
WATER QUALITY IN THE BASIN OF VRLA RIVER AND ITS IMPACT ON ENVIRONMENTAL QUALITY	213
Nikola ZLATANOVIĆ, Mileta MILOJEVIĆ, Sonja JURIŠIĆ	
TORRENT FLOODPLAIN MAPPING - PROBLEMS AND SOLUTIONS	214
Milutin STEFANOVIĆ, Zoran GAVRILOVIĆ, Mileta MILOJEVIĆ	
TORRENTIAL FLOODS AND CONTINGENCY PLANNING	215
N. ČULE, S. MITROVIĆ, D. DRAŽIĆ, M. VESELINOVIĆ, Lj. JOVANOVIĆ, Lj. BRAŠANAC-BOSANAC, M. NEŠIĆ	
USING AQUATIC PLANTS AND PERENNIALS FOR PHYTOREMEDIATION OF MINE DRAINAGE AND BIOMASS PRODUCTION	216
Damir AJRANI	
WATER RESOURCES OF THE MUNICIPALITY GORA – SOUTH SERBIA	217
Ratko KADOVIĆ, Snežana BELANOVIĆ, Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV, Nada DRAGOVIC	
RELATIONSHIP BETWEEN HEAVY METALS CONCENTRATION IN SOIL AND PLANTS OF HIGH MOUNTAIN GRASSLANDS: A CASE STUDY OF THE NP DURMITOR.....	218
Predrag MANOJLOVIĆ, Sanja MUSTAFIĆ, Jelena LUKOVIĆ, Marko MILOSEVIĆ	
RELATIONSHIP BETWEEN CHEMICAL AND MECHANICAL WATER EROSION IN MLAVA RIVER BASIN	219
Marija MAKSIN, Saša MILIJIĆ	
POSSIBILITY FOR INTEGRATING LANDSCAPES IN SPATIAL AND ENVIRONMENTAL PLANNING IN SERBIA	220
Marina NENKOVIĆ-RIZNIĆ, Saša MILIJIĆ, Nikola KRUNIĆ	
STRATEGIC FLOOD IMPACT ASSESSMENT IN THE SPATIAL PLANNING OF CATCHMENT AREAS (CASE STUDY OF THE TAMNAVA RIVER BASIN)	221
Ivan BLINKOV, Borce BOJCOVSKI, Bozin TRENDAFILOV, Aleksandar TRENDAFILOV, Ivan MINCEV	
EFFECTS OF FOREST FIRES ON EROSION PROCESSES (Preliminary results).....	222
Topic C : Landscape Architecture and Horticulture Papers	
Hakan ALTINÇEKİÇ, İ. Müge ÖZGÜÇ ERDÖNMEZ, Sanem ÇINAR, Nilüfer KART AKTAŞ, Alev P. BEKDEMİR	

A METHOD APPROACH WITH THE AIM OF SUSTAINABLE LANDSCAPE PLANNING (CILINGOZ BAY EXAMPLE)	227
Marija MARKOVIĆ, Marija POPOVIĆ	
INVASIVE PERENNIAL SPECIES ASTER NOVI-BELGII L. IN THE BELGRADE AREA.	228
Ana GAČIĆ	
THE ANALYSIS OF ACCESSIBILITY OF OPEN SPACES AS PART OF SUSTAINABLE ENVIRONMENTAL DESIGN	229
Leszek B. ORLIKOWSKI, Magdalena PTASZEK, Tomasz OSZAKO, Justyna NOWAKOWSKA	
NURSERIES AS THE SOURCE OF PHYTOPHTHORA SPP. IN FORESTS AND HORTICULTURE	230
Leszek B. ORLIKOWSKI, Magdalena PTASZEK, Aleksandra TRZEWIK, Teresa ORLIKOWSKA	
OCCURRENCE AND ISOLATE DIFFERENTIATION OF PHYTOPHTHORA SPP. IN POLISH ORNAMENTAL NURSERY STOCKS	231
Ljiljana VUJKOVIĆ, Nevenka GALEČIĆ	
CONTEMPORARY TRENDS IN DESIGN AND USE OF OPEN URBAN SPACES IN LANDSCAPE ARCHITECTURE AND HORTICULTURE	232
Jasminka CVEJIĆ, Stojanka RADULOVIĆ, Andreja TUTUNDŽIĆ	
STATE AND PRINCIPLES OF INVASIVE PLANT SPECIES CONTROL IN SOME PROTECTED NATURE AREAS IN BELGRADE AS POTENTIAL “CORES” OF FUTURE ECOLOGICAL NETWORKS	233
Nataša MITIĆ, Ana GAČIĆ	
THE ANALYSIS OF GREEN STRUCTURES OF THE SUBURBAN AREA VELIKI MOKRI LUG AND THEIR ROLE IN THE FORMATION OF THE URBAN GREEN SPACE SYSTEM	234
Jelena TOMIĆEVIĆ, Margaret A. SHANNON, Ivana BJEDOV, Dragica OBRATOV-PETKOVIĆ	
LINKING PROTECTED AREAS MANAGEMENT AND LOCAL COMMUNITIES – EXAMPLE OF SERBIA	235
Jasmina JAKŠIĆ	
HARMONY OF DESIGN IN LANDSCAPE ARCHITECTURE ON THE EXAMPLE OF PARK UŠĆE IN NEW BELGRADE	236
Marija MAKSIN, Saša MILJIĆ	
POSSIBILITIES FOR THE IMPROVEMENT OF CULTURAL LANDSCAPE PROTECTION AND ARRANGEMENT IN SPATIAL AND ENVIRONMENTAL PLANNING IN SERBIA	237
Milka GLAVENDEKIĆ, Zoran TOMOVIĆ	
COMPARATIVE ARTHROPOD FAUNA IN MATURE FORESTS IN THE AREA OF “OBEDSKA BARA”	238
Olle TENOW, Arne NILSSEN, Helena BYLUND, Milka GLAVENDEKIĆ	
WINTER MOTH OUTBREAKS IN FENNOSCANDIA AND CONTINENTAL EUROPE ..	239

Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV, Dragana SKOČAJIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Matilda ĐUKIĆ, Mihailo GRBIĆ ASTERETUM LANCEOLATI - A NEW INVASIVE COMMUNITY ON WET AND RIPARIAN HABITATS	240
Mihailo GRBIĆ, Dragana SKOČAJIĆ, Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV, Matilda ĐUKIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ PRESOWING TREATMENTS TO BREAKING SEED DORMANCY OF SMALL-WINGED WINGNUT (<i>Pterocarya stenoptera</i> C. DC) AS AN INDICATOR OF POTENTIAL INVASIVENESS.	241
Matilda DJUKIĆ, Danijela DJUNISIJEVIĆ-BOJOVIĆ, Dragica OBRATOV-PETKOVIĆ, Mihailo GRBIĆ, Ivana BJEDOV, Dragana SKOČAJIĆ, Milica MILOJEVIĆ STOMATA PROPERTIES OF THE INVASIVE PLANT <i>Reynoutria japonica</i> Houtt. IN THE AREA OF TOPCIDER RIVER SIDES	242
Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Matilda ĐUKIĆ, Dragana SKOČAJIĆ, Mihailo GRBIĆ, Ivana BJEDOV, Dragica OBRATOV-PETKOVIĆ, Neda ŠARIĆ BIOLOGICAL ACTIVITY OF <i>Reynoutria japonica</i> RHIZOME EXTRACTS – EFFECTS ON SEED GERMINATION AND EARLY SEEDLING DEVELOPMENT.	243
Vjerran MAJNARIĆ THE ZAGREB GREEN HORSESHOE	244
Agnes SZABO, Attila VINCZE HABITAT AND COLLECTION RECONSTRUCTION IN THE BUDAPEST ZOO & BOTANICAL GARDEN 2010.	245
Dusica TRPCEVSKA-ANGELKOVIK, Aleksandar TRENDAFILOV, Lidija TRPENOSKA-SIMONOVIK, Ivan BLINKOV PLANNING OF GREEN AREAS IN THE SKOPJE REGION	246
Dejan POPOV, Jovana MAJOVIĆ, Nikola NIKOLIĆ TIME OF WEEP – TIME OF LAUGH (Memorial center on the river Sava's bank)	247
Haldun MÜDERRİSOĞLU, Necmi AKSOY, Serir UZUN, Neval G. ÖZKAN , Serdar ASLAN H. Samet AŞIKKUTLU THE EVALUATION OF THE CHANGE IN VEGETATION AROUND THE WALKS IN THE ABANT NATURE PARK	248
Dragana SKOČAJIĆ, Mihailo GRBIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Matilda ĐUKIĆ, Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV EFFECTS OF RED AND FAR-RED LIGHT ON SEED GERMINATION OF CERCIDIPHYLLUM JAPONICUM SIEBOLD ET ZUCC.	249
Branislav PERIĆ, Olgica PERIĆ GYROMITRA FR. SENSU LATO (DISCINACEAE BENEDIX 1961, PEZIZALES) IN MONTENEGRO	250

Stojanka RADULOVIĆ, Aleksandar BOBIĆ	
INFLUENCE OF RE-URBANIZATION PROCESS ON TRANSFORMATION OF TWO POSAVINA LANDSCAPES SINCE 18TH CENTURY TILL TODAY	251
M. Poje, I. Vršek, S. Morić	
MAKSIMIR – PARK OR FOREST?	252
Semka Đurić, Jovana Majović, Nikola Nikolić, Nevena Pantović, Dejan Popov	
STUDY OF ASSESSMENT OF THE CULTURAL LANDSCAPE OF KOTOR-RISAN BAY/REMINISCENCE - EVOLUTION	253
Agnes SZABO	
SUBOTICA - SYSTEM AND DEVELOPMENT OF GREEN AREAS IN HISTORIC PART OF THE CITY AT THE BEGINNING OF XX CENTURY	254
Đ. Stojičić, M. Ocokoljić, D. Obratov- Petković	
THE IMPACT OF GLOBAL CHANGES ON THE FLOWERING PHENOPHASE OF THE AUTOCHTONOUS DENDROFLORA IN THE URBAN CENOSES OF BELGRADE	255
D. Čavlović, M. Ocokoljić, D. Obratov-Petković,	
THE INFLUENCE OF DENDROFLORA ON THE STABILITY OF WET ECOSYSTEMS	256
Jovana STEVANOVIĆ , Nenad STAVRETOVIĆ	
URBAN RECREATIONAL AREAS.	257
Jovana STEVANOVIĆ	
POSSIBILITY OF BRINGING ROOF GARDENS INTO BANOVO BRDO IN BELGRADE	258
Topic D : Wood Science and Technologies Papers	
Dritan AJDINAJ, Entela LATO, Hektor THOMA, Doklea QUKU	
ACETYLATION REGARDING PHYSICAL AND TECHNOLOGICAL PROPERTIES OF SOME ALBANIAN WOODS	261
Maks MERELA, Primož OVEN	
ANATOMY AND PROPERTIES OF REACTION ZONES IN BEECH	262
Ales UGOVSEK, Mirko KARIZ, Milan SERNEK	
BONDING OF WOOD WITH ADHESIVE MIXTURES MADE OF LIQUEFIED WOOD COMBINED WITH TANNIN OR PHENOLIC RESIN	263
Irena SWACZYNA, Anna RÓŻAŃSKA, Zofia RŻEWSKA, Agnieszka SZYMCZYK	
CHARACTERISTICS OF THE INTERIOR DECOR OF A HUNTING LODGE IN JULIN	264
Milorad JANIĆ , Dragomir GRUJOVIĆ, Gordana ĐUKANOVIĆ , Vjaceslava MATIĆ	
CONTEMPORARY FURNITURE DESIGN	265
Dimitrios TSALAGKAS, Vassilios VASSILIOU	
EFFECTS OF CURING TIME ON BENDING STRENGTH OF FINGER-JOINED BLACK PINE AND MACEDONIAN FIR LUMBER	266
Rabi BEHROOZ , Hamed Younesi KORDKHEILI , Saeed Kazemi NAJAFI	

EFFECT OF LIGNIN AS A COMPATIBILIZER ON LONG-TERM WATER ABSORPTION AND THICKNESS SWELLING OF WOOD FLOUR-POLYPROPYLENE COMPOSITES. .	267
Mohsen SAFFARI , Komeyl SAJEDI, Ramin VAYSI, Abdollah HOSEYNZADEH	
EFFECTS OF HARDENER TYPE AND PARTICLES SIZE ON PHYSICAL AND MECHANICAL PROPERTIES AND FORMALDEHYDE EMISSION OF UF BONDED PARTICLEBOARD	268
Ivana GAVRILOVIĆ-GRMUŠA, Manfred DUNKY, Jovan MILJKOVIĆ, Milanka ĐIPOROVIĆ-MOMČILOVIĆ	
INFLUENCE OF THE MOLAR MASS OF UREA-FORMALDEHYDE ADHESIVES ON THE SHEAR STRENGTH OF ADHESIVE JOINTS	269
Matija PARUN, Goran MILIĆ, Branko KOLIN	
MOISTURE CONTENT PROFILES AND STRESSES IN BEECH TIMBER DURING CONVENTIONAL DRYING	270
Elisha NCUBE	
NATURAL DURABILITY OF TROPICAL TIMBERS AGAINST WHITE ROT (Trametes versicolor) FUNGUS: Part 1. DURABILITY CLASSIFICATION OF SIX LESSER USED HARDWOODS	271
Elif TOPALOĞLU, Nurgül AY	
SOME MECHANICAL PROPERTIES OF SIBERIAN LARCH (<i>Larix sibirica</i>) WOOD	272
Vasiliki KAMPERIDOU, Vassilios VASSILIOU	
STRENGTH PROPERTIES OF THE MOST FREQUENT CORNER AND MIDDLE JOINTS OF UPHOLSTERED FURNITURE FRAMES CONSTRUCTED WITH BEECH AND POPLAR SOLID WOOD	273
Igor DŽINČIĆ, Dušan SKAKIĆ	
STRESS DISTRIBUTION IN CHAIR CONSTRUCTION	274
Alketa GREPCKA, Leonidha PERI, Edlira KUKALI	
POSITIVE CORRELATION OF TECHNOLOGY MODERNIZATION AND MARKETING AS A FACTOR IN THE DEVELOPMENT OF PRIMARY WOOD PROCESSING INDUSTRY IN ALBANIA	275
Andromachi MITANI, Ioannis BARBOUTIS	
TENSILE STRENGTH BY COMPRESSION LOADING OF SOME HARDWOODS BONDED WITH PVAc AND CASEIN ADHESIVES	276
Milan JAIĆ, Tanja PALIJA, Jovan DOBIĆ	
THE INFLUENCE OF SURFACE FINISHING OF PAULOWNIA SIEBOLD ET ZUCC. ON THE DECORATIVE PROPERTIES OF A LACQUERED SURFACE	277
Elisha NCUBE, Hugh Mansfield WILLIAMS, Mark IRLE	
THICKNESS SWELLING OF JUVENILE WOOD PARTICLES HOT PRESSED IN TRANSVERSE DIRECTION	278

Viljem VEK, Primož OVEN	
VARIABILITY IN CONTENT OF TOTAL PHENOLS IN BEECH STEM	279
Nesime MEREV, Ziya GERÇEK, Turgay BİRTÜRK, Bülent AKGÜN	
WOOD ANATOMY OF EVERGREEN OAKS IN TURKEY	280
Marija MANDIĆ, Nebojša TODORVIĆ, Ranko POPADIĆ, Gradimir DANON	
INFLUENCE OF THERMAL MODIFICATION AND PROCESSING TECHNOLOGICAL PARAMETERS ON CUTTING POWERS IN MILLING WOOD PROCESSING	281
Kristina ZUBOVIĆ, Aleksandar IVANOVIĆ	
ERGONOMIC, ECOLOGICAL, ESTHETIC, AND ECONOMIC ASPECTS (4E) OF FURNITURE DESIGN IN THE CASE OF PRESCHOOL CHILDREN FURNITURE	282
Gregor REP, Miha HUMAR, Franc POHLEVEN	
RESISTANCE OF THERMO-VACUUM MODIFIED WOOD AGAINST WOOD PESTS . . .	283
Andreja KUTNAR, Frederick A. KAMKE	
TRANSVERSE COMPRESSION BEHAVIOR OF WOOD IN SATURATED STEAM	284
Marius C. BARBU	
ACTUAL DEVELOPMENTS OF THE WOOD PANELS INDUSTRY	285
Marius C. BARBU, Helmut SPIEHS, Christoph RICHTER	
AN ENVIRONMENTALLY FRIENDLY ENGINEERED WOOD PRODUCT FOR BUILDINGS: CROSS LAMINATED TIMBER	286
Arno FRÜHWALD, Marius C. BARBU	
CHANGING WOOD MARKETS - CHALLENGES FOR THE TIMBER INDUSTRY	287
Marius C. BARBU, Martin STEINWENDER	
ENVIRONMENTAL IMPACT OF THE WOOD BASED PANELS INDUSTRY	288
Marius C. BARBU, Peter NIEMZ	
WOOD SCIENCE EDUCATION IN EASTERN EUROPE	289
Manfred DUNKY	
SCIENCE AND WOOD BASED PANELS: AN INTERDISCIPLINARY APPROACH	290
MATTIAS RUPP	
OPEN WOODLANDS THROUGH PASTURE: GENESIS, RELEVANCE AS BIOTOPES, VALUE IN THE LANDSCAPE AND IN NATURE CONSERVATION IN SOUTHWEST-GERMANY	291
Abdulkadir MALKOÇOĞLU, Nurgül AY, Elif TOPALOĞLU	
SOME TECHNOLOGICAL PROPERTIES OF ORIENTAL BEECH (<i>Fagus orientalis</i> Lipsky.) WOOD GROWN IN THE ARTVIN REGION IN TURKEY	292
Sergej MEDVED, Milanka ĐIPOROVIĆ-MOMČILOVIĆ, Mladan POPOVIĆ, Alan ANTONOVIĆ, Vladimir JAMBREKOVIĆ	
DIMENSIONAL STABILITY OF PARTICLEBOARDS	293

Jasmina POPOVIĆ, Gordana RADOŠEVIĆ	
PAULOWNIA ELONGATA S. Y. HU - ANATOMICAL AND CHEMICAL PROPERTIES OF WOOD FIBERS	294
Milanka ĐIPOROVIĆ-MOMČILOVIĆ, Sergej MEDVED, Ivana GAVRILOVIĆ-GRMUŠA, Mladjan POPOVIĆ, Jasmina POPOVIĆ	
SOME PROPERTIES OF POLYPROPYLENE-WOOD COMPOSITES PRODUCED BY DIFFERENT PROCEDURES	295
Nebojša TODOROVIĆ, Ranko POPADIĆ, Zdravko POPOVIĆ, Uroš ĐUKIĆ	
BENDING STRENGTH AND MODULUS OF ELASTICITY OF THERMALLY MODIFIED BEECH WOOD	296
Gernot STANDFEST, Bernhard PLANK, Alexander PETUTSCHNIGG, Manfred DUNKY	
CHARACTERIZATION OF WOOD BASED PANELS WITH SUB-MICRON COMPUTED TOMOGRAPHY	297
Nebojša TODOROVIĆ, Ranko POPADIĆ, Zdravko POPOVIĆ, Uroš ĐUKIĆ	
COMPRESSIVE STRENGTH AND BRINELL'S HARDNESS OF THERMALLY MODIFIED BEECH WOOD	298
Vladislav ZDRAVKOVIĆ, Aleksandar LOVRIC	
INFLUENCE OF THERMAL TREATMENTS ON WETTABILITY AND WATER SPREAD ON THE SURFACE OF POPLAR VENEER	298
I.A Adegoke, S.O Badejo, R.A Baiyewu, K.S. Aina, B. O. Fatade	
INVESTIGATION INTO THE COMBUSTION PROPERTIES OF BRIQUETTES PRODUCED FROM TRIPLOCHITON SCLEROXYLON, TERMINALIA SUPERBA AND AFEZILIA AFRICANA	299
Milan NEŠIĆ, Branko GLAVONJIĆ, Dragoljub IVKOVIĆ, Marija NEŠIĆ	
NECESSARY CHANGES IN APPROACH FOR TECHNOLOGY SELECTION IN WOOD PROCESSING INDUSTRY IN SERBIA	300
Mladen FURTULA, Gardimir DANON	
POSSIBLE APPLICATION OF CHP IN THE WOOD INDUSTRY IN SERBIA	301
T. KOCETOV-MISULIC, K. HIEL, R. STULIC	
WOOD STRUCTURES AS CONSTRUCTION ELEMENTS IN LANDSCAPE ARCHITECTURE	302
Milenko MIRIĆ, Snežana IVKOVIĆ	
FUNDAMENTALS OF TESTING OF FUNGAL PHYSIOLOGICAL REQUIREMENTS ...	303
Milenko MIRIĆ, Snežana IVKOVIĆ	
DETERIORATION OF WOOD TISSUE DUE TO IMPACT OF DECAYING BASIDIOMYCETES	304

FOREWORD

During the past few decades an ecological crisis encompassed the entire biosphere, and at the turn of the 21st century, like never before the world faces uncertain survival prospects due to the intensive degradation and destruction of the environment. The decrease and fragmentation of forest covered areas resulting in the impoverished biodiversity are only some of the crucial factors exerting pressure on the global ecosystem. Stability based on sustainable utilization, restoration and recovery of degraded forest ecosystems is one of the imperatives of civilization, impossible to achieve without the engagement of a sufficient number of competent experts. The complex issues of forestry and the related fields require a specific educational process to qualify professionals capable of getting full insight into natural resources exploitation on the one hand, and participating in meeting of the material demands of civilization on the other. At the same time, there is a need for constant efforts aimed at the creation of new initiatives and documents designed for forestry development, defining of the conditions for sustainable utilization and natural resources protection, as well as preventive activities in the protection against natural catastrophes. The expansion and intensification of professional communication, establishment of a common research network and knowledge and experience exchange help create common awareness of the scientific and professional community, which is also the primary aim of the First International Forestry Congress organised in Serbia as part of the activities marking the 90-year jubilee of work at the Faculty of Forestry of the University of Belgrade.

The Organisation Board

Topic A

FORESTRY

Papers

**THE INVESTIGATION OF APPROXIMATE COST AND
PROGRESS PAYMENT FOR FOREST ROADS TO BE
BUILT IN THE ARTVIN REGION OF TURKEY**

H.Hulusi ACAR*, Dilek ERBAS**, Saliha UNVER*,
M.Sinan OZKAYA**, Nedim TUYLU***
hlsacar@ktu.edu.tr

* Dr., Karadeniz Technical University, Faculty of Forestry,
61080, Trabzon, Turkey

** MSc Forest Engineer, Karadeniz Technical University,
Faculty of Forestry, 61080, Trabzon, Turkey

*** PhD Forest High Engineer, Artvin Regional Forest
Directorate, 08000, Artvin, Turkey

Abstract: Forest Roads are high-cost basic facilities allowing economic, ecological and social functions of forests to be fulfilled. Because the most essential work item affecting road construction cost is excavation works, amount of excavation and land classifications have to be most appropriately determined within the bidding process. In regard to application, the amount of work given in approximate cost sheet required for the bidding for forest road construction is determined by means of observational methods and the bidding is conducted within the scope of Public Procurement Law No: 4734 before the project is made. Building contractors submit their bids in accordance with the amount of work given in the bid sheet. If the amount of work given in bid sheet before seems to be different after the completion of work, it leads to serious doubts that contractor acquires light profits or acquires illegally. After the documents including approximate cost, bidding and payment for 36 forest roads built in Artvin Region of Turkey during the period (2003-2008) were obtained, the project started. The amount and cost of work determined in the bidding process for the roads involved in the research were compared with those determined in the progress payment process. Within these comparisons, a consideration has been carried out by using tables, graphics and statistical methods. After the bidding files in the scope of Public Procurement Law in force were inspected, faulting components of the current application were determined and solutions were suggested. It was detected that the cost and amount of excavation determined in the bidding process differ from those determined in the payment process. It has been found out that it is not sufficient to determine the amount of work given in the bidding sheets related to road construction only by means of observation-based field reconnaissance. It was also detected that the amount of excavation and distribution of excavation amount to land classifications determined in the bidding process are different from those determined in the payment process. Projects providing better results as a result of using modern methods which can specify the structure of land depth while conducting a road construction shall be designed. For this reason, geophysical methods can be benefited from. In order to conduct effectively

biddings for forest road construction, amount of excavation and its distribution to land classifications shall be most appropriately determined.

Key words: Road Cost, Land Classification, Approximate Cost, Progress Payment, Artvin Region

**HIGH GENETIC DIVERSITY AND CRYPTIC GENETIC STRUCTURE IN
A STENOENDEMIC SERBIAN SPRUCE PRESENT IN THE BALKANS
OVER A LONG TIME: IMPLICATIONS FOR CONSERVATION**

Jelena M. ALEKSIĆ, Thomas GEBUREK
aleksic_jelena@yahoo.com.au

Federal Research Centre for Forestry, Natural Hazards and Landscape
(BFW), Hauptstr. 7, A-1140 Vienna, Austria and Institute of Molecular
Genetics and Genetic Engineering (IMGGE), Belgrade, Serbia

Abstract: Serbian spruce [*Picea omorika* (Panč.) Purk.] is a stenoendemic conifer present in the Balkans probably since the end of the Tertiary. Due to its limited natural range, this conifer was legally protected in former Yugoslavia in 1964 and IUCN red-listed in 1998. In order to improve current conservation measures implemented without the knowledge on species genetic diversity and structuring, we amplified five nuclear EST-SSRs and one mitochondrial (mtDNA) locus in 499 Serbian spruce trees originating from ten natural populations. Given the limited natural range of this species (approximately 10,000 km²), small number of remnant populations (approximately 30) and their small sizes (ranging from 0.5 ha to 50 ha), the total number of alleles, private alleles and allelic richness at nuclear genome were exceptionally high (125, 39 and 16.14, respectively). Species longevity and overlapping generations in populations, as well as frequent re-arrangements of alleles between populations through admixture and divisions have enabled the maintenance of high and similar HE in all analyzed populations (ranging from 0.691 to 0.845). The effects of inbreeding were low (FIS = 0.016), and STRUCTURE analysis revealed that all populations can be characterized as separate gene pools, mainly because of a very limited pollen flow, as assessed in assignment tests. Therefore, based on the nuclear genome, all populations can be treated as separate Management Units (MU). Non-random distribution of six mtDNA haplotypes caused relatively low haplotypic richness (3.462) and HT (0.231), and enabled recognition of two more ancient gene pools (GST = 0.632) characterized as separate Evolutionary Significant Units (ESU). Due to the very pronounced genetic structuring at both nuclear and mtDNA genome, we recommend in situ conservation, enhancement of natural regeneration and enlargement of all populations, while ex situ conservation measures should avoid admixture of individuals originating from different MU and/or ESU in order to prevent possible outbreeding depression.

Key words: Serbian spruce, genetic diversity, genetic structure, conservation

**PROTECTION REGIMES AND FOREST MANAGEMENT IN PROTECTED
AREAS MANAGED BY THE STATE ENTERPRISE “SRBIJAŠUME”**

Predrag ALEKSIĆ, Gordana JANČIĆ

predrag.aleksic@srbijasume.rs

State enterprise for forest management „Srbijašume“ Belgrade

Abstract: Protection regimes are determined by the protection act and they are a group of measures and conditions which define the way and degree of protection, utilization, arrangement and improvement of a protected area. In a protected area (according to the 2009 Law on Nature Conservation) zones in which protection regimes are carried out can be distinguished: degree Ia - strict protection; degree Ib- strict protection with a possibility to manage populations; degree II – active protection and degree III – active protection with a possibility of sustainable utilization. In Serbia 518, 051.68 *ha* (463 protected areas) or 5.86% of the territory is under protection. The state enterprise for forest management “Srbijašume“ Belgrade manages 95 protected areas with an area of 216, 773.28 *ha* which accounts for 41.84% of the total protected areas in Serbia. Areas of zones in different protection regimes (according to protection acts): degree I – 6, 345.46 *ha* or 2.93%; degree II – 28, 032.93 *ha* or 12.93% and degree III – 182, 394.83 *ha* or 84.14%. This study is an analysis of protection regimes in the protected areas, the protection regimes and forest management and sustainable utilization of the protected areas.

Key words: protected area, protection regime, manager, forest management

THE HISTORY OF PRIVATE FORESTS IN SERBIA

Predrag ALEKSIĆ, Bratislav KISIN

predrag.aleksic@srbijasume.rs

State enterprise for forest management "Srbijašume"

Abstract: The first records of forests and forest legislation in Serbia can be found in the Dušan's code from the XIV century. Little is known about the forests in Serbia during Turkish occupation (1459-1804). Serbia was a country with particularly large areas of woodland at the time of liberation in 1815. After the Second Serbian Uprising there was a growth in population and for the purpose of agricultural development intensive forest clearing was performed. The forests were proclaimed common national asset. In the XIX century almost one half of forests were cleared and the process of privatization of forests started in that period. The period from the year 1820 to the enacting of the first Forest law in 1891 is the beginning of forest legislation. The 1891 Forest Law of the Kingdom of Serbia divided the forests based on the ownership criteria into: state-owned, municipal, village, monastery, church and private forests. During the formation of the Kingdom of SHS (1918), the forests in Serbia were partly state-owned and partly communal or private ownership. In the period after World War II there were two main categories of ownership in Serbia: state-owned (social) and private. At the end of the XIX and the beginning of the XX century private forests covered the area of from 112,855 to 390,621 *ha*, in the year 1938 707,685 *ha*, and in 1979 1.002.152 *ha*. With the national forest inventory NIF (2004-2006) the area of private forests was established on the area of 1,029,200 *ha*. The data refer to the present area of Serbia without provinces. Prior attitude towards the issue of forest management in the private forests of Serbia was inadequate (taking into account their size and significance). Forest legislation did not adequately involve private forests, and for that reason professional forest management was not provided. Private forests were managed by the owner in the way he had to and wanted to perform. Small forest estates used to serve, and today still serve primarily to meet the demands of the owners' needs. Minor quantity of wood assortments is offered on the market, and it is in the first place fuel wood. Private forest estate covers a small area (average plot of land 0.3 – 0.5 *ha*). It is plotted out and most often of inappropriate shape (narrow and long plots of land). The average volume and increment and quality are far below the possible (optimum). So far, there has not been good forest management planning praxis in private forests. The processes of resolving legal issues, primarily ownership and economic issues are slow. Forest management aims and measures are often determined by the ownership himself. The history of ownership, attitude of the state towards private forests, economic conditions etc. caused the present unfavourable condition of private forests. Since the year 1991, the state has been organizing activities which require professional work in the forests of private owners through state enterprises.

Key words: private forests, ownership, areas, forest management

**SILVICULTURAL NEEDS AND MEASURES AIMED AT THE
REALIZATION OF THE NATIONAL FOREST ACTION
PROGRAM OF THE REPUBLIC OF SERBIA**

Predrag ALEKSIĆ¹, Milun KRSTIĆ², Srbojjub MILIĆ³
predrag.aleksic@srbijasume.rs
SE Srbijašume

Abstract: The NFAP among other issues contains the defined chapter “Economic forest functions“with subtitles: Establishment and tending of new forests; Biological reproduction of the existing forests; rehabilitation of damaged stands. This paper focuses on the silvicultural problems, needs and measures in the aim of the realization of the NFAP. On the basis of analyses of the state, problems, needs (of forests) and interests of the owners the following issues have been defined: aims, strategic tendencies and required silvicultural measures. Unsatisfactory state of production potentials can be observed and it is reflected in the following: low values of wood volume ($161 \text{ m}^3/\text{ha}$) and volume increment ($4.0 \text{ m}^3/\text{ha}$); unfavourable structure regarding the origin and silvicultural form (64.7 % forests of coppice origin); unfavourable structure regarding preservation (29 % of the area is covered by understocked and devastated forests); unfavourable age structure (middle-aged and ripening forests account for 70% , i.e. 78% of the area of even-aged forests); considerable absence of natural regeneration; unfavourable health condition, assortment structure and accessibility of forests; insufficient utilization of other potentials of forests and forest sites. Sustainable forest management i.e. improvement of biological stability, regeneration potentials, productibility and social and cultural effects can be enabled by increasing the forest cover percentage to 41.4 %; increasing the participation of high forests in the forest covered area to 55 – 60 %; improvement of the age structure, health condition and accessibility of forests: gene pool conservation, protection of biodiversity etc. General guidelines for optimum utilization of production potentials of sites are the following: defining of areas for future afforestation; realistic assessment of production potentials; conversion of coppice forests into high forests; reclamation of degraded and devastated stands; forming of more stable, well-stocked stands; improvement of the qualitative structure of the stands (by forcing mixed structure; by improving the ratio of basic and accompanying species; by forcing all-aged structure); tending of forests in accordance with the primary silvicultural needs considering the existing state and the established forest management aims; conservation of bioecological stability and diversity in order to achieve natural regeneration; protection of forest ecosystems. On the basis of the existing state, aims and guidelines, as well as silvicultural needs the following were determined: possible future scope of forest utilization, necessary financial means for the realization of the required types of work in silviculture and the expected effects.

Key words: state of forests, regeneration, tending, rehabilitation, financial means.

**EFFECT OF ASPECTS ON QUANTITATIVE FACTORS OF CORNUS MAS
- A CASE STUDY: ARASBARAN FORESTS, NW IRAN**

Ahmad Alijanpour

a.alijanpour@urmia.ac.ir, aalijanpour@yahoo.com

Urmia University, Department of Forestry, Faculty of Natural
Resources, Urmia University, Iran, P.O. Box 165

Abstract: The Arasbaran forests are valuable forests in NW of Iran which have been preserved for many decades. The vegetation type is similar to the Hyrcanian forest in N Iran which contains hornbeam, common yew, oak, etc. *Cornus mas* (European cornel) is growing understory at different aspects and villagers get some benefits of it. A basic approach for preserving this forest is public cooperation in agroforestry activities for non-wood production using of multi purpose trees such as *Cornus mas*. This study aims to assess the quantitative factors of *Cornus mas* stands in different aspects. In order to do this, 40 circular samples (300 m² areas) in different aspects were selected regarding to the occurrence of *Cornus mas* in mature and regeneration stratum. Numbers of trees and regeneration, DBH and crown cover percentage were recorded within plots. The results showed that DBH and crown cover means in the north aspect were significantly higher than other aspects. The mean number of regeneration per sample was 157.7 individuals in the the west aspect which was significantly more than the other aspects. Overall, the north and west aspects were realized as suitable places for doing agroforestry using *Cornus mas* with crops.

Key words: Arasbaran Forests, Forest Stands , *Cornus mas*

**INTRODUCED SPECIES OF THE GENUS NEUROTERUS
AND THEIR DISTRIBUTION IN OAK FORESTS OF
THE WEST AZARBAIJAN PROVINCE (IRAN)**

Esmail ALIZADEH, Mohamad Reza ZARGARAN
ISM478@yahoo.com, ISM478@gmail.com
Agricultural and Natural resources research
center of west Azarbaijan (Iran)

Abstract: Oak gall wasps produce the most structurally complex and diverse galls shape on different part of oak trees and are very important due to having various species, complex lifecycle, sexual and asexual generations. In this survey, the produced galls by oak gall wasps were collected from starting to the end of the growing season and were confirmed in the laboratory by Dr. George Melika. Six species of oak gall wasps which belong to the genus *Neuroterus* were identified. These species are: *Neuroterus macropterus* Hartig, *N. lanuginosus* Giraud, *N. numismalis* Geoffroy, *N. saliens* Kollar, *N. laeviusculus* Schenck and *N. quercus-baccarum* Linnaeus. The produced gall by *N. macropterus* are multichambered (larval chamber) and were formed on the branches of *Quercus brantii* Lindl. , but other species in this survey, are unichambered and are leaf galls. All of the galls which belong to the genus *Neuroterus* were produced by the asexual generation of these seven species of oak gall wasps and different from others due to having various forms.

Key words: Hymenoptera, Oak, Gall wasps and *Neuroterus* spp

IMPACT OF PARASITE FUNGI ON DRYING OF FIR TREES (*Abies alba* Mill.) IN THE TERRITORY OF THE “DURMITOR” NATIONAL PARK

Milosav ANDJELIĆ¹

milosav.andjelic@gov.me

¹ Ph d M.A., Assistant Minister, Ministry for Agriculture,
Forestry and Water Management

Abstract: The paper presents results of studying of the impact of parasite fungi on drying of fir trees (*Abies alba* Mill.) in the territory of the “DURMITOR” National Park. The total of 73 species of fungi was identified, 14 of which occur very often, 25 are moderately frequent, and 34 species are rather rare. Among the parasite fungi in natural fir stands, the biggest damages are caused by *Heterobasidion annosum* and *Armillaria ostoyae* fungi. Both of these species cause decay of roots, trees and drying of trees. The material with symptoms of diseases was collected in this region. International methodology prescribed by EC/UN-ECE was used for studying of the scope, intensity and trends in the drying of forests. During these surveys the following were identified as new species in this region: *Acanthostigma parasiticum*, *Amylostereum chailletii*, *Corniculariella abietis*, *Cryptosporopsis abietina*, *Cyclaneusma* sp..

Key words: Parasite fungi, fir, drying of forests

THE SELECTION OF GROWTH FUNCTION USED TO MODEL THE VOLUME OF BLACK POPLAR TREE

Siniša ANDRAŠEV, Milivoj VUČKOVIĆ, Savo RONČEVIĆ,
Petar IVANIŠEVIĆ, Martin BOBINAC,
andrasev@uns.ac.rs
Institut za nizijsko sumarstvo, Novi Sad

Abstract: Contemporary forest management planning is based on the knowledge and use of biological principles related to the growth of trees in stands and plantations. Growth functions satisfying certain prerequisites are used for this purpose (Peschel, 1938, according to Stameković and Vučković, 1988; Todorović, 1961). The estimation of accuracy of the culmination time, and the size of the current and average tree volume increment at the time of culmination, as well as the size of growth with applied different growth functions were investigated in this paper. Testing was done in stands planted with clone 618 (Lux) (*Populus deltoides* Bartr. ex Marsh.) on two soil types in the Upper Danube Basin in Serbia, when the above ground part of trees reached the age of 24 to 25 years. Detailed analyses of five trees from the category of dominant, and four from the category of average trees per cross section were carried out in each trial stand. The following growth functions were used: Hossfeld IV, Bertalanffy, Chapman-Richards, Levaković III, Korf and Weibull. The growth function having the smallest standard error of regression was chosen as a reference model. The results of investigation showed that growth function according to Korf had the least standard error of regression for analyzing tree categories on both studied soil types. With applied growth function according to Korf, the culmination of current volume increment was achieved at a relatively young age between 10 and 12 years, and even earlier in average trees in relation to the dominant ones. Other applied growth functions had late current increment culmination of up to three years (30%) in relation to the reference model. Difference in the maximum amounts of current volume increment had both positive and negative values in relation to the reference model, and it did not exceed 5.5%. However, the size of tree volume (total growth) was even greater than 50% in relation to the volume of the reference model (Korf). Culmination of the average volume increment of dominant trees on both soil types was achieved between 24 and 25 years, and even two years later (10%) when Korf function was applied in relation to other growth functions. In average trees the differences in culmination time of average volume increment were up to one year, and they also could have both negative and positive values in relation to the reference model. Differences in maximum amounts of average increment between studied growth functions reached up to 1%, while differences in size of tree volumes (total growth) reached up to 10% in dominant trees, and 5% in average trees. The obtained results revealed that when different growth functions were applied as the basis for application of different management procedures, significant differences in

assessing the growth elements could be obtained, and that it affected the choice of the most appropriate model for investigation.

Key words: poplar clone 618 (Lux), volume growth, growth function, reference model selection

**INTERNET COMMUNICATIONS AND PR PROMOTION
OF TOURISM IN PROTECTED AREAS IN THE PUBLIC
ENTERPRISE “SRBIJAŠUME“ BELGRADE**

Jovana ANTIĆ, Milka ZELIĆ, Gordana JANČIĆ
State Enterprise Srbijašume

Abstract: The internet is a global communication network which is used to connect different operational systems and environments using standardization. The Internet is also a global market on which individuals, institutions and companies present their products to millions of internet users. Internet promotions most often employ Web presentations and E-mail marketing. State enterprise for forest management Srbijašume recognized the complexity of global changes and readily engaged in the processes of the “digital era with the aim of environmental protection. PR and marketing activities of the state enterprise for forest management Srbijašume are various and delicate, because the most significant segment of these activities is focused on the raising of awareness of the significance of forests and the protected natural areas as the most important elements of the environment (<http://www.srbijasume.rs>). The vision of the enterprise Srbijašume is to live with and for the nature and that means that experts look after forests in a professional way at the same time drawing the attention of relevant subjects and individuals to the importance of forest conservation. The activities are systemic and planned with the application of information and communicative technologies, TV, media and Internet services. During 2010 marketing and public relations sector of the state enterprise Srbijašume widened the previous range of activities because a part of the Sector is now the Office for general tourism which owing to adequate, up-to-date marketing campaigns takes a prominent place within the enterprise. Its activities are numerous (<http://www.istnews.com/-INTERNET SERBIA TRAVEL NEWS>); the office provides services in the hospitality and tourism facilities which do business within Srbijašume and with its offer it belongs to the market of tourism with specific interests (ecotourism, ethno tourism, mountain tourism, recreational tourism, hunting tourism, etc.). Srbijašume is in favor of the development of tourism in the protected areas in a sustainable way, i.e. of the development and practising of touristic activities in an ecological, economic and socially sustainable way. The paper presents forms of Internet communication, in the PR promotion of tourism in protected areas managed by SE “Srbijašume“.

Key words: Internet communication, PR promotion, protected areas.

FORESTATION WORKS IN TURKEY

Hüseyin AYZAZ, Cantürk GÜMÜŞ, Sevim İNANÇ
canturk@ktu.edu.tr

Faculty of Forestry, Black sea Technical university, Trabzon, Turkey

Abstract: 3 792 176 000 million hectar of the world's surface, namely 30 % part is covered with forests. In Turkey, the amount of forested lands is 21.2 million hectar and comprises 27 % of the total land. As seen, the proportion of forested lands to country's general territory is considerably close to the world's average. However, the forests in Turkey which approximately constitutes 0.5 % of the world lags behind the world average. Half of the country's forests (50%) are ill-formed, whereas 68 % of the world forests are fertile. Moreover, while the average tree asset in unit area is 100 m^3 per hectare, this amount is approximately 60 m^3 per hectare in Turkey. To meet the commodity and service demands of the people from the forest sources is closely related to the sustainability and boosting of these sources. With the population increase, the variation of demands regarding forest sources has also enhanced and the preservation and improvement of forests and even creating new forest areas have gained importance. According to the statute in force in Turkey, meeting the forest product needs of the society, management of the forests in a sustainable way, enhancement of the productivity of forests and creating new forest sites are among the fundamental aims of the forestry organization. There has been a considerable increase in forest sources recently in line with legal regulations. According to the first forest inventory results released between 1963 and 1972 in Turkey, while the forests in Turkey were 20.2 million *ha*, this amount reached 21.2 million hectares with a 1 million-hectare increase in 40 years. While there has been a decrease in forest sources in the world (9.4 million hectares per year), there is approximately 5 % increase in Turkey. The average altitude in Turkey is 1130 metre and the land is highly rough. Considering that there is severe and mild erosion in 65 % of the lands, the significance of forestation for the country has considerably enhanced. When the land structure in Turkey is taken into account, it is seen that the considerable amount of lands which should in fact be employed as forest are used for different purposes. What is more, there is also unbalance in the distribution of forests among the regions. While there has been increase in the number of forests, there is also large scale of lands which should be used as forest lands.

Key words: Forestation, Forest Land, Provision of Sustainability of Forests

**MICROCLIMATE CONDITIONS IN THE STANDS OF SESSILE OAK ON
ACID BROWN AND LESSIVE ACID BROWN SOILS IN FRUSKA GORA**

Violeta BABIĆ, Zoran GALIĆ, Ljubinko RAKONJAC, Snežana STAJIĆ

violeta.babic@sfb.rs

University of Belgrade, Faculty of Forestry

Abstract: The paper presents the data on microclimate conditions (air and soil temperature, relative humidity, solar radiation, wind velocity and direction) and light regime in a pure sessile oak stand located in the area of Fruška Gora national park. Pure sessile oak stands in this area cover 3.960,73 ha, i.e. 17.6 %. The researched stand belongs to the most common sessile oak forest type (*Quercetum montanum typicum* Čer. et Jov. 1953) on acid brown soils and lessive acid brown soils. The stand is even-aged, of vegetative origin, and its age is 105 years. Data collecting was performed in July and August of 2008. The stand is in the south-eastern aspect, located at 350 m a.s.l, the inclination is 25° and the canopy is sparse to complete (0.6 to 0.7). The results of microclimate researches indicate that the air temperature in the researched period ranged from 22.1 °C to 28.8 °C, the relative humidity from 38.1 % to 67.2 % and solar radiation from 10 W/m² to 689 W/m². Stationary isohel method was used to determine the modes of light in the stand. Based on the average value of the intensity of light at the measuring points isohel maps were drawn and for the area between isohels the average light intensity and coefficient light transmission were determined. The average light intensity (L_o) is 6.722,6 Lx/m², and light transmission coefficient amounts to $K_p = 15.45$ %.

Key words: Fruška Gora, sessile oak, microclimatic conditions, light regime

**CONTRIBUTION TO THE DEFINING OF STAND CHARACTERISTICS AND
SITE CONDITIONS IN THE SESSILE OAK FOREST IN FRUSKA GORA**

Violeta BABIĆ¹, Milun KRSTIĆ¹, Milan KNEŽEVIĆ¹,

Zoran GALIĆ², Olivera KOŠANIN¹

violeta.babic@sfb.rs

University of Belgrade, Faculty of Forestry

Abstract: The paper presents the results of research of stand state and ecological characteristics in sessile oak forests located in the area of Fruška Gora national park, FMU Čortanovacka šuma – Hopovo - Velika Remeta, 26/c. The researched stands belong to the most common sessile oak forest type (*Quercetum montanum typicum* Čer. et Jov. 1953) on acid brown soils and lessivé acid brown soils. The stands are in the southeastern aspect, located at the altitude of 415-435 m a.s.l, the inclination is 25-35° and the canopy is sparse to complete 0.6. The stands are even aged, and they are of coppice origin, 100 years of age. The number of trees ranges from 164 to 253 per ha. Stand volume ranges from 145 to 221 m³/ha. Mean stand diameter dg = 32.8 cm and the mean stand height hdg = 23.9 m. The stands are cultivated and characterized as high-quality coppice forests on a preserved site. The investigated stands are located on dystric brown soil, which is characterized by a high fraction of total sand (55.4 to 65.6 %). The textural class ranges from sandy clay soil to sandy-clay loam soil. The reaction of soil solution in humus horizon ranges from 4.30 to 4.50. The cumulative humus horizon has high humus content (9.89 to 13 %). The ratio of C/N is about 15.5, which is indicative of relatively favorable humification conditions. Dystric brown soils of the above listed characteristics are sites in which sessile oak reaches its ecological optimum in the area of Fruška Gora.

Key words: Fruška Gora, sessile oak, stand characteristics, ecological conditions

SORTIMENT TABLES FOR COPPICE BEECH FORESTS IN SERBIA

Vojislav BAJIĆ

v.v.bajic@gmail.com

University of Belgrade, Faculty of Forestry

Abstract: Within the framework of the scientific project financed by the public enterprise “Srbijašume”, dealing with the creation of volume and sortiment tables for main tree species in Serbia, beech was researched in the first step, as our main tree species. In the subproject of sortiment table production, the sortiment structure in beech coppice forests was researched. For this reason, the necessary data for theoretical operation on total 1869 coppice beech trees, was collected. The collected data are mostly from western and southern Serbia, including about 100 trees from eastern Serbia. Theoretical cutting was done for every tree, using SRPS propositions, and sortiments were classified in VI classes of stems, technical roundwood, fuelwood and, finally, wood residue. Data analysis was done after finishing the theoretical cutting, which was based on the need for classifying the received data, which was a prerequisite for using of mathematical-statistical methods, in the first place correlation and regression analysis. The criterion for choosing of functions which best describe nature of participation of certain sortiments in total wood volume, was based on the empirical experience-nature of growth flow or diminishing of their participation in the total wood volume, depending on two variables: $d_{1,3}$ and h . Special care was taken to the principle that correlation between variables must be at least medium strong, to take the chosen function into further work. If participation of the classes of the best quality in total stem volume is taken into account, the processed sample was not large enough to be the basis for representative data for all researched sortiments. For that reason, we were forced to unite sortiment classes F , L and K and to treat them as a unique set in the further data analysis. This methodological deviation has no significant influence on the use of sortiment tables, because their joint share in total brutto stem volume was between 2.02% and 4.90%, for the tree diameters 30 to 50 *cm*. Mathematical functions were produced as a result of the research, and they were the basis for the production of sortiment tables for coppice beech forests in Serbia.

Key words: sortiment structure, beech, coppice forests

**POTENTIAL TECHNOLOGICAL STRUCTURE IN
SEED-GROWN BEECH FORESTS IN SERBIA**

Vojislav BAJIĆ

v.v.bajic@gmail.com

University of Belgrade, Faculty of Forestry

Abstract: In the frame of research project financed by public enterprise “Srbijasume”, on the whole territory managed by this enterprise, except forest management unit “Beograd”, data from total 6100 beech stems were collected and analyzed. Research aim was production of volume and sortiment tables for beech, as a most important tree species. Apart from data needed for volume evaluation of all single stems, on the butts of all stems, all defects and characteristics of sampled stems, needed for theoretical cutting of stems from samples, are recorded and argued by measurement. Research of homogeneity of collected samples, using certain statistical methods, at the first place variance analysis, it was ascertained that the sample can be separated in four homogenous statistic aggregates: western, eastern, central and southern Serbia. Data from those aggregates are processed using standard mathematical methods for this kind of research. The methods of correlation and regression analysis were applied, considering that, among other, the correlation of participation of roundwood and fuelwood in total stem volume are researched. The regression equations are established, as a result of the mentioned analysis, which best describe the nature of the researched dependence. The tables of technological structure for seed-grown beech forests are produced, on the basis of these equations, which can be used as exact basis for the necessary plans in Serbian forestry.

Key words: cutting and manufacturing, beech, technological structure

THE ANALYTICAL BASIS OF SIMPLE LINEAR REGRESSION IN FORESTRY STUDIES (CASE STUDY: RELATIONSHIP BETWEEN BASAL AREA AND TREE COVERAGE OF *QUERCUS BRANTII* LINDL. IN ABSARDEH, CHAHAR MAHALE AND BAKHTIARI ,IRAN.

Reza Basiri

basiri52@yahoo.com

Behbahan higher education complex, Forestry department, Behbahan university, Behbahan city, Khoozestan province, Iran/Behbahan

Abstract: Although there are many univariate techniques for data analysis in statistics, none of them takes into account the effects of other variables. In such a case regression models are being used. Linear regression is the most common method of studying the linear relation between two or more variables. The regression presumptions must be accurately considered to make reliable results of relating two variables and finding the best models. Without considering the presumptions some problems may occur. The purpose of this research is to show the correct model construction, select the best kind of model and validation for a simple linear regression with emphasis on its preassumptions. In this paper the regression preassumptions especially in forestry studies is arrested, because forestry studies use regression tests widely and thus the accuracy of results is completely necessary. The most influence of the nullity of preassumptions is the biased variance estimation, regression coefficients and coefficient of determination, also it is the biased tests hypothesis and interval estimation.

Key words: Simple linear regression, Regression hypothesis, Forestry studies

VARIABILITY OF GROWTH PARAMETERS OF HALF-SIB LINES OF SERBIAN SPRUCE (*Picea omorika* /Pančić/ Purkyne) IN THE JUVENILE PHASE

Branislava BATOS, Nevena ČULE

bbatos@yahoo.com

Institute of Forestry, Kneza Višeslava 3, 11000 Belgrade, Serbia

Abstract: Within the early selection of Serbian spruce the variability of the seed quality and parameters of growth of *half-sib* lines in the juvenile phase of growth were analyzed. The seedling material used in the experiment originates from “test” trees from the Serbian spruce seedling culture from locality Bele Zemlje near Užice (Serbia). In the experiment of growing of *half-sib* lines the following elements were analyzed: seedling emergence and survival, the characteristics of germinating seed, dry weight, as well as height increment and diameter increment of the plants during three successive years of growth. According to the obtained results it is possible to single out the individuals - trees, the carriers of the quality genetic material. Given the periodical of the yield of Serbian spruce, the research confirmed the difference in the quality of the seeds from different years of collection, and the individual variability of the quantitative characteristics of the analyzed plants was determined, which points to the undoubted importance of the individual selection in the refinement of this important species.

Key words: Serbian spruce, seed, *half-sib* off-spring, juvenile growth, selection

**COMPARISON OF MACROELEMENTS CONCENTRATION IN
QUERCUS ROBUR L. LEAF WITHIN FIVE DIFFERENT
POPULATIONS: A MULTIVARIATE APPROACH**

Branislava BATOS, Zoran MILETIĆ, Danijela MILJKOVIĆ, Saša ORLOVIĆ

bbatos@yahoo.com

Institute of Forestry, Kneza Visislava 3, Serbia, Belgrade

Abstract: The leaf analysis of macro elements concentration in the pedunculate oak *Quercus robur* L. conducted in five populations in Serbia („Ada Ciganlija”, „Bojčinska šuma”, „Subotica”, „Sombor”, „Vršac”), included a chemical analysis of percentage concentration of ash and 6 macro elements: nitrogen (N), phosphorus (P), potassium (K), sodium (Na), calcium (Ca) and magnesium (Mg), in total of 150 trees. The results of Scheffe’s means difference test showed that, with regard to leaf concentration of Mg, populations of „Ada Ciganlija” and „Vršac” differ from each other (0.91 % and 0.49% respectively). The leaf concentration of Ca underlined the differences between populations of „Ada Ciganlija” and „Sombor” (both 1.62%) and „Subotica” (1.19%). The populations „Bojčinska šuma” and „Vršac” had statistically more significant concentration of P (0.208% and 0.229 % respectively) in comparison to the other populations. The leaves from populations of „Ada Ciganlija”, „Subotica” and „Vršac” had statistically significantly higher value of N (2.61%, 2.52% and 2.44% respectively) in comparison to the populations of „Bojčinska šuma” (2.19%) and „Sombor” (2.27%). The portion of phenotypic variability conditioned by environmental differences (population effect) was statistically relevant to the concentration of ash, Mg, Ca, P and N. Based on the results of multivariate analysis of variance (MANOVA) of macro elements concentration in dry matter, the significant portion of the population in the total phenotypic variability was confirmed, when the concentration of all analysed macro elements in leaf is taken into account. By the application of Canonical Discriminant Analysis (CDA), it was determined what leaf concentration of the analysed macroelements contributes most to the separation of *Quercus robur* populations. The statistical importance of canonical discriminant axes was confirmed by the results of an χ^2 test. The first canonical discriminant axis (CD1) demonstrated clear separation of populations of „Vršac” and „Bojčinska šuma”, which can be attributed to the highest concentration of P in leaf in these populations (0.229% and 0.208% respectively). The second canonical discriminant axis (CD2) indicates the separation of population of „Subotica” due to the lowest concentration of Ca (1.19 %) in comparison to other populations. The third canonical axis (CD3) confirms the separation of population of „Sombor” owing to the highest concentration of ash in leaf in comparison to other populations (7.71 %).

Key words: macroelements, *Quercus robur*, populations variability

INTER-POPULATION VARIABILITY OF STOMATAL CHARACTERISTICS OF QUERCUS ROBUR L. LEAVES IN FIVE POPULATIONS IN SERBIA

Branislava BATOS, Dragica VILOTIĆ, Danijela MILJKOVIĆ, Saša ORLOVIĆ

bbatos@yahoo.com

Institute of Forestry, Kneza Visislava 3, Serbia, Belgrade

Abstract: Inter-population variability of stomatal characteristics (stomatal density (SD), stomatal length and width, stomata pore surface (SPS), a potential conductance index (PCI) and coefficient of stomatal shape (CSS) in *Quercus robur* L. leaves were examined. The research was conducted on fully expanded leaves from 50 trees from the analysed populations of Serbia (“Ada Ciganlija”, “Bojčinska šuma”, “Subotica”, “Sombor” and “Vršac”). Stomatal characteristics were examined from two leaf positions from open and shaded side of a tree. The traits SPS and SD, i.e. the traits reflecting the direct impact of environmental conditions (light intensity and temperature), showed higher individual variability value measured by the coefficient of variation (CV %). According to the results of the F-test for the SD, ($F(4,1555) = 42.48$, $p = 0.0000$) and for PCI ($F(4,1555) = 19.92$, $p = 0.0000$), there are significant differences between the analyzed populations. The importance of the parameters that determine the dimensions of the stomata, was analyzed by nonparametric Mann-Whitney U-test. The analysis showed highly statistically significant stomatal characteristics, with respect to the (light / exposed position) in all the analysed populations (“Ada Ciganlija”, “Bojčinska šuma”, “Sombor”, “Subotica”, “Vršac”).

Key words: *Quercus robur*, leaf, stomatal characteristics, variability

**METHODS OF ESTIMATING THE ECONOMICAL VALUE OF CARBON
AND THE EVALUATION OF TURKISH FORESTRY REGARDING THIS**

MAHMUT M. BAYRAMOĞLU, DEVLET TOKSOY
Karadeniz Technical University, Department of Forest
Faculty, Trabzon, 61080 TURKEY

Abstract: There have been many recent movements to be able to reduce greenhouse gases, which have been dramatically increasing in the atmosphere, and to prevent potential disasters due to global climate change. Especially CO₂ gets great attention because it is more efficient for greenhouse effects. Forests in the world possess about half of the CO₂ all over the planet and they have an important role in balancing CO₂ in the atmosphere. In spite of the fact that this situation used to be defined as benefit of forests, which cannot be measured economically, today carbon has economical value and it can economically act in markets, which makes the situation quite different. Especially in the past 10 years, new methods have been developed to be able to measure the economical value of carbon owing to the recent studies. Because of this, many countries all over the world made important changes in their forest policies, ecological and economical implementations. Carbon economy is a new issue for Turkish forestry and the main purpose of this study is to discuss different methods regarding measurement of the economic value of carbon within Turkish forestry.

Key words: Greenhouse gases, Forest, Carbon, Economy, Turkey

**INFLUENCE OF ARBUSCULAR MYCORRHIZAL FUNGI
ON GROWTH OF SEEDLINGS OF CITHAREXYLUM
SUBFLAVESCENS SF BLAKE, IN NURSERY PHASE**

María Catalina BECERRA LEAL
Universidad Distrital Francisco Jose de Caldas, Cra
40 No. 39b-25 Sur, Colombia/Bogota

Abstract: *Citharexylum subflavescens* which is commonly named Cajeto, is a highly distributed tree species around the eastern and central ranges of the Colombian Andes, (Mahecha et al, 2004). Scientific studies have recognized a high alimentary potential, because their fruits are the principal food source for insects, hummingbirds and endangered species like the orejiamarillo parrot (after *Ceroxylum quindiuense*) (Salaman et al, 2003); and is also recognized for its influence in the preservation of water margins and its ornamental values are very important at the ecological and social level. However, despite its importance there has not been found information about Cajeto silvicultural improvement and its fungi associations, specifically arbuscular mycorrhizal associations. This study tends to create new information about the Cajeto's growth and development, by using the arbuscular mycorrhizas inocula in different treatments composed by two mycorrhizal genera: *Glomus* and *Acaulospora* inoculated in four concentrations 0g of inocula (0 spore/g), 15g of inocula (7,5 spore/g), 30g (15 spore/g) y 45 g (22,5 spore/g) respectively, to Cajeto seedlings in the nursery phase. After nine weeks of observation and control of height, number of leaves and percentage of colonization, we found an increase in growth (height) of 20.92%, 28%, 20.99% and 22.03% for treatments 1, 2, 3 and 4 respectively. The best concentration of inoculum was the corresponding to 7.5 spores /g (treatment 2) compared with non-inoculated seedlings. There were no significant differences between the birth number of leaves, which was 4 leaves per seedling after nine weeks of observation. Due to atrophy of the roots (caused by the bags size), chlorosis symptoms appeared in all treatments. We confirmed the presence of associations between *Glomus* and *Acaulospora* with *subflavescens* *Citharexylum* seedlings.

Key words: *Citharexylum subflavescens*, arbuscular mycorrhizal fungi, *Glomus*, *Acaulospora*

**RETROSPECTIVE ON THE STRUCTURE OF DYING TREES IN
THE ARTIFICIALLY ESTABLISHED RIPENING OAK STANDS
IN THE AREA OF THE UPPER DANUBE BASIN IN SERBIA**

Martin BOBINAC, Siniša ANDRAŠEV, Miloš SIMIĆ

mbobinac@EUnet.rs

Faculty of Forestry, Kneza Višeslava 1, Serbia, Belgrade

Abstract: Based on the survey data of oak trees in permanent sample plots in the artificially established stands in the upper Danube basin in Serbia the structure of old oak trees that were dying in the period from 1986 to 2005 was analyzed. The studied oak stands were built as a pure or mixed (usually with hornbeam) at the end of the nineteenth century in accordance with syndynamical changes in the habitats of black and white poplar (*Populetum nigro-albae* Slav. 1952) and in the habitats of narrow-leaved ash and elm (*Fraxineto-Ulmetum effusae* Slav. 1952). Altitude habitat is 84.3 m-86 m. Based on the tree measurement in 1985, at the stand age of 90 years, on six permanent sample plots 192-244 oak trees per hectare were recorded, with a wood volume of 340-690 m³·ha⁻¹. In the period from 1986 to 2005 in the form of sanitary felling in the sample plots were recorded 38.5% -68.8% of trees compared to the state in 1985. At the stand age of 110 years the remaining oak trees are 60-128 per hectare. All died oak trees belonged to the dominant (BP-1) or codominant (BP-2) biological position. According to the absolute age of oak trees have been extensively lost vitality and died between 90th-110th year, which coincides with a wave of massive degradation of pedunculate oak and other oak forests in Europe in the eighties of the twentieth century. The results of examination on permanent sample plots indicate that the process of devitalization and dying of trees is in addition to the influence of multiple stress factors, directly linked with the process of biological differentiation between trees in the stands, or with tending measures in the previous period.

Key words: pedunculate oak, permanent sample plots, ripening oak stands, oak decline, structure of dying trees

GENETIC DIVERSITY AND GENETIC DIFFERENTIATION OF EUROPEAN BLACK POPLAR POPULATIONS IN THE SUB-ALPINE REGION

Gregor BOZIC¹, Berthold Heinze², Davorin KAJBA³,
Vedhu KRYSTUFEK⁴, An Vanden BROECK⁵
gregor.bozic@gozdis.si

¹ Department of Forest Physiology and Genetics, Slovenian Forestry Institute, Slovenia

² Department of Genetics, Unit of Genome Research, Federal Research Centre for Forests, Natural Hazards and Landscape, Austria

³ Faculty of Forestry, University of Zagreb, Croatia

⁴ Winkelberggasse 227, A-2392 Grub im Wienerwald, Austria

⁵ Research Institute for Nature and Forest, Belgium

Abstract: The European black poplar (*Populus nigra* L.) is a pioneer tree of floodplain forests on alluvial sites which belongs to the priority EC habitat type 91E0* (Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*/ *Alno-Padion*, *Alnion incanae*, *Salicion albae*, Annex I, Habitat Directive 1992) and takes part in the Natura 2000 network. European black poplar is one of the most threatened indigenous tree species in Europe. We analysed the genetic diversity and genetic differentiation of 10 black poplar populations in its natural habitats along the main river systems across Slovenia and Croatia (the rivers Soca, Sava, Drava and Mura) by using six microsatellite loci (WPMS16, WPMS20, WPMS14, PMGC14, WPMS09, WPMS18) and combined analysis with Austrian data for the rivers Mura and Danube with same microsatellites. Eleven common cultivated clones of *Populus x canadensis* were included in order to assess the level of introgression of genes of the American Eastern cottonwood, *P. deltoides*, into the gene pool of native black poplar. The results of this study indicate that the gene pool of remaining *Populus nigra* populations maintains high genetic connectivity across three European countries, even if fragmented today. In natural populations the introgression of genes of *Populus deltoides* was very low. The obtained results are further compared with the current status of *Populus nigra* populations in Central Europe and discussed in view of natural habitat conservation and its protection at the regional and national levels.

Key words: *Populus nigra* L., microsatellite, genetic variability, introgression

DIGITAL-BASED GREENERY CADASTRE OF THE CITY OF TREBINJE

Jugoslav BRUJIĆ, Boris MARKOVIĆ, Vladimir STUPAR,
Jovan TRAVAR, Drago PETKOVIĆ, Đordije MILANOVIĆ
arbormagna@yahoo.com

Forestry Faculty, University of Banjaluka, S. Stepanovica 75a, 78000
Banja Luka, Bosnia and Hercegovina/Republic of Srpska

Abstract: The paper explains the method requirements, general ecological frame, space distribution principles and other important conditions for the making of the digital-based cadastre of the greenery matrix of Trebinje, the only Mediterranean city in the Republic of Srpska. It is necessary to distinguish three phases within the process of GIS-based inventory of the greenery. The first one is represented with terrain manual forms, including a set of very heterogeneous parameters, which need to be measured or evaluated. Also, in this phase spatial data about greenery units are recorded into field maps or directly into GPS. The second phase represents the input of raw data into the GIS software where the processing and analyzing of the data is being undertaken. The last, third phase represents the output, usually in the form of analogue maps, whose contents depend on the purpose and needs in the communal operative unit. The built GIS-database of a city has at least four levels, depending on the details degree: greenery unit (solitaire tree, tree-group, shrubs etc.), stroke (occasionally in lined-types of greenery), block and suite. Every level has its own structure of needing data. This database could be established, but never finished; it should be updated almost annually. Digital-based cadastre of the greenery of Trebinje is the example of such a database.

Key words: GIS database, greenery cadastre, Trebinje

**RADIAL, HEIGHT AND VOLUME GROWTH OF CALABRIAN
PINE (*Pinus brutia* Ten.) FIVE YEARS AFTER DEFOLIATION
BY THE PINE PROCESSIONARY MOTH IN TURKEY**

Serdar CARUS

scarus@orman.sdu.edu.tr

Süleyman Demirel University, Faculty of Forestry, Department of Forest Management Planning, 32260 Isparta, Turkey

Abstract: An outbreak of the Pine processionary moth (PPM), *Thaumetopoea wilkinsoni* Tams (Lepidoptera: Thaumetopoeidae), began in spring 1998 and lasted for 5 years in a *Pinus brutia* Ten. (Calabrian pine) stand in Burdur of Turkey. Tree volume and volume elements increments were examined throughout a PPM outbreak cycle from 1981 to 2003, for an even aged, pure, undisturbed, young Calabrian pine plantation. Tree ring chronologies of 'undefoliated (control)' Calabrian pine, which was not defoliated by PPM during the period of 1998-2003, were used to estimate potential growth characteristics in the 'defoliated (host)' Calabrian pine (moderate and high defoliation groups) for current and past outbreaks. Increment cores were collected from 70 host and 78 control dominant or co-dominant trees and annual radial growth indices from 1981-2003 were calculated for each defoliation group in a 41 point sampling. Growth functions were defined as the cumulative sum of radial, height, and volume increment and graphically compared between host (moderate and high defoliation groups) and control Calabrian pine sample trees. Growth functions of individual trees were related to degree of defoliation five years after a severe outbreak of Pine processionary moth. Trees on the same point samplings were measured in 2008 to determine growth recovery five years after the outbreak. For the period 2004-2008, growth of the trees surpassed and was significantly greater than in the preoutbreak period, 1998-2003. Growth of undefoliated trees was also greater during the postoutbreak period, indicating that above-normal precipitation aided tree recovery. Increment cores were taken from every dominant and co-dominant Calabrian pine in 41 point samplings; a sample of undefoliated trees was also cored. Growth rates were compared for individual tree-defoliation classes between the preoutbreak and postoutbreak periods by using regression analysis and the analysis of covariance to test the differences among these linear relations. Growth sharply declined the year after defoliation began, and the amount of decline was proportional to percent defoliation (moderate and high defoliation groups). Growth recovery which began the year after defoliation ceased and radial, height and volume increment had returned to pre-outbreak levels, 5 years after defoliation.

Key words: Radial growth, Pine processionary moth, Calabrian pine, Dendrochronology, Turkey

**RESPONSES OF FOREST ECOSYSTEM TO THE
WENCHUAN EARTHQUAKE, CHINA**

Song CHENG^{1,2*}, Li ZHANG^{3*}, Jiyue LI⁴, Hui YU^{1,5}, Gang YANG^{1,5}
chengs889@gmail.com

¹ Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, No.9. Section 4. South Renmin Road, Chengdu, Sichuan 610041, China

² School of Urban Management and Natural Resource Environment, Yunnan University of Finance and Economics, 273 Longquan Road, Kunming, Yunnan 650221, China

³ Schiermeier Olentangy River Wetland Research Park,
The Ohio State University, Columbus, Ohio 43202, USA

⁴ College of Forestry, South China Agricultural University,
Guangzhou, Guangdong 510642, China

⁵ The Graduate School of Chinese Academy of Sciences,
Beijing 100049, China * Corresponding author

Abstract: The Wenchuan Earthquake (8.0 Ms) on May 12, 2008 triggered 13.9 billion m³ of mass movements from mountain collapses, landslides and huge debris flows, and extremely disturbed soils in a 132, 000 km² area that encompasses globally-important natural giant panda habitat reserves. The earthquake denuded at least 32,000 hm² of vegetation, led to a large number of fallen trees in the forests and created more than 58,000 canopy gaps that drastically changed the forest floor environment. The impacted area is considered a tectonically active period for the next 10 years. As of February 8th 2009, 110 and 40 aftershocks occurred with 4-5 Ms and > 5 Ms, respectively. The earthquake has long-term impacts on the local ecosystems. The soils have been critically impacted from 0 to 40-cm deep layer. Soil aeration, temperature, drainage, and evaporation have increased with enhanced levels of water lost from the soils. Additionally, capillary porosity significantly decreased in the landslide areas. The damage has weakened the transportation of capillary water from the lower to upper soil layer, which significantly impacts plant survival and development. The soils are likely to become dry. *Cupressus funebris* and *Cryptomeria fortunei* are two of the dominant tree species in the northwestern disaster area. The altered soils have severely disturbed their fine root growth. Mean tips length in the roots have apparently declined, suggesting that absorptive ability of the forests may have decreased, and the forests may suffer from a decrease in soil water supply in the upcoming years. Since June 2009, the *Cupressus funebris* forests have begun to die. The changes in physical properties of the soil are altering soil chemical properties both simultaneously and gradually. How the complex changing environment will further impact the forest ecosystem, including plant diversity and soil organisms, is unknown and concerned.

Key words: *Cupressus funebris*, *Cryptomeria fortunei*, Forest root growth, Soil physical property, Wenchuan earthquake

**DISTRIBUTION AND ECOLOGY OF DINARIC CALCAREOUS
FIR FORESTS IN THE HIGH-KARST ZONE**

Pavle CIKOVAC

pavle_cikovac@yahoo.com

Landwirtschaftskammer NRW

Abstract: Conifers are unevenly distributed through all mountain ranges in the sub-mediterranean oro-Mediterranean biome, where endemic firs, cedars, pines and junipers constitute separate vegetation belts. These non deciduous Mediterranean forests prevail from ecological determination of limited hygric, rather than thermal conditions. Since climate and well known regional combinations to geologic phenomena of karst landscapes, where limestone substrates and calcareous soils deliver to xeric conditions, several close related but geographically isolated Mediterranean fir species constitute fragmented calcareous fir-forest associations related to cool-humid mountain zones. At the northern margin of the Mediterranean, xerophilous fir forest ecotopes are associated to a mesothermal and mesophilous species, the medio-european silver fir (*Abies alba* Mill.). Xeric forests of the silver fir characteristic for the Dinaric High-Karst zone are Dinaric calcareous silver fir forests (*Calamagrostio-Abietetum* Horv., *Rhamno-Abietetum* Fuk.) from the wettest, but also most heavily karstified coastal ranges and transitional limestone mountains in the NW- and SE-Dinaric Alps. Still lacking specific distributional and spatial information, GIS-and remote sensing analyses (supervised classification procedures, multi-temporal and high resolution aerial photographic interpretation and spectrometric analyses of various multi-spectral data from ETM+, TM, and LISS sensors) were used for mapping the specific *Rhamno-Abietetum* Horvat (1957) association in the Herzegovinan-Montenegrinian High-Karst territory. Phytocenological studies in *Rhamno-Abietetum* from complex structured glacio-karstic landscapes in the Bijela gora plateau (Mt. Velika Jastrevica 1879 m) and polygonal-(pitfall-) karst mountains in the Rudine region on Jelovica (1280 m) and Pusti lisac (1470 m) necessitated GIS procedures based also on vectorized high resolution DEMs (Digital elevation models) to interpret distributional and ecological patterns. Floristic composition and variety of its biota was complemented with soil analyses. While *Rhamno-Abietetum* associations spatially and floristically relate to thermophilous Balkan pine (*Pinus heldreichii*) and Black pine (*Pinus nigra*) forests, fine scale spatial resolution based only on remote sensing procedures without ground evidence is not possible, as spectral signatures from open and uneven coniferous canopies and spectral mixing of fir-pine communities can be problematic. *Rhamno-Abietetum* characterized as “resilient pioneer fir forest communities” were termed Dinaric calcareous block fir forests, an English translation of the German “Dinarischer-Karst-Blockhalden Tannenwald”, where “Blockhalde” is associated to disturbed pioneer habitats of montane and alpine forests on rock-landslides. Ecological evidence from evolved karst, where massive rock

escarpments, limestone pinnacles, crests and pitfalls characterise resilient karstic ecotopes and when boulders, blocks or landfalls in more dynamic ecosystems are mostly erroneous assumptions for the given association, the appropriate signification is therefore better termed to Dinaric calcareous fir forests.

METHODICAL PROCEDURE FOR DETERMINATION OF NATURAL WEALTH OF THE URBAN FOREST FOR RECREATIONAL FUNCTION

Milijana CVEJIĆ

milijana_cvejic@yahoo.com

Institute of Forestry, Kneza Visislava 3, Serbia, Belgrade

Abstract: Forests that are retained within the administrative area of the city of Belgrade according to the General Plan of Belgrade 2012 are classified as urban forests. In accordance with the rules of urban forest management this plan document defines the function of recreation in the urban forest as a priority. General Plan further emphasizes the importance of urban forests, that in addition to recreational features affect the improvement of environmental conditions in the city. This leads us to the next fact in addition to determining the implementation of recreational features in the urban forest. The preservation and improvement of environmental conditions of urban forest ecosystems which is planned to implement this function are equally important in the forest. Several authors address the establishment of natural forests for recreational equipment function, among the first: Method forest project (SSSR, 1965) which valued the natural forest equipment and its position in relation to the environment in which it is where the analysis only estimated the aesthetic properties of forests' 11 elements. Other authors have dealt with similar goals, score a number of other elements such as: landscape differences in the forest territory (V.D.Prjahin and V.T.Nikolenko, 1981); Score value of trees and forests (K.Pintaric, 1980); while K.Rupert (1971) developed a practical method of evaluation of natural forests for recreation equipment. In addition to these on this issue worked Medarevic (1983), Molnar, Skamponi and Hofmani. Recently Krznar and Lindic (1999) also evaluated the natural characteristics of forest ecosystems, Saletto-Jankovic (1995) spoke about the evaluation of forest tour and so on. The aim of this paper is to present the methods used so far and methodical procedures to determine natural wealth of the urban forest for recreational function and to exclude the method that is consistent with the social and environmental needs of present acceptable. The analysis method is separated and selected Rupert's method which has a small number of input parameters, accurate and comprehensive. It is assumed that the results obtained using the selected method can be used for: - assessment of natural forest equipment, - evaluating the stability of the analyzed forest ecosystems, - making

proposals for allocating the zone where the forest recreation complex to be implemented at the same time will not endanger the forest ecosystem.

Key words: Urban forest, Recreational functions , Methodological process of establishing urban forest benefits for the recreational function

**MECHANICAL DAMAGES ON THE REMAINING TREES
OF PEDUNCULATE OAK ON THE TERRITORY OF SREM
DURING THE FIRST PHASE OF TRANSPORT**

Vladimir ČORBIĆ

corbic.vladimir@yahoo.com

Faculty of forestry, University of Belgrade

Abstract: Application of mechanized means in the process of production causes inevitable occurrence of damages on the remaining trees, progeny and the ground. In which scale and what types of damages occur are the subject of research of this article. Research was conducted in May of 2010, on the territory of forest administration Morovic. Preparatory cutting was conducted during December of 2009 and January of 2010 in the forest type of pedunculate oak, narrow-leaved ash and common hornbeam. Transport of assortments was performed by a Timberjack 1410 B forwarder. Results of the conducted analysis indicate that the damages on the older trees that remained after the preparatory cutting occurred in 33.33% of the cases. These damages do not present a major problem, considering the fact that they will be cut not before too long in the subsequent cutting. Damages to the ground reflect in the occurrence of tire tracks on the cutting site. The average depth of tire tracks was 6.56 cm, in winter conditions and on frozen ground. Tire tracks take up around 15% of the total cutting site.

Key words: Pedunculate Oak, stem damages, the first phase of transport, tire tracks, Timberjack 1410 B

**MAJOR CHARACTERISTICS OF THE MIXED FIR AND BEECH
VIRGIN FORESTS IN THE “BIOGRADSKA GORA”
NATIONAL PARK IN MONTENEGRO**

Milić ČUROVIĆ¹, Milan MEDAREVIĆ²
curovic@t-com.me

¹ Biotechnical Faculty-Podgorica,

² Forestry Faculty-Belgrade

Abstract: To manage forest ecosystems in a sufficiently high biodiversity level it is necessary to meet the structural characteristics of intact forests. The research was focused on identifying characteristics of mixed forests of fir and beech (*Abieti-Fagetum* s. lat.) in the area of the strict reserve of the National Park Biogradska Gora in Montenegro. Basic characteristics of those forests were included in the research and defining of forest types. This was preceded by basic ecological, structural and production research, and on the basis of their analysis and evaluation, their multi-disciplinary character, forest types recognizable according to basic characteristics were singled out. In that way, a realistic base for typological managing of these forests and forest ecosystems with similar ecological and structural characteristics is provided for the first time.

Key words: forest type, virgin forests, structure, forest management planning

**THE STATE OF FORESTS IN SERBIA IN TERMS
OF THEIR UTILIZATION**

Milorad DANILOVIĆ, Nenad ĆUPRIĆ

milorad.danilovic@sfb.rs

Faculty of Forestry, University of Belgrade

Abstract: This paper deals with problems in the utilization of Serbian forests from different aspects (technical, technological, economical, ecological, energetic, and ergonomic). Systems and working methods, which are in use, are often unbalanced in terms of forest characteristics, machines types and logging intensity, considering that in certain cases they do not include variable factors affecting their efficiency. Equipment used in Serbian forestry for forest utilization differs, from semi mechanized (motor chainsaw) to modern (harvester, forwarder etc.). Besides that, their capacities are not in use to the extent that provides high productivity. Results of the performed estimation of the mechanization state and the usage level of mechanization in utilization of privately owned forests show that they are considerably lower compared to state forests and that they need to undertake a series of measures to comply with the principle of sustainable utilization. Utilization equipment that is used in Serbian forestry is in most cases outdated and amortized, its maintenance is expensive, resulting in high total unit production costs. The renewal of Serbian forestry mechanization, obtained by purchasing modern forestry equipment, has to be in strong accordance with ecological and economical principles. On the other hand, purchasing of that type of mechanization requires significant investments being the main limitation for its wide usage. However, the state could support private forestry companies in Serbia to renew their mechanization by stimulation measures (subsidized affordable loans, graded system of taxation etc.). That would enable development of that part of Serbian forestry increasing levels of sustainable utilization.

Key words: Logging equipment, Technology, Mechanization level, Transport, Logging, Systems and methods

**EVALUATION OF THE COMPATIBILITY BETWEEN THE FOREST
OPENING-UP WORKS AND THE NATURAL ENVIRONMENT**

Vasileios C. DROSOS*, Vasileios J. GIANNOULAS**,
Sarantis - Angelos G. LIAMPAS*

* vdrosos@fmenr.duth.gr, angel40das@yahoo.gr

Department of Forestry and Management of Environment and Natural Resources,
Democritus University of Thrace, Ath. Pantazidou 193 Str.,
PC 68200, N. Orestiada

** vgiannou@for.auth.gr

Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki,
PC 54124, BO 226

Abstract: The development of an integrated forest opening-up method with forest works such as primary haul roads, haul passages and staking grade line harvesting methods (tractor roads, hauling road path) of wood, constitutes an interference to nature. This has to be studied with a very critical mind from the ecological aspect because of the consequences to the natural environment. Since forest opening-up is inevitable, in order to achieve their commercialization and at the same time their protection that corresponds to the viable development and the efficient forest fire confrontation, a golden section has to be found. Contrary to the classical opening-up methods, which are mainly based on financial criteria, a method for the forest roads appreciation including financial, ecological and social criteria has to be developed. In this case, the straightforward forest opening-up as an independent variable in the model shouldn't be accepted, but as a part of the whole because of the close connection to the development of the each time area that contributes to the protection of the natural attraction. It is very hard to estimate the forest opening-up consequences with financial extents by using familiar methods such as cost-benefit analysis. In order to estimate these consequences, the compatibility of the opening-up forest works with the natural environment could be used. That requires the use of countable criteria for the intensity of human impact to the forest ecosystem and the forest ecosystem absorption of the opening-up forest works. The aim of this paper is to investigate the contribution of these criteria to the evaluation of compatibility of the existing opening-up forest works with the natural environment. Geographic Information Systems are an efficient and reliable solution for these criteria. The results testify that the use of this method provides the estimation of the existing opening-up forest works and the selection of compatible alternatives.

Key words: Compatibility, forest opening-up, natural environment, G.I.S.

SPATIAL ACCURACY OF MEASUREMENTS USED IN CARTOGRAPHY

Vasileios C. DROSOS*, Kiriaki KITIKIDOU*, Chrisovaladis MALESIOS**

*Department of Forestry and Management of Environment and Natural Resources, Democritus University of Thrace, Ath. Pantazidou 193 Str.,
PC 68200, N. Orestiada

vdrosos@fmenr.duth.gr, kkitikid@fmenr.duth.gr

**Department of Agricultural Development,
Democritus University of Thrace, Pantazidou 193, Orestiada,
malesios@agro.duth.gr

Abstract: An important development in cartography has been the emergence of geometry. Besides, the word “geometry” was originally the concept of “measuring the earth”. The first examples of maps that appear to be constructed using certain principles of geometry were from Babylon. However, based on our knowledge to date, the ancient Greeks, and even the Ionians, were those given for the first time a scientific background in cartography, combining amazing knowledge with technology, theory with practice. The ancient Greeks and Romans built, made simple surveying instruments for various technical works. Station was the construction of the first theodolite by the English Engineer Sisson in 1700. With the appearance of new technologies and instruments and the contribution and development of personal computers new perspectives are being opened and new possibilities are being created such as the Total Stations. With the conquest of space we had in the use of satellites to map the earth the well known GPS which then evolved. Finally, for greater accuracy in our time we have gone from the analog to digital maps. In this paper, the achieved spatial accuracy of the measurements used to create maps with the classical topographical way of data collection is investigated and shown. The measurements were accomplished in different time of the year and under different forest conditions. To the statistic analysis the values of the total station were taken as true values. The technique is based on the original estimated accuracy and at the principal of errors transmission, to determine a number of control points. The control points distributed at random in order to achieve unbiased assessment. An accurate and reliable digital map can be a useful tool in many fields of forestry such as in forest management planning, forest protection, forest utilization, forest policy, economy, management, soil erosion, natural hazards and watershed management, cultural landscape-planning, management and protection, sustainable design in landscape planning, integral protection of forest ecosystems and urban green surfaces etc. Finally, the measurements’ accuracy was calculated, the suitable results were drawn and the relative suggestions for the forest application are indicated.

Key words: mean square error, spatial accuracy, standard deviation

**STRUCTURAL FEATURES AND REGENERATION PROCESSES OF
BEECH AND FIR FORESTS IN „RISNJAK” NATIONAL PARK**

Tomislav DUBRAVAC, Stjepan DEKANIĆ,
Department of Silviculture, Croatian Forest Research Institute Jas-
trebarsko, Cvjetno naselje 41, 10450 Jastrebarsko, Croatia

Abstract: Forestry practice in management of forest ecosystems applies the principle of sustainability. This principle, that is common in Croatian forestry for over two centuries, helped in maintaining Croatian forests among the most stable forest ecosystems in Europe. Recent negative environmental developments pose a threat to the stability of forests, especially of beech and fir forests. One of the main reasons is absence of timely management measures leading to the deterioration of stand structure as a main precondition for successful functioning of the entire ecosystem. Consequences are evident in absence of fir regeneration, divergence of stand volume in comparison with normal volume, decrease of increment, ageing, physiological weakening and dieback of dominant trees, all further amplified by climatic changes (warming and drought), acid rain and other pollutants of air, water and soil. Negative processes are even more evident in non-managed forests. This paper presents some of the results from almost a decade long monitoring (1998-2007) on permanent experimental plot within the national park „Risnjak”. Stand structure, regeneration processes, characteristics of young growth, damages of beech and fir crowns are monitored, and possibilities for application of modern methodologies like three-dimensional visualization of horizontal and vertical stand structure, are explored. Results of this research indicate disturbed uneven-aged stand structure. There are no fir trees in the lower and middle diameter classes of the diameter distribution, which implies the absence of fir regeneration for several decades. This space in the diameter distribution is occupied by low-quality beech trees, indicating alternation of species. High canopy cover, absence of stepwise vertical canopy layering, volume that is accumulated on old, physiologically weak trees, all imply the absence of characteristic uneven-aged structure. These stand attributes have a negative impact on abundance, quality and survival of young growth, and pose a question mark over the expected normal process of natural regeneration. Obtained results suggest that protected forest ecosystems are in need of active protection regime which will ensure that they perform their role in a stable and sustainable way. Heretofore accumulated knowledge of many forest scientists give as the right to conclude that foresters, due to their long tradition, have the know-how, ability and an obligation to help forest ecosystems in protected areas to permanently fulfill their purpose.

Key words: national park, stand structure, natural regeneration, young growth, fir, beech

**ROLE OF SOME PRE-TREATMENTS ON SEED GERMINATION OF
EASTERN STRAWBERRY TREE (ARBUSUS ANDRACHNE L.)**

Murat ERTEKİN, Ö. Lütfü ÇORBACI, M. Ertuğrul YAZGAN
murarterekin@hotmail.com

University of Bartın, Faculty of Forestry 74100-Turkey

Abstract: Eastern strawberry tree (*Arbutus andrachne* L.) is one of 12 species, which belongs to the genus *Arbutus* of Ericaceae family. In general, it is native to Lebanon, Greece, Southern Europe and Anatolia. It is used in several domains; the eastern strawberry tree produces the forage of good energizing value, leaves and fruits can be used in the pharmaceutical industry. Also, *A. andrachne* is an ornamental bush; its beauty resides in the mixture of its foliage green obstinate brightness with its white flowers and its red fruits decorating the bush all along of year. Propagation of the eastern strawberry tree is difficult by seed. The seed included in their fruit have a very rate of germination, caused by the presence of certain inhibitory substances diffused by the fruit. The seeds require pre-treatment to overcome dormancy. Dormant seeds can be stimulated to germinate using treatments that emulate natural conditions or satisfy certain physiological requirements. Stratification, leaching, scarification, light and, plant growth regulators (especially gibberellic acid (GA3) and cytokinin) are effective dormancy releasing treatments. In developed countries, the synthesis of new phytoactive compounds that control or regulate plant growth or protect plants against environmental stress is highly advanced. Analogues to auxin or cytokinin that have high biological activity which have been synthesized. The synthetic high-molecular weight plant growth regulators polystimulin-A6 (PS-A6), which is similar to auxin, and polystimulin-K (PS-K), which is similar to cytokinin, have various effects on plant growth and development. This study was conducted to break dormancy and enhancing germination of *Arbutus andrachne* seeds. With this aim, seeds prior to sowings were treated as follows: stratification of the seeds at 4°C for 15, 30, 60 and 90 days, soaking in 50 and 100 mg per 100 mL Polystimulin (PS) or indole butyric acid (IBA) for 48 h. Results indicated that the highest germination rate was obtained by stratification at 4°C for 60-days treatment, and soaking the seeds in 50 mg per 100 mL PS for 48 hours treatment. The stratification temperature of 9°C was more effective than 4°C. Breaking dormancy for *A. andrachne* seeds should be used to stratification for 60 days and application to PS hormone at lower doses.

Key words: Eastern strawberry tree, dormancy, germination, hormone treatment, ornamental plant.

**GENETIC VARIATION IN CONE PRODUCTION IN AN ANATOLIAN
BLACK PINE SEED ORCHARD IN TURKEY**

Dr. Murat ERTEKİN*, Dr. Halil Barış ÖZEL

* murarterekin@hotmail.com

University of Bartın, Faculty of Forestry, Department of Silviculture, Bartın-Turkey

Abstract: This study was conducted for two years (2003-2004) in a black pine seed orchard from Yenice-Bakraz established at Bartın with 30 clones in 1990. During the research, the variations between the clones in the seed orchard were determined based on their one year old cone and two year old cone production. According to the investigation of the average values of cone production in two years, it was determined that the number of the one year and two year old cones were 65.1 and 58.6 respectively. In the seed orchard, 10 clones out of 30, produced maximum numbers of two year old cones, supplied the 48 and 58 percent cone production of the total production in the orchard in two years respectively. It was also determined that the amount of the flowers for the cones showed significant differences within the years.

Key words: *Pinus nigra*, seed orchard, cone production, genetic variation, fertility.

SOIL PROPERTIES UNDER THREE HYRCANIAN FOREST TYPES

Javad ESHAGHI RAD

J.Eshagh@urmia.ac.ir

Urmia university, Department of forestry, Faculty of Natural Resources,
Urmia University, West Azarbayjan, Iran

Abstract: The Hyrcanian forests of the Alburz and Talysh mountains form a green belt along the southern coast of the Caspian Sea, surrounded by semiarid or arid landscapes. Together with the Colchic region in Georgia these mountain ranges and the adjacent coastal plains have been the most important refuge areas for temperate broadleaved deciduous forests in western Eurasia during Pleistocene glaciations. Under current climatic conditions Hyrcanian forests potentially occur in an altitudinal range from sea level to 2800 m a.s.l. This study was done in Beech (*Fagus orientalis*), Beech-Hornbeam(*Carpinus betulus*) and Beech-Hornbeam-Maple(*Acer velutinum*) forest types of Namkhaneh, Gorazbon and Chelir districts of Kheiroudkenar forests located in the centre of Hyrcanian forest (north of Iran). The aim of the research was comparison between soil physical and chemical properties under abovementioned forest types of the study area. 15, 36 and 37 sites were selected in Beech, Beech-Hornbeam and Beech-Hornbeam-Maple forest types respectively. In each site, two soil samples were taken from 0-10 and 10-30 cm layers of mineral soil. The physical and chemical soil properties in this research were the following: Soil texture (percentage of sand, silt and clay), pH, total nitrogen, available phosphorus, exchangeable potassium, calcium and magnesium, lime, organic matter, C/N ratio. Duncan test was used to compare the means of soil physical and chemical properties among 3 forest types. The results showed that there were significant differences in total nitrogen, organic matter and calcium in the first layer between Beech-Hornbeam-Maple type and the other types. However, the soil conditions were not statistically different between Beech and Beech-Hornbeam types. Total nitrogen, organic matter and calcium increased in the order Beech < Beech-Hornbeam < Beech-Hornbeam-Maple. The results suggest that Hyrcanian deciduous tree species differ in the soil total nitrogen, organic matter and calcium content in which these soil characters decreased where Beech are dominated.

Key words: Beech, Hornbeam, Maple, Hyrcanian forests, Soil

**LONG-TERM MECHANICAL DISTURBANCE IMPACTS ON SOIL
PHYSICAL PROPERTIES AND ECOLOGICAL RESPONSE OF HARD-
WOOD SPECIES IN THE HYRCANIAN FORESTS, IRAN**

Sattar EZATTI¹, Akrab NAJAFI, Tarbiat MODARRES¹, Tarbiat MODARRES^{1*}
ezzati@modares.ac.ir, a.najafi@modares.ac.ir
University, Department of Forestry, P. Box: 46417-76489, Noor, Mazandaran, Iran

Abstract: The applied skidding technology strongly influences the impact of harvest on the ecosystem and success of natural regeneration. The current paper was designed to study physical properties in topsoil depths and regeneration hardwood species as indicators of soil recovery 1 and 10 years following logging on 2 of the North of Forest, Iran Long-Term abandoned skid trails sites. Soil physical properties were measured in skid trails and undisturbed areas. Within the skid trails, measurements were made for three traffic intensity; low (LTI), medium (MTI) and high (HTI) traffic intensity. The results showed that recovery of soil bulk density (BD), in both site 1 yr and 10 yrs old, on high traffic intensity (HTI) was less in the surface topsoil of the skid trails. The recovery of soil from compaction was very slow in two sites in HTI. 1 yr after logging, in the MTI and HTI, soil moisture (SM) was increased by about 3.39 and 3.38% respectively compared to the undisturbed areas; while in the MTI and HTI by about 8.18 and 2.38% lower than undisturbed area in 10 yrs old skid trail. 1 yr after abandoning of skid trail the values of BD in the MTI and HTI were 35.42 and 34.83% respectively greater undisturbed areas, while these values in 10 yrs after logging in the MTI and HTI were greater than in undisturbed areas 22.85 and 32.90% respectively. The density of regeneration of hardwood species, 1 yr after logging in low traffic intensity (LTI) by about 56% in the skid trail zones was greater than in the undisturbed area, while in the MTI and HTI, no seedlings were recorded. These results confirmed that, compaction was beneficial in the early yrs establishment of samplings; while a dramatic decrease in regeneration of hardwood species occurred in later yrs after logging. So that 10 yrs after logging, seedling density by 60% lower in the HTI zones when compared to the control zones. Further investigation would be required to verify that these results also apply over the long term.

Key words: Timber harvesting, Recovery, Skid trail, Bulk density, Soil Moisture, Regeneration establishment, Iranian Forests

EFFECT OF LINEAR TRAFFIC OBJECTS ON WILD ANIMALS IN SERBIAN NATIONAL PARKS

Gačić. Dragan¹, Bjedov Vladan², Delić Jadranka³

dragan.gacic@sfb.rs

¹ Faculty of Forestry, University of Belgrade, Kneza Višeslava 1, Belgrade, Serbia

² Institute for Nature Conservation of Serbia, Dr Ivana Ribara 91, Belgrade, Serbia

³ Province Institute for Nature Conservation of Serbia, Radnička 20a, Novi Sad, Serbia

Abstract: Roads and other linear objects of traffic infrastructure can have multiple negative effects on individuals and populations of wild animals and their habitats. This problem has especially been rarely studied in national parks and other protected natural areas of Serbia inhabited by species which are under different regimes of protection (eg, brown bear, lynx, chamois, red deer). The aim of the paper is to register and analyze the current and potential effect of the linear traffic infrastructure objects on the population status of wild animals in the Serbian national parks. Besides the basic data on the traffic network in the territory of the Parks, the data on recorded losses are also presented. Moreover, the potential effects of those objects are commented on in broader spatial and legal context and measures are proposed for the prevention of negative effects.

Key words: roads, habitat, wild animals, National park, Serbia

APPLICATION OF MOLECULAR METHODS IN FORESTRY

Vladislav GALOVIĆ, Saša ORLOVIĆ, A. PILIPOVIĆ,

Bojana KLASNJA, S. STOJNIC

Institute of Lowland Forestry and Environment

Abstract: Identification of clones, cultivars and hybrids, gathering knowledge about their genetic relations is necessary for the introduction of effective selection, breeding, belonging to species, their protection and in the process of their registration and handling of planting and raising of reproductive and breeding materials. The main concerns faced by breeders in the forestry sector is to improve knowledge of the genetic constitution, the nature of the relationship and identification of gene pool that they possess. Genetic variation in the population is important for biodiversity, because without variability, it becomes difficult for the population to adapt to environmental changes and therefore be more prone to extinction. In order to determine the level and structure of genetic variability in populations of various lowland species we used various molecular, DNA techniques such as SSR, AFLP, RAPD, cpDNA PCR-RFLP. Investigating the genetic structure of poplar clones and hybrids, genetic variability in the existing gene pool was determined. Research work with beech provenances showed exact belonging to the species of the particular provenance under observation. Using those techniques *Melampsora* sp. types of pathogens were established in different clones of poplar and oak. Genetic divergence of weed species *Ambrosia artemisiifolia* has been established at different localities in Srem region of Vojvodina province. Determining the genetic variability due to molecular methods in forestry we can contribute identifying the genetic resources that we possess, facilitate and speed up the breeding processes. By establishing the existence of new types of pathogens or the level of variability and the direction of spreading of undesirable weed species helps adequate and forehand response in the system of protection of forest species. Using molecular methods for determining genetic variability it could be possible to influence the increase in forest tree species abundance by increasing the threshold of the adaptability of existing species and thus reduce or prevent their extinction.

Key words: poplar, beech, *Melampsora*, SSR, AFLP, RAPD, cpDNA PCR-RFLP

**THE EFFECT OF CONSTRUCTION AND OPERATION OF AN
ASPHALTED FOREST ROAD ON THE ENVIRONMENT**

Vasileios J. GIANNOULAS*, Vasileios C. DROSOS**,
Orestis Ath. GIOVANNOPOULOS**

* Faculty of Forestry and Natural Environment, Aristotle University of Thessaloniki,
PC 54124, BO 226
vgiannou@for.auth.gr

** Department of Forestry and Management of Environment and Natural
Resources, Democritus University of Thrace, Ath. Pantazidou 193 Str.,
PC 68200, N. Orestiada
vdrosos@fmenr.duth.gr, orestis_giannopoulos@yahoo.gr

Abstract: The concept of environment is a concept whose content varies. For Road Construction the environmental care covers air, noise, flora and fauna, landscape, ecosystems, land uses around the road, etc. The effects observed in the natural environment on soil, terrain, water, atmosphere, biosphere and the microclimate and can be positive and negative. The supporters of the view that environmentally friendly construction and rehabilitation measures are costly, have become aware that they are less costly to society in the long run. The road under study was the improved and upgraded forest road of Kassandras - Fourkas, in the Municipality of Kassandras with the total length of 3560m. The road is already constructed and it is flawed and problematic in many of its parts; a table was prepared which included all the possible consequences of improving the existing forest road, both at the stage of improvement, construction and during the phase of operation. We seek and provide documented explanations for the environmental impact of an improved forest road on soil, air, water, flora, fauna, noise, land use, natural resources, creating dangerous situations in population, housing, transport and traffic in general, energy and utilities, human health, aesthetics, recreation, cultural heritage and an end to the protected areas. The effects are mainly related to construction and partly to the operating phase of the work would not be significant but will contribute decisively to the improvement of the general protection of forests. It is a work that will not alter the landscape. Any temporary impacts can be minimized by implementing preventive and remedial measures.

Key words: forest road construction, criteria, GIS, absorption, intensity

**ANALYSIS OF LEGISLATIVE AND INSTITUTIONAL FRAMEWORK
OF THE RESTITUTION PROCESS IN FORESTRY OF SERBIA
AND THE COUNTRIES OF SOUTHEASTERN EUROPE**

Predrag GLAVONJIĆ, Dragan NONIĆ, Nenad RANKOVIĆ,
Vojislav MILIJIĆ, Dragan JANKOV
predragglavonic@yahoo.com
University of Belgrade, Faculty of Forestry

Abstract: The process of restitution is an important precondition for the development of modern and contemporary country. Restitution is the establishment of the previous state of the assets of a person, as it was before the act of confiscation, and refers primarily to the return of property in the form of subsistence. Without establishing a legal framework and implementation of process, it can not be talked about respect for human rights and rights to private property. Seizure of private property from its holder was conducted in Serbia in a systematic way, in the period since 1944. till 1948. year. The basis for the implementation of this process was a series of property laws, regulations and administrative measures. Big political and socio-economic changes in Serbia after 2000 had a great influence on the process of restitution of confiscated property in Serbia, which is in progress. Restitution is important in the field of forestry, because of a large area of forest and forest lands that were confiscated after World War II, as well as the significant influence of those areas on the ownership structure. The basic document that provides the legal framework in this area is the Law on restitution of property to churches and religious communities. According to this Law refund of the seized property to churches and religious communities, which caused formation of large forest owners' lands is made. New EU member countries adopted regulations related to restitution, which was one of the basic conditions for EU membership. In such a way they begun restitution process and in most of the countries the process is in the terminal phase. Unlike those, countries which are in the integration process have only started the restitution. The aim of this paper is to find a solution that can be applied in Serbia, especially in the field of forestry, through the analysis of legal and institutional framework related to the restitution process in the countries that have begun this process before or have already completed it.

Key words: restitution in forestry, private forest owners, legislative, institutional framework

**STATE AND SILVICULTURAL PROBLEMS IN UNEVEN-AGED FORESTS
OF BEECH, FIR AND SPRUCE IN THE REPUBLIC OF SRPSKA**

Govedar ZORAN, Milun KRSTIĆ

jbgovedar@blic.net

Faculty of Forestry Banja Luka, Republika Srpska, BiH

Abstract: The paper dealt with the situation and issue of growing of mixed forests of beech, fir and spruce. The structural changes of the element of development and productivity of the types of forests in 10 years were analyzed. For the analysis of the existing data SPO related to supply, growth rate, mixture ratio, the quality of trees, volume and data harvesting of natural renewal were used. The analysis was conducted in the context of the implementation of the group - selection management system and methods of natural regeneration in order to achieve normal (balanced) state. For the successful definition of silvicultural measures to achieve a balanced state of uneven-aged mixed forests of beech, fir and spruce required constant sample surface and monitor changes in the basic elements of structure in the long run.

Key words: uneven-aged forests, beech, fir, spruce

**RATIONALIZATION OF LAND COVER DETERMINATION
USING REMOTE SENSING**

Dragomir GRUJOVIĆ^{1*}, Milorad JANIĆ¹, Kristian ARTN², Branko MIŠIĆ¹

*grujovic@eunet.yu

¹ Forestry Faculty of Belgrade University

² Norsk Institut for skog

Abstract: 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 the National Forest Inventory project. For this exploration we have used LANDSAT 7 image for Vojvodina region, aero photographs, topographic maps scale 1: 25 000 and software ERDAS Imagine. In this case the VI and NDVI methods have shown better compatibility. Global change-challenges for all civilization. All of us have as a priority to think and to try to find the best answers on the way from degradation, through conservation to sustainable natural resources management. One of the basic issues, of course, is the issue of the land cover determination. The special aspect of that issue today is the aspect of modern and rational technology for monitoring and control of all of those so dynamic changes in the land cover. Remote sensing today presents one of the most up-to-date technologies, not even in the spaces of those questions about land cover determination. During the cooperation with the colleges from Norway, we are in the position to inform you about some results from our investigations which are especially dedicated to the forest land.

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

NATURE CONSERVATION AND NATIONAL PARKS IN TURKEY

Cantürk GÜMÜŞ, Gökhan ŞEN, Devlet TOKSOY,

Hüseyin AYZAZ*, Betül BAHAT*

canturk@ktu.edu.tr

Karadeniz Technical University, Faculty of Forestry, Department
of Forest Economics, 61800, Trabzon, Turkey

Abstract: Turkey is a transcontinental Eurasian country. As a country of transition between the continents of Europe, Asia and Africa, Turkey demonstrates great differences in the topographical aspect. Our country supports a very distinguished flora and fauna, including many endemic species, because of its location, and the diverse landscapes and climatic conditions found in the country. In 1958, Yozgat Camligi National Park was established as the Turkey's first National park. Since then their number has increased to 42. Some of these parks, which were initially established for archeological and historical purposes, are at the same time rich in different habitats where biological diversity is being protected. The majority of the National parks are found in forest lands and in terms of scenic beauty rich in flora, fauna, and areas of great historical importance, National parks are of great interest to visitors. In addition to National parks there are many other protected areas, which have been established to conserve, research, tourism etc. Rules and regulations for protected areas vary. Some types of protected areas were named 'strict nature reserve', 'Nature monument', 'nature parks', 'wildlife reserve' and 'Ramsar site'. Other protected areas vary in character and conservation objectives. The purpose of this paper is to present the current legal status of Turkey's National parks and protected areas.

Key words: National Parks, Protected Areas

**FOREST HARVESTING AND ECOLOGICAL ASPECTS IN
THE HYRCANIAN FORESTS OF IRAN**

Seyed Mohammad HOSSEINI, Alois SKPOUPY

S_hoseini99@hotmail.com

Ministry of Sciences, Research and Technology, Shahrak Gharb, Bolvar Hormozan,
Pirozane Jonobi, Vezarate Olom, Tahghigaht va Fannavari, Tabaghe 12, Tehran/ Iran

Abstract: The Hyrcanian Forests of Iran are located in the north of Iran, near the Caspian Sea. These forests cover 1.8 million hectares and are completely natural and broadleaved forests. As these forests are of uneven topography with steep terrain, harvesting operations have been with non-mechanized systems and timber products have mostly been squared timber, saw logs and fuel wood. Industrial Timber products like logs have been increased by nearly 100% when the mechanized logging systems developed in these forestlands, while squared timber and saw logs about reduced by 105% and 20%, respectively. In this paper, harvesting operations and ecological aspects in the Hyrcanian Forests of Iran during the last decade will be discussed.

Key words: Logging, Ecology, Sustainable and Hyrcanian Forests

**EX SITU CONSERVING, TESTING AND UTILIZATION OF GENE
POOL OF ENDEMIC-RELICTREE SPECIES IN SERBIA**

Vasilije ISAJEV¹, Milan MATARUGA², Vladan IVETIĆ¹, Aleksandar LUČIĆ³
dule78@hotmail.com

¹ Forestry Faculty of Belgrade University

² Faculty of Forestry Banja Luka, Republika Srpska, BiH

³ Institute of forestry of Belgrade

Abstract: One of the forms of conserving, testing and utilization of gene pool of endemic-relic tree species ex situ, as well as commercial exploitation, is the establishment of provenance tests and seedling seed orchards. In West Serbia, near Užice, Požega and Ivanjica, provenance test of Norway spruce and seedling seed orchards of Serbian spruce, Austrian pine and Balkan maple were established. There are several essential reasons for establishing provenance tests and seedling seed orchards of these species: development of production of genetically improved seed, using spontaneous and controlled hybridization, and enhancement and conservation of selected genotypes ex situ. The study results indicate that only a part of the variability is visible, and that the greater part of the variability is hidden thanks to various genetics mechanisms. Application of genetic-selection programs can lead to the production of planting stock of desired and defined properties, which could survive the stress environmental factors, thanks to its morphological and physiological properties.

Key words: gene pool, conservation, provenance test, seedling seed orchards, Norway spruce, Serbian spruce, Balkan maple, Austrian pine

**APPLIED BIOTECHNIQUES FOR IMPROVEMENT OF SOME SPECIES
OF THE GENUS *Pinus* L. AND *Picea* L. IN SERBIA**

Vasilije ISAJEV¹, Milan MATARUGA², K. KONSTATINOV³,
S. MLADENović-DRINIĆ³, Vladan IVETIĆ¹, Aleksandar LUČIĆ³
dule78@hotmail.com

¹ Forestry Faculty of Belgrade University

² Faculty of Forestry Banja Luka, Republika Srpska, BiH

³ Institute of forestry of Belgrade

Abstract: The general objective of a genetic improvement programme of forest trees should be the sustainable management of genetic variation in order to produce, identify and multiply well-adapted genotypes for operational planning. For industrial forestry species, the most common approach is recurrent selection in genetically diverse breeding populations. Genetic gains are most commonly captured in open-pollinated general combiner seed orchards, while a few advanced programmes feature deployment of superior full-sib families or clones. Various biotechniques, such as : molecular markers, somaclonal variation, genetic engineering, protoplast fusion, micropropagation and others, have a potential to genetically improve both industrial and non-industrial trees. The actual demand and applicability of these techniques to the various tree species differ greatly. Some of the derived results of applied biotechniques for improvement of some species of the genus *Pinus* L., and *Picea* L. in Serbia, are presented in this paper.

Key words: Biotechniques, improvement, *Pinus* L, *Picea* L

MODELING METHOD FOR SOIL DATA IN ALLUVIAL HYDROPHILIC FORESTS OF VOJVODINA FOR BASIC DATA BASE FORMATION IN GIS

Petar IVANIŠEVIĆ, Zoran GALIĆ, Saša PEKEČ,
Savo RONČEVIĆ, Siniša ANDRAŠEV, Nenad RADOSAVLJEVIĆ
perai@uns.ac.rs

Institute of Lowland Forestry and Environment, Antona Čehova 13, Serbia / Novi Sad

Abstract: Contemporary utilization of data upon the characteristics of the area, and characteristics of the soil within it, such as soils distribution, characteristics, way of utilization, demands the application of new technologies like Geoinformation System (GIS). In the work the process of abstraction and modeling is one of the most important factors in the formation of non-zonal soils in alluvial hydrophilic forests. In Vojvodina the factors of soil formation in these forests are numerous: fluvial sedimentation, wind sedimentation, relief, over moisturizing (Gleying, Pseudogleying, Swamp formation), humification, eluviation, salinization, alkalization and forms of floral communities that should be given in the digital form and defines the level of function. The modeling of these data in the digital form is examined in this work and described in three levels: the first - geometrical (position, shape and size), the second, topological (relations among hierarchical soil units, the relation among soil formation processes in soils and other attributes) and the third – thematic (hierarchy of objects and classes). The gained digital data could be used in formation of unique and flexible data basis, as the most important segment of GIS, for different aspects, concerning polyvalent functions of forest ecosystems as the renewable natural resources.

Key words: Soil, alluvial plain, alluvial hydrophilic forests, digital model, GIS

**THE INFLUENCE OF FLOODING AND DRAINING DURATION OF
PHYSIOLOGICALLY ACTIVE LAYER OF FLUVISOL SOIL ON
DYNAMICS OF GROWTH OF CLONE I-214 IN INUNDATION
OF THE RIVER DANUBE IN THE AREA
OF SOUTHERN BAČKA**

Petar IVANIŠEVIĆ, Zoran GALIĆ, Saša PEKEČ,
Savo RONČEVIĆ, Siniša ANDRAŠEV, Branislav KOVAČEVIĆ
perai@uns.ac.rs

Institute of Lowland Forestry and Environment, Antona Čehova 13, Serbia / Novi Sad

Abstract: The results of research of the influence of flooding and draining duration on the growth dynamics of euramerican poplar clone I-214. The examination is performed in 30-years old experimental plantations in inundation of river Danube in the area of southern Bačka. The plantations of clone I-214 are being established in unprotected as well as in protected parts of river inundations, on soils formed on alluvial deposits (most often on fluvisol soil type), on the habitats of black poplars (Section Aigeiros) within complex of alluvial hydrophilic forests. Opposite to protected parts of inundation, unprotected areas (Forland) are under regular and direct influence of hydrological regime of river, that is expressed as hydrological potential of habitat. The hydrological regime of river (water level) is in functional relation with the duration and frequency of flooding, i.e. drainage of physiologically active soil layer (the zone of poplar rhizosphere). The period of flooding (the complete saturation of soil with gravitational water) and the period of soil drainage (the drainage of gravitational water from non-capillary pores) down to the depth of root system expansion (the physiologically active layer) was defined as the wet part of growing period. The gained results suggest that the duration of wet period within the growing period is significantly related to the deviations of annual income wood volume from the general growth model for the clone I-214. The positive deviation from the general growth model for the clone I-214 appears when a half of the growing period is wet and maximum values are obtained when the wet period lasted for 112 days. The ratio between the duration of wet period and the duration of the growing period (183 days) is close to 1,612-1,618 (the golden ratio or lat. *Secio oreo*) gave maximal positive deviation of annual income from the general growth model for the clone I-214. Thus, results of this research suggest that productivity of the clone I-214 is significantly dependent on the dynamics of the rivers hydrological regime (hydrological potential of habitat), when the current hydrological conditions define the annual dynamics of growth and income.

Key words: Clone I-214, hydrological potential of a habitat, flooding and drainage duration of soil

**FLUSHING PHENOLOGY VARIATION OF THE EUROPEAN BEECH
(*Fagus sylvatica L.*) PROVENANCES FROM THE BALKAN REGION**

Mladen IVANKOVIĆ, Maja POPOVIĆ, Ida KATIČIĆ, Saša BOGDAN

mladeni@sumins.hr

Croatian Forestry Institute, Cvjetno naselje 41; HR-10450 Jastrebarsko

Abstract: Research on the amount, pattern and causes of genetic variation of European beech (*Fagus sylvatica L.*) is crucial for its genetic resources conservation as well as for breeding activities. Especially in the context of climate change, it is important to understand genetic variation of adaptive traits, such as flushing phenology. Several studies of various sets of European beech provenances have shown that traits connected with flushing phenology are highly heritable and important adaptive traits. Some authors reported clinal geographic variation regarding adaptive traits (Muhs 1985, Teissier du Cros et al. 1988, von Wuehlisch et al 1995), while others revealed ecotypic differentiation (Chmura and Rozkowski 2002, Jazbec et al. 2007). The aim of this study was to determine the amount and pattern of genetic variation in flushing phenology of the European beech (*Fagus sylvatica L.*) south-east European provenances, as well as to discuss its possible causes. The analyzed provenance trial was established in Croatia with thirteen beech provenances originating from south-eastern Europe. Flushing phenology was recorded in two successive years (in springs of 2008 and 2009) on 1-7 scale. The analysis of variance was conducted by the MIXED procedure in order to determine the significance of variance caused by provenances, replications and provenance by replication interaction. Differences between the studied provenances were analyzed by the Tukey-Kramer test. The CORR procedure was conducted to analyze relationships between flushing phases in successive years as well as between flushing and ecological variables of the provenance mother stands. Differences in flushing phenology between studied provenances were statistically highly significant. The provenances were identified as late, early as well as intermediate flushers. Tukey test of the provenance mean difference did not show clinal geographical pattern. However, the obtained results from the study support ecotypic pattern of differentiation as reported by some other authors. The ecotypic variation pattern also supports the previously reported higher level of genetic variability of beech populations from south-eastern Europe.

Key words: genetic variability, provenance trial, flushing, quantitative traits

**NATURAL RECOVERY OF SOIL CHEMICAL PROPERTIES FROM
TIMBER SKIDDING DAMAGE IN HYRCANIAN FORESTS
NORTH OF IRAN**

Abolfazl Jaafari^a, Akbar Najafi^a, Seyed Khalagh Mirnia^b
a.najafi@modares.ac.ir, najafi_akbar@yahoo.com

^a Tarbiat Modares University, Department of Forestry,
PO Box: 46417-76489, Noor, Mazandaran, Iran

^b Department of watershed management Engineering, Tarbiat modares University, Iran

Abstract: Compaction and soil disturbance can have a long-term detrimental impact on soil properties. There is paucity data on the time required for recovery of disturbed soil properties. The recovery of disturbed forest soils, in the absence of ameliorative treatment, is slow under the influence of climatic processes and the activity of roots and soil fauna. Persistence of soil disturbance and recovery of soil properties is likely to vary with traffic intensity, soil type, vegetation and climate. Soil chemical properties could be used as indicators to assess soil activity and health. Therefore, investigation on the time required for the recovery of altered soil chemical properties is necessary. The present study was conducted to evaluate recovery ratio of chemical properties (N, P, and K) of the degraded soil by timber skidding 10 years after logging operations in Hyrcanian forests, North of Iran. By field inspection, three levels of traffic intensity, inclusive, light traffic (LT), medium traffic (MT) and heavy traffic (HT) on a skid trail, left for ten years without any traffic, were identified. Soil information was collected in three replicates consequently, 36 plots with 10 m long by 4 m wide were applied in the study. Soil samples were taken up to 0-100 mm in each plot and undisturbed area. Results indicated the rate of recovery of N, P, and K depending on the degree of traffic intensity and soil disturbance. However, there was no significant difference among treatment and undisturbed area from the N and P point of view. But the amount of N concentration at LT, MT and HT was lower than the undisturbed area by 10%, 31.5% and 32.5%, respectively. In the case of P, the concentration at HT was merely lower than in the undisturbed area by 1.65%. K Shortage at the treatments of skid trail was observed in comparison with undisturbed area by 5%, 5.8% and 18.5% respectively, however significant difference was observed at HT compared to the undisturbed area. As a whole, this research revealed that ten years after skidding, degraded soil has not been completely recovered from disturbance by timber skidding and requires more time than ten years for complete recovery.

Key words: Timber skidding, Traffic intensity, Soil disturbance, Harvesting Impacts, Nutrition, Hyrcanian forests

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

Milorad JANIĆ^{1*}, Dragomir GRUJOVIĆ¹, Kristian ARNT², Branko MIŠIĆ¹

* mjanic@eunet.yu

¹ Forestry Faculty of Belgrade University

² Norsk Institut for skog

Abstract: In this text are presented the results of classification and interpretation of forest and forest land for the 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: 25,000. The accuracy of applied methodology is approximately 95 % which is acceptable not even for the National Forest Inventory. 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 boundaries. One of the most important projects for our country and the belonging resources was the Forest land inventory. During the realization of that project, in the same time Forestry Faculty started 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, at the right time we made a parallel link between those two activities. Now we are in the position to evocate a general way of our researches.

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

**MARKETING AND MANAGEMENT IN THE ROLE OF RENEWABLE
DEVELOPMENT OF FORESTRY AND WOOD CONVERSION**

Petronije JEVIĆ¹, Ljiljana S. MIHAJLOVIĆ²

¹ PhD in Management, The College of Applied Vocational Studies, Vranje, Serbia, pjevtic@verat.net

² PhD in Management, The College of Applied Vocational Studies, Vranje, Serbia, mihajlovicp@ptt.rs

Abstract: This paper systematizes postulates of managing forests, i.e. management in the forestry and wood conversion, as well as marketing in this field, while keeping in mind that marketing penetrates into each pore of the economical tissue of national and world economy. From this point of view, management and marketing in forestry and wood conversion are in the role of renewable economical development of economy. Specificity of management and marketing in forestry and wood conversion sector is generated from the general theory of management and marketing and simulated to our business reality. Explanation of above mentioned phenomena should contribute to the vision of possible ways of activities in the development of the sector.

Besides, the paper considers global strategic possibilities for development of forestry and wood conversion, their mutual conditioning, as well as the effect of biotechnical and social-economic rules on their development. Keeping in mind alternative strategies of development of forestry and wood conversion in the world and in our country, certain presumptions on synergy have been created, as well as on the contrasts that we should keep in our mind and which should be followed while determining development strategies of these branches in the future. Basic postulates on the role of marketing and management in renewable development of forestry and wood conversion refer to redefining the function of the forest, a forest as a source of resources, forest as an assimilator of waste and a forest as a direct source of economical benefits. The development strategy was presented in wood conversion, starting with the basic assumption connected with the shift in the strategy of so called comparative values into the strategy of competition advantages.

Key words: forestry, management and marketing in the forestry, renewable development, forest resources, renewable natural resources

CHARACTERISTICS OF BLACK SOIL ON JAVOR MOUNTAIN LIMESTONES IN THE REPUBLIC OF SRPSKA

Marijana KAPOVIĆ, Milan KNEŽEVIĆ
kapovicmarijana@yahoo.com
University of Banja Luka, Faculty of Forestry

Abstract: This paper explored characteristics of black soil on Javor mountain limestone, in the Republic of Srpska. These soils are generally very shallow and skeletal. Depth of A horizon ranges from 19-41 *cm*. They have a well defined and stable spherical structure. Its textural class is silty-clay loam, and loam as well. These are slightly acidic to neutral soils with a high degree of base saturation and total adsorption capacity. The following subtypes are represented: organic, organ – mineral and brown subtype. Small depth of black soils (especially of organic subtype) causes dryness and their ecological value mostly depends on climatic conditions in the research area. Dryness of black soil is moderated due to the mountain climate especially in areas where natural vegetation is preserved. Most often they come together with brown soil on limestone and with leached soil.

Key words: limestone, black soil, Javor mountain

THE OCCURRENCE OF PARASITIC AND SAPROPHYTIC FUNGI AFTER FOREST FIRES

Dragan KARADŽIĆ, Slobodan MILANOVIĆ,
Tanja MILIJAŠEVIĆ, Milan MILENKOVIĆ
Faculty of Forestry, Kneza Višeslava 1, Belgrade

Abstract: Fires are the greatest danger for forests, especially for coniferous species. In Serbia, the most endangered important tree species are Scots pine (*Pinus sylvestris*), Austrian pine (*Pinus nigra*), European larch (*Larix decidua*) and Spruce (*Picea abies*). Fire danger is especially great in plantations containing only one coniferous species. In Serbia, several dozens up to several hundreds forest fires break out each year and the entire burned area measured is several thousands of hectares. According to the Ministry of Agriculture, Forestry and Water Management, 258 forest fires and the entire burned area 33 229 ha were recorded in Serbia in the period January-September 2007. The entire damage was estimated to 40 million euros. The main aim of this paper was to research the influence of parasitic mycoflora on the further decay of trees on burned areas. In addition, the saprophytic fungi and the dynamics of their occurrence were also recorded. Two mutually remote areas were chosen for field trial. First area was in the plantations of Austrian pine on Stara Planina, on locations G.J. Nišava – Temska (burned area 64 ha, the fire was in the period July 19-22nd 2007) and G.J. Zavojski (burned area about 350 ha, the fire was in the period July 20-22nd 2007). The second area was in the National park “Durmitor”, where the fires occurred on several spots in the natural stands of Austrian pine in the period August 15th – September 5th 2007. The research period was two years. During the first year after the fire, fruiting bodies (mushrooms) of numerous species of fungi were recorded on the burned areas. In the majority of cases, they were mycorrhizal species. The entire number of recorded species was 21. During the second year after the fire (2007), it was recorded that the numerosness of fungi was significantly reduced (40 %, according to our estimations). Our data indicate that the growth of fungi was stimulated only in the first year. This is the case especially with the *Morchella* species. In addition, 16 species of parasitic fungi were recorded on half-dry trees or trees killed by fire. These species cause further decay of trees and they are permanent danger on reforested areas. The most important species in this group are: *Rhizina undulata*, *Cenangium ferruginosum*, *Sclerophoma pityophilla*, *Mycosphaerella pini*, *Sphaeropsis pini* and *Lophodermium* spp. *Antrocobia macrocystis* and *A. melanoma* were two fungi species which first occurred on the burned area, and they were recorded 30 days after the fire. These species grow on the ash. Fruiting bodies of *Schizophyllum commune* (cause of the white rot of sapwood) were frequently present on the bark of the killed trees.

Key words: forest fires, fungi, *Rhizina undulata*, *Mycosphaerella pini*, *Sphaeropsis pini*, *Antrocobia*, *Cenangium ferruginosum*, mushrooms

**INFLUENCE OF EXTREME HAIL ON EPIDEMIC OCCURRENCE OF
FUNGUS SPHAEROPSIS SAPINEA Dyco et Sutton IN PLANTATIONS
AUSTRIAN PINE IN THE VICINITY OF DOBRUN**

Dragan KARADŽIĆ, Tanja MILIJAŠEVIĆ,
Ljubodrag MIHAJLOVIĆ, Zoran STANIVUKOVIĆ
Faculty of Forestry, Kneza Višeslava 1, Belgrade

Abstract: *Sphaeropsis sapinea* is widely distributed in the Serbia. Many pine species are infected by this fungus; however major damage has occurred in plantings of Austrian and Scots pine. The fungus causing *Sphaeropsis* blight infects new shoots of pines. Commonly, the entire new shoot is killed. Older stem tissues also become infected, with the result that major branches are killed back to the main stem. Dying trees in plantings are very frequent on the trees between 20 and 30 years old. Pines in plantings less than 20 years old have been damaged, but usually when younger plantings were established near older pines. The fungus causing bud wilt, curling, stunting and necrosis of current year shoots and needles, dieback of top shoots, parts of crown or tree tops, branch and stem bark canker, root collar rot on the young plants in nurseries and their dying. This fungus also prevents seed germination of *Pinus* species and causes blue sap stain of the freshly cut wood, although sap stain was also observed on standing trees. This fungus also causing (several years after infections) trees dying pines in the parks, shelterbelts and wind-breaks. Diagnosis of *S. sapinea* blight is relatively easy. Symptoms of the disease are distinctive, and fruiting body location and appearance are such that confusion with other fungi is unlikely. After germinated of conidia, hyphae of the fungus break through a soft bark young shoots. The critical period for infection is from the middle of April till the beginning of May (sometimes to the middle of May). The incubation period is very short, only 3 weeks. The first visible symptoms of infection are appearance droplets of resin on infected new shoots before the needles have broken through fascicle sheaths. A close examination of such shoots usually reveals that one or a few needles are shorter and darker in color than the rest. The fungus rapidly invades and kills all needles and tissues of new shoots. Commonly, this will occur after the needles have broken through fascicle sheaths but well before needles have reached full size. Because new shoots can be killed by other agents, the best field evidence comes from observation of fruiting bodies of the fungus. The dark fruiting bodies (pycnidia) erupt through the epidermis. They usually are numerous at the base of needles and are particularly numerous on the section of the needle covered by the fascicle sheath. The time of appearance of erumpent fruiting bodies on new shoots varies considerably. Fruiting bodies are rarely found on newly infected needles before late summer or early fall. The pycnidia are formed also in the bark, on the second-year seed cones (sometimes on the cones in the first year of development), on male and female flowers. The pycnidia on cones are an abundant source of inoculum for infection of new shoots. Damage to older pines is attributed to the fungus first infecting second-year

Topic A - Forestry

seed cones, then spores from pycnidia on the seed cones infecting new shoots. Several years observations have revealed that second-year seed cones may be infected before new shoots are significantly infected. Although they are most infections from the middle of April till the beginning of May, observations in Austrian pine plantings in the vicinity of Dobrun demonstrated that infections are possible during all summer and fall if bark of shoots and branches have been damaged. In such a way, very strong hail (which happened on 8.07.2008.y.) damaged bark pines trees. Wounds caused by hail become infected and thus wounds would make the older tissues vulnerable to infection. The same year in November most trees in plantings of Austrian pine were killed.

Key words: Sphaeropsis sapinea, hail, epidemic, Austrian pine, plantings

**INVESTIGATING OF THE EFFICIENCY OF ROUNDUP, BASAGRAN,
AND GRAMAXON HERBICIDES ON ARCEUTHOBIVM OXYCEDRI
IN JUNIPER FOREST IN CHAHARBAGH (GORGAN)**

M.R. KAVOSI¹, F. FARIDI²

kavosi.reza@gmail.com , kavosi_66@yahoo.com

¹ Assistant prof., of Dept. forestry Univ of Agricultural sciences and Natural Resources, Gorgan, Iran

² M. Sc student Univ of Agricultural sciences and Natural Resources, Gorgan, Iran

Abstract: Epiphytes are vegetables that live on the branch and stems of other plants. Dwarf mistletoes (*Arceuthobium oxycedri*) is important macroepiphytes that can cause intensive damages to *Juniperus polycarpus* and provide conditions for the attack of pathogens, pests, rodents, and undesirable climate condition. In the study three herbicides including: Roundup, Basagran, and Gramaxon at three densities and repetitions were used for the evaluation of their effects on *A. oxycedri* in Juniper Forest)Chaharbagh. According to results, the Basagran herbicide desiccated 95.55 percent of *A. oxycedri*. The Roundup herbicide was less effective (61.67%) on Dwarf mistletoes than the Basagran herbicide. The Gramaxon herbicide least desiccated percentage on Dwarf mistletoes (23.89%). Results show that there was significant difference between the type of herbicides ($\alpha < 0.01$). As a concluding remark, the third density has most effective in desiccate on Dwarf mistletoes but was not significant with the second densities. Therefore, the second density of Basagran herbicide, for the reduction of casts, can be utilized for the control of Dwarf mistletoes.

Key words: *Arceuthobium oxycedri*, Juniper, Roundup, Basagran, Gramaxon, Chaharbagh

ANTIOXIDANT SCREENING OF SOME LIGNICOLOUS FUNGI

M. KEBERT, M. KARAMAN, S. ORLOVIĆ, S. STOJNIĆ, B. KLASNJA

kebertm@uns.ac.rs, markokebert@yahoo.com

Institute of lowland forestry and environment,

Antona Cehova 13 , 21000 Novi Sad, Serbia

Abstract: Lignin as an organic, aromatic, hydrophobic, heterogenic biopolymer constitutes a quarter to a third of the dry mass of wood and plays a significant role in the carbon cycle of ecosystems. Lignin presents one of the most slowly decomposing components of dead vegetation and it is indigestible by animal enzymes. Only some fungi which secrete the lignolytic enzymes such as lignin peroxidase, manganese and cellobiose dehydrogenase etc., are able to decompose the polymer. The process of decomposition is simultaneously followed by propagation of free radicals. In order to protect themselves from oxidative stress, these fungi developed strong antioxidant system during the evolution. The aim of this study is to investigate antioxidant activity of extracts made from different lignicolous fungi species such as *Meripilus giganteus*, *Agrocyba aegerita*, *Xylaria polymorpha* and *Fomes fomentarius* using different in vitro tests. These spectrophotometric tests included tracking of radical scavenger capacity as a capability to neutralize DPPH (2,2-diphenyl-1-picrylhydrazyl radical) and hydroxyl radical and investigation of ferric reducing ability of extract (FRAP test) as well. Methanolic extract of *Fomes fomentarius* showed the best DPPH and FRAP activity while water extract of *Meripilus giganteus* has shown as the best OH. scavenger with a 50% effective concentration similar to one that some synthetic antioxidant (BHT, BHA and PG) showed.

Key words: Lignicolous fungi, antioxidant, free radicals, flavonoides

TREE RISK ASSESSMENTS IN THREE DIMENSIONS

Géza Kelemen

kelemen.geza@aeszh.hu

University of West Hungary, Institute of Silviculture and Forest,
Bajcsy Zs. u. 4., Hungary / Sopron

Abstract: Nowadays the urban people establish an intense claim to the healthy environment and the well maintained parks and trees. There is a big challenge for urban foresters to keep huge and old trees, and to take care about them. The management decisions of urban forestry and trees demand patent knowledge in plant biology, and forest protection. However, there is a lot of technical support, which gives us operative help. The following researchers must be mentioned by all means: SHIGO, 1977, DUJESIEFKEN for biological tree examination, or WESSOLLY, 1998, SINN, 2004 MATTHECK and BRELOER, 1994, RINN, 2004, who have Europe-wide reputation in the area of technical side of tree assessment, and last but not least FERENC DIVÓS (2005), who developed different appliances for tree workers. This poster shows the three dimensional results and their interesting conclusions of the use of the Fakopp 3D acoustic tomograph with 10 channels and at different levels of the stem. This appliance is able to use the non-destructive detection of the dimension and location of decayed or hollowed parts in the tree stem. Thereinafter are exposed some case studies, whose results are highly practice-oriented, and extraordinary. Bibliography-Divos, F.; Denes, L.; Iniguez, G. (2005): Effect of cross-sectional change of a board specimen on stress wave velocity determination, *Holzforschung*, 2005 Vol. 59, no.: 2.-<http://www.fakopp.com>-Mattheck, C., Breloer, H. (1994): *Handbuch der Schadenkunde von Bäumen*. Rombach Verlag, Freiburg im Breisgau-Rinn, F. (2004): *Statische Hinweise im Schall-Tomogramm von Bäumen*, *Stadt und Grün* 7/2004, 41-45.-Shigo, A. L. (1977): *Tree decay*. Agriculture Information, Bulletin Number 419., 4/1979, Department of Agriculture, Forest Service-Wessolly L., Erb, M. (1998): *Handbuch der Baumstatik und Baumkontrolle*. Patzer Verlag, Berlin

Key words: tree assessment, tree examination, tree tomography, decay, trunk, urban forestry, hollow

**SOILS IN HYGROPHILOUS FORESTS OF NARROW-LEAVED ASH
IN RAVNI SREM**

Milan KNEŽEVIĆ, Olivera KOŠANIN

olivera.kosanin@sfb.rs

Faculty of Forestry, University of Belgrade

Abstract: Monodominant forests of narrow-leaved ash in lowland Srem occur on hydromorphic soils that have been permanently flooded by underground water over a long period of time. According to the soil classification by Škorić *et al.* (1985), these soils belong to gley soils, with morphological profiles A-GsO-Gr and A-A/Gso-Gr. The humus accumulation horizon is affected by ground water from autumn to late spring. Gso horizon is a zone of frequent fluctuations of groundwater levels and Gr horizon presents a zone of permanent stagnation of ground water. Based on the thickness of A horizon and the depth of permanent groundwater stagnation, two types of soils can be defined: eugley and humogley. Eugley soils are the wettest sites of narrow-leaved ash monodominant forests. Humogleys are also very wet sites, with long periods of flooding.

Forests of narrow-leaved ash in the lowland Ravni Srem occur on two forms of hypogleyic subtype of eugley: calcareous and noncalcareous. The hydrological regime and groundwater dynamics are important factors of eugley ecological conditions and productivity. Humogleys have greater physiological depth of the profile and they are characterised by greater productivity.

Key words: soils, narrowed-leaved ash, Ravni Srem.

NATURE CONSERVATION MEASURES IN SLOVENIAN FORESTS

Tadej KOGOVŠEK, Gregor DANEV, Darij KRAJČIČ

tadej.kogovsek@zrsvn.si

Institute of the Republic of Slovenia for Nature Conservation

Abstract: The authors present the Slovenian experience in the field of biodiversity conservation in forest area. The long tradition of sustainable management of forests and consequently preserved forests are the reason why more than 50% of the forest areas are included in the European Natura 2000 ecological network. Changes in legislation in the forestry sector took place as a result of the implementation of the European Union directives in the Slovenian legislation. New tasks require changes in forest management planning and participating institutions, covering the areas of forestry and nature conservation. Incorporation of Natura 2000 management in forest management plans is analysed and results of two forestry unit management plan cases (Gotenica, Smrečno) are presented. The selected units are part of two major forest complexes, which are included in the Natura 2000 network (Kočevsko, Pohorje), unit Smrečno is also a part of the NATREG project pilot site. The basis for evaluation of changes in operational planning is the analysis of old and current forestry unit management plans, which include measures to provide for a favourable conservation status of species and natural habitats. In addition, this corresponds to the conservation objectives programmed in the Natura 2000 areas management programme. Measures for accomplishing these objectives require adaptive management and thus set limits for forest owners.

Key words: biodiversity, Natura 2000 management, protection measures, nature conservation guidelines, NATREG project, Slovene forestry

**A SUGGESTED DEVELOPMENT MODEL FOR THE
GREEK FOREST SECTOR POLICY
AND ECONOMICAL MEASURES**

Panagiotis KOULELIS

pkuleli@ath.forthnet.gr

Technical Institution of Kavala, Department of Forestry and Natural Environment Management, Drama ; A. Papandreou 14, Asvestohori, Greece/Thessaloniki

Abstract: There have been a lot of discussions in Greece over the last years regarding forest policy and economy issues. The main question remains about the sufficiency of the existing forestry strategies and the economical support applied in the Greek forest sector. On the other hand, difficult bureaucratic problems must be resolved rapidly with new policies and legislation based on tested approaches. A theoretical model with future view that could be applied and used by the policy and decision makers is suggested in this study. Also the economical support from the government is analyzed and reevaluation and measures are proposed whenever needed.

Key words: forest economics, forest policy, theoretical model, Greek forest sector

**ROOTING CHARACTERISTICS OF ONE-YEAR OLD BLACK
POPLAR (*Aigeiros Duby*) PLANTING MATERIAL TYPES**

Branislav KOVAČEVIĆ, Sasa ORLOVIĆ, Marina KATANIĆ,
Savo RONČEVIĆ, Ivanišević PETAR, Saša PEKEČ
branek@uns.ac.rs

Institute of Lowland Forestry and Environment, Antona Čehova 13,
21000 Novi Sad, Serbia, Tel/fax: +38121540835

Abstract: Considering the importance of successful rooting of planting material for the establishment of black poplar (section *Aigeiros Duby*) plantations, it is important to evaluate the significance of factors that affect rooting of planting material. In this work two types of one-year old planting material (1/1, plants with shoot and old cutting and 1/0 plants without the old cutting), for three promising black poplar genotypes (182/81, B-229 and B-81, selected in Institute for lowland forestry and environment, Novi Sad, Serbia), were examined. The experiment was established in mid April 2008, on sandy fluvisol in three replicates with no irrigation applied. At the end of the growing season vital plants were dug out and following characters were examined: number of first-order roots (TRN), sum of cross-section areas of first-order roots near the root base (CSA) and shoot height increment during the growing season (SHI). The data was analyzed by two-way ANOVA with the plant stem height of the plant before planting as covariate. According to analysis of covariance the differences among the examined clones was significant for all examined characters and their effect (assessed by partial eta-squared) dominated over the effect of plant type. The main effect of planting material type was not significant but the effect of interaction clone x plant type for number of first-order roots was. Clone B-229 did not show significantly more roots on 1/0 type of planting material, opposite to 182/81 and B-81. LSD-test also registered differences in the reaction of examined clones. Sum of cross-section area and height increment was significantly higher in 1/1 type of planting material only for 182/81 and B-229. Similarities in the results of the sum of cross-section area and height increment suggest the possibility of evaluation of root system development by height increment during growing season after plantation establishment. These results could be implemented in breeding and design of cultivar-adjusted plantation establishment technology, but research should be continued concerning early rooting and survival of planting material.

Key words: Black poplars, planting material, rooting, plantation establishment, cultivar technology

**THE EFFECT OF GENOTYPE AND DATE OF PREPARATION
ON THE ROOTING OF WHITE POPLAR CUTTINGS**

Branislav KOVAČEVIĆ, Saša ORLOVIĆ, Saša PEKEČ,

Marina KATANIĆ, Srđan STOJNIĆ

branek@uns.ac.rs

Institute of Lowland Forestry and Environment, Antona Čehova 13,

21000 Novi Sad, Serbia, Tel/fax: +38121540835,

Abstract: The cutting rooting is one of the key moments in the nursery production of white poplars. The effect of the date of the cutting preparation, genotype and their interaction are examined for four clones of white poplar (*Populus alba* cl. BT, Villafranca, L-12 and L-80). Cuttings were prepared in two terms: 18th February and 15th March 2010 and kept in a cool chamber at 4°C until the planting (30th April). After 38 days (7th June) the following morphological characteristics were analyzed: the height of dominant shoot [cm] (SH), number of leaves (LN), number of roots on the basal cut (RN0), number of roots from the basal cut to the 5th cm of cutting (RN05), number of roots on the first five cm (RN5), number of roots from the 5th to 10th cm of cutting (RN510), number of roots above the 10th cm from the cutting (RN1020) and total number of roots (TRN). Beside those, the contribution of number of roots on the examined parts of cutting to the total number of roots was also examined (RN0P, RN05P, RN5P, RN510P, RN1020P). According to the results, the main effect of the date of cutting preparation was clear through higher formation of wound roots on the basal cut (RN0) after the second date and higher contribution of roots at the middle part (RN510) and lower at the basal part of cutting (RN5) prepared in the second examined date. Differences among genotypes (mostly BT and L-80) were also found in their reaction to the dates of cutting preparation by characters that describe rooting at the upper part of cutting (RN1020 and RN1020P). The implications of the gained results to further research of white poplar vegetative propagation are discussed.

Key words: *Populus alba*, cultivar technology, rooted cuttings

THE STUDY OF STAND STATE AND THE PROPOSAL OF RECLAMATION OPERATIONS IN THE FORESTS OF HUNGARIAN OAK AND TURKEY OAK IN THE TERRITORY OF LIPOVICA – BELGRADE

Marina VUKIN, Ivan BJELANOVIĆ
ivan.bjelanovic@sfb.rs
University of Belgrade - Faculty of Forestry

Abstract: Forest complex in the territory of Lipovica – FE Beograd belongs to special-purpose forests within the suburban zone of the city of Belgrade, with the characteristics of a protective reclamation forest and especially significant forest. A large part of these areas is covered by the complex of xerothermophilic forests of Hungarian oak and Turkey oak and other types of forests and its area amounts to 1,273.84 *ha*. Forests of Hungarian oak and Turkey oak in the territory of Belgrade within the oak belt are characterized by a very high percentage of stands of coppice origin (about 90%), with various stages of degradation, even-aged structure (about 65-70 years old) and unfavourable composition of tree species. The paper presents the results of the study of ecological conditions, stand state, the development of individual trees and the selection of optimum silvicultural operations in the coppice stand of Hungarian oak and Turkey oak in the territory of FMU Lipovica, FE Beograd. The age of the stand is 65–70 years. The stand is typologically defined as: Typical forest of Hungarian oak and Turkey oak (*Quercetum farnetto-cerris aculeatetosum*) on lessivé brown forest soil. A total of 8 experimental areas were established, in two series, with 4 sample plots each, in two different stand situations regarding the ratio of edifiers in the mixture (in the first one, the dominant species is Hungarian oak; in the second one the prevailing species is Turkey oak). The total average number of trees ranges from 515 to 740 per hectare and from 51.5% to 60.1% of Hungarian oak in the mixture and the percentage of Turkey oak ranges from 13.5% to 40.8%. Wood volume ranges from 258.1 to 277.9 $m^3 \cdot ha^{-1}$, the percentage of Hungarian oak from 42.2% to 73.2%, and the percentage of Turkey oak ranges from 25.2% to 56.9%. The performed analysis of dominant trees revealed that the onset of the culmination of the current height and diameter increment of both tree species occurs at the same time, from the age of 5 - 15 years. That indicates the time for the beginning of carrying out of thinnings as a tending measure, which should be started immediately after the culmination of the current diameter and height increment i.e. around the age of 20 years. The optimum silvicultural and reclamation measure proposed is mixed selective thinning with a moderate degree of thinning. The priorities in forest management are: prolonged conversion phase, the enhancement of the percentage of Hungarian oak and other valuable broadleaves in the mixture and provision of all-aged structure in the future stand. This will provide the basic functions of the investigated stands as special-purpose forests.

Key words: Hungarian oak, Turkey oak, special purpose forests, reclamation, stand state

**THE NEGATIVE IMPACTS OF TOURISM ON
FORESTS: THE CASE OF TURKEY**

Yalçın KUVAN

ykuvan@istanbul.edu.tr

Istanbul University, Faculty of Forestry, İ.Ü.Orman Fakül-
tesi Bahçeköy/Sarıyer Turkey/İstanbul

Abstract: The growth of mass tourism has led to a wide range of environmental and socio-cultural problems throughout the world. The central feature of mass tourism is the use and conversion of large natural lands to built tourism-related facilities. Worldwide, forests and coastal zones are the principal resources used for the construction of tourist facilities. On the one hand, forests constitute tourism's natural capital and raw material; on the other hand, they suffer the impacts of individual activities or facility development associated with tourism. Deforestation is one of the most important global environmental consequences of mass tourism development. Similar to many parts of the world, mass tourism activity is heightening pressure on forests and other natural areas in Turkey. Monitoring and eliminating the negative environmental impacts of tourism is crucial for the protection and continuity of forest resources. First of all, the formulation and implementation of nature protection-oriented policy objectives should be essential for all relations between the natural environment and tourism. This study examines the impacts of mass tourism development on forests and focuses on deforestation and forest fragmentation as the most critical impacts with specific reference to Turkey.

Key words: Forest and tourism, tourism's environmental impacts, deforestation, mass tourism, Turkey

**ECOLOGICAL ADAPTABILITY OF DOUGLAS - FIR PROVENANCES
IN SERBIA**

Vera LAVADINOVIĆ¹, Vasilije ISAJEV², Zoran MILETIĆ¹
veralava@eunet.rs

¹ Institute of Forestry Belgrade, Serbia

² Faculty of Forestry Belgrade, Serbia

Abstract: Douglas-fir (*Pseudotsuga menziesii* Mirb/Franco) is a North American native conifer widely distributed in lowland and high forests throughout the country from the sea level to 150 m (Pacific coast) in the North and up to 3,000 m (The Rocky Mountains) in the South. Genetic and ecological diversity of Douglas-fir results from its wide natural range of species distribution and, as a result, it is the most popular introduced tree species in Europe. Transferring indigenous seeds imported from the natural site is aimed at improving the forestry conditions in the country to which they will be introduced. For the selection of genetic material with species of wide natural distribution it is necessary to set up a provenance test. The model and capacity of the provenance test is one of the best preconditions for the selection of the productivity of the introduced species. The most important condition which the introduced species must meet is to be effective in the economic sense. Since the introduction of species to the new sites poses success and adaptability challenges, The Institute of Forestry set up the provenance test in Serbia. The test included Douglas-fir seed from a part of its natural area in North America. The paper presents results of several previous years of testing of Douglas-fir studied in order to evaluate the adaptation and productivity of species.

Key words: Douglas-fir, provenances, introduction, ecological adaptability, Serbia

**THE USAGE OF CAPTURE-MARK-RECAPTURE/RESIGHT
METHODS IN ESTIMATING POPULATION ABUNDANCE**

Vukan LAVADINOVIĆ
vukanlavadinovic@yahoo.com
Faculty of forestry, University of Belgrade

Abstract: The estimation of population abundance is crucial for proper wildlife management. Therefore, wildlife managers are focused on searching for the most suitable practice, which would be precise, economically justified and easy to carry out. Variety of direct and indirect methods have been developed, of which Capture-Mark-Recapture and Capture-Mark-Resight techniques became quite common in estimation of populations' number. These methods are popular due to their accuracy and feasibility. However, recent increase of Capture-Mark-Recapture/Resight methods resulted in numerous statistical models whose robustness varies a lot. Therefore, wildlife managers are facing the challenge of how to choose the right model for their study. Except for choosing the right model, it is also crucial to analyze data using a proper software. Otherwise, non logical trend line of population growth rate or wrong estimation of population abundance could be expected. This paper gives the review of the most common methods in use, software and models for the estimation of population abundance.

Key words: population abundance, Capture-Mark-recapture, Capture-Mark-resight, statistical models

**MYCORRHIZATION OF CONTAINERIZED PINUS NIGRA SEED-
LINGS WITH AUTOCHTHONOUS PISOLITHUS ARRHIZUS**

Jelena LAZAREVIĆ

ena.lazarevic@gmail.com

Biotehnički fakultet, Podgorica

Abstract: Containerized *Pinus nigra* Arnold seedlings are commonly used for reforestation in Serbia and Montenegro as well. There is an increasing knowledge of importance of mycorrhization in nursery production, but controlled mycorrhizal inoculation of seedlings is not a common practice in Montenegrin and Serbian nurseries.

Experiences in using *Pisolithus arrhizus* (Scop.) Rauschert in coniferous mycorrhization are excellent all over the world. Regarding the mycorrhization of seedlings, *P. nigra* is a poorly investigated species. It is important to select compatible fungal-host species combinations, the most suitable inoculation method and the optimization of its application for nursery inoculation. It is also necessary to examine the characteristics of fungi and isolates from autochthonous and geographically close populations of ectomycorrhizal fungi, as a source of inoculums adapted to the environmental conditions of transplantation site, and those which could be easily used.

We have tested spores and mycelial inoculums of *P. arrhizus* collected in Podgorica, MNE for their effectiveness with containerized *P. nigra* seedlings. Inoculations have been done at several, relatively high, application rates, 106, 107 and 108 spore per plants as spore inoculums, and 1:4, 1:8 and 1:16 (vol of inoculums: vol of substrate) as mycelial inoculums. Eleven months after sowing, all investigated treatments have shown effects. All seedlings became mycorrhizal. The percentage of mycorrhizal short roots (according to Hartig-net presence) has also been high and about 100% in all treatments. The differences have been detected according to overall ectomycorrhiza development, especially in the type of ramification and development of mantle. Differences in growth due to inoculation have not been detected.

**FOREST ENGINEERING IN IRAN: BACKGROUND, EDUCATION
AND LOOKING TEN YEARS FORWARD**

Majid LOTFALIAN, Nastaran ZARE

nastaran.zare@gmail.com

Sari Agricultural and Natural Resources University

Abstract: The objective of this paper is background of forest harvesting, development and prediction of forest engineering and forest engineering education in Iran. Techniques in forest engineering must not be transferred directly from developed countries. They must match the existing social, economic, and physical conditions. In Iranian temperate Forests, the importance of forests in supplying non-wood forest products such as water and soil protection, climate adjustment, ecotourism and wildlife is more than others and need to be considered when decisions are made about forest engineering activities, such as road construction and forest harvesting. Forest operations, as an important part of integrated forestry, should be planned from the point of view of sustainability of both timber and non-timber forest products. It is evident that a concerted effort is needed to encourage forest development programs that harmonize interests in conserving forests as well as to wisely use the potential of the forest while maintaining its full regeneration capacity. All forest engineering activities, such as forest resource surveying and harvesting planning, forest road planning and construction, harvesting, post-harvesting site disposal, planting and protection and so on should serve the key purpose of sustainable forestry. In view of the forest quality decline in Iran, it is essential that forest engineering practices are carried out in a manner to guarantee the sustainability of the forest resources base.

Key words: Forest engineering, development, Iran, looking forward

**ASSESSMENT OF PROGRESS TOWARDS SUSTAINABLE FOREST
MANAGEMENT IN CROATIA THROUGH USAGE OF QUANTITA-
TIVE IMPROVED PAN-EUROPEAN CRITERIA AND INDICATORS**

Marko LOVRIC, Ivan MARTINIĆ, Nataša LOVRIC,
Matija LANDEKIĆ, Mario ŠPORČIĆ
mlovric@sumfak.hr
Faculty of Forestry, University of Zagreb, Croatia

Abstract: The paper analyzes the transition of forestry in Croatia from 1995 up to the situation in 2006. The comparison between these two situations is made through quantitative Improved Pan-European Criteria and Indicators for SFM. The paper also tests the applicability of the framework on a national reporting scale, and comments on the format of the framework itself. According to this framework, the forestry in Croatia has made a progress in 15 out of a total of 35 indicators while no indicator showed a negative trend, 8 showed no significant change and 12 could not be calculated. The main impediment to the calculation of the indicators was the format of the requested information, notably division of total forest area to forests and other wooded land, and division of total forest land according to availability for wood supply.

Key words: MCPFE's criteria and indicators, sustainable forest management, national reporting

**ASSOCIATIONS OF PRIVATE FOREST OWNERS AS A
TOOL FOR SUSTAINABLE DEVELOPMENT OF FOR-
ESTRY – A CASE STUDY OF THE R. MACEDONIA**

Nataša LOVRIC, Marko LOVRIC

natasa.lovric@efi.int

European Forestry Institute – Regional office for SEE

Abstract: This paper describes the state of private forests and provides to owners of private forests an insight into R. Macedonia, as well as the attitudes of the most important actors in the forestry sector, which is connected to the process of organizing of the private forest owners. It also analyzes the possibilities of future private forest management regimes. There are 65,000 households that are owners of private forests in R. Macedonia. Private forests hold about 10% of the share of total forests area. The average size of one forest parcel under private ownership is about 0.4 *ha*, and there are about 220.000 parcels that are owned by private forest owners in the Republic. The private sector in the Macedonian forestry has not been analyzed precisely enough. The results of the research give answers to questions regarding silvicultural, sociological, economical and institutional aspects. It also tackles the issue of defining the primal concerns of different types of association of private forest owners, whose foundation is predefined by different types of interest of the private forest owners groups that they represent. The analysis reveals three different groups of private forest owners, whose potential associations require different approaches regarding membership obligations. In order to enhance the sustainability of private forest management it is necessary to empower the associations of their owners, who expect that these associations will support their activities regarding management of their forests, but also to lobby for their inclusion in forest policy processes. It is also important to define the attitudes of the decision makers regarding their enrolment in raising awareness about the issues of private forest owners, who mostly look for unlimited and free usage of their own forests.

Key words: private forests, membership obligations, sustainable development, private forest owners' associations.

**FOREST UTILIZATION, HUNTING AND PROTECTION
OF HUNTING FAUNA**

Richard LUKWETE BISHA, Coordonator
joyrichardlukwete@yahoo.fr; ong_tcc.congo@yahoo.fr;
TCC NGO RDC (TOUS CONTRE LE CHANGEMENT CLIMA-
TIQUE), 1, MAYALA STREET, BINZA OZONE, NGALIEMA,
DEMOCRATIC REPUBLIC OF CONGO/ KINSHASA

Abstract: Global warming is a cause of major changes in many ecosystems. These changes include changes in latitude and altitude in the geographical distribution of species, changes in seasonal life history events, and changes in food availability and food web structure. The evolutions of ecosystems also have the ability to strongly influence the well-being of man. For example, the distribution and ecology of several species of pests and diseases of great importance to human health and animal agriculture, fisheries and forestry, are strongly influenced by climatic factors. An important question is whether evolutionary processes have the potential to significantly influence patterns and rates of species responses to climate change. The complexity of genetic information, physiological, behavioural and ecological necessary to answer these questions is extensive, requiring an interdisciplinary approach. The purpose of our presence in this conference and to propose future actions to achieve a lasting solution that will help our biodiversity is now threatened by erosion „climate change>>. We also talk about our country: the Democratic Republic of Congo is the second lung of the world after the Amazon in its forest, wildlife; these forests are now in May and leave never undergo an interview for its effective protection. Here in a few words of our contribution to the success of the international conference. The protection of forests has always been at the heart of the mission of TCC. Now it is more important than ever. The burning and clearing of tropical forests accounts for about 20 percent of global emissions of greenhouse gases and climate change fuels. Human activity is the main cause of deforestation, usually tied to economic development, increases the rate of consumption - in developed and developing countries - and extractive industries such as logging. Thus also discuss more in the Congo Basin finally promote good expectation of innovative approaches in the financing of transboundary protected areas.

Keywords: Forest protection

DISTRIBUTION, ECOLOGY AND HOST RANGE OF ARMILLARIA SPECIES IN ALBANIA

B. M. Lushaj^{1,5}, S. Woodward², N. Keča³ and M. Intini⁴
bmlushaj@hotmail.com

¹ Institute of Energy, Water and Environment, Road of “Durrës”, P.O. Box 219, Tirana, Albania.;

² University of Aberdeen, Institute of Biological and Environmental Sciences, Department of Plant and Soil Sciences, Scotland, UK;

³ Faculty of Forestry, University of Belgrade, Department of Forestry, Serbia;

⁴ Istituto per la Patologia degli Alberi Forestali del Consiglio Nazionale delle Ricerche, Italia;

Abstract: Species of *Armillaria* were identified from 645 isolates obtained in a nationwide survey in Albania. The material was collected from ca. 250 permanent plots, established for monitoring forest health, and from forests and orchards attacked by *Armillaria*. *A. mellea* s.s. occurred on several coniferous and broadleaved trees in most areas examined, although it was absent above 1100-1200m in northern Albania. This species damaged *Abies* and *Quercus* spp. and, to a lesser extent, other forest trees. *A. mellea* was also commonly recorded causing damage in orchards and vineyards. *A. gallica* was a common saprophyte or weak pathogen in coniferous and deciduous forests at altitudes from 600 to 1600m, and less commonly on oaks at lower altitudes. *A. ostoyae* was rare in central and southern Albania, but common in northern Albania, causing significant damage to pine and other conifers, mostly at altitudes from 600 to 1800m. *A. cepistipes* was recorded at altitudes from 800 to 1800m as a saprophyte or weak pathogen on conifers and deciduous trees, mostly in beech and silver fir forests. *A. tabescens* was found in oak forests at altitudes from sea level to 900m. In orchards, *A. tabescens* occasionally attacked almond and pear trees. *A. borealis* was found in a few locations in northern Albania, at altitudes from 800 to 1800m.

Key words: Agaricales, *Armillaria mellea*, *A. gallica*, *A. tabescens*, *A. ostoyae*, *A. cepistipes*, compatibility test, host preference.

FOREST ROAD NETWORK LAYING USING GIS THROUGH THE IMPLEMENTATION OF THE MULTI-CRITERION EVALUATION MODEL IN THE FOREST MANAGEMENT UNIT “KOZARA-MLJEČANICA”

Darko LJUBOJEVIĆ, Milorad DANILOVIĆ
University of Belgrade, Faculty of Forestry

Abstract: Forest opening issue and strategic planning of forest road network is an essential and a long run task that provides the basis for all forest management activities such as exploitation, silviculture and afforestation activities, forest fire and environmental protections. Problem of accomplishing that complicated task was resolved in many different ways in previous years, mostly appropriate to the time and space in which the forest opening policy fundamental principles had to adapt to real time and space inherent current achievements of theory and field work in forest road network planning. The most appropriate method to find that density of forest road network which will give the lowest costs of wood skidding and road construction was to lay on several variants of different forest roads on topographic map of the specific forest area. One achieved road density in this way was taken as the “optimal forest road network”. In recent years, technological progress and the development of informational technologies provided the possibility of considering the overall issues of forest management in a way that was practically unimaginable until now. This gives the possibility of a more comprehensive analysis of forest areas, which this time includes non-economic benefits and a multi criteria evaluation (MCE).

An example of this analysis is derived by applying GIS system as the basis for planning of a network of forest roads and its expansion in the forest management unit „Kozara-Mlječanica”.

Key words: forest opening, forest road network, forest management unit “Kozara - Mlječanica”

**FOREST TYPES AND ECOLOGICAL GRADIENTS IN FLOODPLAIN
FORESTS IN THE SUBPANNONIAN REGION OF SLOVENIA**

Aleksander MARINŠEK^{1,4}, Andraž ČARNI^{1,2}, Petra KOŠIR^{1,3}, Urban ŠILC¹
marinsek@zrc-sazu.si

¹ Institute of Biology, Scientific Research Centre of the Slovenian Academy of Sciences and Arts, Novi trg 2, SI-1000 Ljubljana, Slovenia

² University of Nova Gorica, Vipavska 13, Rožna Dolina,
SI-5000 Nova Gorica, Slovenia

³ University of Primorska, Titov trg 4, SI-6000 Koper, Slovenia

⁴ The Higher Vocational College for Forestry and Hunting,
Ljubljanska 2, SI-6230 Postojna, Slovenia

Abstract: The study took place in forests along the Mura river in eastern (subpannonian) part of Slovenia, where we wanted to find some answers to the following research questions: 1. Which are the main forest vegetation types and the main ecological gradients in those forests? 2. Can be the main vegetation types and ecological gradients detected in the area explained by distance from the water? 3. What is the response curve of the main tree species of those forests? Research showed the potential vegetation types of the region: along Mura river there is *Salicetum albae* forest, *Fraxinus angustifolia* subsp. *oxycarpa* forest, *Fraxino-Ulmetum laevis* and on the highest position there is *Genisto elatae-Quercetum roboris* and *Pruno padi-Carpinetum betuli* on an alluvial plane. In depressions we can find *Lonicero caprifolii-Quercetum roboris* and secondary *Alnus* community as *Carici brizoides-Alnetum glutinosae*, *Pruno padi-Fraxinetum oxycarpeae* and *Carici elongatae-Alnetum glutinosae* in the lowest position. In the hilly region there are beech forests as acidophilous *Castaneo-Fagetum sylvaticae* and mesophilous *Vicio oroboidi-Fagetum sylvaticae*. Species response curves, fitted using HOF models, describe relationships between the main tree species of flooded forests and environmental variables distance from the main stream and distance from the nearest stream. *Carpinus betulus* and *Quercus robur* respond to both distances, *Fraxinus angustifolia* does not respond to neither of them and *Salix alba* and *Populus nigra* respond only to distance from the main stream. It seems that for the zonation of vegetation types more important is the zonation from the main stream and the zonation from the nearest water body is of minor importance.

Key words: floodplain forest, forest vegetation, phytocenology, ecological gradient

MYCOLOGICAL COMPLEX ON WILD CHERRY (*Prunus avium* L.)

Miroslav MARKOVIĆ¹, Dragan KARADŽIĆ², Saša ORLOVIĆ¹,
miroslavm@uns.ac.rs

¹ University in Novi Sad, Institute of Lowland Forestry and Environment, Antona Cehova 13, 21000, Novi Sad, Republic of Serbia

² University in Belgrade, Faculty of Forestry, Kneza Vis-slava 1, Belgrade, Republic of Serbia

Abstract: The paper presents results of investigation of mycoflora on Wild cherry (*Prunus avium* L.). Dendromaterial used in this study was collected in natural stands, where Wild cherry occurs either as subdominant species or individual trees (Fruska Gora, Zlatibor, Golija, Tara, Rtanj, Juhor, Bor, Pirot, Vlasina), seed orchard (Crni Vrh) and nurseries (Batocina, Naupare, Milentija and Novi Sad). The collected material was placed into herbarium and after that laboratory identification of fungi was done. The preparation of temporary microscopic preparations was done prior to fungi identification. After that, determination of species was carried on the basis of fruit bodies, spore bearing, and reproduction organs. In cases where disease symptoms were found, and no fruit bodies were formed, fungi were isolated on nutritive media (PDA and MEA according to Booth, 1991) and determination was done after pure fungi cultures were obtained and developed. Fungi the wood decayers were determined on the basis of appearance of carpophore, and the types of decay. Previous investigations showed that 46 fungi were isolated from wild cherry. From that number, 18 fungi species were isolated from bark, 6 from leaves, and 22 decay fungi from trees. The determined fungi were divided into three groups depending on significance. Those developing as parasites, which can cause serious consequences to the host plant were placed into the first group. The most significant among these are *Polistigma rubrum* (Persoon) Saint-Amons and *Daedaleopsis confragosa* (Bolt.: Fr.) J. Schroet. The following conclusion was made by comparison of micoflora appearing on wild cherry trunk in natural habitats with that in nurseries and stands: fungi causing tree decay are dominant on old trees in natural habitats, while parasitic fungi appearing on leaves and bark of young trees are dominant in nurseries and stands. In order to protect young cherry trees in nurseries and stands (first of all from leaf parasites) it is necessary to apply chemical protection measures, i.e. to use herbicide during periods critical for parasitic infection.

Key words: Wild cherry, *Prunus avium*, fungus, Serbia.

**PROGENY TESTS OF NORWAY SPRUCE (*Picea abies* Karst)
IN BOSNIA AND HERZEGOVINA - CONTRIBUTION
TO THE EUROPEAN EX SITU CONSERVATION**

Milan MATARUGA¹, Vasilije ISAJEV, Pero BALOTIĆ,
Čedomir BURLICA, Branislav CVJETKOVIĆ
mmataruga@gmail.com

Faculty of Forestry, University of Banja Luka, Republic of Srpska, B&H

Abstract: Classical breeding programs through ex situ conservation refer to the establishing of the following: seed orchards, clone archives, progeny tests, generative tests of full or half-sib lines and others. By transferring the major genofond populations of particular species to the new habitat conditions we provide: their conservation, testing adaptability and genetic improvement for commercial use of seeds. In each selected population of spruce - a total of 6 (Han Pijesak 1; Han Pijesak 2; Kneževo; Drinić; Foča; Olovo) the seeds were collected from 10 trees. During a three-year-analyses at the level of seeds and seedlings, intra-and inter-lines and population differences were monitored. The seedlings produced in „Nisula rolls“were transplanted to four locations - different ecological and vegetation areas (Pannonian area - site Derventa; Transitive-Illyrian - Mezić area - site Srebrenica; Inner Dinarides area - site Drinić; Mediterranean area – site Nevesinje). One year after the seedlings were planted, the observation of the survival of seedlings and measuring the height growth were carried out. The first results indicate a significant intra - population and half-sib lines biodiversity, which justifies the research like this/of this kind.

Key words: Norway spruce, progeny test, Bosnia and Herzegovina

FORESTRY POLICY IN THE CONTEXT OF GLOBALISATION

Elena I. MAYOROVA, Elena V. TEMNOVA

caf-pravo@mgul.ac.ru

Moscow State Forest University 1, 1st Institutskaya st., the Town
of Mytishi, Mytishi-5, Moscow Region, 141005, Russia

Abstract: The value of forest as a natural resource is estimated by ecological functions which are hardly restricted by the borders of a state, forest being the property of the global community. In accordance with this assumption forest is an object of globalization of forestry policies. The role of Russia in resolving global problems in the area of forest conservation is identified by possession of greater quantities of the forest cover in the area, which are deemed to conserve the planet's biological diversity and keeping it in balance. Forests fall under the national jurisdiction of a state, so their management and conservation are regulated by the domestic law of a state. In the global arena, the Russian Federation sticks to the principled position of supporting forestry management on the national scale in accordance with the principles of sustainable development of forests (regulated by the Helsinki Commission and the Montreal Process). These indicators specify the principles of forestry management on the national scale and are valid for all forms of property. They are documented and refer to the category of "soft law", i.e. quasi-legal instruments, which possess less legal binding force, or whose binding force is somewhat „weaker” than the binding force of traditional law. Nevertheless, Russia expresses readiness to follow the rules of international law and international agreements in the field of forest management, forest conservation, forest protection and forest regeneration. Rules of international law take priority over the rules set by the national legislation. However, The New Forestry Code of the Russian Federation adopted in 2006 has no trace of either regulations of the priority of the rules of international law in terms of implementing strategy of sustainable forest management in Russian Federation or whatever references to international commitments in this functional area. Legislative acts of the low order (subordinate regulations) only partly contain declarative regulations on sustainable development of forests. Inasmuch as forests are planet Earth property, they should be managed in accordance with the rules stipulated in international agreements. Currently implementation of international commitments through the implementation mechanism is required by one of the imperative principles of international legislation, which goes as "pacta sunt servanda" (Latin for "agreements must be kept"). This principle is the basic one for both international and domestic law. In Russia and in a series of European countries we are observing the process of gradual deforestation, for forest is being widely utilized for economic needs. Decrease of forest areas has an adverse impact on the ecological situation within the area of the entire continent of Europe. In the context of globalization it is well-advised to impose a certain condition on those states who are willing to join the WTO. In accordance with

this condition the applicant states should comply with the provision of legal regulations, which guarantee sustainable management, conservation, protection and reproduction of specified amount of growing stock.

Key words: Forest/forestry, sustainable development, biological diversity, forest management, forest conservation, forest protection and forest reproduction, international law, national jurisdiction, forestry legislation, Forestry Code of the Russian Federation, forest policy, globalization, international agreements, the Helsinki Commission, the Montreal Process.

**PROTECTIVE FORESTS IN SERBIA: POSSIBILITIES FOR BRINGING
NATIONAL REGULATIONS INTO CONFORMITY
WITH MCPFE ASSESSMENT GUIDELINES**

Milan MEDAREVIĆ, Staniša BANKOVIĆ, Damjan PANTIĆ,
Biljana ŠLJUKIĆ, Nenad PETROVIĆ, Snežana OBRADOVIĆ, Biljana PEŠIĆ
milan.medarevic@sfb.rs
Faculty of Forestry, University of Belgrade

Abstract: The possibility of comparing the state of protected and protective forests in different European regions is very small due to a wide spectrum of separations and limitations at national levels. In order to facilitate easier reporting on the state of protected and protective forests, created in the course of 2001-2003 were MCPFE Assessment Guidelines for Protected and Protective Forests and Other Wooded Land in Europe. These forests were classified according to the main management objective. Data on protected and protective forests is shown using Pan-European indicators 4.9, 5.1 and 5.2., while these forests need to meet the general principles in order to be defined as such in line with the MCPFE Guidelines. This paper is a result of an analysis of the state and widespread of protective forests in Serbia (primarily protective forests preserving water and protective forests preventing soil erosion). Analyzed was the degree of conformity between the definitions and aims of forest management and the extent to which the general principles of the MCPFE Guidelines are honoured, in order to ensure that the national report can be used at international level. Based on the results of this analysis which show that the definitions and aims of protective forest management are in conformity with the MCPFE Guidelines yet, on the other hand, point to the fact that the general principles have only been partly met, the paper also offers potential solutions for the harmonization of national regulations with MCPFE Guidelines.

Key words: protective forests, MCPFE Assessment Guidelines, international reporting

**CLIMATE CHANGE AND NATURE CONSERVATION IN FORESTS:
CHALLENGES FOR CONSERVATION CONCEPTS
AND PRACTICE IN CENTRAL EUROPE**

Mirjam MILAD

mirjam.milad@landespflge.uni-freiburg.de

Institute for Landscape Management, University of Freiburg, Germany

Abstract: Climate change with a predicted rise in average temperature at an unprecedented rate, changes in precipitation regimes as well as an increase in extreme climatic events (IPCC 2007), leads to new challenges for nature conservation in forest ecosystems. In addition to the protection of species and habitats, related conservation concepts and site specific objectives will be affected, such as maintaining a native tree species composition. Focal points in conservation efforts may shift, for example from the consideration of specific species within restricted habitats to higher spatial (international, continental) scales or to the superordinate objective of maintaining ecosystem functionality. Forest ecosystems seem to be especially susceptible to climate change. Reasons are the high anthropogenic imprint on forest composition, as well as the comparatively long generation times and low migration rates of many species living in forest ecosystems. Hence, adaptation might lag behind the high predicted rates of climate change. Problems could be further aggravated by interdependencies between impacts of climate change and other anthropogenic influences (e.g. fragmentation, habitat destruction or deposition). Still, knowledge on adaptive capacities and reactions of forest ecosystems is insufficient. To be efficient, nature conservation needs to take climate change and its direct and indirect consequences into consideration. Concepts and objectives based on static or historical conditions should be reassessed and refined. The project "Forest conservation and climate change" (duration 3 years) at the Institute of Landscape Management, University of Freiburg, Germany, analyses and evaluates current guidelines and objectives of nature conservation focusing on forests in the light of climate change. In conclusion, recommendations for future forest conservation in Germany will be given, which should provide a framework for a range of strategies at a regional level. Methods include the comprehensive analysis of topical national and international literature. In an empirical part of the project, expert interviews on current adaptation measures in silviculture and forest specific nature conservation in Germany will be conducted. Further, scientific workshops will be held and interpreted. Our study results will demonstrate the impacts of climate change for forest ecosystems, possible adaptation strategies and key challenges for nature conservation in forests. The project is part of the research cooperation "Forests and climate change – future strategies for protection and sustainable use", which is funded by the Federal Nature Conservation Agency of Germany (BfN).

Key words: global warming, forest ecosystems, nature conservation

**DISTRIBUTION OF AUTOCHTHONOUS DENDRO SPECIES IN THE
MANAGEMENT UNIT „OZREN“-PETROVO – IMPLEMENTATION
OF GIS TECHNOLOGY**

Đorđije MILANOVIĆ, Vladimir STUPAR, Jugoslav BRUJIĆ, Davor NIKIĆ
arbormagna@yahoo.com

FORESTRY FACULTY, UNIVERSITY OF BANJALUKA, S. Stepanovi-
ca 75a, 78000 Banja Luka, Bosnia and Herzegovina/Republic of Srpska

Abstract: The paper shows the distribution of autochthonous dendro species in the Management unit „Ozren“ of the Forest office „Petrovo“ in the northern Bosnia. Species were mapped using GIS technology, with the square network 1x1 km, that was laid into the National Cartesian coordinate system, in zone 6. In the total of 109 squares, 93 species of trees and shrubs were recorded. Using the GIS software the spatial database was made, which as the main output gave the distribution maps of those species in the research area. This work should contribute to the knowledge of the horology of dendro species in Bosnia and Herzegovina, as well as to starting of a unique database, which would, using the method proposed, be filled up with data on distribution of dendro species in this country.

Key words: Dendrohorology, distribution maps, GIS mapping, Bosnia and Herzegovina

**ROLE OF *PHYTOPHTHORA* SPECIES IN DECLINING
OF OAK FORESTS IN SERBIA**

Ivan MILENKOVIĆ, Nenad KEČA
ivanmilenkovic60@yahoo.com
Faculty of Forestry, University of Belgrade

Abstract: During the last century, the drying processes in oak forests are registered on several occasions. The affected area and the intensity of declining were differed from country to country, but also within individual regions. In the mid-eighties of the 20th century the process of drying was intensified in Sessile oak forests in the area of eastern Serbia. Using special selective medium (V8 – PARPH) on the roots of the most important European oaks (*Quercus robur*, *Q. petraea*, *Q. cerris*, *Q. frainetto*, etc) numerous pathogenic species from the genus *Phytophthora* were isolated and described. Namely, the appearance of the characteristic symptoms such as chlorosis, dying branches, necrosis, and cancers, are the result of the cambial tissue necrosis, and the presence of specific toxic substances, which synthesize some *Phytophthora* species. Declining processes in the oak forests are present on the significant areas throughout Serbia. The task of this study was to determine the presence of *Phytophthora* species, and to define their role in the decline of oak trees. During these studies five species were isolated and identified: *P. quercina* T. Jung, *P. cactorum* (Lebert. and Cohen) Schröt, *P. citricola* Sawada and *P. citrophthora* (R. E. Smith & E. H. Smith) Leonian and *P. Gonapodyides* (Petersen) Buisman.

Key words: oak forests, decline, *Phytophthora* spp., *P. quercina*, rhizosphere

BIOLOGY AND CONTROL OF PATHOGENIC FUNGUS *Sphaeropsis sapinea*

Tanja MILIJAŠEVIĆ, Milan MILENKOVIĆ
Faculty of Forestry, Kneza Višeslava 1, Serbia, Belgrade

Abstract: *Sphaeropsis sapinea* is a fungus of worldwide distribution and importance. It is a destructive pathogen of conifers and it has an extensive host range including *Abies*, *Larix*, *Picea*, *Thuja*, *Pseudotsuga*, *Araucaria*, *Chamaecyparis*, *Cupressus*, *Cedrus* and 48 species of *Pinus* spp. It is widely distributed in Serbia and Montenegro in the continental and in the Mediterranean parts of these countries. It was researched intensively during late 80-ties and 90-ties. It is recorded on *Pinus nigra*, *P. sylvestris*, *P. halepensis*, *P. jeffreyi*, *P. peuce*, *P. pinaster*, *P. ponderosa*, *P. peuce*, *P. pinea*, *P. mugo*, *P. heldreichii*, *Abies concolor*, *Cedrus atlantica*, *Chamaecyparis lawsoniana*, *Cupressus sempervirens*, *Juniperus virginiana* and *Thuja occidentalis*. *Pinus heldreichii*, a Tertiary relic and Balkan subendemit is a new plant host in these countries. The pathogen was identified on individual trees near Pećka Patrijaršija and the Monastery Ostrog. Most of the damages occurs in Austrian and Allepo pine plantations and also in urban areas. On pines *Sphaeropsis sapinea* can affect almost all the parts of the trees. The most common symptoms are shoot blight, bud wilt, branch cankers, branch dieback, necroses of the seed cones and their dwarfishness. The critical period of infection is from the middle of April till the middle of May. It infects buds before they are opened in the spring and also in the summer, in the year of their forming, young shoots through the bark and young needles. Changing of colour of the infected needles can be seen at the beginning of June, while in the middle of June they become yellow-brown. Pycnidia of *S. sapinea* are observed on young shoots and needles, buds, current year and second year seed cones, and in the bark of older branches. The combination of silvicultural and chemical measures of control can reduce the consequences of this serious disease. The most efficient are the copper fungicides.

Key words: *Sphaeropsis sapinea*, *Pinus* spp., distribution, biology, significance, control

**CHARACTERISTICS OF SMALL AND MEDIUM FOREST ENTERPRISES
IN TIMOK FOREST AREA AND THEIR PROPENSITY
FOR CLUSTER ESTABLISHMENT**

Vojislav MILIJIĆ, Nenad RANKOVIĆ, Dragan NONIĆ,
Nikola STAMENKOVSKI, Marko MARINKOVIĆ
vojimil@sezampro.rs
Faculty of Forestry, Kneza Višeslava 1, Serbia, Belgrade

Abstract: Significance of small and medium enterprises (SMEs) reflects on their role in employment increase, their impact on commercial structure, innovations and technical progress, along with their impact on realization of general social goals. Various authors suggest that development of SMEs can be considered as a key factor for economic growth and competitiveness in both Western and transitional economies. In Serbia, significance of SMEs in forestry is recognized by basis sector strategic documents. Forestry Development Strategy from 2006 underlines the importance of forest SMEs development in fulfilment of the basic forest sector goal: increase of forest sector input in economic and social development of the country. The term “cluster” entered economic literature due to enterprises’ tendencies of gathering and organizing in order to improve their businesses. During the nineties increased interest for clusters occurred, and one of the main causes for this was suggested cluster influence on enterprises performance, regional development and country competitiveness. Today, clusters develop in various organisational forms and in various industries. Some authors define clusters as geographically close group of enterprises which produce similar products and services, while the other define clusters as groups of interconnected industries located in close geographical units. Goal of this paper is to explore basic characteristics of SMEs, which exercise their business in forests as a resource. Additional goal is to investigate propensity of those enterprises for cluster establishment. Since clusters are in most cases defined by marked regional units, for the area of research we have chosen Timok forest area, as the area with traditional significance of both forestry and wood industry, due to area’s wealth on forest resources and intensive entrepreneurship initiatives.

Key words: entrepreneurship, forestry, organization, clusters, forest area

**THE MOST COMMON TYPES OF ACIDOFIL BEECH FORESTS
IN SERBIA AND THEIR ECOLOGICAL – PRODUCTION
CHARACTERISTICS**

Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ, Željko MALJEVIĆ
rajko.milosevic@sfb.rs
Faculty of Forestry, University of Belgrade

Abstract: In the mountain beech forest belt, on the border of the mountain and hill belt and in the hill belt, we can find acidofile beech type of forests in the typical ecological conditions, expressed through orographic conditions, and, in particular edaphic conditions. Most areas of these forest types are spread in the mountain belt, and in the border mountain hill belt. Through typological definition of these stands we separate the most common types:

- Type of acidofile mountain beech forests with white wood-rush (*Luzulo - Fagetum moesiacaе montanum*) on brown podzolic acid brown soils and less districts - silicate soils;
- Type of acidofile beech forest (*Musco - Fagetum*) on brown podzolic acid brown soil.

These types of forests have been registered in almost all mountain and hill in Serbia. Stands of the first type of forest are more present, with the wider ecology and significantly higher potential production.

Key words: acidofile beech forest, types, ecology, productivity, Serbia

**THE MOST COMMON TYPES OF BEECH – FIR FORESTS IN SERBIA
AND ECOLOGICAL – PRODUCTION CHARACTERISTICS
OF THESE FORESTS**

Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ, Željko MALJEVIĆ
rajko.milosevic@sfb.rs
Faculty of Forestry, Belgrade

Abstract: Beech - fir forests in Serbia are very modestly represented, they cover an area of approximately 11.000 hectares which makes 3% of the total forest of the Republic of Serbia. They are represented on that area mostly as fragments on Veliki Jastrebac, Zlatibor, Kopaonik, Prokletija and Željin. Only at the location of the mountain Goč they cover a significant area where they make the differential and homogeneous spatial and ecological integrity in terms of a developed clima-regional belt. Through the typology definition, we separated the most common types of these forests:

- Type of fir and beech forests (*Abieti - Fagetum moesiacaе montanum typicum*) on deep brown acid soils on granodiorite;
- Type of beech and fir forests with curve (*Abieti - Fagetum moesiacaе montanum drymetosum*) on middle deep (often Scelet) acid brown soils on granodiorite;

The defined types of forest with their characteristics and elements make the base for defining management and silviculture measures, represents another significant different wholes. That requires a different approach to practical work, starting from management target to the choose breeding target and silviculture measures with the main target of achieving functional optimum or exclude the possibility of unification of the same.

Key words: beech - fir forest, most represented types, ecology, productivity.

**THE TYPES OF MONODOMINANT MONTANE BEECH FORESTS
WITH THE HIGHEST PERCENTAGE IN SERBIA AND THEIR
ECOLOGICAL - PRODUCTION CHARACTERISTICS**

Rajko MILOŠEVIĆ, Vladan ŽIVADINOVIĆ
rajko.milosevic,@sfb.rs
Faculty of Forestry, Belgrade

Abstract: Montane beech forests in Serbia form a clearly differentiated and distinguished spatial and ecological entity – a climate - regional belt - on all mountain massifs. They were formed under the synerctc effect of a complex of factors. Consequently, they are characterized by high ecological diversity, expressed by petrographic - edaphic, orographic, microclimate and coenological characteristics. This belt is characterised by a specific microclimate, which is favourably reflected to the ecological and coeno-ecological optimum for beech forests in the greatest number of forest types: more rainfall, higher relative humidity, lower temperatures (which is especially important during summer droughts) and lower temperature fluctuations. The highest percentage in this climate-regional belt is that of monodominant montane beech forests. The following most represented types of these forests are differentiated by typological classification:

- Forest type montane beech (*Fagetum moesiacaе montanum typicum*) on deep and very deep acid brown soils;
- Forest type montane beech with fescue grass (*Fagetum moesiacaе montanum drymetosum*) on medium deep and sometimes skeletal acid brown soils.

The above forest types have been identified on all mountain massifs in Serbia. The percentage of stands of the former type is greater, with a wider and more mesophilous ecology and with significantly higher potential productivity.

Key words: Montane monodominant beech forests, the most represented types, ecology, Serbia.

**TIME CONSUMPTION, PRODUCTIVITY AND COST ANALYSIS
OF THE SHORT-LOG AND LONG-LOG SKIDDING
IN THE HYRCANIAN FOREST IN IRAN**

Rostam Mousavi,
r.mousavi@urmia.ac.ir
Urmia University, Faculty of Natural Resources,
Danshgah BLV, Urmia - West Azerbaijan, Urmia, Iran

Abstract: This paper presents research results of the performance of the skidder Timber jack 450 C in timber skidding at two working sites and two different cut-to-length method, short-log and long-log method, of non-coniferous trees in hilly and mountainous conditions. Time consumption and productivity of skidding depends on some variables such as distances and slope, number of logs per cycle, volume, and log lengths. To evaluate the current skidding system in Hyrcanian forest in northern Iran and possibility of finding out better techniques and group organization; the empirical time study has been conducted in order to collect the necessary information. The elements of skidding work phase were identified and 123 cycles were recorded for short-log and long treatment. The models for effective time consumption, total productivity and also unit cost of skidding in short-log and long-log were calculated. The validity of the model was tested at 95% confidence interval. The achieved effective time at the working sites was 92%, 90% of total time consumption in short-log and long-log method, respectively. The average load per cycle in short-log and long-log method is 2.77 m³ and 3.08 m³, respectively. The average one-way skidding distance was 380 and 497 m in the short-log and long method, respectively. The average slope was 18 and 20 % in the short-log and long-log method, respectively. The average travel speeds of unloaded skidder were 5.74 km/h and the average speeds of loaded skidder were higher than the speed of the unloaded ones by 1.93 km/h; 0.42km/h in short-log and long-log method, respectively. As a general rule, skidding should be done downhill; That way unloaded travel time was less than the loaded travel time. The travel speed was predominantly affected by longitudinal slopes and types of strip roads. The average speeds of pulling the choker were 1.71 km/h, and of load winching 0.72 km/h and 0.69 km/h. The average outputs in short-log and long-log were 10.86, 11.11 m³/hour and the unit cost in short-log and long-log was 9.00\$ and 8.80\$ per hour.

Key word: Hyrcanian forest, Iran, skidding, short-log, long-log, skidder, cost

INCIDENCE OF SHISHAM (DALBERGIA SISSOO ROXB.) DIE-BACK IN VARIOUS AGRO ECOLOGICAL ZONES OF PUNJAB

Irum MUKHTAR, Rukhsana BAJWA

erumm21@yahoo.com

Institute of Mycology and Plant Pathology, University of the Punjab Lahore, Pakistan

Abstract: Shisham (*Dalbergia sissoo* Roxb.) is an important timber tree of the Indian sub-continent. Gradual change in eco-edaphic factors has induced stress conditions, which invited fungal attacks on shisham. A detailed survey conducted during 2005-06 in the selected areas of different agro ecological zones was carried out to assess the incidence and severity of shisham dieback disease in Punjab. The selected zones were IIIA & IIIB-sandy deserts (Bahawalpur, Bahawal nager, Khushab, Mianwali), IV-A-northern irrigated plains (Multan, Sahiwal, Sargodha, Faisalabad, Lahore, Sheikhpura, Gujranwala and Sialkot), V-Barani (Jhelum, Chakwal, Rawalpindi, Attock) and X- Sulaman piedmont (D.G. Khan). Survey results showed that shisham die back incidence, severity, disease index and disease prevalence in different zones ranged from 16.3-31.4, 0.5-0.9, 10-24.46 and 50-100 respectively. Maximum disease severity and prevalence was recorded in Zone V while the lowest disease severity and prevalence was observed in IIIA sandy desert. During the survey, it was also learned that dieback disease is an age specific disease. This disease occurs in the old trees. Shisham dieback is not a nursery disease. Root bark, seeds and soil samples were also collected for the pathogenic studies. Any correlation between Soil pH and physical structure and rainfall was not found regarding shisham dieback.

Key words: survey zones, shisham dieback, disease incidence: prevalence of die back, timber die back

**LEGAL FRAMEWORK OF NON-WOOD FOREST PRODUCTS
IN WESTERN BALKAN COUNTRIES**

Jelena NEDELJKOVIĆ, Dragan NONIĆ,
Ljiljana KEČA, Nenad RANKOVIĆ
jelena.nedeljkovic@sfb.rs
University of Belgrade, Faculty of Forestry

Abstract: In recent decades, gathering and utilization of non-wood forest products (NW-FPs) have enjoyed a noticeable increase in the interest of both scientific and professional organizations, and non-governmental institutions and private sector. Since the Western Balkans have a very rich biodiversity, collection and use of NWFPs have a long tradition in this region. Although in the last decade in the region a number of modern laws and regulations in the field of forestry, which in some articles regulate NWFPs have been adopted, it is important to emphasize that these products are issues of laws in other areas, particularly the laws on nature and environmental protection. In the analysis of the law, need for a multisectoral approach to this area is respected. The aim of this paper is to determine the similarities and differences in the legislative governing the area of NWFPs through examination and analysis of laws and other legal documents in this area in the Western Balkans.

Key words: non wood forest products, law on forests, law on nature protection, Western Balkans

FOREST FRUIT TREE SPECIES IN SERBIA – STATE AND DIVERSITY

Biljana NIKOLIĆ, Mihailo RATKNIĆ, Milorad VESELINOVIĆ,
Dragana DRAŽIĆ, Ljubinko RAKONJAC

* The Institute of Forestry, Kneza Viseslava 3, 11000 Belgrade, Serbia

Abstract: More than one hundred different fruit species are present in the autochthonous flora of Serbia. They are very important because of their nutritive values, medicinal or honey characteristics, or as progenitors of various strains and hybrids of cultivated fruits, or as grafting media of the highbred strains, etc. Many of them are abundant only in the mountains at the borders of Serbia. The main aim of our studies was to determine the diversity of their genetic pool which is the base for further in – situ and ex – situ preservation, improvement and economic use. So, in the last several years we started inventarization of the fruit trees across Serbia, both at the population and individual level. We selected trees, collected seed from them and produced seedlings in the process of establishment of the living archive in Belgrade, too. In the first phase of this program walnut, sweet chestnut, hazelnut, wild apple, wild pear, wild cherry, etc. were studied. Some of them were already well known as genetically endangered species or species with a reduced natural area. Beside the natural sites, we also considered some populations of artificial origin (sweet chestnut, for instance) with the aim to investigate their ecological variability.

Key words: variability, diversity, forest fruits, gene protection, gene conservation

**A TIME STUDY OF FELLING OF BROAD LEAF
TREES IN THE CASPIAN FOREST OF IRAN**

Nikooy, M. Barzkohi, H. Firozan, A. Hemmati, V. Ershadifar, Moona
nikooy@guilan.ac.ir

Faculty of Natural Resources, Guilan University, Somesara, Iran

Abstract: Caspian forest is the green belt which covers the southern coasts of the Caspian Sea. The harvesting methods in Caspian forest is cut-to-length, tree length and is performed according to forest management plan. Because of some special conditions including irregular, often steep, topography and large hardwood sawn timber; chainsaw is the dominant cutting tool in this forest. This study was designed to provide information on felling turn for a directional felling operation in a Caspian hardwood stand. A selective cut was carried out on a 62 hectare parcel with an average slope of 25 percent. Felling time per tree was most affected by diameter at breast height and by the distance among harvested trees. The gross and net production rate was $89.55m^3/PMH$ provided and $99.37m^3/PMH$. The unit cost considering gross and net production rate was $266614Rial / MPH$ and $252395 Rial /MPH$, respectively. The significant variables included diameter at breast height (D) and Latitudinal slop (Cs) for the time expenditure model. This regression function is statistically significant at $\alpha = 0.01$.

Key words: Caspian forest, directional felling, time study, production, cost

**ESTIMATION OF SPECIES DIVERSITY IN DIFFERENT STORIES OF
FOREST AREA (CASE STUDY: HYRCANIAN FOREST OF IRAN)**

Zahra NOURI, Seyed JALIL ALAVI, Jahangir FEGHHI,
Ghavamaldin ZAHEDI, Ramin RAHMANI
zanouri_8185@Yahoo.com
Faculty of Natural resources- University of Tehran, Zobe Ah-
an Street, P.O.Box 31585-4314, Iran, Karaj

Abstract: Nowadays biodiversity conservation is of great importance in environmental and forest policies. The aim of this study is to investigate the tree species diversity in a forest region with no management planning and introduce the calculated indices as the norm for forest sustainability assessment. This study was performed in the Hyrcanian forests in the north of Iran. After laying out the inventory grid (75 m × 100 m) in the study area, sample plots were located in the study area and DBH of all tree individuals and their stories were recorded in each sample plot. In this research, in addition to richness index, evenness (Simpson, Smith & Wilson) and heterogeneity (Simpson, Shannon-wiener and N2) indices were also calculated. The richness index shows a decreasing trend from the third story to first one. The heterogeneity indices increased from the third story to the second one and then decreased to the first layer. These indices were calculated for the study area and also for each story, separately. Among the evenness and heterogeneity indices, Smith & Wilson and N2 showed the highest CV, respectively.

Key words: Biodiversity, species diversity indices, Tree layers, coefficient of variation, Hyrcanian forests, Iran

**ANALYSIS OF THE FLORA AND DIVERSITY OF PLANTS OF BEECH
AND FIR FORESTS ON SERPENTINE IN BOSNIA AND SERBIA**

Marijana NOVAKOVIĆ, Rade CVJETIĆANIN, Sead VOJNIKOVIĆ
marijana.novakovic@sfb.rs
University of Belgrade, Faculty of forestry

Abstract: Peridotite-serpentine massif is specific for the Balkan countries. Geology - Soil characteristics of the substrate influenced the occurrence of specific flora and vegetation of this area. Beech and fir forests represent one segment of vegetation that occurs on this geologic base. The Balkan region in which this forest appears is divided into two floristic-geographical provinces: the Illyrian and Mesian. The comparison of flora and diversity of beech-fir forests from Bosnia and Serbia, which belong to different provinces, have not been made so far. The aim is to obtain floristic data and index of diversity by comparing the flora of the forest that will help clearer ecological-vegetation differentiation and syntaxonomic location of these forests. In order to investigate this forest, the following phytocoenological records were used: Beus 1986, Vojniković 2006, Jovanović 1959, Gajić et al. 1954. A total number of 49 releves (28 from Bosnia, 21 from Serbia) were entered into the database Turboveg 2:38, and then imported into CANOCO 4.5 and JUICE 7.0 software, where the analysis was carried out. CA analysis showed a clear differentiation of plots and species of BiH in relation to those from Serbia. Also, the average number of species by plots as well as Shannon – Wiener index showed differences between these forests. Synoptic analysis of the species showed a specific occurrence of identical species with approximately similar frequency of occurrence and specific floristical difference in both investigated areas.

Key words: serpentine, Bosnia, Serbia, beech and fir forests, flora, diversity

**FISHERY AND WILDLIFE MANAGEMENT IN PROTECTED
AREAS MANAGED BY PUBLIC ENTERPRISE FOR FOREST
MANAGEMENT SRBIJAŠUME, BELGRADE**

Nenad NOVAKOVIĆ, Gordana JANČIĆ¹, Petar NEČAK

nenad.novakovic@srbijasume.rs

Public enterprise for forest management Srbijašume,

Mihajla Pupina 113, Belgrade, Serbia

Abstract: The protected areas in Serbia cover 542,805 ha (482 protected areas) or 6.14% of the territory of Serbia. Public enterprise for forest management Srbijašume, Belgrade manages 95 protected areas covering 216,773.28 ha which accounts for 40% of the total of areas under protection in Serbia. According to the Law on conservation and sustainable utilization of fish fund, in order to provide sustainable utilization of fish fund in fishing waters, fishery areas are constituted. Fishing areas within the protected areas are constituted by the manager of protected area, which is obliged to adopt a Management program for the fishery area. Public enterprise for forest management Srbijašume constituted fishery areas within the protected areas: Nature park „Stara planina“, Nature park „Golija“, Nature park „Sićevačka klisura“, Special nature reserve „Jelašnička klisura“, Landscape of exceptional features „Lepterijski Sokograd“ and the Monument of nature „Lazarev kanjon“. According to the Law on game and wildlife management, conservation, management, hunting, utilization and improvement of game populations in protected areas is held by the Manager of the hunting area, according to the management plan, which has to be harmonized with legal acts on nature protection and the special law on conservation and utilization of national parks. The paper analyzes fishery and wildlife management problems in the protected areas, and the obligations of the manager of the protected areas.

Key words: Protected areas, fishery areas, hunting area, management

**MORPHOPHYSIOLOGICAL CHARACTERISTICS OF BEECH
(*Fagus sylvatica L.*) SEEDLINGS LEAVES IN THE AREA
OF MANAGEMENT UNIT VRBANJA**

Rodoljub OLJAČA, Vladimir PETKOVIĆ, Zorana HRKIĆ, Zoran GOVEDAR
oljaca_r@yahoo.com

Forestry Faculty, University of Banjaluka, S. Stepanovica 75a, 78000
Banja Luka, Bosnia and Hercegovina/Republic of Srpska

Abstract: The aim of this paper was to determine the state of beech seedlings, growth and development, in the conditions of MU Vrbanja. Knowledge of the state and the growth rate of forest seedlings is an important indicator that tells about the possibility of seedlings of certain kinds to fight in the first years of life with the ground flora, which threaten to suffocate them and thus obstruct the natural stand regeneration. It also wanted to determine which interactive relationships and dependencies prevail between individual parts of the seedlings such as leaf (leaf number, fresh and dry weight of leaves, leaf area). The studies were conducted in an open and a closed range. Based on the research results, it can be concluded the following: Morphophysiological indicators are interrelated and affect each other. Leaves areas are significantly associated with leaf number on the investigated beech seedlings. Fresh weights of leaves are also significantly associated with the number of leaves of investigated beech seedlings. Fresh and dry weights of the investigated beech seedlings are less dependent on the leaf surface.

Key words: seedlings, beech, leaf, leaf area, interactive relationship

**FOREST RESERVES OF SERBIA
CONDITION, DISTRIBUTION AND SYNECOLOGY**

Dragana OSTOJIC
dragana-ostojic@zzps.rs

Institute of Nature COnservation of Serbia, Dr Ivana Ribara 91, Serbia, Belgrade

Abstract: The nature conservation of Serbia started with the establishment of strict forest nature reserves, as the most preserved parts of the nature. The first Nature Reserve called “Zelenicje”, situated on the mountain Ostrozub, was established in 1948. Since then, nature reserves have been the most important objects of species and ecosystem diversity conservation of Serbia. Furthermore, they are the most important categories in biological diversity conservation of the international classification. Reserves care is one of the top priority activities of the Institute for Nature Conservation of Serbia. In the last 60 years, the Institute has put 123 nature reserves under conservation and 98 of those reserves are forest reserves, making more than 20% of the total number (461) of the conserved nature objects of Serbia. The condition, distribution and synecology of the forest reserves are presented in the paper. The most represented forest reserves are those created of the community of beech and various oak species. Also, the analysis determines and defines the nature reserves division in appropriate categories and groups, according to the dominant tree species, types of community as well as the level of vulnerability and conservation.

Key words: Forest nature reserves, protection, condition, distribution, synecology.

ECOLOGICAL CHARACTERISTICS AND CONDITION OF FOREST ECOSYSTEMS IN THE NATURE PARK “SARGAN-MOKRA GORA”

Dragana OSTOJIĆ, Biljana JOVANOVIĆ

dragana-ostojic@zzps.rs

Institute of Nature Conservation of Serbia, Dr Ivana Ribara 91, Serbia, Belgrade

Abstract: The natural resource “Sargan-Mokra Gora” was first protected in 2005, as the Region of Exceptional Characteristics. The area, including the part situated between Tara and Zlatibor and spanning on 10.800 ha, was declared a Nature Park “Sargan-Mokra Gora” in 2008. It is characterized by a very dynamic morphology with the fragments combination of high areas on the watersheds, pastures, steep valley sides and deeply cut river valleys, overgrown with thick coniferous centennial forests, giving the whole area an extraordinary peculiarity and specific beauty. Thanks to its natural characteristics and location, the area of “Sargan-Mokra Gora” is characterized by miscellaneous flora. An extraordinary floral richness is confirmed by the presence of more than 700 species of vascular flora that means this space is inhabited by about 22% of the total flora of Serbia, including 6.2% endemic and sub-endemic taxa. The whole area is characterized by a high presence of forests, among which the natural pure and mixed white and black pine forests are especially outstanding. The basic natural values, representing criteria for defining borders of the protected area, are presented and processed in the paper. The condition, conservation goals, measures of conservation and the evaluation of fulfilled requirements for the nature park conservation are also presented. Special attention is paid to the results of the research and analysis of the forest ecosystems conditions, especially of the most valuable ones, on the preserved habitats, included in the regime system of the first level conservation.

Key words: Nature park “Sargan-Mokra Gora” relict and endemic flora species, pure and mixed white and black pine forests, stands condition, conservation regime and measures.

THE FACTORS AFFECTING THE SUCCESS OF GROUP NATURAL REGENERATION PRACTICES IN ORIENTAL BEECH (*Fagus orientalis* Lipsky.) FORESTS IN TURKEY (BARTIN AND DEVREK CASE STUDY)

Halil Barış ÖZEL^{1*}, Murat ERTEKİN¹, Erol KIRDAR¹

* halilbarisozel@yahoo.com

¹ University of Bartın, Faculty of Forestry, Department of Silviculture 74100/Bartın-TURKEY.

Abstract: This study carried out in 2001 in Bartın and Devrek, in which the factors affecting the success of group natural regeneration practices in oriental beech (*Fagus orientalis* Lipsky.) are examined was carried out between 2004 and 2010. For this purpose in 2001, 43 experimental areas were selected out of total 12 divisions in the four Forest Range Districts (Ardıç, Kumluca, Sökü and Akçasu) and group natural regeneration practices being done in oriental beech and several measurements and evaluations were carried out in these experimental areas. According to the results of the last juvenility enumeration in experimental areas in 2010, it is determined that the most beech juvenilities are in Kumluca (1.00/m²), division 101a-II. On the other hand it is determined in the evaluations carried out the same year that there are no beech juvenilities left in the divisions of Kumluca 116b-I, Kumluca 116b-II, Sökü 57b and 59c. Average height growth values in beech juvenilities; in the age of 9 it alters between 13.3-17.8cm. Their root collar diameters growth at the age of 9 alters between 8.6-14.7mm. According to these values, it appeared that growing of beech juvenilities in group regeneration areas are very low. Within the scope of study, factor analysis has been applied in order to define the most important factors that can be effective on the success of group natural regeneration practices in oriental beech. As a result of factor analysis it is identified that rainfall of 2010, altitude, growth of seed trees, absolute soil depth and amount of organic material quantity are effective on the success of regeneration.

Key words: Oriental beech, natural regeneration, growth, success of regeneration, factor analysis.

**AUCTION OF FINISHED WOOD ASSORTMENTS IN PUBLIC
ENTERPRISES IN SERBIA FOR THE PERIOD 2001-2009.**

Sanja PAJIĆ, Ljiljana KEČA

pajicsanja@yahoo.com

P.E. "Vojvodinašume", Petrovaradin, F.E. "Sremska Mitrovica", Sremska Mitrovica, Fruskogoškog odreda 3, Serbia/Sremska Mitrovica

Abstract: Wood production is a decades-old process, which requires rational and well planned management, both in production and sales of produced assortments. The financial effects generated by selling timber are important not only for the forest owner or custodian, if they are public companies, but also for the national economy. In this sense are studied the characteristics of the wood market in Serbia, manner and procedure for sale which in certain market conditions, for certain class of wood gives the maximum effect. The survey was conducted in two public companies that exist in Serbia, PE Srbijašume and PE Vojvodinašume. The effects of public sale of finished wood of high quality was analyzed (veneer end technical roundwood) by auction in relation to the sale of the established price list and the number of auction participants. The aim of this paper is to show the validity of organizing of public-auction sales technical of roundwood in certain market conditions. The producer of raw materials, in this case a public company, achieved the best price for raw materials, and customer-processors have free access to purchase goods. This way achieves equality of opportunity of buying of raw materials, regardless of the size of the customer and his need for raw materials.

Key words: technical roundwood, auctions, sales organization, profitability

**RECONSTRUCTION OF PAST FOREST ASSOCIATIONS IN
SW SLOVENIA WITH THE HELP OF REMOTE SENSED
DATA AND HISTORICAL CADASTRAL LAYERS**

Andrej PAUŠIČ, Andraž ČARNI

andrej.pausic@zrc-sazu.si, andrej.pausic@gmail.com

Institute of Biology, Scientific Research Centre of Slovenian Academy of Sciences and Arts, Novi trg 05, 1000 Ljubljana

Abstract: Our research study took place in the south eastern part of Slovenia (Bela Krajina). We took 83 vegetation samples- on standard plots with a surface of 100m² (studying main floristic properties- percentage of the cover layer, abundance of sample species in different plots). In our second step we investigated the statistical similarities between the measured data and have compared them with statistical programs (Statistica, Juice etc.). As a result, we got a matrix that was in fact our main tool for implementation of clusters that divided our investigation plots (aka different plant communities) in 5 groups. As given groups coincide with the age stage of overgrowth (reforestation process), we have the possibility to explain how old different stages or association in our investigated area is. Therefore our plots were used as testing polygons for input data that was then transformed into informational polygons for prediction analyses with remote sensing (studying vegetation for that area for the period of last 250 years). Results of that investigation are different stages of condition of vegetation in different time periods and a predictive model of changes that occurred during that time.

Key words: landscape analysis, modelling, biodiversity, cultural-landscape planning, forest ecosystems protection.

**FINANCIAL INSTRUMENTS FOR SUPPORTING RESPONSIBLE
FOREST INVESTMENTS: A REVIEW OF
INTERNATIONAL EXPERIENCES**

Davide PETTENELLA, Dragana STOJKOVIĆ

davide.pettenella@unipd.it

Dipartimento Territorio e Sistemi Agro-Forestali, ripolis - Univer-
sità di Padova, Via dell'Università 16,35020 Legnaro PD – Italy

Abstract: In the recent decades it has been demonstrated that timberland investments can be highly profitable. The paper discusses the causes and explores the potentials of timberland investments at the international level. There are four main factors influencing timberland investment returns: biological growth, timber prices, land appreciation, and inflation. Timber investments are stable, and less risky; which is especially acknowledged in the recent years of financial crisis. The institutional portfolio investors from United States are among the first who recognized timberland as an attractive investment, and together with Timberland Investment Management Organisations (TIMOs) are still the leaders in this field. Nowadays, three decades later, the market of timberland investments is moving from United States to a global scale, with a growing focus in the emerging markets region. Besides conventional timber investments, and due to the climate change politics and legislation, biomass projects, and carbon sequestration projects such as REDD, are also becoming attractive options. As a consequence of an enlarged set of forest investments, also in the forest sector there is an interesting trend towards Socially Responsible Investing (SRI). An increased number of investors are using, apart from profit, additional criteria for investment design and selection that are usually explained as ESG criteria (Environment, Society, and Governance). In giving evidence on how responsible or ethical investing is influencing the forest sector. The paper presents the perspectives from various institutional forest investors, as well as other involved stakeholders; and various criteria for the selection of forest investments are analyzed and compared. Finally, the paper provides recommendations for developing more comprehensive criteria for responsible forest investment.

Key words: forest investments, corporate social responsibility, ethical standards, TIMOs

**ANALYSIS OF FORESTLAND INDICATORS OBTAINED
BY CORINE LAND COVER METHODOLOGY**

Slaviša POPOVIĆ, Miroљjub MITIĆ, Jovana DŽOLJIĆ
Serbian Environmental Protection Agency, Belgrade.

Abstract: Based on the data obtained by Corine Land Cover methodology, Serbian Environmental Protection Agency following established indicators for monitoring of forested landscape in the period 1990-2000, the following indicators are featured: Forest area, Forested landscape, Forest land and Forest and semi natural area. The analysis of forested landscape indicators established the trend of their changes during the period from 1990 - 2000. A different increase in the values of every of those indicators has been noticed. Dynamics of changes can directly affect their use in appropriate issues. Indicator Forest area can be used in planning of the sustainable use of forests. Recorded growth rates of value change in the year 2000, compared to the 1990th is 0.296%. Indicator Forested landscape recorded an increase in value rate of 0.186%, while the indicator Forested Land recorded value changes rate of 0.193%. Changes in rates of those indicators can be used in the future for “emission trading”. The smallest increase in the value of the rate change of 0.1% was recorded in indicators, Forests and semi natural area. Information given by this indicator can be used for monitoring of habitats in high mountain areas.

Key words: indicator, forest, biodiversity, habitat, trend, Corine Land Cover, sustainable use.

USE OF VARIOUS GEODETIC METHODS IN FOREST ENGINEERING

Igor POTOČNIK

igor.potocnik@bf.uni-lj.si

University of Ljubljana, Biotechnical faculty,

Jamnikarjeva 101, 1000 SI LJUBLJANA

Abstract: Nowadays, geodetic methods are used in all segments of civil engineering. The purpose of this thesis was to find out which of the currently used methods is the most appropriate one for use in forest civil engineering. The compass method was used, as well as tachymetry and GPS. The measurements were performed using four different instruments: Suunto TANDEM, Wild RDS, Thales Z-MAX and Garmin V. For the research project, three different locations were selected with three completely different terrain configurations. At each location, 550 meters of a forest road were measured and from these measurements the site plan and the longitudinal profile for the measured road section were obtained. In addition to accuracy, on which we focused most, and the difficulties related to work with a certain instrument, the economic factor was also crucial, as this aspect is very important in forest civil engineering. Results were thus obtained that show how instruments perform in different environments. It can be seen from the collected results that in spite of certain shortcomings such as low accuracy, the most appropriate method is still the compass method, which is currently also the most widespread one. Wild RDS is useful under certain conditions which may develop during construction. Garmin V is much too inaccurate and much too prone to errors to be seriously considered in forest engineering. Thales Z-Max is not useful due to poor reception in forest areas and due to the very high price of the instrument. However, in the future, GPS technology which is becoming increasingly more affordable and perfected will also become important in forest civil engineering, as it is simple to use and opens new possibilities and new possible work methods.

Key words: forest road, land survey, GPS, forest

**IMPACT OF FOREST ROAD ON TREE REGENERATION ON ROAD
SIDES A CASE STUDY IN ZALEMROOD TEMPERATE
FOREST IN SARI- IRAN**

Nahid RIAHIFAR, Majid LOTFALIAN, Mohamad HO-
JATY, Asghar FALLAH, Nastaran ZARE

Abstract: Forest road is a route in the natural habitat in order to extract wood or non wood resource or recreation and outing. Forest road construction causes cutting trees in definite width and therefore leads to direct and indirect changes in ecosystems and forest environment through changes in the amount of incoming light to the forest floor, changes in temperature, humidity, soil and air, direct and rate of wind, changes in water flow rate and the amount of sediment. Cutting trees during road construction leads to increase in understory light and then has an effect on adjacent herbaceous cover and tree regeneration. Statistical data on ecological effects of forest roads is limited. For this purpose a research was performed in Zalemrood forest of Sari in Iran. Similar situation from the standpoint of topographic condition and slope has been identified. One kilometer length of road at least has been constructed 10 years selected. In each side of the road 2*2 meter microplots were used for regeneration measurement. In order to study tree regeneration biodiversity, species diversity index Shanon Winner, Simpson and species richness index Menhinik, Margalef have been used. These are results of this research. Shannon Winner diversity index two way Anova showed that road position and reciprocal effect of position and distance from road to tree regeneration diversity completely significant in 95% probability level. Menhinik richness index two way Anova showed that road position and distance from road on this index is completely significant. Margalef richness index, two way Anova showed that the effect of road position on the amount of index is perfectly significant, distance from the road on Margalof index is significant in 95% level probability.

Key words: Forest road, Tree Regeneration, Two way Anova, Zalemrood forest

**THE EFFECT OF THE TYPE OF PLANTING MATERIAL
AND TIME OF PLANTING ON PLANT SURVIVAL IN EAST-
ERN COTTONWOOD (POPULUS DELTOIDES BARTR.)**

Savo RONČEVIĆ, Siniša ANDRAŠEV, Petar IVANIŠEVIĆ, Branislav KOVAČEVIĆ

roncevic@uns.ac.rs

Institute of lowland forestry and environment – ilfe, Serbia

Abstract: The experiments were established on the Experimental estate of the Institute of lowland forestry and environment in the vicinity of Novi Sad, in the conditions of moderate continental climate, on fluvisol soil type. The spacing was 4,0 x 4,0 m. The experiment was established by multifactor design in three repetitions in time and space. The following factors were examined: I Planting material type (1/2 for regular planting, 2/3 for regular planting and 2/0 for deep planting), II Time of planting (a – planting in autumn (November), b - planting in winter (January – February), c – planting in spring (March) and planting in late spring (April – May)) and III Clones (*Populus deltoides* cl. 457, *Populus deltoides* cl. 618). The influence of planting material type and time of planting on variation of plants' survival was significant. The best results among examined planting material types had the type 2/0 planted by deep planting (87% – 99%) while 2/3 planting material showed the poorest survival (65% - 75%). Among the examined times of planting the best survival was achieved after the winter planting (94% - 100%). There were no significant differences between autumn and spring planting, while the poorest results were achieved after the late spring planting. However, the results of 2/0 planting material were satisfactory.

Key words: planting material type, time of planting, clones

**„OPEN WOODLANDS THROUGH PASTURE: GENESIS, RELEVANCE
AS BIOTOPES, VALUE IN THE LAND-SCAPE AND IN NATURE
CONSERVATION IN SOUTHWEST-GERMANY”**

Mattias RUPP

mattias.rupp@landespflge.uni-freiburg.de

Albert-Ludwigs-Universität Freiburg, Germany; Institution for Landscape Management

Abstract: Open woodlands through pasture (owp) play an important role as a landscape component rich in ecotones and biodiversity, but slowly vanishing due to intensified or abandoned land use and forestry. Pasture with livestock can sustain the open character, but wood pas-ture is banned in Germany for 176 years. In the project “Open woodlands through pasture” the spatial dispersal, genesis, local diversity in plants and surface structures and the socio-economic situation of still existing and lately initiated owp’s are examined. Main objectives are to find out, whether wood pasture can support the demands towards protection and sustainable use of biodiversity. The research connects socio-empiric and field methods. The frequency analysis is applied using frames (1 m²) which are put into the owp’s as well as in the adjacent non-pasture woodland. In these frames all plant species are recorded and afterwards statistically compared. Additionally, vegetation and surface struc-tures are registered in 2500 m² plots. Ensuing, specific structural elements are recorded along 2 transects crossing each square using the step-point method. Through interviews with farmers and members of the forestry and nature conservation managements, different pasture and management systems can be identified. First results show a multiple use of recent wood pasture, successful if done together with the forestry administration, supporting the appropriate herding of livestock. The flora reflects the mechanical influences and leads to a species composition in the herb layer. Plant diver-sity nearly triples, the richness of surface structures increases and habitat qualities are initiated that accumulate inside the pasture woodland.

Key words: Biodiversity, structural diversity, open woodlands, wood pasture, frequency analysis, disturbance hypothesis

BRYOPHYTES AS SIGNAL-SPECIES OF FOREST STANDS IN SERBIA

Marko SABOVLJEVIĆ, Milorad VUJIČIĆ*, Aneta SABOVLJEVIĆ

vujicicm@hotmail.com , milorad@hotmail.com

Institute of Botany and Garden, Faculty of Biology,

University of Belgrade, Takovska 43, 10000 Belgrade, Serbia

Abstract: For the estimation of the biological quality and nature conservation value of woodland areas, some species are suitable as indicators of particularly valuable habitats and most of them occur only in remnants of natural and semi-natural woodland ecosystems. Such indicator species, especially intended for nature conservation purposes are called signal-species. Among other cryptogams, bryophytes (i.e. mosses and liverworts) are considered to be good signal-species giving ideas on the stage of ecosystems they are living in. Signal-species, by rule should be easy to find and identify, with the aim to become practical tools in woodland stage inventory. Ubiquitous species are rather unfitting for this purpose as well as geographically limited taxa. However, the increase of ubiquitous species can give us an idea on the ecological changes and woodland stage as well, but the presence of well selected signal species can lead us to find rare, threatened and more demanding species. The presence of signal-species gives us an idea not only on the stage of the forests but an insight into the woodland history. In our survey, 17 bryophytes are considered to be signal-species in both beech and spruce forests, indicating the potential hot spot woodlands. Further studies should include other cryptogams (i.e. lichenes and higher fungi) to make the possibility of woodland ecosystem estimation from the conservation point of view even more refined.

Key words: cryptogams, bryophytes, signal-species

EFFECTS OF DIFFERENT EUCALYPT SPECIES ON FOREST SOIL PROPERTIES IN THE GUILAN PROVINCE

Hossein SARDABI

sardabi@rifr-ac.ir, hsardabi@gmail.com

Research Institute of Forests and Rangelands

Abstract: The aim of the study when started in 2005 was to investigate the effects of eucalypt plantation on different soil properties. For this reason, a eucalypt trial consisting of six species: *E. camaldulensis*, *E. macarthurii*, *E. maidenii*, *E. rubida*, *E. saligna*, *E. viminalis* which were planted in 1983 in Guilan province of the Islamic Republic of Iran under the experimental design of Randomized Complete Blocks with four replications at 2 x 2 m spacing and total number of 100 seedlings at each plot, was used for this research. Soil samples were taken from each plot, including four control ones by an auger up to 60 cm depth (in total 28 samples). Soil morphology was studied by digging three soil profiles at the eucalypt site and two adjacent parcels, including a poplar and an oak forest. Soil samples were taken from four soil horizons of each profile (in total 12 samples). The results showed that the species differed significantly in respect to only few soil properties, including silt percentage, litter dry weight, bulk density, penetration resistance, pH and phosphorous amount. The soil profiles at the eucalypt site and the two adjacent sites of poplar plantation and oak forest consisted of four horizons, including A, AC, B and C. Root development at eucalypt, poplar and oak sites limited to 100, 85 and 150cm soil depth. Overall, eucalypt plantation was able to improve soil structure and porosity, particularly at topsoil. Although there was intensive livestock traffic in the eucalypt site, but soil compaction was significantly less than the control plots and there was not significant difference between the eucalypt species in response to penetration resistance.

Key words: Eucalyptus, soil, productivity, compaction

FOREST SOIL FERTILITY VARIATION UNDER EUCALYPT PLANTATION

Hossein SARDABI

sardabi@rifr-ac.ir, hsardabi@gmail.com

Research Institute of Forests and Rangelands

Abstract: The aim of the study when started in 2007 was to investigate the status of N, P and K elements in leaves of six eucalypt species, planted 24 years ago on a coastal, heavy and acidic forest soil at Guilan province of Iran (Western Caspian Forests). For this reason, a eucalypt trial consisting of six species: *E. camaldulensis*, *E. macarthurii*, *E. maidenii*, *E. rubida*, *E. saligna*, *E. viminalis* which were planted in 1983 under experimental design of Randomized Complete Blocks with four replications at 2 x 2 m spacing and total number of 100 seedlings at each plot, was used for this research. At each plot, three trees were selected randomly and leaf sampling was made from each tree at 1/3 end of crown height, at the end of summer. The results of leaf analysis showed that there was no significant difference between the replications in respect to the amount of N, P and K elements. Although the species did not differ significantly in respect to the amount of K and P leaf elements, but there was significant difference between the eucalypt species in respect to the amount of N element. The lowest amount of N belonged to *E. maidenii* and there was no significant difference between the other species. Overall, eucalypt plantation on a heavy, hydromorphic and acidic forest soil of north forests of Iran did not leave any negative effects on soil fertility, because there was no nutrition deficit in the soil and nutrition disorder in the eucalypt species. It is necessary to indicate that eucalypt plantation on heavy, hydromorphic and acidic soils of the northern forests of Iran with humid and high humid climates, particularly species with thick leaves and high oil extract, should be avoided. In that case, mixed plantation of eucalypt and native broad leaved species such as Alder is recommended.

Key words: Eucalyptus, soil, productivity, leaf analysis, nitrogen, phosphorus, potassium

**PROMOTING SYNERGIES FOR FOREST CONSERVATION UNDER
GLOBAL BIODIVERSITY AND CLIMATE POLICY**

C.B. SCHMITT^{1*}, S. ENTENMANN¹, D. BENICK², T. PISTORIUS²

* christine.schmitt@landespflege.uni-freiburg.de

¹ Institute for Landscape Management, Freiburg University,
Tennenbacher Str. 4, 79106 Freiburg, Germany

² Institute of Forest and Environmental Policy, Freiburg University,
Tennenbacher Str. 4, 79106 Freiburg, Germany

Abstract: Deforestation and forest degradation are the largest source of greenhouse gas (GHG) emissions in tropical developing countries. The United Nations Framework Convention on Climate Change (UNFCCC) aims to tackle this issue under a post-Kyoto agreement through a mechanism on reducing emissions from deforestation and forest degradation in developing countries (REDD), which is currently under negotiation. The mechanism initially had the objective to compensate developing countries that succeed in reducing their emissions from deforestation and forest degradation, and has been extended to cover issues such as forest conservation, sustainable management and carbon stock enhancement (REDD-plus). The implementation of REDD-plus has the potential to create synergies between the climate objectives of the UNFCCC and the targets for biodiversity conservation under the Convention on Biological Diversity (CBD). However, the extent to which so-called “biodiversity co-benefits” will be realised depends on pending decisions regarding, for example, forest definitions, reference levels and the establishment of safeguards. Although many technical and political issues still remain unresolved at the international level, there are already numerous REDD-plus pilot projects and many tropical countries have started to develop national REDD-plus strategies. The research project “The Protection of Forests under Global Biodiversity and Climate Policy”, hosted by the Institute for Landscape Management and the Institute of Forest and Environmental Policy of the Freiburg University, aims to evaluate the potential risks and synergies of different REDD-plus options for forest conservation and to develop recommendation for the establishment of biodiversity safeguards at international, national and the project level. The research combines analysis of the ongoing negotiations under the UNFCCC and the CBD with case studies on the integration of biodiversity issues in country strategies and pilot projects. So far, observations covered the 15th Conference of the Parties (COP15) of the UNFCCC (Copenhagen, December 2009) and the 14th meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA14) of the CBD (Nairobi, May 2010). In addition, an international expert workshop on “Greening REDD-plus: Challenges and opportunities for forest biodiversity conservation” was convened at the University of Freiburg in April 2010. First results indicate that while there

Topic A - Forestry

is broad international consensus that the consideration of biodiversity issues under the REDD-plus mechanism is important, it still remains unclear how this can be achieved. Owing to the highly divergent environmental and political conditions in different developing countries, the development of coherent REDD-plus strategies at the national level stands out as a crucial issue. In particular, this requires good cooperation between the different governmental sectors related to land-use planning. Existing maps, guidelines and standards for biodiversity-related monitoring and reporting at national and project level provide a useful basis for developing safeguards and monitoring schemes that can ensure positive impacts for biodiversity conservation under REDD-plus.

Key words: CBD, REDD-plus, governance, monitoring, UNFCCC

**A COMPARATIVE STUDY OF THE STRUCTURE OF GALLS PRODUCED
BY OAK GALL WASPS OF GENUS ANDRICUS SP. (CYNIPIDAE)
ACTIVITY IN THE WEST AZARBAIJAN PROVINCE**

Noraddin SHAYESTEH, Esmail ALIZADEH, Mohamad Reza ZARGARAN
profshayesteh@yahoo.com
Islamic Azad University of Mahabad

Abstract: Oak gall wasps are very important due to having various species, complex life cycle, sexual and asexual generations and exciting of warped insects in galls. In this survey, the galls produced by the genus *Andricus* spp. activity, were collected from the oak forests of west Azarbaijan province, from the start to the end of the growing seasons, once in 15 days (from April to November). These collected galls were confirmed by Dr. George Melika in a laboratory. Other information such as date and location of gall collection, host and the common shape of the galls were recorded. Many species of oak gallwasps have sexual, asexual generation or have the sexual and asexual generation in the period of the life cycle. In this survey, for example, the galls produced by *Andricus aries* and *A. Askewi* activity, were produced by the asexual generation of these two species but the produced gall by *A. ceconi* activity was produced by the sexual generation of this species. The larvae chamber of the galls were studied. The results were detected that the larvae chamber of produced galls by *A. Kollari* activity is one chamber and the multichambered galls were observed in the produced galls by *A. lucidus* activity.

Key words: Gall wasps, Oak, Structure of Galls and *Andricus* sp.

**POTENTIAL OF BIOMASS AND WAYS OF USING
IT IN THE DISTRICT OF DIBRA**

Malvina Shehi¹, Gazmend Zeneli¹

vinashehi@yahoo.com

¹ Faculty of Forestry sciences, Agriculture University of Tirana – Albania

Abstract: With increasing concern about energy security and greenhouse gas emissions, growing attention has been drawn to wood biomass as one of the potential bioenergy sources. One of the potential bioenergy sources is wood biomass from either conventional forests or energy plantations. This paper reviews the current situation of wood biomass energy development in the region of Dibra (Albania), particularly on its relationship to sustainable development. It points out that the forest in the regions could provide considerable amounts of biomass coming as residues from forest harvesting or from silvicultural treatment. The analysis shows that the rising fuelwood demand in the “wood-for-energy” scenario would clearly lead to a much stronger competition for small roundwood (pulpwood) and sawmill residues. This competition would increase pulpwood prices and — to some extent — forest product prices (especially sawmill residues and pulp). Forestry can play a vital role in bringing additional benefits via land care and rural investment which would help the establishment of new regional industries based on new plantations. Unused agricultural land together with abandoned land presents a great opportunity for the establishment of Short Rotation Forest (SRF) plantations producing higher biomass and offering several inherent environmental benefits unavailable with annual crops. In addition, the harvesting of forest fuels can be a driving force for improved forest management, and thus enhancement of the overall economy of forest industries. The development of biomass-based district heating and the sustainability of bio-fuel supply will require more fuel directly from forests, but might lead to a better management of communal forest.

Key words: Albania, biomass, forest residue, short-rotation plantation, “wood-for-energy” scenario

**LOCAL FORESTRY, A COMPREHENSIVE METHOD FOR SOLVING
ECONOMIC–SOCIAL PROBLEMS OF WOODSMEN**

Reza SHEIKHPOORA, Seyed GHOLAMALI JALALIB*, Ali YAKHKESHIC
and Shamsollah SHARIATNEJADD

^aMaster Sciences of Forestry, Tarbiat Modares University, Iran; [sheikhpoo.reza@yahoo.com]

^bAssociated Professor of Forestry, Tarbiat Modares University, Iran; [Jalali_g@modares.ac.ir]

^cProfessor of Forestry, George-August Gottingen University, German;
^dExpert of forests, rangelands and watershed organization, Iran

Abstract: With regard to the confluence of economic – social problems of woodsmen with sustainable conservation and utilization of Iran northern forests and so considering the lack of successful forests management during recent 85 years, the presentation of a comprehensive model of forest management method with meeting woodsmen needs, sustainable conservation and forests utilization is unavoidable. So, in this study the economic, social and cultural condition of local human living and present conditions and potential of the natural environmental situated in district 6 of Babolrood forest management planning was analyzed to obtain the mentioned aim. Different parameters survey of economic and social aspects using questionnaire forms and complete inventory showed that villagers are taking pains from economic welfare lack and their weak acquaintance of nature wonderful beside economic poverty is due to environmental cultural poverty. Therefore, with considering the uninteresting residential of three villages to going out of the forest and having villagers from reconstruction sub structures such as asphalt roads, electricity, piping water, etc. and also predicting crisis the lack of power man for performing forestry planning in future, a model is proposed entitled “local forestry” with rural organizations pivotal in people partnership framework for forests optimum management.

Key words: Forest management planning, local forestry, Woodsmen, Livestock going out, People’s Participation

**MITIGATING THE GAP IN DEMAND AND AVAILABILITY OF
BAMBOO IN THE STATE OF MADHYA PRADESH
IN CENTRAL INDIA**

Shrivastava Ajit Kumar

ajitshri@gmail.com

Forest Department, Madhya Pradesh India

Abstract: Synchronous flowering of Bamboo over vast tracts of varying extent is observed as „gregarious flowering”. In case of gregarious flowering there is likelihood of bamboo getting wiped out from the area if special attention is not paid to protect and regenerate. The main species of Bamboo is *Dendrocalamus strictus* in the Seoni district of Madhya Pradesh in central India. The bamboo flowering is observed to occur at the interval of about 40 years since 1922-24 and 1962-64. Recently, Bamboo flowering took place from 2004 to 2007 in an area of 27,380 hectares resulting in the chopping of the Bamboo forests in the span of 3 years. This has created a sudden blank in the Bamboo forest severely affecting the socio economic scenario for local people and also bamboo availability for future. The paper industry which is currently operating at about 41 % of its capacity is facing all odd and its fate is at a stake. There is a severe shortage of quality bamboo material. Hence the need for a new and vast scale plantation is a must. A special drive for mass scale planting of bamboo has been taken up in the state by observing the year 2010 as “Bamboo Year” with an ambitious target of planting 50 million bamboo seedlings in the current year with continuous efforts in the future. The quality planting material is a major deciding factor. Availability of good quality seed is not possible always due to erratic flowering in different areas hence developing the tissue culture plants at mass scale for the selected species is to be looked for. Other than paper industry the bamboo is used for scaffolding in fencing, handicrafts, incense sticks, ladders, agriculture implements, fishing rods, fire crackers, support for plants, flag poles etc. Some modern applications of bamboo have also developed for food processing industry, alternative energy, new generation building material and health and pharmaceutical industry. The various measures like bamboo regeneration, protection, fire control and research are of prime importance to bring existing area to well stocked status. It is to be promoted as an important component of agro forestry and an agri-horticulture crop to bring more and more area under bamboo.

Key words: „gregarious flowering, *Dendrocalamus strictus*, “Bamboo Year”, green gold.

**PINE WILT DISEASE IN PORTUGAL TEN YEARS AFTER THE
FIRST REPORT: THE TRÓIA PENINSULA CASE STUDY.**

Edmundo SOUSA, Luís BONIFÁCIO, Pedro NAVES

pedro.naves@inrb.pt

INRB, IP (National Institute of Biological Resources), 2780-159 Oeiras, Portugal

Abstract: Ten years have passed since the first report of the Pine Wilt Nematode *Bursaphelenchus xylophilus* in Maritime Pine (*Pinus pinaster*) at Pegões region in Portugal, in 1999. Since then the research developed established the cerambicid *Monochamus galloprovincialis* as the only vector responsible for the nematode introduction in healthy hosts while feeding on the bark of the trees. In Portugal, this beetle has one generation per year, with females laying their eggs on dead and weakened trees during summer months and only larvae inside the wood of the host trees in a dormancy stage are present during winter. Control measures involve the detection and felling of all dead or symptomatic trees before adult beetles' emergence in May and afterwards trapping flying adults with lures based on host volatiles and scolytids pheromones. Tróia Peninsula is an important touristic site with 400 ha of maritime pine forest located close to the initial Pine Wilt Disease detection. Starting in the year 2000, a new integrated forest management plan allowed reducing of the number of dead pine trees, from over 4000 to fairly constant yearly rate around 500 trees, in 2009. Control measures produced an even more significant reduction of nematode infected trees from initial rate over 80% to less than 15% of the total number of dead pine, since 2006.

**DISPERSION OF THE INTRODUCED PINE
WOOD NEMATODE IN PORTUGAL**

Edmundo SOUSA, Pedro NAVES, Luis BONIFÁCIO

pedro.naves@inrb.pt

INRB, IP (National Institute of Biological Resources), 2780-159 Oeiras, Portugal

Abstract: In 1999 the Pine Wood Nematode (PWN) *Bursaphelenchus xylophilus*, which is the causal agent of the Pine Wilt Disease (PWD) and a quarantine organism within the European Union, was found for the first time in dead maritime pines (*Pinus pinaster*) in Portugal and in Europe. The confinement of the PWN to Setúbal peninsula, South of Lisbon, led to the definition of a PWD Demarcated Area, subdivided into an Affected Zone and a bordering Buffer zone. Over the following years, the Portuguese official authorities implemented phytosanitary regulations and measures to avoid the dispersion of the disease, with the Demarcated Area annually assessed. Furthermore, and to prevent the natural spread of the disease, all susceptible trees were removed within a 3km-wide barrier (the “Clear Cut Belt”) implemented in 2006/2007 in the entire periphery of the Demarcated Area. Nevertheless, and despite all efforts, in 2008 the nematode was detected in the centre of Portugal (Lousã and Arganil districts), more than 150Kms from Setúbal peninsula. Even more recently, its presence was confirmed in Madeira, an isolated Island almost 1000Kms south-west of Lisbon. Human activities are the most important factor in the spreading of the PWN from outside its native range in North America to countries such as Japan, China, Korea and Portugal. In all these new locations the PWN associates with insect vectors which locally further disseminate the disease, the most important belonging to the genus *Monochamus*, being *M. galloprovincialis* the sole vector in Portugal. Preliminary studies conducted in Portugal, using mark-recapture beetles and trapping, suggest that this insect has a limited flight-range, with an initial dispersal phase immediately after emergence (which went over 400 meters), and subsequent limited and small-distance flights during the breeding period. Although additional studies about the flight behaviour of the vector need to be conducted, our results suggest that the natural (by the vector) spread of the PWN in Portugal is conditioned by the limited dispersal capacities of its vector, and that the Clear Cut Belt was not overcome by the flying insects. Instead, the new nematode focuses were probably a consequence of human activities such as illegal or accidental transportation of infected wood through major freeway and railway networks, which have direct connection to the original Demarcated Area in Setúbal peninsula hundreds of kilometres away.

**STAND STRUCTURE AND DIVERSITY IN THE NATURE
RESERVES IN THE KOPAONIK NATIONAL PARK**

Branko STAJIĆ, Milivoj VUČKOVIĆ, Marko SMILJANIĆ
branko.stajic@sfb.rs

Faculty of Forestry University of Belgrade, Kneza Višeslava 1, Belgrade

Abstract: The modern forest management necessitates unambiguous and practical ways of defining and measuring biodiversity and structure of forest and forest ecosystems. This is especially significant in the highly structured natural forest ecosystems (nature reserves, virgin or virgin-like forests) rich in tree species of different positions, dimensions and ages. The research was performed in four nature reserves in the National Park „Kopaonik”. The structure and diversity of nine uneven-aged stands (0.2 ha each) were analyzed and numerically defined from the aspect of spatial arrangement of trees and species, variations of tree dimensions and tree species diversity. For that purpose some of the latest developed structural and biodiversity indices were applied. These case studies have shown that the studied parameters enable a detailed and a good-quality description of the actual stand state as well as the potential quantification of the possible reduction of biotic diversity and ecological stability at the stand level in time and space.

Key words: stand structure, diversity, quantification, nature reserve, National park Kopaonik

**DENDROCHRONOLOGICAL STUDIES IN NORWAY SPRUCE
(PICEA ABIES (L.) KARST.) STANDS FROM NP KOPAONIK**

Branko STAJIĆ, Milivoj VUČKOVIĆ, Marko SMILJANIĆ

branko.stajic@sfb.rs

Faculty of Forestry University of Belgrade, Kneza Višeslava 1, Belgrade

Abstract: Tree ring characteristics are very sensitive to conditions that existed during their formation. In order to study impact of these conditions on tree growth most often used characteristic is width of tree rings. Detrended and standardized tree ring width series are compiled into tree ring chronologies. In principle, dendrochronological studies were not undertaken in Serbia until now. Since the spruce is one of the most studied species in dendrochronological research. Primary aim of this research was to build tree ring chronology for Norway spruce (*Picea abies* (L.) Karst.) from NP Kopaonik. Secondary aim of this research was to determine so called “marker” or “pointer” years, in which growth conditions were critical of favorable. Tree rings that were formed in these years are characteristically narrow or wide. It is concluded that chronology building is the most important procedure, which represents the basic step for determining the impact of climate and other conditions for tree growth.

Key words: Dendrochronology, Tree rings, *Picea abies* L., National Park Kopaonik

THE MISTLETOE (*VISCUM ALBUM L.*) – A PROBLEM IN FIR (*ABIES ALBA MILL.*) FORESTS IN SERBIA AND THE REPUBLIC OF SRPSKA

Zoran STANIVUKOVIĆ, Milan MILENKOVIĆ,
Dragan KARADŽIĆ, Ljubodrag MIHAJLOVIĆ
milan.milenkovic@sfb.rs

Faculty of Forestry Banja Luka, Republika Srpska, BiH
Faculty of Forestry University of Belgrade, Belgrade

Abstract: The mistletoe is one of the most important semiparasitic flowering plants. *Viscum album* ssp. *abietis* (Weisb.) Abromeit occurs on fir and causes great damage in natural fir stands. The mistletoe is a very important factor of fir tree decay. After the mistletoe, the bark beetles and other harmful organisms occur. The main factors determining the appearance of mistletoe in certain area are the altitude, the amount of light in the stand (determined by the canopy) and the silvicultural system. In the research in Serbia and Republika Srpska, the appearance of mistletoe has been recorded at 400-1200 m altitude, and the greatest attack intensity has been recorded up to 800 m altitude. The appearance of parasitic fungus *Melampsorella caryophyllacearum* (DC.) J. Schröt is very common on fir trees in this altitude zone. This fungus causes tumours, broom rust and cankers. During the research, following insect species were recorded on fir: *Acanthocinus griseus* (F.) (Coleoptera, Cerambycidae), *Pissodes piceae* Ill. (Coleoptera, Curculionidae) and *Pityoectenes vorontzovi* (Jacob.) (Coleoptera, Ipidae). The presence of the mistletoe on the fir trees was mostly in the conditions of open canopy. However, even with the continuous canopy, a great number of covert mistletoe shrubs was recorded on the fir trees. These shrubs represent latent danger in the case of opening the canopy. The best results in the mistletoe control can be obtained by the use of preventive measures which are the part of the silvicultural system. The aim of these measures is preservation of the canopy. Certain results in the control of the mistletoe can be obtained by the use of herbicides. However, the application of herbicides is difficult, because of the height of trees and the presence of mistletoe shrubs on the top of the trees. The following insect species have been recorded on the mistletoe on the fir trees: *Psylla visci* Curt. (Homoptera, Psyllidae), *Carulaspis visci* (Schr.) (Homoptera, Diaspididae), *Agrilus viscivorus* Bily (Coleoptera, Buprestidae), *Pogonocherus fasciculatus* Deg (Coleoptera, Cerambycidae) and *Synanthedon loranthe* (Kral.) (Lepidoptera, Aegeridae). All the previous species, with the exception of *P. fasciculatus*, are the potential biological agents for the mistletoe control. Especially interesting species are *Carulaspis visci* (mistletoe scale insect) and *Agrilus viscivorus*. Mistletoe scale insect appears in Republika Srpska in the great numerousness and causes the decay of mistletoe shrubs. *A. viscivorus* has been described recently, it is monofagous and also causes the decay of the mistletoe shrubs. 35 fungi species have been recorded on the mistletoe on the fir trees. Out of this number, 8 species are with strongly expressed parasitic

Topic A - Forestry

characteristics, while 9 species are facultative parasites. The following species are potentially important for the biological control of the mistletoe: *Cytospora* sp., *Gloeosporium harposporum* Bres. Et Sacc., *Phoma visci* Sacc., *Phyllosticta visci* Sacc., *Septoria visci* Bresad., *Sphaeropsis visci* (Solm.) Sacc. and *Gibberidea visci* Fuckel..

Key words: *Viscum album*, *Abies alba*, entomofauna, mycoflora, control, Serbia, Republika Srpska

NICKEL CONTENTS IN PLANTS AND SOIL IN THE AREA OF THE PROTECTED NATURAL RESOURCE „AVALA” – BELGRADE

Dragica STANKOVIC¹, Milan KNEZEVIC¹, Borivoj KRSTIC²,
Mirjana SIJACIC NIKOLIC¹, Dragica VILOTIC¹

¹ Faculty of Forestry, University of Belgrade, no.1 Kneza Visaslava st, Belgrade

² Faculty of Natural Sciences, University of Novi Sad,
no.2 Trg D. Obradovica st., Novi Sad.

Abstract: The purpose of this research is in the first place focused on the aim of determining the load of ecosystem or rather soil and plants with the heavy metal (Ni) and the level of accumulation in this area so that on the basis of the obtained results adequate protection measures could be timely taken. The research of nickel (Ni) contents in the leaves of herbs and woody plants growing under urban conditions in comparison to the nickel concentrations in the plant leaves in the protected natural resource „Avala” (16 km away from Belgrade) indicates that the recorded values of nickel concentrations by locations are statistically significantly different and range from A to F on locations 1, 2 and 3 while on location 4 in urban conditions the values range from A to B in accordance with the Duncan’s Test.

Key words: Nickel, concentrations, urban conditions, traffic arteries, leaf, soil.

**DESIGN OF SERPENTINE ON FOREST ROADS
BY THE INTERNAL CIRCULAR CURVE METHOD**

Bogdan Stefanović

bogdan.stefanovic@sfb.rs

Faculty of Forestry, University of Belgrade,

Abstract: The paper provides an overview of geometric solutions of marking all four types of serpentine by the method of internal circular curve in the design of forest roads on the ground. The main objectives of presenting this new original method for marking of serpentine in one place is to show similarities and differences of marking certain types of serpentine, and identify opportunities for further research on this topic. The method is based on the set of required minimum number of elements to mark the serpentine forest roads and other budget elements and their design on the field. This method reduces errors in design, i.e. reduces the number of attempts to mark the serpentine, which leads to the increase in the impact of design in relation to the previous way of marking the serpentine on forest roads.

Key words: forest roads, serpentine, internal circular curve method

**ANALYSIS OF SCIENTIFIC INFORMATION: STUDIES
OF SYCAMORE MAPLE**

Milena Stefanović¹, Dragica Obratov-Petković², Srđan Bojović³
milenast983@gmail.com

¹ PhD student, Faculty of Forestry, University of Belgrade, Serbia

² PhD, Professor, Faculty of Forestry, University of Belgrade, Serbia

³ PhD, Professor, Institute for Biological Research "Siniša
Stanković", University of Belgrade, Serbia

Abstract: In scientific research we often deal with extensive databases, for instance bibliographic references and with numerous information they provide. There are certain difficulties to examine such a large amount of data and to get an insight into their structure, organization and implication of predominant tendencies. In this study we used "Scopus" database of peer-reviewed literature to search for relevant scientific information concerning studies with sycamore (*Acer pseudoplatanus* L.) for the past ten years. Our aim was to demonstrate analysis methods in the previous studies, so that we can chose the right direction more efficiently in the future studies for the determined species. Concerning keyword frequency we defined domains of scientific research, predominant tendencies and discussed the recommended directions of the future research with sycamore.

Key words: *Acer pseudoplatanus*, „Scopus”, research tendencies

**SHAPING FUTURE WITH FORESTS THROUGH STATE FOREST
INSTITUTIONS POTENTIALS FOR USING BENCHMARKING
MODEL AS DECISION-MAKING SUPPORT**

Mirjana STEVANOV, Max KROTT

mzavodj@gwdg.de

Institute of lowland forestry and environment (Novi Sad, Serbia) & Chair
of forest and nature conservation policy (Goettingen, Germany)

Abstract: What the future with forests will look like strongly depends on the direction state forest institutions will take. It is while these institutions play a key role in the forest sectors of the most European countries. As such, they indispensably shape development perspectives of both, forests and forestry. For that reason, it seems considerably relevant to engage in monitoring of their overall performance on a fair and common base. This paper deals with one possible solution, which is the application of a causative benchmarking model for global comparison. The aim of the paper is to introduce this innovative approach, to discuss its applicability potentials (as a decision-making support), strengths and weaknesses. For this purpose the model was (pre)tested on the case of Serbian state forest management institutions, with positive results.

Key words: forest policy, benchmarking, state forest institutions, decision-making

**POSSIBILITIES FOR ADDITIONAL FINANCIAL SOURCES
OF THE MAVROVO NATIONAL PARK IN R. MACEDONIA**

M. STOJANOVSKA, V. STOJANOVSKI, M. MIOVSKA

makedonka@sf.ukim.edu.mk

University of St. Kiril and Metodije, Faculty of Forestry, Skopje

Abstract: This paper analyses the current way of management of the Protected Areas management institutions in the Republic of Macedonia and new trends in forest policy for obtaining additional financial sources. Protected areas (PA) have shown as essential to conserve wild nature and as well the associated cultural aspects. They provide help to sustain life on the Earth. It means that not only economical, but also ecological, social and cultural aspects should be incorporated in the new management trends. Nevertheless, this is not a case in Macedonia. The national parks are still managed in a traditional way and wood cut takes above 80% of their income. “Mavrovo” National Park is not an exception in that situation. The purpose of this study is to describe present financial sources, determine possible other sources and provide recommendation on the future management of the Mavrovo national park. Regarding methods used in this research, there were interviews of multiple actors related to forest management and nature protection. For the data analysis a method of interpretation was used. Results have shown that there are a lot of additional financial sources that can be applied in the management of the national park. Activities like hiking, mount biking, skiing, eco-tourism, recreational fishing should be applied as the most significant part of the management plan regarding the variety of the terrains. All obtained data in this paper will be a benefit not only for the “Mavrovo” NP and relevant stakeholders but also for other national parks in the Republic of Macedonia, other state institutions interested in or concerned with protected areas, institutions connected with the tourist sector and rural development as well as scientists from this area of covering.

Key words: nature conservation, management, multifunctional use, forest, income, recreation, eco-tourism.

**EFFECTS OF DIFFERENT MINERAL FERTILIZERS ON THE
GROWTH AND DEVELOPMENT OF ONE YEAR OLD SEEDLINGS
OF NORWAY SPRUCE (*Picea abies* /L/Karst) WITH BARE ROOT**

Dragan STOJICIC, Milan MATARUGA, Vasilije ISAJEV
stojicic_dragan@yahoo.com

Abstract: This paper presents the effects of complex and nitrogen mineral fertilizers, the morphometric performances of one-year seedlings of Norway spruce (*Picea abies* /L/Karst.) produced in the traditional way in terms of seedling nursery. Analysis of the influence of mineral fertilizers on the development of one year Norway spruce seedlings was performed in the experiment which is set in the nursery Stanovi near Doboje, Republic of Srpska/BiH/. Nursery conditions have caused widespread modification impacts of mineral fertilizers on the elements of the morphometric characteristics of seedlings. There was a positive influence of mineral fertilizers on most traits.

Key words: mineral fertilizers, Norway spruce, seedlings, bare root, nursery

**ASSOCIATION OF BEECH, FIR AND SPRUCE IN KLEKOVAČA
MT. – MANAGEMENT EFFECTS ON ITS FORM AND COMPOSITION**

Vladimir STUPAR¹, Jugoslav BRUJIĆ¹,
Đorđije MILANOVIĆ¹, Rade CVJETIĆANIN²
stuparvladimir@gmail.com

¹ Forestry faculty, University of Banja Luka, Stepe Stepanovića 75a,
78000 Banjaluka, B&H

² Forestry faculty, University of Belgrade, Kneza Višeslava 1, 11000 Beograd, Serbia

Abstract: The paper shows the variants of the association of beech, fir and spruce in the area of the Klekovača Mt. in the northwestern Bosnia. Variants of this association are compared against the floristic composition and physiognomy, with each other, as well as with original virgin forest association of beech, fir and spruce of the Forest reserve “Lom” that lies in the area of research. Forests are situated in the similar ecological conditions, yet there are large differences in the proportion of the edificers, as well as floristic composition and vertical form of those forests. Retrospective view on the influence of the management measures on those changes was given.

Key words: Piceo-Abieti-Fagetum, syntaxonomic analysis, Klekovača Mt., virgin forest, forest management

**VARIABILITY OF CONE MORPHOMETRICAL TRAITS AND SEED
QUALITY PARAMETERS OF NORWAY SPRUCE SAMPLE
GENOTYPES FROM KOPAONIK MOUNTAIN**

Mirjana ŠIJACIĆ-NIKOLIĆ¹, Jelena MILOVANOVIĆ², Radmila KNEŽEVIĆ¹
sijacic68@nadlanu.com

Faculty of Forestry University of Belgrade, Kneza Višeslava 1, Belgrade
2 Faculty of Applied Ecology "Futura" University "Sing-
idunum", Lazarevački drum 13-15, Belgrade

Abstract: Over 300 ha or 44% of total forest cover of Kopaonik mountain are pure stands of Norway spruce seriously degraded during last years. High mountainous conifer communities cover the area between 1400 and 1750 meters above sea level where Norway spruce is the most frequent species. Poor health condition, frequent tree falling, semi-opened stands and low stand quality influence natural regeneration. With the aim of regenerative ability improvement of Norway spruce from Kopaonik Mtn., 15 test trees have been selected and cones were collected during the winter of 2009. This paper presents results of analyses of cones morphometrical traits (length, width and mass), as well as seed quality analyses (total mass and seed germination rate). The data show cone length values between 7,8-11,5 cm; cone width values between 2,2-3,2 cm and cone mass values between 16,36-22,02 g. Total seed mass has values between 4,2 and 6,6 g, while seed germination rate is between 23,02 and 75,5%. Research results show lower average values of cones dimensions, total mass and seed germination rate than optimal which is an added problem to already difficult regeneration of Norway spruce forests from Kopaonik mountain.

Key words: Kopaonik mountain, Norway spruce, cones morphometrical traits, seed quality, regeneration

ESTIMATION OF PAULOWNIA ADAPTABILITY IN SERBIA

Mirjana ŠIJACIĆ-NIKOLIĆ¹, Dragica VILOTIĆ¹,
Radmila KNEŽEVIĆ¹, Suzana MITROVIĆ²
dragica.vilotic@sfb.rs

¹ Faculty of Forestry, University of Belgrade, Kneza Visaslava 1,
11030 Beograd, Republic of Serbia

² Institute for Forestry, University of Belgrade, Kneza Visaslava 3,
11030 Beograd, Republic of Serbia

Abstract: Paulownia is a deciduous tree originating from China, whose main characteristic is fast growth, and it is often classified as the fastest growing tree in the world. This tree is mainly used as raw material for the production of pulp. It is nowadays grown in plantations all over the world. This species was first introduced in Serbia in planned manner in 1993, and ever since several experimental plantations have been erected. Individual and group trees of this species, known for their extraordinary decorative properties, can be found in urban green areas. In order to estimate adaptability of this species in our environmental conditions, certain quality and quantity researches have been applied with selected test trees of Paulownia elongata S.Y. Hu. In addition, development analyses for Paulownia elongata S.Y.Hu and Paulownia fortunei Hemsl. have been published for experiments held in nursery and field conditions. The results obtained in initial research years have shown high potential of adaptability among the analyzed species, which presents good basis for its more extensive growth in dedicated plantations.

Key words: Paulownia elongata S.Y.Hu and Paulownia fortunei Hemsl., adaptability, field conditions, Serbia

**THE MOST PROMINENT MANAGEMENT PROBLEMS IN THE
KOPAONIK NATIONAL PARK**

Predrag ŠUMARAC, Biljana SAKOVIĆ
su_pre@yahoo.com

Abstract: Protected areas present “islands of wilderness” that are in theory protected from all types of negative impact originate from human activity. This tool for nature protection and biodiversity conservation is facing the constantly growing threats which jeopardize its very existence. Variety of issues that are threatening the nature of protected areas influence that management in them more or less effectively conduct different measures with mitigating consequence towards these negative impacts. This paper deals with problems of financing aspect of management, waste disposal and illegal construction in the Kopaonik National park. Over the years these unsolved problems (especially in the field of financing) culminated and seriously undermine management efforts in relation to nature protection and biodiversity conservation. Total budget amount and the related financing structure are not optimally correlated with the prescribed role of the national park and necessary management activities. Illegal and to landscape inadaptable construction followed by undeveloped infrastructure together lead to more negative impacts towards the national parks nature.

Key words: financing, nature protection, management, national park, illegal construction

Topic A - Forestry

EFFECT OF SEED SIZE, FENCING AND PROTECTIVE TREATMENT ON GROWTH AND ESTABLISHMENT OF QUERCUS CASTANEIFOLIA (C. A. MEY.) SEEDLING

Masoud TABARI, Alireza Ali ARAB

masoudtabari@yahoo.com, mtabari@modares.ac.ir

Faculty of Natural Resources, Tarbiat Modares University

Abstract: The effects of seed size, fencing and protection treatments (treeshelter and mulch) were investigated on seedling establishment of Chestnut-leaved oak (*Quercus castaneifolia*) in the first growing season. For this purpose, a degraded forest in 750 m above sea level was selected in Loveh (Golestan province-Iran). Then, 1728 sound and ripe acorns were selected from a seed lot, collected from six parent trees located in adjacent to the examination area. Using a split-split plot design, the effects of 3 seed size classes: small (diameter < 15 mm), medium (diameter between 15 and 17 mm) and large (diameter > 17 mm), 2 fencing levels (fenced and open), and 4 protection treatments (control, mulch, treeshelter, and treeshelter with mulch) were engaged for measuring the seedlings emergence, establishment percent, total length, and survival rate. At the end of the first growing season, seedlings originated from the large seeds had higher emergence percent, establishment percent, total length and survival rate. Fencing promoted establishment percent about twofold, and treeshelter, singly or with mulch, increased establishment percent, total length and survival. From this investigation it can be deduced that large seeds in seed sowing can improve seedling establishment chance, provided that suitable methods of collection, sterilization and storage of seed lots are applied. Likewise, treeshelter, singly or along with mulch can improve establishment percent, total length and survival rate, but with constructing a suitable fence around the plantation area, treeshelter and mulch treatments can be ignored.

Key words: Establishment, Fencing, Mulch, *Quercus castaneifolia*, Seed plantation, Seed size, Treeshelter

Topic A - Forestry
**POSITIVE AND NEGATIVE EFFECTS OF NEW FOREST LEGISLATION
ON SUSTAINABLE FOREST MANAGEMENT PRACTICES AND
OWNERSHIP RIGHTS OF FORESTS IN MACEDONIA**

Todorov VOISLAV
vtodorov@snvworld.org
SNV – Netherlands development organization –Macedonia

Abstract: In the recent past Forests have gained a significant role in the society. Concerns about sustainability of forests and biodiversity protection are no longer topics of interest only to scholars and professionals, but are being debated and discussed also in the media, in policy and political fora, on the street, in schools and at home. In Macedonia there is discussion among professionals about other forest functions, role of forestry and private forest owners in environmental issues, rural development and development of mountain or Eco-tourism, but implementation of all these aspects in forestry is missing. Traditional forestry practiced in Macedonia today should be gradually abandoned and experts and scholars in this field should start promoting and introducing sustainable forest practices fulfilling the economic, environment and social elements in society. The strategy for development of forestry is a strategic document that complies all the necessary changes and perspectives that should be embedded in the forest legislation of R.Macedonia in order to meet the EU requirements. Present law in force does not comply with the EU standards, it is also discriminating for the private forest owners, taking into account some articles of the law. In order to provide proper legal provisions related to management functions within the forestry sector, first of all the term “forest management” needs to be clearly defined. Then, it is necessary to allow private forest owners to manage their forests by themselves according to some basic management requirements. In Macedonia, instead of one clear solution (state authorized body of control) the current forest legislation deals with three different types of bodies that provide the control function in forests. There is a need for political consensus and also for political will to bring all relevant stakeholders around one table. Joint efforts are needed to prepare a forest law that will stand for years more, and will be compatible with the needs of the forestry sector and with the requirements of sustainable development, according to EU criteria. This study is based on content analyses of forest related legislation in Macedonia. The main method which is going to be used is qualitative research based on content respectively document analysis. This paper analyses the current policy and legislation documents in the Forestry sector, and how this affects sustainable forest management and ownership rights over forests in Macedonia.

Key words: law, sustainability, forestry, ownership rights.

EFFECTS OF CURING TIME ON BENDING STRENGTH OF THE FINGER-JOINED BLACK PINE AND MACEDONIAN FIR LUMBER

Dimitrios TSALAGKAS¹, Vassilios VASSILIOU²

Aristotle University of Thessaloniki, Faculty of Forestry and Natural Environment, Department of Harvesting and Forest Products Technology

¹ Wood technologist, Msc, email: dtsalag@for.auth.gr

² Wood technologist, PhD, Associate Professor, email: vass@for.auth.gr
Thessaloniki 2010

Abstract: Curing time of an adhesive consists one of the most important factors on the performance of finger-jointed wood. Any further handling of the joint, should be occurred, after most of the curing has being completed. The object of this study was to investigate the effect of curing time (2 ½, 7, 24 and 168 hours) on bending strength properties of finger jointed macedonian fir (*Abies borisii regis*) and black pine (*Pinus nigra*), with two different finger lengths (12.5 and 20 mm). An emulsion polymer isocyanate adhesive cured at room temperature, was used for this purpose. MOR of all specimens of macedonian fir ranged from 18.22 up to 56.27 MPa, which correspond to a percentage level of 27.43 % up to 84.71 % of the solid wood (66.42 MPa) and MOE mean values fluctuated from 8726.25 to 12246.11 MPa, which correspond to a percentage level of 111.99 % up to 157.17 % of the solid fir wood (7791.39 MPa). On the other hand, MOR mean values of black pine wood specimens were from 16.79 up to 64.35 MPa, which correspond to a percentage level of 18.76 % to 71.92 % of the solid black pine wood (89.47 MPa) and MOE mean values of black pine wood specimens fluctuated from 7559.83 to 12990.4 MPa, which correspond to a percentage level of 61.57 % up to 105.8 % of the solid black pine wood (12277.3 MPa). Results showed that curing time had a statistically significant effect on the bending strength properties of finger joints. After 24 hours finger joints obtained more than 65 % of the reference MOR of 168 hours.

Key words: black pine, bending strength, curing time, EPI adhesive, finger joint, Macedonian fir

TRAPPING POSSIBILITIES AND RESULTS OF DUSKY CLEARWING

Katalin TUBA, Géza KELEMEN

tubak@emk.nyme.hu, kelemen.geza@aesz.hu

University of West-Hungary, Institute of Silviculture and Forest Protection,
9401 Sopron, Hungary,

Abstract: The dusky clearwing (*Paranthrene tabaniformis*) is one of the most noxious xylophagous insects on the poplar. The moth can colonize poplar, occasionally willow plantings, first of all in nursery school, in young plantation and in energy plantation where larvae damage the poplar trees by boring into the trunks. Most of the cases it develops in hybrid poplar one or two years. Larvae chew in the trunks and cause an asymmetric gall like a swelling. The attacked trunks often break. The protection against this moth is difficult. The larvae live in a protected, hidden site and there is only a short time to the efficient manages. Therefore it is important to time the protection. The dusky clearwing can not be catch by light traps. Its male is attracted by sex pheromone. We have tested pheromone baited traps for three years (2008-2010). We used sticky delta traps and funnel traps with lure in a nursery and in a poplar forest in western part of Hungary. The traps worked from the beginning of May until the end of August. We checked the catching every week. The moth starts to fly on the last week of May and finishes it in the middle of August. This moth has one generation per year, however with a long swarming time. Both traps form is suitable to catch the dusky clearwing but there is significant difference between the catch of the sticky delta traps and funnel traps. The pheromone of *Paranthrene tabaniformis* is not fully species specific either. It attracts other Sesiidae species too. This pheromone is suitable to examine the level of the infection of the dusky clearwing in a poplar forest and it is possible to set the application time according to the swarming of the moth. The shape of the trap can make the trapping of this moth more efficient.

Key words: dusky clearwing, poplar, pheromone, sticky delta traps, funnel trap, energy plantation

**INNOVATION AND SUSTAINABILITY IN FORESTRY IN CENTRAL
AND EASTERN EUROPE: CHALLENGES AND PERSPECTIVES**

Tykkä, S.¹, J. Nedeljković²

saana.tykkae@boku.ac.at

¹ EFICEEC, University of Applied Life Sciences, Vienna (BOKU), Feistmantelstrasse 4, A-1180, Vienna

² Faculty of Forestry, University of Belgrade. Kneza Visislava 1, 11000 Belgrade

Abstract: The sale and the restitution of state owned forests and the conversion of state owned forests from a state-agency into enterprises in public ownership are the main pillars of the restructuring of forest management in CEE countries. The strategies applied to achieve privatization in forest management differ widely from country to country. The paper will present the key findings and results of the project SUSI-CEE “Innovation and Sustainability in Forestry in Central and Eastern Europe: Challenges and Perspectives”. In total, eight countries are included in the analysis. The countries covered are as follows, Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Romania, Serbia and Slovakia. The restructuring of the forest business environment has happened in order to increase economic efficiency of forestry and improvement of forest status from ecological and stability perspective. Overall, privatization of forest land had no particular role in the forest-related privatization, whereas restructuring of state forest administration had a bigger role.

Key words: privatization, restructuring, sustainable forest management, Central and Eastern Europe

THE IMPLEMENTATION OF THE EUROPEAN LANDSCAPE CONVENTION (ELC): THE ENGLAND FORESTRY ACTION PLAN AS A MODEL FOR THE IMPLEMENTATION ELC IN SERBIA FORESTRY SECTOR

Nevena VASILJEVIĆ, Ratko RISTIĆ, Milan MEDAREVIĆ,
Biljana ŠLJUKIĆ, Boris RADIĆ
nevena.vasiljevic@sfb.rs
University of Belgrade, Faculty of Forestry

Abstract: This article intends to introduce The European Landscape Convention (ELC) as the first international instrument which is formally dealing with landscape. Endorsed by the UK government it has required a national level action to plan, manage and protect landscapes and also to liaise and co-operate at an international level across Europe. As the government's agent, dealing with forest and woodland matters, the Forestry Commission in England has agreed to produce an ELC Action Plan that includes proposals for strengthening, promoting, understanding and consideration of the landscape issues on all areas, including those on the Public Forest Estate. This Action Plan has set out actions to be undertaken over a period of five years (started in April 2010) to assess existing landscape regulation, policies, strategies and programmes, guidance and training, to ensure that principles of the ELC are applied in an appropriate manner to the management and creation of woods and forests throughout England. Republic of Serbia signed ELC in 2007. The next step should be ratification and endorsement by Serbian government. Since the documents as the National Forestry Action Programme of the Republic of Serbia and the Environment Impact Assessment for ski-trails on ski resort "Stara planina", in a way dealing with the protection and promotion of the landscape diversity in Serbia, a brief review of the landscape treatment will be given. Finally, this research should be useful and instructive in the process of ELC implementation in the Forestry sector in Serbia.

Key words: European Landscape Convention, The England Forestry Action Plan, Landscape Character Assessment, Environmental Impact assessment, National Forest Action Programme

**COMPARATIVE RESEARCH ON CIRCULATORY VESSELS
WITHIN GROWTH RINGS OF GYMNOCLADUS
CANADENSIS LAM. FROM SRPSKA CRNJA**

Dragica VILOTIĆ¹, Mirjana ŠIJAČIĆ-NIKOLIĆ¹, Milorad VESELINOVIĆ²,
Milan REBIC³, Dušan JOKANOVIĆ¹

dragica.vilotic@sfb.rs

¹ Faculty of Forestry, University of Belgrade, Kneza Visaslava 1,
11030 Beograd, Republic of Serbia

² Institute for Forestry, University of Belgrade, Kneza Visaslava 3,
11030 Beograd, Republic of Serbia

Abstract: This paper shows the results obtained in a research on macroscopic-microscopic structure (circulatory vessels) of the *Gymnocladus canadensis* Lam. tree, which grows in the area of Srpska Crnja. This species, originally coming from North America, belongs to Fabaceae family and is not anatomically examined in our region. The samples used in this research all originate from GJ "Muzljanski rit" from Srpska Crnja. Bark of the iron tree is dark grey to brownish-grey in colour. As bark of a young tree, it already becomes creased with deep, irregular wrinkles, while its surface gets covered with crusts. The tree with sapwood colour is distinct from heartwood colour. The white is narrow (several growth rings) and light yellowish in colour, while its marrow is dark brown. Growth rings are notable, with a darker zone in the older tree compared to the young tree zone. Wooden stripes not visible to human eye. *Gymnocladus canadensis* Lam. is classified as ring-porous type according to its porosity, with larger early zone tracheas. Lumen of the early zone tracheas in the white, having the function to pass water, reach up to 160 µm, while lumens of the early zone tracheas in the narrow growth rings reach up to 120 µm. The results obtained in this research have shown good characteristics of the tree, and growth of this species is recommended in our country.

Key words: *Gymnocladus canadensis* Lam., Srpska Crnja, macroscopic-microscopic structure

CAPACITY DEVELOPMENT IN ALBANIAN FORESTRY: MARKET ACTORS, TRENDS, REGULATORS, AND ENABLING ENVIRONMENT

Gazmend Zeneli¹, Abdulla Diku²

gzeneli2000@yahoo.de

¹Faculty of Forestry Sciences, Agriculture University of Tirana - Albania

²DIAVA Consulting, P.O. Box 228/1, 1800 Tirana - Albania

Abstract: Capacity building (CB) in Albanian forestry has been a highly donor orchestrated market where donors have moved in and phased out according to their development policies or agendas. In almost 20 years of market liberalization many donors' funding and development agendas have shaped the CB market in Albania in terms of legal constitution, areas of expertise, technical specialization and network. This paper is an attempt to shed light on the current situation on capacity development level of forestry sector, market trend, policies collaboration and also the current state of the demand in Albania and analyzes market actors' decision criteria related to engagement in forestry projects that provide environmental services. In a questionnaire survey, experts representing key market actor groups, were asked to name and weight factors influencing the selections of CB services; ways through which are determined the needs for CB; factors or players that affect choice of opportunities available for CB; factors determining the quality of services; the main ways to market services and the factors that determine the quality of services; and the need to enable the service providers to provide (quality) service to contribute to the forestry sectors, amongst other. The method for this survey and analysis for a large part is based on the approach called comprehensive market survey, analyzing both individual suppliers and demanders of services. The survey provides preliminary insights into bottom-up defined decision criteria relevant for key-actors in the market of Albanian forestry-based environmental services, and compiles information for further multi-criteria based assessments of forestry projects providing Capacity Development for environmental services. The survey identifies strength, weakness, opportunities, threats and obstacles of service provision process considering all related factors and indicators. We hypothesize that the development of markets for these environmental services will substantially depend on compliance with requirements of key market actors representing supply and demand sides.

Key words: Albania, Capacity development, forestry, market actors, suppliers, value-added chain

**ANATOMICAL STRUCTURE OF EXTRAFLORAL
NECTARY OF ACACIA MANGIUM**

Chunhua ZHANG, Atsushi KATO, Katsushi KURODA, Hisashi ABE
chunhua@affrc.go.jp

Forestry and Forest Products Research Institute, Tsukuba Ibaraki 305-8687, Japan

Abstract: Extrafloral nectary, which secretes viscous juice (nectar) outside of plant body, was found on adaxial side of the basal part of every leafstalk in *Acacia mangium*, and its anatomical structure was studied by light and electron microscopy. The nectary in the shape of a pancake increased in size with the development of the leafstalk, and reached its maximal size at the stage at which the leafstalk itself had reached its mature size. The nectary was composed of numerous small parenchyma cells and an intercellular space (nectar cavity) in which the nectar was pooled. Those small parenchyma cells were more deeply stained with safranin than the surrounding tissue, and could be divided into nectariferous tissue and epithelial cells, which line the lumen of the nectar cavity and secrete the nectar into the cavity. Each nectary was surrounded by several vascular bundles that are probably the place of origin of the nectar. A cross section of the nectary showed a slit-like nectar cavity in the early stage of the development, and a spindle-shaped cavity in the final stage at which nectary had reached its maximum size. Scanning electron micrographs of the outer surface of the nectary showed many stomata through which nectar is possibly exuded from the nectariferous tissue. In addition to the above microscopic study, constituent of the nectar was also measured by NMR (nuclear magnetic resonance analysis). The measurement result revealed that the nectar mainly consisted of sugars with 60% of sucrose, 25% of glucose and 15% of fructose.

Key words: Nectary, *Acacia mangium*, nectar, nectar cavity, stoma.

**SYMPTOMS OF *BOTRYOSPHAERIACEAE* ON FOREST
AND SHADE TREES IN SERBIA**

Milica ZLATKOVIĆ, Nenad KEČA, Tanja MILIJAŠEVIĆ

milica.zlatkovic@hotmail.com

Faculty of Forestry-University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Species of the Botryosphaeriaceae family are fungal pathogens occurring on numerous hosts, including ornamental, forest and agricultural trees. Field surveys carried out in Serbia during the last decade have shown the appearance of symptoms of *Botryosphaeriaceae* on various tree genera such as *Chamaecyparis* spp., *Cupressus* spp., *Thuja* spp., *Sequoia* spp., *Sequoiadendron* spp., *Cedrus* spp., *Prunus* spp, *Malus* spp., *Populus* spp., *Quercus* spp., etc. Observed trees exhibited trunk and/or branch cankers, top-killing, scattered twig and branch die-back and wood discoloration usually followed by resin or gum production. *Botryosphaeriaceae* are hard to manage pathogens that may kill or severely reduce the esthetic value of trees in the landscape. High incidence of these species in Serbia may be due to drought stresses and higher annual temperatures experienced over the last decade.

Key words: *Botryosphaeriaceae*, dieback, canker, ornamental and forest trees, stress.

**CONNECTIONS BETWEEN PROTECTED AREAS, TOURISM
AND DEVELOPMENT OF THE COUNTRYSIDE**

Jana Zurc

jana.zurc@gmail.com

University of Ljubljana, Biotechnical Faculty, Jamnikarjeva 101

Abstract: Connections between protected areas, tourism and development of the countryside were studied in the examples of the Triglav National Park and the Kozjanski Park. 200 local inhabitants were interviewed in each area. According to the results, it can be concluded that the studied protected areas give an opportunity to develop rural tourism. It cannot be claimed that the development of tourism in protected areas is more successful than the development of tourism outside the protected areas. The interviewed inhabitants of the Triglav National Park most support the development of tourism in the area (86.5%) out of all other industries, whereas this is not true for the interviewed inhabitants of the Kozjanski Park. The latter agree the area should be oriented in agriculture and the development of small business and craft. Nevertheless it is not insignificant that a high share of the interviewed inhabitants of the Kozjanski Park agrees on focusing this area on tourism development (74.5%). Almost half of the interviewed inhabitants of the Triglav National Park (47%) and only 15% of the interviewed inhabitants of the Kozjanski Park agree that the opportunity of the protected area is a better possibility in tourism business. Thus we can conclude that the Triglav National Park offers more opportunities or additional possibilities for business in tourism than the Kozjanski Park. In the protected area, where tourism is more developed (the Triglav National Park), the interviewed inhabitants believe that the nature conservation strategies are less successful and perceive more negative burdens of tourism (traffic and crowds, higher prices). On the contrary, in the protected area, where tourism is less developed (the Kozjanski Park), the interviewed inhabitants observe that nature conservation strategies are more successful and they are less influenced by tourism.

Key words: protected areas, national park, regional park, development, tourism, rural areas, Slovenia

**NEW RISK FOR EUROPEAN FORESTS – USSURYJSKY
BARK BEETLE POLYGRAPHUS PROXIMUS**

Gninenko Y.I., Cheelakhsaeva E. A., Klukin M. S.

gninenko-yuri@mail.ru

Russian Research Institute for Silviculture and Mechanization of Forestry, Pushkino,
Moscow region, 15, Institutskaya Street, Pushkino, Moscow region 141200 / Russia

Abstract: Two new for European fauna stem insects *Polygraphus proximus* and *Hylurgops longipilis* (Mandelstam, Popovichev 2000) were found on a spruce near Sankt-Petersburg in 1999. Thus a new aggressive invasive species occurred in coniferous forests in European Russia and Siberia. So far its real occurrence as well as its biology specifics in new habitats is unknown. Data on repeated findings of *Hylurgops longipilis* is missing but several years after dieback of old firs caused by *Polygraphus proximus* (Cheelakhsaeva, 2008) it was identified in fir plantations in Moscow. This species had not been found in the Moscow region before (Petrov, Nikitsky, 2001). This finding drew attention as a clear proof that the bark beetle can acclimatize successfully in new habitats and become a dangerous pest of fir and possibly other coniferous species. In natural area this species covers the southern part of Russian Far East, Japan, Korea and north-east China. There it is associated primarily with local firs (*Abies nephrolepis*, *A. holophylla*, *Abies manesii*, *A. firma* and others), but can evolve on other conifers including *Pinus koraiensis*. In European Russia this species actively infests and evolves on *Abies sibirica* and *A. balsamea*, however it was found on *Picea abies*, in Siberia it evolves on *A. sibirica*. In its natural habitats Ussuriysky bark beetle is not a factor of tree mortality. There are cases of mortality of *P. proximus* infested firs weakened by crown damages caused by other phytophages (Hara et al., 2008; Tokuda et al., 2008). In Far East forests it can result in mass reproduction in forests affected by wildfires, stem or root rots or on harvested timber (Kurenkov, 1950). Surveys in Moscow region found this bark beetle on a major part of Moscow region territory (Cheelakhsaeva, 2008) directly adjacent to Moscow. The bark beetle affected firs die during 1-2 years after infestation. First, beetle infested fir crowns turn clear brown-red. There are evident rich oleoresin leaks released by a tree out of beetle entry holes. Then needles cast and bark starts to fall off. At this time typical bark beetle galleries are very evident. Ussuriysky bark beetle infestation of new habitats is likely due to timber transported from Far East forests to European Russia. Bark beetle identification in Kemerovskaya region proves it as well. The first outbreaks of *Xylechinus pilosus* Ratz. were found on area of over 5.2 thousand ha in this region in 2005. Outbreak identification on such a big area clearly indicates that the phytophage came there much earlier than 2005. It is unlikely to date its infestation but we can be pretty sure that it had occurred there no less than 10 years before. This bark beetle outbreaks were found in Krasnoyarsky region as well, reportedly on 55 ha. Our special surveys in 2010 and beetle species identification showed outbreaks of exactly *Polygraphus proximus* which have developed and are

ongoing there. Fir condition in these mass outbreaks is bad and getting worse due to growing mortality of the bark beetle infested trees.

Key words: Polygraphus proximus, fir, mass outbreaks.

PLANT-MICROBE RELATIONSHIPS USING BACTERIAL PREPARATIONS

O. Sidorenko, F. Kleshkanov

soleg39@mail.ru

Agriculture Academy named by K. A. Timiryazev, Moscow,
127550, Moscow, st. Timiryazevskaya 50, Moscow, Russia

Abstract: Interdisciplinary approach to the study of „soil - plant - microorganisms” greatly expanded our understanding of the basic principles defining the growth of plants in soil, management of the agricultural crops production process, use introduced, fertilizer means by plants, the fate of microbial cenosis etc. It became clear that the individual and society requirements should be brought into compliance with the laws of nature, since the ability of human impact on the environment is much greater than its right to do so. We should not forget that 80% of the national life of countries is dependent on natural resources. Soil as a living system must be developed safely and sustainably, to preserve and increase soil fertility and genetic biodiversity of the soil cenoses. The degree of soil fertility is determined by the intensity of life processes of microbial populations and plants are a powerful environmental factor selecting the certain biocenoses, i.e. species composition that form relationships in the system „soil-plant-microorganisms”. In recent years, humic preparations nanogumats have been widely used in agriculture. It is a combined drug combining biological and chemical effects on plants. There are the factors that have a positive effect on realizing the potential of the plant organism and its genetic features. Growth stimulating effect of the drug starts with a seed. This is especially important in areas with frequent spring droughts. Nanogumats of the drug-fertilizers help to increase the productive tillering, as well as the formation of a strong root system. Activated metabolic regulation, general metabolism, transport of organic and mineral compounds in the plant and forms the ideal type fulwoll plants with a well developed root system, extremely resistant to lodging. Nanogumats, trace elements, members of the drug, and microbial metabolites, which successfully complement each other, providing a synergy of action and protection of plants during the growing season. Being an effective means of fertilizer, the drug reduces the affecting of plant phytopathogenic microorganisms, has a direct positive impact on the structure of the harvest and generally increases plant productivity. It is combined with chemical seed dressing. Of particular interest is the pre-sowing seed treatment. Correspondingly introduction of chemicals are reduced, which increases the quality of crop production, and, therefore, guaranteed the safety of raw materials. Thus, the interaction of microorganisms with plants are diverse and very complex. Biological

Topic A - Forestry

agents (biocides, biostimulators, bioprotectors etc.) normalize the level of useful microflora in the root zone and improve metabolism in plants. At the same time, biological activity of drugs yield increase for different cultures may differ, and sometimes not at all, due to unequal sensitivity of the plants themselves. Responsive plants (and stable culture) are able to run faster repair processes, including enzyme activity, increased synthesis of proteins, phospholipids, sugars, which play a protective role.

Key words: soil microorganisms, nanogumats

**CLUSTERS IN HORTICULTURE AND FORESTRY IN SERBIA:
SIGNIFICANCE AND POSSIBILITIES OF ORGANIZING**

Marko MARINKOVIĆ, Marina JOVANOVIĆ, Todora GRASIĆ

marko.m.marinkovic@gmail.com

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: In recent years, great importance and attention is given to the small and medium enterprises (SMEs) sector, which is the backbone of the economy and the basis for the development of market economy. Necessary condition to increase the competitiveness of SMEs is reflected through the processes of company mergers, to each other, and through connections with leading companies in the same or close to commercial areas, educational, scientific and all relevant state institutions. In today's business environment, these specific and complex processes for connecting companies are increasingly frequent, and result is the development of specific forms of association, called clusters. In the last decade, the concept of clusters has become a central idea of economic competitiveness and development. Stimulation of company mergers in clusters was accepted as an effective instrument for strengthening and improvement of business operations, as well as better positioning in the domestic and international markets. When it comes to the establishment of clusters, it should be noted that the methodology of formation and development of clusters requires a multidisciplinary approach, the knowledge and experience, not only on clusters, but also knowledge of the field of economics, marketing and management. The aim of this paper is analysis of recommended methodology for establishing clusters, and ways of doing business and development of already established clusters such as *cluster manufacturers and retailers of ornamental plants „Plants United“*, *the cluster of flower manufacturers „Sumadia Flower“* and *cluster „Agency for Wood“*. Also, paper analyzes current situation of SMEs and attitudes of entrepreneurs, look at possibilities for the establishment and further development of clusters in forestry and horticulture. Different materials and methods were used for writing this paper. Adequate methodological approach was developed with synthesis of several stages: preparatory works (theoretical

Topic A - Forestry

framework, the preparation of the questionnaire), field research in the form of interviews, analysis and processing of data. This research included three groups of enterprises, enterprises which are dealing with forest management and exploitation of forest, enterprises dealing with collecting and distributing of non-wood forest products and enterprises dealing with the production and trade of ornamental plants. The combination of theoretical preparation, data collection and processing in terms of quantitative and qualitative analysis, gives results that reflect the characteristics of SMEs in all the important indicators. Also, attitudes and level of interest of entrepreneurs for association and the formation of clusters are given, which is the main goal of this paper.

Key words: forestry, horticulture, private sector, small and medium enterprises, clusters

Topic B

**ECOLOGICAL ENGINEERING IN PROTECTION
OF SOIL AND WATER
RESOURCES**

Papers

First Serbian Forestry Congress - Future with Forests -

Topic B - Ecological Engineering in Protection of Soil and Water

HIGHER EDUCATION IN THE FIELD OF ECOLOGICAL ENGINEERING FOR SOIL AND WATER RESOURCES PROTECTION

Ratko KADOVIĆ, Stanimir KOSTADINOV,
Ratko RISTIĆ, Tatjana SUBAŠIĆ-NIKOLIĆ
ratko.kadovic@sfb.rs
Faculty of Forestry Belgrade University

Abstract: Theoretical bases of ecological engineering were considered in many significant papers (Odum, 1971, 1975, 1983; Teal, 1991; Hall, 1995et.al.), but they have been more intensively elaborated only since the beginning of this century. This is partly due to the fact that ecological engineering is characterized by a transdisciplinary approach, and because it offers a new philosophy of the 21st century engineering for solving environmental problems, in which engineers develop new techniques, skills and solutions according to the needs of the society. Ecological engineering combines the disciplines of ecology and engineering in order to solve environmental problems. The development of disciplines in the field of ecological engineering is a response to the ever growing need for the provision of technical solutions for the development of certain economic sectors, and at the same time the need to protect natural resources and the environment. In those terms the society cannot be separated from the natural systems and it is dependent on them. Ecological engineering implies designing of sustainable systems, in accordance with the ecological principles which integrate the society with the natural environment as the benefit for both sides. Successful ecological engineering requires the development of design methodology based on ecological principles. This paper presents a part of the vision of further development of ecological engineering, primarily from the aspect of higher education in the in the field of ecological engineering for soil and water resources protection in Serbia. Beside pointing out the values of ecological engineering, the aim of the paper is the expansion of the original vision of the theorists of ecological engineering (Mitsch and Jorgensen, 1989; Mitsch, 1993; Barrett, 1999; Bergenl et. al., 2001; Odum, T.H, Odum B., 2003), but also the assessment of the present state in practice and the legislation for further development of ecological engineering.

Key words: ecological engineering, environmental protection, soil and water resources, higher education

**URBAN TORRENTS - THE INFLUENCE OF SETTLEMENTS
ON RUNOFF AND FLOOD PROPAGATION**

M. CHIARI*¹, G. ANGELMAIER¹, H. HÜBL¹

*contact: Michael.Chiari@boku.ac.at

¹ Institute of Mountain Risk Engineering, University of Natural
Resources and Life Sciences, Vienna

Abstract: The surroundings of major cities are very popular places for living especially if the city is encircled by hills or mountains. Human activities in these areas may have an influence on the hydrology of the catchments. Due to surface sealing and changes of the roughness the discharge may be increased. To investigate these phenomena several torrents in the city of Linz are investigated. One of these torrents is the Höllmühlbach. To estimate the effects of intensive settlement a comparison of the runoff event between a historical state and the today's current state is made. Therefore the catchment of the Höllmühlbach has been modeled with the hydrologic model ZEMOKOST. In order to obtain the affected areas of the potential design event, several two-dimensional hydraulic simulation models have been tested for their suitability for modeling floodplains of steep torrential catchments. The programs MIKE FLOOD and RiverFLO-2D were applied. Due to unsatisfactory results and unsolvable problems with the above-mentioned programs at steep slopes, the approved program FLUMEN was used to simulate different flood scenarios. The results show that the discharge is significantly increased due to the settlement activities and the time of concentration is decreased. Therefore the flooded area and the associated energy heights of the flow are increased compared to the historical state. Buildings serve as obstacles whereas some streets can be regarded as new waterways by transferring discharge to areas that were not affected in the historical state.

Key words: rainfall-runoff modeling, urbanization, 2D-flood modeling

**ACCUMULATION OF ORGANIC CARBON AND NITROGEN IN
RECLAIMED LIGNITE MINE SOILS UNDER THE INFLUENCE
OF AUSTRIAN PINE CULTURES**

Zoran MILETIĆ, Vesna GOLUBOVIĆ-ĆURGUZ,
Zlatan RADULOVIĆ, Snežana STAJIĆ, Vlado ČOKEŠA
zoranmil@ptt.rs
Institute of forestry, Kneza Višeslava 3, Serbia/Belgrade

Abstract: Accumulation of organic carbon and nitrogen in the soil was studied in Austrian pine cultures established on deposited mine wastes of an opencast lignite mine. Studies were carried out on three testing areas over a 9-year period, with two determinations each. The first determination was made in the year 2000 when the cultures were 18 years of age, while the second was conducted in 2009 when the cultures reached 27 years of age. The testing conducted on the same sites, after nine years of influence of the Austrian pine cultures on the soil, revealed no significant modification of the organic carbon content. A balanced condition of input of the organic matter into the soil, its humification and mineralization in Austrian pine cultures, is established by the time cultures reach the age of eighteen.

Key words: Barren soil, *Pinus nigrae*, Organic carbon, Nitrogen

AFFORESTATION WORK IN TURKEY

Sevim INANC, Huseyin AYAZ, Canturk GUMUS
inanc_sevim@hotmail.com

Karadeniz Technical University Faculty of Forest Department of Forest Engineering, Turkey/Trabzon

Abstract: 3 792 176 000 hectares of the earth's surface, i.e. 30% are covered with forests. Forest area of our country is 21.2 million ha and it constitutes 27% of the territory. As seen, the rate of the forest areas to the country area is close to the world average rate. However, Turkey's forest area that forms approximately 5% of the world forest area is not in a good condition from the aspect of quality. Because half of the forest (50%) area of our country has a distorted structure. The structure of 68% of the world forest area is productive and the rest is damaged. In Turkey, while there were 20.2 million hectares of forest area according to the inventory results in the 1963-1972, there has been 21.2 million hectares in 2008. Afforestation work had an effect on this increase as well as rural-urban migration. From the aspect of forest policy to increase the amount of the forest area we can mention some tools. 99% of Turkey's forest area is owned by the government so increase of the amount of the forest area is the aim of the government. The government has given place to this subject in some laws and the fundamental law, has mobilized individuals, institutions and foundations to spend their sources in order to increase the amount of the forest area. In this study, afforestation work in Turkey is evaluated and some information about the place of Turkey among other world countries is given.

Key words: afforestation, forest policy

**AN OVERVIEW OF THE NATURAL DISASTER WHICH HAPPENED
ON DECEMBER 4TH 2008 IN THE MUNICIPALITY OF RADOVIS**

Daniela IROTOVA-LAZAREVA², Ivan BLINKOV¹,

Tatjana KOJCEVSKA², Aleksandar TRENDABILOV¹

www.sf.ukim.edu.mk daniela_irotova@yahoo.com; ivanblinkov@yahoo.com

¹ University "Ss.Cyril and Methodius" – Skopje, Faculty of forestry – Skopje,
bul."Alexander Makedonski "bb. 1000 Skopje, Republic of Macedonia,

² UKIM – Faculty of forestry - Skopje, MSc student,

Abstract: On December 4th 2008, in the vicinity of the town of Radovis a storm followed by heavy rains occurred. According to preliminary reports the intensity of the rainfall was of 1mm/min. The high intensive rainfalls caused high runoff, which was especially prominent in the catchment areas of the rivers Sushichka, Radovishka - Stara Reka, Injevska and Dedinska Reka as well as other smaller catchments in the surroundings. The floods which originated from the hilly and mountainous areas resulted with catastrophic discharge, unseen in the region for the last 50-60 years. The aim of the analysis and the research in this article is to consider the reasons for the floods that occurred in the Radovish region, as a consequence of the rainstorm. A complete prospection and the state of the torrent beds will be analyzed, with regard to the vegetation factor (mainly wooded and shrubs) as well as the bridges and their role for the flooding. The influence of the type of land cover, especially forest vegetation, and the way of running the economy are of crucial importance for the water flow and water balance in the confluence of the researched watercourses: river Susica, Radoviš River and Injevska River. The whole process of development of the storm on December 4th 2008 is described by the documented analysis based on various data on the disaster: meteorological reports and report to assess the damage from the storm. In addition to this, personal observations were also used as well as interview responses from people directly affected by the disaster. In order to define the preconditions, the analysis is made from the existing documentation regarding this topic and the area of research. The latter however, depends on the effectiveness of the authorities to assess and record the damage given the short time period. The conclusion aims to fortify the reasons for the occurrence of the floods as well as provide suggestions in regard to alleviating and eliminating the consequences of the floods.

Key words: natural hazard, natural disaster, flood damages, hazard management system

**ANALYSIS OF THE IMPACT OF APPLIED ANTIEROSION WORKS
ON REDUCING SILTATION IN THE RESERVOIR „ĆELIJE“**

Irina MILOVANOVIĆ, Jelena ČOTRIĆ, Milutin STEFANOVIĆ

irina.cerni@gmail.com

Institute for Development of Water Resources “Jaroslav Černi”

Abstract: Successful reservoir operation can be greatly affected by the reduction of reservoir capacity due to sediment deposits. Reservoir „Ćelije“ was built primarily for flood protection, but over time has become multi-purpose with an emphasis on water supply. This reservoir faces sedimentation and siltation problems during flood wave events, due to unknown water regime and erosion characteristics of the watershed. According to experience norms, when sediment deposit volume reaches 60% of the initial reservoir capacity, the reservoir becomes obsolete. Upstream of the reservoir, over the past few decades the Rasina river basin has seen the construction of antierosion works for the protection of the reservoir, although with extreme imbalances of technical, biotech and biological works. Erosion and land use mapping hasn't seen recent changes, and the data currently being used is over 40 years old. This paper presents results of the comparison of sheet erosion and production of sediment from 40 years ago and the current situation in the basin, and the impact of derivative antierosion works on reducing the intensity of erosion and the amount of sediment that is bound for reservoir „Ćelije”.

Key words: sediment, erosion processes, degradation, sedimentation, siltation

**APPLICABLE BMPS FOR ALLEVIATING SOIL EROSION
IN NORTHERN IRANIAN FOREST WATERSHEDS**

S.H.R. SADEGHI, A. NAJAFI

sadeghi@modares.ac.ir

Department of Watershed Management Engineering and Assistant
Professor, Department of Forestry, College of Natural Resources
& Marine Sciences, Tarbiat Modares University

Abstract: Despite the oft-reported balanced conditions in forest watersheds, soil erosion phenomenon is one of the main factors in controlling profitable implementation of silvicultural measures. Furthermore, the determinant factors in soil erosion processes in such watersheds are numerous and complicated as well. However, soil erosion studies in forest watersheds are limited and consequently soil conservation measures are rarely applied and proper management of the forest watersheds cannot then be effectively acquired. Towards this attempt, the present study aimed to briefly review the affecting factors on soil erosion in Northern Iranian Forest Watersheds in order to advise appropriate best management practices (BMPs) to alleviate the soil erosion rates. The study covered main commercial forest watersheds in the south of Caspian Sea with further focus on the results of studies conducted on soil erosion and sediment yield processes in a research forest which comprises ca. 13000 *ha*. The study was based on temporal variation of suspended sediment yield collected at the main outlet of the watershed for the last 3 years and experimental plots were installed in different parts of the watershed and subjected to different harvesting methods and managerial approaches. The results of the study verified that the over and untimely exploitation of forests and sand and gravel mines in river beds as well as applying inappropriate machineries were the main reasons for accelerating soil erosion. Accordingly, buffer strip between haul roads and drainage system, seasonal operating restriction, slash disposal, land acquisition, sign posting, written agreement, plan review with distinct attention to soil erosion, watershed inspection programs, field monitoring, legal action and public education and participation were suggested as main applicable BMPs for soil erosion alleviation in the study of forest watersheds.

Key words: BMP, Forest watershed, Iran, Sediment Yield, Soil Erosion, Soil Conservation

**APPLICATION OF INSPIRE DIRECTIVE ON MUNICIPALITY
LEVEL – CASE STUDY: MUNICIPALITY OF KAVADARCI
(an extract from BSc diploma thesis)**

Radica LELOVA, Ivan BLINKOV

www.sf.ukim.edu.mk, radica5616@yahoo.com; blinkov@sf.ukim.edu.mk;
University “Ss.Cyril and Methodius” – Skopje, Faculty of forestry – Skopje,
bul.”Alexandar Makedonski “bb. 1000 Skopje , Republic of Macedonia,

Abstract: One of the objectives of EU policy is the principle of compatibility. Therefore the EU is due to various adjustments and requires each state to bring the same methodology, i.e. the uniform implementation of all laws and measures. With the implementation of appropriate directives, we help our country to reach the same level as the developed countries. However, every municipality is obliged to take the initiative to introduce the basic provisions as some kind of ultimatums in order to be able to achieve a scale that would satisfy certain rights and criteria on state level, which also guarantees entry in EU. INSPIRE is Directive 2007/2/EC of the European Parliament and Council adopted in May 2007 with the objective To build a Spatial Data Infrastructure in the European Union i.e. to provide access to public administration and public to improve the spatial data and to support the process of policy making and strategic planning that has an impact on the environment. About 34 basic layers classified in 3 categories are obliged to be developed on national and municipality level and to be available for the general public. The aim of development of Spatial Data Infrastructure is to facilitate the access of public administration and public, to facilitate the process of policy making and strategic planning that has an impact on the environment and education of citizens. The best way to achieve this level would be using the GIS method, which partly explains the text up to here, and the next part will focus on the development of the method for establishing a database of the Municipality of Kavadarci that is the working region of the case study. The aim of this paper is to develop a part of the necessary thematic layers of the municipality of Kavadarci that cover a territory of 391 km^2 and have a population of about 37 000 inhabitants. The working scale of the map was 1:100 000. The objectives of this study were: to check data availability of the municipality, to check the official web-site of the municipality; to collect paper data from various sources; to organize and digitize data; to develop a web-page. Because of the absence of any digital data several thematic layers were developed. After scanning (i.e. getting raster image), data were imported in GIS software, then georeferenced and digitized. Depending on the theme, the vector data were expressed as points, lines and polygons. Attributes that describe the geographical shape were developed for all forms. All of these together formed digital landscape model of the working region. Finally a web-page which is ready to be linked to the official web site of the municipality was prepared.

Key words: INSPIRE, GIS, Kavadarci

**BEAVER DAMS AND THE HYDROLOGY OF SMALL MOUNTAIN
STREAMS OF THE ARDENNES, BELGIUM**

J. NYSSSEN^{1*}, J. PONTZEELE, P. BILLI^{1,2}

jan.nyssen@ugent.be

¹ Department of Geography, Ghent University, Belgium,

² Department of Earth Sciences, University of Ferrara, Italy

Abstract: The European beaver (*Castor fiber*) was recently reintroduced to Belgium, after an absence of more than 150 years. Beavers are particularly known for their dam building activities; therefore they have been described as ‘ecosystem engineers’. Accordingly, there has been much research interest on the topic, particularly on the effects of the beaver ponds on biodiversity. So far, in Europe few studies have focused on the hydrological effects of those dams, and the spatial scale larger than that of one beaver pond system has not been addressed at all. This study focuses on the hydrological effects of a series of six beaver dams on the Chevral, a second order river in a forested catchment of the Ourthe Orientale basin in the Central Ardennes. Thereby, also the Ourthe Orientale basin itself was taken into account, being the area with probably the highest density of beaver dams in Belgium. The relevance of this hydrological research deals with the possible reduction of flood risks downstream, as a cumulative effect of beaver dams in the headwaters. The main research questions were: (1) whether the discharge peaks are reduced because of beaver dams, (2) how long the stored water can stay in the retention ponds, and (3) what impact the beaver dams may have for sedimentation. The first approach consisted of a temporal analysis of the Ourthe Orientale discharges and precipitation data for two periods 1978-2003 (before) and 2004-2009 (after the establishment of beaver dams in the basin). In the second approach an in situ study was done to determine the impact of the beaver dams: discharges and sediment loads were measured (September 2009 - March 2010) upstream as well as downstream of the 0.52 ha beaver dam system on the Chevral river, and changes in water level within the system of the six dams were monitored. Our findings at the scale of the Ourthe Orientale basin and at that of the Chevral site indicate that there is a significant lowering of discharge peaks in the downstream river reach due to the effect of the beaver dams. The temporal analysis of the Ourthe Orientale basin shows an increase in the recurrence period for major floods since the establishment of the beaver dams. At the level of the Chevral beaver dams’ site, we measured that the dams top off the peak flows, in addition delaying them by approximately one day. There was also indication for increased low flows. With respect to sediment transport, no significant difference was found between the incoming and outgoing sediment load, except after a major rainfall event, when the sediment concentration was significantly lower at the outlet (4.7 mg L⁻¹) than at the inlet (28.3 mg L⁻¹) of the beaver dam system. The sediment accumulation in the inundation area was calculated as 2.4 to 7.5 cm yr⁻¹. These findings

tend to agree with studies that suggest natural measures for flood control at the level of small mountain streams instead or in complement of building large anthropogenic constructions. Nevertheless, more studies are needed to assess the effectiveness of beaver dams in flood mitigation.

Key words: Castor fiber, hydrograph topping, water storage, sedimentation

DETERMINATION OF ECOLOGICAL SPECIES GROUPS BY ANGLO-AMERICAN APPROACH (Case study in West Azarbaijan, Iran)

Reza BASIRI

basiri52@yahoo.com

Behbahan high educational complex, Forestry department, Behbahan
university, Behbahan city, Khoozestan province, Iran

Abstract: In this paper, vegetation was studied on the basis of Anglo-American approach in Sardasht region. In this approach, vegetation samples which can be defined as plant species by their distribution can be considered as groups. Systematic-random sampling with 76 plots and 256 in area was selected. Combined method of cluster analysis, two way indicator species analysis and similarity indices were used for the determination of ecological species groups. The results of this study showed that there were 6 ecological species groups in the above-mentioned region. Indicator species of these groups included: *Quercus libani*, *Quercus infectoria*, *Pyrus syriaca*, *Pistacia atlantica*, *Trifolium camp-estre* and *Teucrium polium*.

Key words: Ecological species groups, Anglo-American approach, two way indicator species analysis, Cluster analysis, Iran.

**DIFFERENT ASPECTS OF THE BENEFIT OF EROSION
AND TORRENT CONTROL IN SERBIA**

Slobodan PETKOVIĆ, Mileta MILOJEVIĆ
dane@EUnet.rs

Belgrade University, Faculty of Forestry, Kneza Višeslava 1, Srbija/Beograd

Abstract: The hilly and mountainous regions represent the major part of Serbian territory (about 75 %). Due to geomorphic features of Serbian territory, there are serious erosion and sedimentation problems. On the other hand, numerous torrents in the mountainous regions cause the problem of flash floods. The synergy of erosion, sediment yield and floods imperil the populated areas, communication network, agricultural land, water engineering structures etc. The river network in the Serbian territory is relatively dense and includes a large number of water courses of different sizes, ranging from small creeks to very big rivers such as the Danube. The largest part of Serbian territory belongs to the Danube drainage basin. The most important tributaries of the Danube River in Serbia are the Tisza, Sava and Velika Morava rivers. It should be pointed out that the flash floods are related not only to the torrent creeks, but also to the larger rivers, with the catchment areas smaller than 1000 km². These rivers are the tributaries of the Danube, Sava and Velika Morava rivers. Erosion problems in mountainous region of Serbia refer to both the on-site and off-site effects. The on-site effects are related to the deforestation and the soil loss of arable land. On the other hand, the off-site effects of erosion are related to the excessive sediment transport in the rivers, downstream of eroded areas. In terms of sedimentation problems, reservoir siltation is of primary importance. Regarding the serious problem of erosion, sediment yield and floods, the erosion and torrent control is very important. Benefit of this control is related to the protection of flood prone areas from floods and excessive sediment transport. The protection encompasses different areas and structures: populated communities, communication network, agricultural land and other goods. These erosion and torrent control measures encompass the combination of hydraulic structures in the torrent beds and the biological activities (afforestation and biological reclamation of degraded natural grassland). The experiences in the erosion control works in Serbia indicate the efficiency of the combination of technical and biological measures in view of decrease of the sediment yield in the watersheds. Taking into consideration the vulnerability of the mountainous areas, the erosion and torrent control should be connected to the complex measures of the watershed management. The use of water resources in these areas requires the appropriate structures, in order to avoid the risk of perturbation of the natural equilibrium. From this point of view, the basic principles of the soil and water conservation should be respected.

Key words: soil erosion, torrent, benefit

**DIGITAL CADASTRE OF URBAN GREENERY – CASE STUDY
MUNICIPALITY OF KAVADARCI (an extract from BSc diploma thesis)**

Radica LELOVA, Ivan BLINKOV

www.sf.ukim.edu.mk, radica5616@yahoo.com, blinkov@sf.ukim.edu.mk

¹ University “Ss.Cyril and Methodius” – Skopje, Faculty of forestry – Skopje,
bul.”Alexandar Makedonski “bb. 1000 Skopje, Republic of Macedonia

Abstract: Green areas are very important for the urban environment. There are various types of urban green areas. Cadastre of urban greenery is necessary, for its appropriate maintenance. The Geographic Information System (GIS) is a system performing various analyses using map information stored in a computer. In recent years, this system is used in planning and managing of parks and greenery. Consequently, large volumes of GIS data are collected. The technique itself is becoming more accessible to individuals participating in landscaping and greening activities. This special feature issue examines GIS used in urban park development projects and urban environment planning, in environmental impact surveys and ecological conservation, as well as in other forms of green conservations and creations from various angles to offer an insight into numerous latest findings. The aim of this paper was to develop GIS based cadastre of urban greenery. The study we completed is for the territory of the city of Kavadarci. The objectives of this study are to check and collect all paper data about the greenery in the city; to collect various other data related to the greenery; to carry out various activities for developing the basic data; to digitize the data and to create a web page for this data. For fulfilling all those objectives, we carried out the following steps: collection of available data (paper or digital); on-field inventory of the greenery; laboratory work (scanning, georeferencing, digitizing, etc.). There were almost no data on urban greenery of Kavadarci in the communal enterprise. Because of that, we selected only four items for the study: the city park and three squares where we carried out on field inventory and photosets. The paper data for the general urban plan and the cadastral data we scanned and digitized using the software Arc GIS. Working map scale was 1:1000 and because of this, the city park we presented as a polygon and the square parks as points. For each item we prepared a document file which contained data about it; location, brief history, inventory of tree species, photoset. We saved all the files in “pdf” format. On the basic, GIS map using “hyperlink” operation touching on the define point open this file and all data is available to the user. These files are used for the preparation of a web page.

Key words: urban greenery, GIS cadastre, Kavadarci

**DISTRIBUTION OF MERCURY AND LEAD IN PEATY SOIL AT
GLENSAUGH RESEARCH STATION, SCOTLAND**

Snezana BELANOVIĆ¹, Renate WENDLER², Charles SHAND²

snezana.belanovic@sfb.rs

¹ University of Belgrade, Faculty of Forestry, Kneza Visislava 1, Belgrade, Serbia

² Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen, AB15 8QH,
UK

Abstract: Much of Scotland is covered with acidic, organic rich soils which can accumulate heavy metals such as lead and mercury. Although information on the concentration of lead and mercury is available for some soils in Scotland there is little detailed information about changes in concentration of the elements with depth in the profile. We sampled a peaty podzol at a remote site in Scotland at Glensaugh Research Station about 40 km south west of Aberdeen on heather dominated moorland at three increasing distances from a minor road (50, 700 and 1500 m). At each site the soil was sampled at 0-5 and 5-10 cm by taking cores. For the site nearest the road, the cores were subdivided into 1-cm increments. The air dried soils were milled and digested with aqua regia in a reflux system designed to retain volatile mercury species. The lead and mercury contents of the extracts were determined by inductively coupled plasma - mass spectrometry and atomic fluorescence, respectively. The highest concentration for lead (319 mg kg^{-1}) was found in the 3-4 cm layer and for mercury (0.39 mg kg^{-1}) in the 2-3 cm layer of soil closest to the road. The concentrations of lead are within the range of values ($< 3 - 400 \text{ mg kg}^{-1}$) and the concentrations for mercury are slightly higher ($0.03 - 0.37 \text{ mg kg}^{-1}$) than values previously reported for Scottish soils.

Key words: Peaty soil, mercury, lead, accumulation, profile distribution

EFFECT OF EROSION CONTROL WORKS ON THE STATE OF EROSION AND SEDIMENT TRANSPORT IN THE ŽUNJSKA REKA CATCHMENT UPSTREAM OF THE STORAGE “ĆELIJE“

Stanimir KOSTADINOV, Vukašin MILČANOVIĆ, Slavoljub DRAGIĆEVIĆ,
Irina MILOVANOVIĆ, Ivan NOVKOVIĆ
stanimir.kostadinov@sfb.rs

Belgrade University, Faculty of Forestry, Kneza Višeslava 1, Serbia, Belgrade

Abstract: The Žunjska Reka is the right tributary of the river Rasina, with the confluence in the vicinity of the village Razbojna, upstream of the storage “Ćelije“, which is used for the water supply of the settlements in the Rasinski District, and also the surrounding settlements. The space of the catchment covers the areas of the villages Arsići, Vučići and Virijevići. After the Second World War, the Žunjska Reka catchment was affected by the processes of intensive water erosion, the consequences of which were frequent torrential floods which endangered the regional road Kruševac-Brus-Kopaonik, as well as the villages and agricultural areas. This resulted in large-scale sediment yield which reached the river Rasina and the storage “Ćelije“, with all the negative consequences for the storage and its water quality. In the aim of preventing the damage, and especially after it was decided to construct the dam and the storage “Ćelije“, over the period 1972 – 1990, intensive erosion control works were undertaken in the Rasina catchment upstream of the future dam “Ćelije“, first of all in the Žunjska Reka catchment. In the Žunjska Reka catchment, the works included the afforestation of 220 *ha* of bare land and degraded areas, and also the grassing of about 100 *ha*. In addition, four check dams were constructed to check the bed load. This paper, based on field investigations, presents the effects of the performed erosion control works, by the assessment of the present state of erosion in the catchment, sediment yield and sediment transport. The research shows a considerable decrease in erosion intensity, sediment yield and transport (delivery) to the receiving river Rasina. This fact is very significant because this decreased sediment delivery to the storage “Ćelije“, which is vital for the water supply of numerous towns and villages in the District.

Key words: soil erosion, sediment transport, erosion control works, effects

EROSION IN THE BISTRICA RIVER WATERSHED

Svetlana NIKOLIĆ
draganan@teol.net

B.Sc.C.E., Institute for Water Management Ltd, Bijeljina, Milosa
Obilica no.51, Bijeljina 76300, Republic of Srpska, BiH

Abstract: This paper analyzes the Bistrica River Watershed, located in the North part of Bosnia and Herzegovina. Within the Bistrica River Watershed, the most endangered watersheds are analyzed as follows: Crnoborski potok, Galašenica, Brezovača and Duboki potok. Floods periodically appear in the watershed. Floods, as natural disasters, cause huge damages to the economy, society, and, as such, represent one of the biggest threats for human community, and they also have significant impact on the social and economic development. According to the available backgrounds, available technical documentation and analyzing conditions on the field, it is necessary to suggest appropriate activities, as well as adequate protection measures for the Bistrica River Watershed.

Key words: erosion, floods, protection measures

EXPANSION OF AREAS WITH FOREST TREE SPECIES THROUGH NATURAL REGENERATION ON THE LOCALITY “VRTUSKA” WHITIN THE NATIONAL PARK “PELISTER”

Nikolco VELKOVSKI, Ivan MINCEV, Kole VASILEVSKI¹,
nvelkovski@sf.ukim.edu.mk; i_mincev@yahoo.com
University Ss.Cyril and Methodius, Faculty of Forestry – Skopje,
Dept. of Land and Water - , bul.”Aleksandar Makedonski “bb.
1000 Skopje, Republic of Macedonia

Abstract: The ability of natural regeneration is very important attribute of the forest tree species. Owing to that, they can extend their range to areas on which these species were absent or were extinguished in the distant past. In this paper, the results of the expansion of the forest tree species through natural regeneration on the locality “Vrtuska” in the period of 1971-2004 are presented. The aim of this paper is to give a contribution to the establishment of the processes of extension and spreading of the forest plants on non-forest areas. Based on the results, sustainable development of the forest as a growing formation on the surveyed locality and further can be assessed.

Key words: natural regeneration, forest tree species, sustainable development

**FALCE ACACIA AMELIORATIVE AFFORESTATION EFFECT
ON CARBON ACCUMULATION IN SOIL**

Sara LUKIĆ, Snežana BELANOVIĆ, Milan KNEŽEVIĆ, Milorad DANILOVIĆ
sara.lukic@sfb.rs

Belgrade University, Faculty of Forestry, Belgrade, Kneza Višeslava 1

Abstract: Forest ecosystems have an important role in carbon sequestration from atmosphere in biomass and forest soil. Ameliorative afforestation of degraded areas is very important both in enlarging of wooded areas, protection of degraded soils, further degradation control and increase in carbon accumulation potential. This paper describes the effect of ameliorative afforestation by pit planted false acacia (*Robinia pseudoacacia L.*) on the level of accumulated carbon in soil followings. The research was conducted on the soils of Grdelička gorge, which were affected by intensive soil erosion before numerous afforestation programmes were conducted in the mid-1950s. Carbon accumulation in some soil layers and in the soil profile is presented. It is found that C accumulation in A-horizon depends on: humus content, *pH*-value and A-horizon thickness and ground inclination class. Also, there is correlation between C accumulation and clay content in A-horizon. By observing the soil profile, it is recognized that C accumulation in it depends on the *pH*-value of the soil, A-horizon thickness and ground inclination class. Results indicate that soils do not have the same C accumulation potential and their potential depends on some soil properties, principally, on A-horizon thickness - horizon of the most carbon accumulation, then reaction of the soil solution and particle fraction distribution of soil, concerning clay content. Ground inclination is also an important factor of carbon accumulation potential.

Key words: ameliorative afforestation, forest soil, carbon sequestration potential, ground inclination

**FRESHWATER FISH FARMING POSSIBILITIES IN
THE HILLY-MOUNTAIN AREA OF SERBIA**

Vojislav ĐEKOVIĆ, Ljubomir LETIĆ, Radovan SAVIĆ,
Vesna NIKOLIĆ, Neđo MILOŠEVIĆ.

ljubomir.letic@sfb.rs

Belgrade University, Faculty of Forestry, Belgrade, Kneza Višeslava 1

Abstract: Hilly-mountain area of Serbia has an ecological and socio-economical potential for trout species farming. Mountainous regions of the country, which are overgrown with forest vegetation, are rich in many streams and brooks of high quality water suitable for the production of aqua culture organic nutrients. These potentials, inadequately explored and used, represent a good basis for the rural area revitalization program of the region. These regions are poorly inhabited, with a trend of population migration in the absence of proper economic programs.

Key words: hilly-mountain area, ecological factors, trout fish species, farming, rural regions.

**IMPACT OF HEPP “ĐERDAP I” BACKWATER ON FORELAND
FORESTS AND REVITALIZATION**

Zoran GAVRILOVIĆ, Sonja JURIŠIĆ, Renata PUZOVIĆ
gavrilovicz@sbb.rs

Institute for Development of Water Resources “Jaroslav Černi”, Serbia, Belgrade

Abstract: Large areas between the river and the protection embankments along the flow of the Danube and its tributaries the Sava, Tisza, Tamis and V. Morava, are called „foreland” and are usually covered with wood, mostly poplar and willow trees. After the construction of the HPP Djerdap I a great lake has been formed in the Danube and its tributaries, which prolonged the foreland flooding into the vegetation season. In the period 1979 up today intensive research of the backwater influence in the vegetation and nonvegetation season, were carried out bringing new knowledge, conclusions and solutions. Nowadays climate changing and sedimentation made a new problem for forest surviving. The analyses have shown that the changed flooding regime had caused a serious deterioration of natural conditions in the foreland, which resulted in the forest degradation of both autochthon and cultivated forests and new solutions.

Key words: Degraded Forest; Flood Impact; River Regime, Revitalization

**INTRODUCTION IN THE PROCESS OF RECLAMATION
OF THE GOVRLEVO PIT-MINE**

Biljana TACEVSKA-RADOVIC², Aleksandar TRENDAFILOV¹,
Ivan BLINKOV¹

www.sf.ukim.edu.mk; bibiradovic@yahoo.com, trendafilov_a@yahoo.com,

¹ University "Ss.Cyril and Methodius" – Skopje, Faculty of forestry – Skopje,
bul."Alexandar Makedonski "bb. 1000 Skopje , Republic of Macedonia,

² UKIM – Faculty of forestry - Skopje , MSc student

Abstract: The subject of this work is to examine and analyze the natural/ecological factors on the site of Govrlevo an open-pit mine for lime and its nearby location as a primary phase in the process of the physical stabilization, assessment and the most importantly in the process of the biological land reclamation. The objectives of this work were to define the level and type of degradation and to analyze the natural/ecological factors (climate elements, the soil characteristic and autochthonous vegetation) which are needed for the benefit of biological land reclamation. The Govrlevo open-pit mine is located in the vicinity of the city of Skopje, Republic of Macedonia. From the geological point, the dig is mainly made of lime, marble and dolomites. The mine is surface and spread on the lake deposit zone. This deposit is being used by Titan-AD, "Cementarnica Usje" - Skopje. This open pit-mine drastically physically changes the landscape in the study area. The causes of land degradation are as follow: loss of vegetation, siltation, pits/excavation, waste dumps, decreases of soil quality. Extents of damages are land degradation: topography changes due to digging, land-use pattern changes, topsoil characteristics changes, changes in drainage pattern. All natural conditions in the study area are unfavorable for planting as follow: warm continental climate characterized by a long dry period and frequent heavy rainfalls that cause high erosion processes, carbonate geological bedrock that inhibit growth of some plant species bad soil characteristics.

Key words: Open-pit mine, land reclamation, afforestation

**LAND USE CHANGES AND FLOOD PROTECTION
- CASE STUDY OF RIVER JELAŠNICA -**

Ratko RISTIĆ, Boris RADIĆ, Nevena VASILJEVIĆ, Zoran NIKIĆ

ratko.ristic@gmail.com

University of Belgrade Faculty of Forestry , Kneza Višeslava 1, 11030 Belgrade

Abstract: Hilly-mountainous regions are extremely vulnerable as a consequence of natural characteristics and human impact. Land mismanagement influences the development of erosion processes, soil degradation with significant reduction of its infiltration and retention capacity. Inadequate land use decreases permeable surfaces in the watershed and simultaneously increases impervious surfaces, leading to faster forming of surface runoff, more frequent appearance of torrential floods and bed-load deposition on downstream sections of local streams. Soil degradation, erosion processes and torrential floods are followed by depopulation, economic and social problems within local societies. Restoration of watersheds to their optimal hydrologic state would yield more water in periods of small and mean discharge, reducing flood discharge. Best management practices could be obtained through specific combination of biotechnical, technical and administrative measures, with the concept of "natural reservoirs". The problem was analyzed on the watershed of river Jelasnica, located in southeastern Serbia.

Key words: land use, flood protection, agroforestry, „natural reservoirs”

**LAND USE CHANGES IN MONTENEGRO SINCE THE EARLY
20TH CENTURY AND IMPACTS ON HYDROLOGY**

Jan NYSSSEN¹, Jeroen VAN DEN BRANDEN¹, Velibor SPALEVIĆ²,
Milić ĆUROVIĆ³, Miodrag ZLATIC⁴, Amaury FRANKL¹,
Koen GILLIJNS¹, Lisa VANDEVELDE¹, Paolo BILLI^{1,5}
jan.nyssen@ugent.be

¹ Department of Geography, Ghent University, Ghent, Belgium

² Delegation of the European Union to Montenegro, Podgorica, Montenegro

³ Biotechnical Faculty, University of Montenegro, Podgorica, Montenegro

⁴ Faculty of Forestry, University of Belgrade, Belgrade, Serbia

⁵ Department of Earth Sciences, University of Ferrara, Ferrara, Italy

Abstract: Like in most regions of the world, the few existing land use change studies of Montenegro only cover periods starting from the 1970s. In order to make a quantitative assessment of land use changes and its regional variability throughout the 20th century, we used historical landscape photographs (dated between 1895 and 1985) that were repeated in 2009. These land use changes were linked up with changes in population density as well as with hydrological response. The locations of the 47 historical photographs are distributed over the three major geographical regions of Montenegro (coast, inner land and mountains). The share of different land use classes on every historical and repeated photograph was assessed by 6 experts, and averaged after discarding the 2 most atypical results. Hydrological data (minimum and maximum daily as well as average monthly discharges) for several stations on the Moraca and Zeta rivers, as well as population data at district level were obtained for the period starting from 1948. At all time periods between 1895 and 1970, around 35% of the land was covered by forests or shrub land, which increased steadily thereafter to reach 56% in 2009. This increase was at the expense of barren land which decreased from 50% to 23%. Especially in the northern mountain region, the forest cover increased from 38% in 1903-1929 to 56% in 2009 (areas below the alpine level). The mountain region underwent a strong depopulation: its share in the total population was 45% or more as far as 1961, whereupon it shrank to 31% in 2003. This trend of abandonment of rural and mountain areas at the benefit of urban centres has been observed within all districts. In Montenegro, the period up to the mid 1950s was characterized by great agrarian pressure, followed by industrialization and changes in the structure of agricultural production. Marginal arable fields were left uncultivated and turned into shrub- and woodland. Mountain areas were largely abandoned and came under woody vegetation. As a consequence of this, the Moraca and Zeta rivers have seen a decrease of the average yearly runoff coefficient and an increase in low flow discharges between 1948 and 2004. The yearly average runoff coefficient of the Moraca at Podgorica decreased by 19.5% between 1949 and 1980 and by a further 3.9% between 1980 and 2004. The decreased average runoff coefficient is deemed to be due to greater

interception by the vegetation and to increased evapotranspiration. An increase in low flows was also observed, which is most probably related to the increased vegetation cover enhancing infiltration. On the other hand, the maximum daily flood with a 10-year recurrence increased from 1626 m³ s⁻¹ in 1948-1975 to 2018 m³ s⁻¹ in 1985-2004. This stronger flooding is assumed to be related to in-stream works that have taken place, such as channel straightening and establishment of concrete embankments. It also indicates that the engineering works impact is more effective than the level of vegetation recovery that does not seem strong enough to override such effects on major floods. In the same order of ideas, all repeat photographs displaying landscapes with rivers show that the rivers were deeper incised and narrower in 2009 than in the first half of the 20th century, most probably a 'clear water effect', due to better vegetation cover, decreased soil erosion. The occurrence of gravel mining in river beds also played a role. The Montenegro situation provides a mirror for what could be the impact of strong intervention regarding erosion control in other degraded places with similar environmental conditions.

Key words: repeat photography, urbanization, forest, base flow, hydrograph

LAND USE EFFECTS ON EROSION INTENSITY AND LOSS OF CARBON IN SOILS OF WEST AND SOUTHEAST SERBIA

Mirjana TODOSIJEVIĆ, Snežana BELANOVIĆ,
Stanimir KOSTADINOV, Ratko KADOVIĆ, Nada DRAGOVIĆ
mirjana.todosijevic@sfb.rs

Belgrade University, Faculty of Forestry, Belgrade, Kneza Višeslava 1

Abstract: Erosion intensity, content and the loss of carbon depend on the land use effects. Carbon content related to the erosion intensity is presented in this paper. The effect of land use is assessed for the forest soil and soil with grassy vegetation. The research was undertaken in two areas with different soil use: Vranjsko-banjska river watershed (southeast Serbia) and Trešnjica watershed (west Serbia). Two areas were chosen with similar natural characteristics (mean altitude of the basin area, average temperature and mean slope of the basin area), but with different soil usage on eutric and dystic leptosol. The soil in areas of forest ecosystems has higher capacity for SOC isolation (soil organic carbon) than the soil in agricultural areas. These results indicated that changes in SOC depend on the way of soil usage and depend on the soil types. The lower carbon accumulation is registered in Vranjsko-banjska watershed having higher erosion intensity.

Key words: erosion intensity, carbon content, soil types, land use effects

LEGAL ASPECTS OF ENVIRONMENTAL PROTECTION FROM MUNICIPAL SOLID WASTE IN SERBIA

Danica ZUPANSKI

dzupanski@gmail.com

Institute for the Development of Water Resources "Jaroslav Cerni" Belgrade

Abstract: This paper contains a review of the role and participation of the domestic legal policy in waste management activities. This review includes a description of the current state of landfills with a special focus on their location at the riverbanks. These landfills are permanent sources of floating debris that cause different contamination of the environment. The concluding remarks summarize the need for an immediate change to legislation concerning waste management and future activities of the state.

Key words: unicipale waste, landfills, legal policy, environmental contamination

MOISTURE AND AIR CHARACTERISTICS AND THE REGIME OF UNDERGROUND WATER OF EUGLEY SOILS

S. PEKEČ, S. ORLOVIĆ, P. IVANIŠEVIĆ, Z. GALIĆ, B. KOVAČEVIĆ

pekecs@uns.ac.rs

Institute of Lowland Forestry and Environment, Antona Čehova 13,
Serbia / Novi Sad

Abstract: The eugley soils are in the bent-protected area of the riparian zone of the middle part of Danube basin in the Republic of Serbia. Results suggest that these soils span from loam to clayish loam. The total sand content varies from 29.74 to 39.98%, while the total clay varies from 60.02 to 70.26%. According to the total porosity the examined soils are classified in porous soils with total porosity varying from 50.91-56.62% vol.. According to differential porosity the content of coarse pores (more than 10 μm in diameter) varies from 3,09-13,26% vol., middle pores (10-0.2 μm) from 8,67-27,74% vol. and fine pores (< 0.2 μm) from 19,33-34,31% vol. Air capacity varies from 3,09-13,26% vol., plant available water from 13,29-28,80% vol., k-Darcy coefficient from $2,4 \times 10^{-5}$ - $4,4 \times 10^{-4}$ cm/s and capillary water movement from 1,7-5,3 cm/h . The average relative level of underground water varied from 38 cm - 80 cm beneath the soil surface, with amplitude varying from 55 - 127 cm , during the high water level of Danube, and from 51 - 124 cm of average relative level of underground water and 43 - 166 cm of amplitude in the year with low Danube water level. Considering considerable distance of examined sites from Danube (3106 - 4161 m) the high correlation between Danube water-level and the level of

Topic B - Ecological Engineering in Protection of Soil and Water
underground water during the high Danube water level ($r = 0,78-0,96$), and low correlation ($r = 0,07-0,21$) during the low Danube water level.

Key words: riparian zone, eugley, underground water, Danube

MONITORING OF EROSION ON A BURNED FOREST AREA

Borce BOJCOVSKI, Aleksandar TRENDAFILOV,
Bozin TRENDAFILOV, Ivan BLINKOV

borda_b@yahoo.com; ivanblinkov@yahoo.com

University Ss.Cyril and Methodius, Faculty of Forestry – Skopje,

Dept. of Land and Water - , bul.'Aleksandar Makedonski "bb.

1000 Skopje, Republic of Macedonia

Abstract: The erosion as a phenomenon and process is present with various intensities on all land surfaces on the Earth. The erosion processes follow humanity since the early ages, and on many occasions, in different parts of the globe, they defined its destiny. The main cause for the occurrence and development of the erosion processes is the destruction of the vegetation cover, the forests primarily. The occurrence of erosion processes in various types, forms and intensities on areas affected by fires, have not been studied sufficiently in the Republic of Macedonia. Consequently, their investigation is of great importance to the scientific community from various fields (protection of natural heritage, natural resources, geo-diversity, etc.). The effects of these processes are long-term, invaluable and unpredictable for the environment and human life. The aim of this research is to study the erosion processes and their intensity on fire-affected areas, to process and analyze in order for them to be interpreted consequently. The erosion processes which occur on areas which have not been affected by wildfires were studied as well. A correlation was carried out, and the results were compared. To this end, on the "Parkac" locality, where two years ago a large wildfire had occurred and burnt around 1.000 *ha*, several test plots were set up. The test plots were designed by using the Gavrilovic methodology, in a square form with areas of 100 m^2 (10 x 10 *m*). Such plots were established on the area where wildfire had occurred and on areas which were not affected by any natural disturbances. However, both areas have the same natural conditions. The measurements were taken after each rainfall, by going out in the field, to the plots. The data are collected from the barrels, processing and analyses are being carried out. The data gathered so far point out that there is a substantial difference between the areas where there was wildfire and the one where no fire occurred. The results from this research should provide us with more data so we can better comprehend the processes and intensities of erosion which arise when the vegetation cover is removed, thus pointing out the importance of forests in the protection of land from erosion.

Key words: erosion monitoring, burned forest

MULTIHAZARD MAPPING FOR BETTER PLANNING

Lidija TRPENOSKA-SIMONOVIC², Ivan BLINKOV¹,
Dusica TRPCEVSKA-ANGELKOVIC², Aleksandar TRENDAFILOV¹
www.sf.ukim.edu.mk; l.trpenoska@gmail.com; blinkov@sf.ukim.edu.mk
¹ University "Ss.Cyril and Methodius" – Skopje, Faculty of forestry – Skopje,
bul."Alexandar Makedonski" bb. 1000 Skopje, Republic of Macedonia,
² UKIM – Faculty of forestry - Skopje, PhD candidate;

Abstract: The space, being finite, given and limited, is treated as a value in the planning process. The space is not renewable and is shared among many beneficiaries. These beneficiaries, that often have conflicting, diverse interests, decide on the use of the space. Sustainable planning means harmonizing of the conflicts and optimizing the use of all the resources, including the space itself. A hazard is a situation which poses a level of threat to life, health, property or environment. Most hazards are dormant or potential, with only a theoretical risk of harm, however, once a hazard becomes 'active', it can create an emergency situation. Spatial planning enables detecting and avoidance of the areas prone to hazards, i.e. decreasing risks of occupying those areas. The urban planning refers to already occupied space, settlements that have been built at sometime in the past. Nevertheless, the awareness of possible hazards implies a change in the standards applied in urban planning for the purpose of mitigation of the consequences of a possible hazard. Several theoretical approaches in the planning were analyzed. The aim of this study is to point out the necessity of multihazard mapping as a tool that differs in regional and urban planning and enables harmonization of the urban space. The objectives are: an analysis of the theoretical background of multihazard mapping; analysis of the necessity of spatial and urban planning and elaboration of the most acceptable approach for each level of planning. Qualitative method is used in the research. The result is that the vulnerability approach is most appropriate in spatial planning. This approach is also applicable in urban planning, but upgraded with the cumulative action method.

Key words: hazards, spatial planning, urban planning, multihazard mapping

**NATURAL AND ECONOMIC EFFECTS AND ASSESSMENT
OF RISK AND UNCERTAINTY OF SUSTAINABLE SOIL
MANAGEMENT IN THE PARIGUZ WATERSHED**

Miodrag ZLATIC, Tijana ANDRIJANIĆ, Mirjana TODOSIJEVIĆ,
Stanimir KOSTADINOV, Vladimir ŠUŠNJEVIĆ
miodrag.zlatic@sfb.rs

Belgrade University, Faculty of Forestry, Belgrade, Kneza Višeslava 1

Abstract: Pariguz watershed is a part of the Rakovica Community. Rakovica constitutes a part of the hilly region of the wide area of Belgrade. This watershed is characteristic for all the erosion processes in agricultural areas of this Community. The existing structure of agricultural production indicates that erosion processes in this region have narrowed and also decelerated the yield increase rate which would be possible on natural and economic conditions. In this paper the establishment is discussed of the production taking into account the conservation of land resources, the needs of the population and profitability in the case of the hilly Pariguz Watershed. In this sense, agricultural, fruit and forest productions are anticipated from the aspect of soil management for sustainability. The assessment of the long term effects of the planned model I and improved model II (with honey as chief product and propolis, wax and flower powder as co-products) and improved model III (with royal jelly without co-products) is presented through natural effects (by a decrease in soil loss) and economic efficiency (through benefit cost analysis).

Key words: erosion, sustainability, effects, benefits, risk.

NUTRIENTS ACCUMULATION IN DRAINAGE CHANNEL SEDIMENTS

Radovan SAVIĆ*, Ljubomir LETIĆ**,
Gabrijel ONDRASEK***, Vesna NIKOLIĆ**

rassa@polj.uns.ac.rs

* Faculty of Agriculture, Department for Water Management, Novi Sad, Serbia,

** Faculty of Forestry, Belgrade, Serbia,

*** Faculty of Agriculture, University of Zagreb, Croatia

Abstract: Drainage channel network in Vojvodina (northern part of Republic of Serbia), in total length of around 20,000 km, collects and drains excessive (under)ground waters from around 2.15 million ha of lowlands. Channels are mostly in direct connection with the surrounding agricultural arable land, and exposed to different run-off, leaching and/or wind erosion processes. Close to community areas, some channels sections are used as recipients of unrefined sewage and industrial waste waters. Water flows and velocities, as well as transportable capacity for sediments, are relatively low, which in combination with other natural and anthropogenic impacts, contributes to sediment generation in the drainage channel network. Due to relatively high amount and specific properties of sediment material, channel sludging has certain hydrotehnic, agronomic, economic and ecological aspects. Based on around 80 sediment samples from forty channels, concentrations of primary macronutrients (N, P and K) are presented in the following. Excessive presence of the mentioned elements in channel sediments, due to interactive processes between water medium and sediment material, can adversely influence water quality and life conditions for channel biota. First of all, it may accelerate eutrophication processes, and all other negative related impacts. Detected concentrations of analyzed nutrients in channel sediments exceeded their contents in surrounding arable land by a few times. In some samples, concentrations of certain elements were very high, for example: nitrogen (N) – majority of samples were between 1-1.2%, phosphorus (P_2O_5) – over 100, and even up to 265 mg/100 g and potassium (K_2O) – one portion of samples, between 100-380 mg/100 g. Increase of macronutrient concentrations was also confirmed along certain channel sections. Namely, significantly higher nutrient concentrations were detected in downstream, compared to upstream, channel cross section. Influence of different point and/or diffuse pollution source between the observed profiles, in downstream (vs. upstream) samples, resulted in nutrient content increment on average by 50%, i.e. even by 5 times in some channel parts. The obtained results clearly indicate the processes of increase of nutrients accumulation / concentrations in channel sediments, whereby compared to surrounding land or along some channel section network. Erosion of unprotected agricultural areas and sediment transport, as the most important pollution pathway from drainage basin to channel, may be one of the essential factors of the detected condition.

Key words: erosion, drainage channels, sediments, nutrients

OPPORTUNITIES FOR LAND CONSOLIDATION IN FORESTRY

Saso PETROVSKI

spetrovski@snvworld.org;

SNV Netherlands Development Organization, Dane Krapcev 10a;
Macedonia, Skopje

Abstract: Forestry is an economic sector which statistically belongs to agriculture (with hunting and fishery). Taking into account that the share of this sector is around 12% in GDP, it is one of the most important economic sectors in Macedonian economy. Forest land in Macedonia is covering around 37% of the territory of Macedonia, where 90% are state and 10% are private property. Land properties in private ownership, including forest land are highly fragmented. Forest land fragmentation is one of the factors that have negative impact on sustainable forest management. Taking into account that Macedonia is a country candidate for EU membership; European funds for pre accession are available for development, adjustment and preparation of Macedonia for full membership status in to EU. As a part of pre-accession assistance, IPARD component is available to Macedonia as an EU country candidate member. The objective of this paper is to present land consolidation (LC) as an instrument for overcoming fragmentation on private forest land properties. The paper was prepared with the method of text analysis of Macedonian forest and rural development policy compared to EU policy and instruments for resolving land fragmentation. In this paper fragmentation of private forest properties is elaborated, also recognized in many national development documents as an obstacle for sustainable forest land management. Further, present policies and instruments in Macedonia for resolving land fragmentation are analyzed, with the objective to investigate if they are sufficient for resolving the negative impact of land fragmentation. In continuation, LC is presented as one of the instruments that are very often used in EU countries to deal with fragmented land parcels. LC is recommended as one of the supportive instruments that should be used to overcome the problem of fragmented land forest properties as a part of rural development policy in Macedonia. The results from this paper are recommendations for resolving fragmentation of private forest properties in the framework of rural development policy in Macedonia including legal framework issues, institutional building and other important issues as policy instruments. This paper can be used by forest sector authorities in order to develop and take proper actions for resolving the issue of fragmentation of private forest properties.

Key words: fragmentation, forest management, land consolidation

PHYTOENGINEERING EROSION CONTROL MATERIALS

Vjačeslava MATIĆ

vjaceslava.matic@sfb.rs

Belgrade University, Faculty of Forestry, Belgrade, Kneza Višeslava 1

Abstract: The advantage of these materials is their efficiency, price, ready production and application, as well as the aesthetics and the rate of matching in the natural environment. This points to the necessity of their wider application in our country, because of the cost efficiency and supporting the world trends and achievements. The increased concern for ecology and environmental protection brought about the development in the application of natural vegetation materials, as well as their residues in the form of prefabricated elements (bands, mats) in slope protection against erosion especially in urban regions.

Key words: erosion control materials, bioengineering, biofixators, erosion, ecology, erosion control, *Juniperus* (L.), *Chamaecyparis* (L.)

QUALITY OF WATER IN STORAGE RESERVOIRS RELATED TO CATCHMENT LITHOLOGY

Zoran NIKIĆ¹, Ratko RISTIĆ¹,

Danica SREČKOVIĆ-BATOČANIN², Ivica RISTOVIĆ²

zoran.nikic@sfb.rs

¹ University of Belgrade, Faculty of Forestry, Belgrade, Serbia

² University of Belgrade, Faculty of Mining and Geology, Belgrade, Serbia

Abstract: One of the targets of the national water resources management policy is the construction of dams in the near future for storage reservoirs. In an artificial lake, water changes in quality with the time compared with the flowing water in the same stream before the lake was formed. The causes of the change may be artificial or natural. The modification of water quality in storage reservoirs is presently considered in relation to natural factors. The parameters of influence on the lake water quality are classified into groups of factors, impacts and state of water quality. Materials produced by erosion in a river basin and carried mostly as stream load into a storage reservoir exert some influence on the lake sediment and the lake water. The influence of lithology on the formation of chemical composition of lake sediment and water is explained on case examples of three storage lakes for water supply in Serbia.

Key words: lithology, water quality, surface-water reservoir, erosion, water supply.

**RAIN GENERATORS - IMPORTANT EQUIPMENT
IN THE FIELD OF EROSION SCIENCE**

Zoran GAVRILOVIĆ, Mileta MILOJEVIĆ, Sonja JURIŠIĆ
gavrilovicz@sbb.rs

Institute for Development of Water Resources "Jaroslav Černi", Serbia, Belgrade

Abstract: The study of the intensity of erosion is a very complex scientific research problem, as it consists of the study of a natural phenomenon which has a multi - functional dependence, only one of which is accessible for human intervention, while others are incidental natural events. The usual investigation procedure for such multi - functional dependences set up experimental stations for this investigation. The classified goal was accomplished by forming erosion plots on slopes at equal angles, and on a homogeneous geologic and pedologic layer used for different purposes (forest, arable land, orchard, pasture, etc.). The purely experimental results were insufficient for any conclusions to be made about the actual effect of a single factor, because the basic erosion factor namely the climate, could only be roughly selected. Repetition of the complete climatic picture and observation results was not registered in a single case. The erosion process depends on natural conditions. Rains do not fall all the time and their intensity is changeable even in the same rainfall. Daily, seasonal and annual temperature changes destruct the soil. First intensive rain collects all prepared soil particles. It is often that next strong rainstorm can move too many soil particles. In order to get the necessary corrections, obtained results during plot investigation research process need establishing tests. Several types of rain generators possible to generate rain of different intensities were developed all around the world. This special equipment helps us to understand the natural erosion process and get results in a shorter investigation period. The paper presents obtained results of a series of tests using laboratory rain generators in comparison with field results.

Key words: Soil Erosion, climate, rain intensity, rain generators

**RED LIST OF SPECIES THREATENED BY
AVALANCHES AND LANDSLIDES**

S. JOVIČIĆ, Z. MARKOV

ecosneza@gmail.com

Prirodno-matematički fakultet Novi Sad, Student doktorskih studija, stipendista
Ministarstva nauke, Janka Veselinovića 16, Novi Sad

Abstract: The IUCN Red List of Threatened Species is widely recognized as the most objective global approach for evaluating the conservation status of species. Different types of factors are a threat to species, including geological events such as avalanches and landslides. According to IUCN Red List of Threatened Species there are 98 species of plants and animals which are directly or indirectly affected by these factors. There is continuing habitat loss worldwide and species are dealing with different challenges. Therefore it is necessary to study the biology and ecology of species in order to reduce the threatening factor.

Key words: Red list, endangered species, avalanches, landslides

**RESEARCH CONCENTRATION OF POLLUTANTS IN FOREST
ECOSYSTEMS OF THE PROTECTED NATURAL
PROPERTIES „AVALA”**

Dragica STANKOVIĆ, Borivoj KRSTIĆ, Dragica VILOTIĆ,

Mirjana ŠIJACIĆ-NIKOLIĆ, Milan KNEŽEVIĆ

stjulija@eunet.rs

Faculty of Forestry University of Belgrade, Kneza Visislava 1

Abstract: The aim of this paper is focused on determining the degree of concentration of heavy metals in the vegetative parts of 8 types of specially selected plants on the 3 sites of Avala and 1 location in central Belgrade. Soil samples at all localities were taken for analysis. Content analysis of heavy metals in plants and soils were performed using atomic absorption spectrophotometry. Testing of the existence of significant differences between mean values was determined by applying Duncan's test for significance level of 95%. Based on the results of the Duncan's test, it can be concluded that the value of concentration of the investigated elements is significantly different at different locations and varies in the range of (AF). Our data show that herbaceous plants (dandelion and plantain) are hyperaccumulators examined in relation to the trees, and that they accumulate lead in particular. Heavy metals in plants and soil in the area of protected natural property

”Avala” so far do not represent a risk for the occurrence of visible damage to forests, but tend to increase concentration, and should be intensively monitored.

Key words: Plants, soil, Avala, pollutants, pollution

ROLE OF PLANTED TREES AND FOREST PLANTATIONS IN LOW FOREST COVER COUNTRIES (LFCC) - CASE STUDY OF IRAN

Nasrollah BASSIRANI

Naser_Bassz@yahoo.com & N_Bassirani@yahoo.com

Dept of soil science Zabol University, Zabol - I R Iran

Abstract: The decrease of woodland and tree vegetation in and around rural and human settlements in Low Forest Cover Countries (LFCC) has raised concerns among the countries concerned and the international community. The loss of these resources impacts directly on the poor communities, which rely on trees and wooded formations to maintain their quality of life. To confront this situation, the planting of trees will become more and more frequent in order to create more wooded areas. To make these plantations sustainable, careful consideration must be given to their position in the overall land use patterns, and this paper draws attention to the role of trees planted both within and outside the areas formally classified as forest. Low forest cover raises various issues for which plantations, tree growing and the encouragement of regeneration have been identified as vital activities in order to:

- Replace the loss of natural forest and planted forest cover (reforestation);
- Introduce forest to sites that have never supported forest, or have not had non forest cover for a long period (afforestation);
- Improve degraded natural forest ecosystems;
- Expand tree cover on non-forest areas, rehabilitate degraded lands, restore soil fertility and control soil erosion;
- Provide services and goods that natural forests may no longer be able to meet, including the provision of fuelwood, fodder and non-wood forest products;
- Provide industrial wood and fuelwood;
- Ease human and animal pressure on limited natural forest areas;

Key words: Planted Trees, Forest Plantations, Low Forest Cover Countries

**SEGMENT OF REMOTE SENSING APPLICATION
IN SOIL AND WATER CONSERVATION**

Mileta MILOJEVIĆ, Zoran GAVRILOVIĆ, Milutin STEFANOVIĆ
mmvodomar@gmail.com
Institute for Development of Water Resources “Jaroslav Černi”, Serbia

Abstract: In agreement with the methodology of “Erosion Potential“ which is applied in the mapping of erosion and erosive regions, the Institute of Water Management “Jaroslav Černi“ applies remote sensing by aero-photo, digital orthophoto and multispectral satellite images, primarily in land use mapping, calculation of torrential flood zones and in the analysis of forest state. Most frequently used images are digital orthophoto in combination with digital terrain model (DTM). The objective of this study is to focus on a segment of assessment of vegetation protection role in the conservation of soil and water resources, by remote sensing, in the aim of fast, economic and precise acquisition and processing of digital topographic data of adequate accuracy, for the analysis of the state of forests and erosion processes, so as to reduce the possibility of investment failures. Each failure which results from the mistakes on an erosion map has significant negative consequences, such as silted up storages and melioration systems, destroyed railway lines and roads, destroyed parts of settlements and industrial plants, etc. By all means, there is also the opposite case when huge resources are unnecessarily invested in the protection systems. Our long-term experience shows that the combination of field research and remote sensing produces the best results. The rational proportion of field research and office work is the precondition of economic, fast and good-quality performance of the tasks. The future development of technology will speed up and shorten the research of remote sensing, which will reduce the need of field research only to the control of remote sensing results.

Key words: remote sensing, erosion, torrents, forests, land use.

**SLOPE OF SILTATION IN TORRENT CHANNELS OF
THE TRGOVIŠKI TIMOK CATCHMENT**

Svetlana BILIBAJKIĆ, Tomislav STEFANOVIĆ,
Renata GAGIĆ SERDAR, Zoran PODUŠKA

bilibruz@verat.net

Institute of forestry, Kneza Višeslava 3, Serbia/Belgrade

Abstract: The slope of siltation is the slope of the upper surface of the deposited material in the storage area upstream of the constructed dam. Silting up is a complex process, and the assessment, i.e. the forecast of the slope of siltation is a major issue in the practice of torrent management. This paper analyzes the dependence of newly formed slopes of siltation on natural bed slopes, on the siltations of the constructed dams in torrent channels of the Trgoviški Timok catchment. The analysis of the dependence of newly formed slopes of siltation on natural bed slopes was performed by the method of modeling as the basic method. Regression and correlation analyses were applied as the concrete research methods. The results show high correlation between the slope of siltation and natural bed slope, based on which it can be claimed that the obtained model is a fairly good base for the slope of siltation forecast in future.

Key words: dam, bed slope, slope of siltation

THE STATE OF FOREST SHELTERBELTS IN SERBIA

Stevan DOŽIĆ, Matilda ĐUKIĆ, Sara LUKIĆ

stevan.dozic@sfb.rs

Belgrade University, Faculty of Forestry, Kneza Višeslava 1, Serbia, Belgrade

Abstract: Raising forest shelterbelts has a long tradition in Serbia, with insufficient performance in the application, considering the needs and opportunities. In order to perform determination by the condition of belts, the sites were selected, in similar climatic conditions and sites and the analysis of belts was performed to compare taxonomic indicators of the growth of forest trees, pedology characteristics, analysis of the composition of spontaneously developed flora and the impact on biodiversity. In particular, the results show the overall effects of forest protection belts to reduce wind speed in the immediate area and a level playing field. The review of similarities and differences in tree species that are used in belts in the past fifty years for poplar, locust, Polish ash, Siberian elm, black pine and Thuja are presented. The research results indicate the necessity of establishing and maintaining forest shelterbelts in Serbia.

Key words: aeolian erosion, forest species, biodiversity, environment

**SUITABILITY FOR TREE SPECIES AFFORESTATION USING GIS AIDED
LANDSCAPE MODEL IN THE REPUBLIC OF MACEDONIA**

Božin TRENDABILOV¹, Ivan MINČEV¹,
Bojan SIMOVSKI¹, Nikolčo VELKOVSKI¹
bozint@gmail.com; i_mincev@yahoo.com; bsimovski@sf.ukim.edu.mk;
nvelkovski@sf.ukim.edu.mk

¹ University Ss.Cyril and Methodius in Skopje, Faculty of Forestry in Skopje,
bul. Aleksandar Makedonski bb, MK-1000 Skopje, Republic of Macedonia

Abstract: The area of the Balkan Peninsula has been exploited to a large extent throughout the history. For thousands of years this region has been populated; much of the landscape has been distorted and on certain vulnerable sites not much of the primary vegetation is left. There are information from the famous Turkish traveler Evlija Celebija from a couple of centuries ago, that the area along the river Vardar was covered with dense forest. Today this area is the most vulnerable area to desertification. The purpose of this study is to assess the possibility to perform afforestation of the non-forested vulnerable areas with the most common autochthonous tree species and to assess the most suitable places for the reforestation on the area of the Republic of Macedonia. The study area is very diverse in sense of growth conditions for the trees. For this study dozen tree species are chosen from different climatic zones in which they normally thrive. For identifying the natural potential of the site, three main factors were chosen: soil with geology, slope and vegetation zones. These factors were integrated into a GIS landscape model created through multi-criteria decision process. Finally, suitability maps for afforestation of different tree species were created.

Key words: natural regeneration, forest tree species, sustainable development

**THE ECOLOGICAL EFFECTS OF WIND ON SOIL NUTRITION
ELEMENTS STATUS IN THE HYRCANIAN
FORESTS OF IRAN**

Yahya KOOCH, Seyed Mohsen HOSSEINI,
Jahangard MOHAMMADI, Seyed Mohammad HODJATI
yahya_kooch@yahoo.com
Tarbiat Modares University, Natural Resource Faculty, Depart-
ment of Forestry, Nour, Mazandaran, P.O. Box 46414-356, Iran.

Abstract: Tree uprooting creates multiple microsites that can be effective on soil heterogeneity and changes. Monitoring changeable value of Cation Exchange Capacity (CEC) and nutrition elements in uprooted tree position is essential for forest ecosystems management. For this purpose, twenty hectare areas of Tarbiat Modares University Experimental Forest Station that are located in Mazandaran province, northern Iran were studied. Numbers of thirty four uprooted trees were found in study areas. Five microsites were distinguished including mound top, mound wall, pit bottom, pit wall and closed canopy. Soil samples were taken at 0 – 15, 15 – 30 and 30 - 45 *cm* depths from all microsites using core soil sampler with 81 *cm*² cross section. CEC of closed canopy is fourth as much than mound microsites soil with considering joint increasing clay and organic matter. Results are indicating the most and least CEC considered in closed canopy and mound top microsites, respectively. Also, the mentioned character gathered in lower depths. Pit bottom and the first depth had maximum of nitrogen and the least devoted in mound wall and the third depth. The highest amounts of phosphorus, potassium and calcium were considered in closed canopy and the least devoted in mound top, mound wall and mound top, respectively. Phosphorus and potassium values had a descending trend and calcium showed an ascending trend in relation to the increase of depth. The results of this research indicating the presence of uprooted trees and pit - mound creation are due to soil revenue diversity that can be effective on biodiversity and forest stability.

Key words: uprooted trees, microtopography, microsite, soil texture

**THE SELECTION OF TREE AND SHRUB SPECIES AS AN IMPORTANT
FACTOR IN THE PROCESS OF SUCCESSFUL
BIOLOGICAL RECLAMATION**

Aleksandar TRENDAFILOV¹, Ivan BLINKOV¹, Bozin TRENDAFILOV¹
atrendafilov@sf.ukim.edu.mk, blinkov@sf.ukim.edu.mk, bozint@gmail.com
University Ss.Cyril and Methodius in Skopje, Faculty of Forestry in Skopje,
bul. Aleksandar Makedonski bb, MK-1000 Skopje, Republic of Macedonia

Abstract: The success and longevity of the reclamation processes of tailing dams and landfills, especially the process of biological reclamation, depends on several elements which are of ecological and anthropogenic character, but primarily on the climate conditions, the properties of the soil and the strength and depth of the applied soil layer, the micro relief/geomorphology of the object, the selection of the plant species, the technique and technology used during the preparation of the object of reclamation, the employment of adequate nurturing and protective measures, and the concept of biological reclamation as a whole. One of the most significant and essential elements of the process of biological reclamation is the selection of the plant species to be used. The aim of this research is the analysis of the actions and methodology used during the process of biological reclamation of the tailing dam "Topolnica" at the copper mine "Bucim" near the town of Radovich. The florisols-slag deposits from the tailing dam Topolnica, as actually many other tailing dams throughout the country (Sasa, Kamenica, Zletovo) are characterized with being unconsolidated, extreme erodible and susceptible to strong processes of erosion.

Key words: biological reclamation, erosion control, tree species selection.

**WATER QUALITY IN THE BASIN OF VRLA RIVER AND
ITS IMPACT ON ENVIRONMENTAL QUALITY**

Vojislav ĐEKOVIĆ, Grozdana GAJIĆ, Aleksandar ANĐELKOVIĆ,
Nedo MILOŠEVIĆ, Jelena KERNALIS
vojislav.djekovic@sfb.rs

University of Belgrade Faculty of Forestry, Kneza Višeslava br.1, Srbija, Belgrade

Abstract: The resources of healthy and clean water on the Earth are scarcer and scarcer, water is being more and more contaminated and polluted every day, and is thus made useless. Modern man, preoccupied with technological development and busy time race, is becoming increasingly isolated from nature. The irresponsibility of man's attitude to the environment is growing. Water flows of hilly-mountainous regions of Serbia are, as a rule, characterized by high water quality. Although they represent precious water reserves, these areas are exposed to the pressure of civilization and permanent environmental pollution. This paper presents the state of the environment in the basin of Vrla River, the state of water quality in its watercourse, and the possibility of environmental protection.

Key words: surface watercourses, pollution, Vrla, suspended alluvium, drawn alluvium

TORRENT FLOODPLAIN MAPPING - PROBLEMS AND SOLUTIONS

Nikola ZLATANOVIĆ, Mileta MILOJEVIĆ, Sonja JURIŠIĆ

zzznikola@gmail.com

Institute for Development of Water Resources "Jaroslav Černi", Serbia, Belgrade

Abstract: Serbia is a country that is endangered by flooding from the largest European river, the Danube, its largest tributaries, as well as by countless torrents. During the 19th and 20th centuries, an imposing scope of protection structures was constructed. The existence of the protection system created the perception that flood protection was achieved and that it should only be complemented on a great number of unregulated torrents. Floodplain mapping, although required by law, was postponed because of the high price of traditional geodetic surveying. Small torrents are mostly regulated in the vicinity of roads and towns, so it was believed that protection was accomplished. What is often overlooked is that the majority of torrents in Serbia are not regulated by any system of protection, and urbanisation is progressing unrestrainedly. The government cannot afford to construct all necessary protection systems, so numerous settlements remain at risk unprotected. The floods were particularly unforgiving, and raising awareness of the need for collecting data on floodplains and providing flood protection have become imperative. The rational method of floodplain mapping was explored, as well as methods for reducing flood damages without large investments. This paper will present the results achieved using low-budget flood zone mapping of torrential flows and the applied measures for torrential flood control, which were successfully implemented in Serbia.

Key words: Floodplain, flood, torrent, flood defense

TORRENTIAL FLOODS AND CONTINGENCY PLANNING

Milutin STEFANOVIĆ, Zoran GAVRILOVIĆ, Mileta MILOJEVIĆ
stefanovic@jcerni.co.rs

Institute for Development of Water Resources "Jaroslav Černi", Serbia, Belgrade

Abstract: Many areas in Europe have been affected by an increasing number of severe flood events in the past few years. Because of these floods numerous measures to improve the organization of disaster management have been taken. This includes the preparation of specific alarm plans for flood disaster events or the definition of a hazard mapping guideline.

The frequency of torrential floods throughout the world, including Serbia, has given rise to the need for monitoring, prediction and preparedness for these natural disasters. Institute Jaroslav Černi has created a methodology for torrential flood control in 1998, and it is under constant improvement and development.

Serbian Torrent Flood Defense methodology, which combines radar meteorology, torrential hydrology and new GIS techniques to enable quick determination and assessment of the detected situation in order to provide sufficient time for the flood defense system to be put into operation.

Despite a large number of variables affecting the destructiveness of torrential floods, methodology for torrential flood control has been created based on long-term research and experience. This paper will present experiences as well as new technologies regarding prevention and activities in the case of emergency situations due to torrential floods. The paper shows obtained results in the developed methodology and prepared contingency plans for many local communities which are obligated to put them into operation.

Key words: torrents, torrential flood defense, Contingency Plan

**USING AQUATIC PLANTS AND PERENNIALS
FOR PHYTOREMEDIATION OF MINE
DRAINAGE AND BIOMASS PRODUCTION**

N. ČULE, S. MITROVIĆ, D. DRAŽIĆ, M. VESELINOVIĆ,
Lj. JOVANOVIĆ, Lj. BRAŠANAC-BOSANAC, M. NEŠIĆ

Institute of Forestry, Kneza Višeslava 3, Serbia, Belgrade

Abstract: Acidic mine drainage is one of the major environmental problems related to the mines of various types and categories. This drainage with low *pH* value can lead to the release of heavy metals from contaminated soil or surface water sediments. If such pollution remains uncontrolled it can completely destroy the biodiversity of wetlands and streams. Constructed wetlands have the capacity to remove heavy metals from wastewater and may even completely neutralize the acidic reaction of mine drainage. Because aquatic ecosystems are self-sustaining systems, theoretically they would be able to perform remediation of contaminated drainage water as long as they are generated. Because of that, these alternative systems represent long-term solution for the removal of acid mine drainage and all other pollutants, which can get into the environment due to the conduct of mining activities. Post exploitation areas of mining basin have multiple potential for biomass production by perennials and aquatic plants. Potential areas for the establishment of these plants are lakes formed in depressions in the process of coal exploitation. Aquatic macrophyte *Phragmites communis* Trin. and decorative perennial *Canna indica* L. have all characteristics that a plant suitable for phytoremediation must possess. Both plants can remove large amounts of heavy metals, organic and inorganic pollutants and harmful microorganisms from contaminated water and soil. Since these plants tolerate high levels of pollution they can grow well in contaminated sites and thereby create a large amount of biomass, which can be used for different purposes, and as a source for obtaining biofuel.

Key words: phytoremediation, mine drainage, aquatic plants, perennials, biomass

**WATER RESOURCES OF THE MUNICIPALITY
GORA – SOUTH SERBIA**

Damir AJRANI
ajranovic@orion.rs

Belgrade University, Faculty of Forestry, Belgrade , student

Abstract: The municipality of Gora is located in southern Serbia. It covers an area of 385.6 km^2 , with a terrain of about 750 m to 2675 m altitude. Gora's water resource are numerous watercourses, lakes and groundwater. The largest rivers are the Plav river, the Brodska river, the Restelička River and the Crn kamen (Black Stone). There were hydrological stations on the Plav, the Brodska and the Restelička rivers in the past, within the Hydrometeorological Service of Serbia. All the watercourses from the municipality of Gora go to the White and the Black Drim, which belongs to the Adriatic river basin. The lakes are of glacial origin, some of which dry up in summer. The groundwater resource is quantitatively and qualitatively significant. The ground waters are located in the karstic and karst-fissured type aquifers. They are fed by the atmospheric waters, and drained off by the springs and the wells. Generally, the water resource of Gora municipality is important, but it is not adequately used and it represents developmental potential of the municipality Gora.

Key words: water resources, Gora, Šar mountain

**RELATIONSHIP BETWEEN HEAVY METALS CONCENTRATION
IN SOIL AND PLANTS OF HIGH MOUNTAIN GRASSLANDS:
A CASE STUDY OF THE NP DURMITOR**

Ratko KADOVIĆ, Snežana BELANOVIĆ, Dragica OBRATOV-PETKOVIĆ,
Ivana BJEDOV, Nada DRAGOVIC
ratko.kadovic@sfb.rs
Faculty of Forestry, Belgrade University

Abstract: In the Durmitor area, anthropogenic factor is primarily manifested through negative impacts on forests and grasslands as the most complex and important ecosystems, then on the state and quality of waters, soil, biodiversity (collection, use and trade of commercially important species), urbanization effects and exploitation of nature in general. Natural grasslands in Lake Plateau of the NP “Durmitor” were regularly managed, cut once a year, livestock grazed or partly grazed by sheep. The grasslands are composed of different numbers of plant species of different morphological, biological and production characteristics. The floristic mixture of the studied grasslands consisted of the species of the families Gramineae, Leguminosae, Compositae, Rosaceae, Caryophyllaceae, Cyperaceae, Juncaceae etc. The aim of this paper is to present the content of heavy metals (Zn, Cu, Pb and Cd) in the surface soil layers (0–10 and 10–20 cm) and in the grass mixture, and relationships between concentrations of heavy metals in plants and the soil. The relationship between heavy metals concentration in the soil and plants is explained with a linear regression. Statistical analysis has shown that there is a high, statistically significant correlation coefficient between the content of heavy metals in the grass mixture and the soil. The chemical composition of plants and the chemical composition of the soil are dependent on each other. Different factors affect the bonding of heavy metals to the soil, and the main problem is the estimation of the heavy metal load in the soil. The chemical composition of plants in general reflects the elementary composition of the environment in which they grow.

Key words: grassland, heavy metals, soil properties

**RELATIONSHIP BETWEEN CHEMICAL
AND MECHANICAL WATER EROSION
IN MLAVA RIVER BASIN**

Predrag MANOJLOVIĆ, Sanja MUSTAFIĆ,
Jelena LUKOVIĆ, Marko MILOSEVIĆ
peca@gef.bg.ac.rs

University of Belgrade Faculty of Geography, Studentski trg 3/3 , Serbia, Belgrade

Abstract: The Mlava river basin is located in the Eastern part of Serbia, covering the area of XX. In this paper the relationship between mechanical and chemical erosion was determined in the profiles Zagubica (194 km^2) and Petrovac (1124 km^2) in the period from October 2001 until November 2002. Down the River from the second profile anthropogenic impact on water chemistry is great, and therefore this part of the basin is not taken into consideration. The strongest spring in Serbia shows the rate of chemical erosion of $70.2 \text{ t/km}^2/\text{god}$, while silt does not exist. Downstream there are neogene sediments dominating and type of soil related so in the profile Petrovac chemical erosion is $56,3 \text{ t/km}^2/\text{god}$ and silt erosion is $22.3 \text{ t/km}^2/\text{god}$, which makes the relationship between the chemical and mechanical erosion of 1:2.5. As we know, silt transportation is the excessive silt process. In the investigated period only in 2.4% of the total time or nine days was carried 72% annual quantity of silt. In contrast chemical solution is much more balanced throughout the year. The reason for this phenomenon is the relationship between geological structure and discharge in the upper and lower basin. In the upper part of the watershed limestone is dominating with a strong underground runoff, and downstream there are Neogene sediments which are more prone to dissolution, which leads to increased water mineralization, and therefore chemical erosion.

Key words: chemical erosion, mechanical erosion, Mlava river basin, Eastern Serbia

**POSSIBILITY FOR INTEGRATING LANDSCAPES IN
SPATIAL AND ENVIRONMENTAL PLANNING IN SERBIA**

Marija MAKSIN¹, Saša MILIJIĆ²

¹ Associate Professor at the Faculty of Tourism and Hospitality Management, Singidunum University

² Senior Scientific Associate of the Institute of Architecture and Urban & Spatial Planning of Serbia

Abstract: The paper presents an overview of expected role of spatial and environmental planning in coordination with and integration into various plan bases, particularly relating to the open space and landscape protection and development. Application of the integrated approach to sustainable territorial development planning and management in the European Union is analyzed also in the context of problems associated with and possibilities to enhance ECL implementation. Contribution of reforms in current legislation and plan basis to the establishment of coordinated system of sustainable territorial development planning and management in Serbia and to obtaining support for the integration of landscape planning and management into the process of spatial, environmental and sectoral planning, are considered. The approach to and problems associated with landscape protection and development in practice in spatial planning are analyzed through several examples of a new generation of spatial plans in Serbia. Through the example of mountain Stara planina, the role of strategic environmental assessment in coordination between spatial and sectoral planning is analyzed, as well as a potential contribution to landscape integration into the process of planning. For including landscapes in Serbian system and practice of spatial, sectoral and environmental planning, it is essential to identify regional diversification of landscape types, as well as to establish appropriate recommendations and measures for planning and managing the identified landscapes. Starting from this assumption and experiences in implementation of the European Landscape Convention, as well as from the necessary redefinition of planning system in Serbia, the possibilities for landscape integration into the process of spatial, environmental and sectoral planning is indicated.

Key words: landscape planning and management, legal basis, coordination of plan basis, landscape integration into spatial, environmental and sectoral planning, implementation.

STRATEGIC FLOOD IMPACT ASSESSMENT IN THE SPATIAL PLANNING OF CATCHMENT AREAS (CASE STUDY OF THE TAMNAVA RIVER BASIN)

Marina NENKOVIĆ-RIZNIĆ*, Saša MILIJIĆ**, Nikola KRUNIĆ***
marina@iaus.ac.rs

****Institute of Architecture and Urban & Spatial Planning of Serbia,
Bulevar Kralja Aleksandra 73/II, 11000 Belgrade

Abstract: Serbia is considered to be one of the regions with uneven annual water discharge which causes flash floods. This requires integrated approach to catchment planning and management. In this paper, the authors indicate a current problem of catchment regulation associated with flood impact control through the latest instruments of spatial planning - strategic flood impact assessment, which is carried out through the process of multicriteria analysis. Guidelines for regulation of the region are determined by the process of integral spatial planning through various aspects of forestry, water resource management, natural values and immovable cultural heritage protection, rules of construction, etc., in which an important segment is the regulation of waters and flood protection. In the so far practice in planning in Serbia, only segments of these aspects have been present, but the process of their implementation failed to take place, which has caused a series of adverse impacts on natural and created resources. The Directive 2007/60/ES on the assessment and management of flood risks sets out legislative guidelines for developing flood risk management plans, and also for the realization of strategic assessment of flood impacts on the environment, quality of life, facilities and space use. Given that country's practice in planning does not include development of risk management plans, an adequate implementation of postulates set out in the Directive is possible through adaptive Strategic Environmental Impact Assessment, namely, Strategic Flood Impact Assessment, according to the Law on Strategic Environmental Impact Assessment of the Republic of Serbia („Official Gazette of RS“ No.135/04). An approach to catchment spatial regulation is shown through an analysis of the Kolubara river basin and pilot project of the Flood Risk Management Plan for the Tamnava river basin.

Key words: strategic impact assessment, catchment spatial plan, flood, the Tamnava river basin.

EFFECTS OF FOREST FIRES ON EROSION PROCESSES
(Preliminary results)

Ivan BLINKOV, Borce BOJCOVSKI, Bozin TREDAFILOV,
Aleksandar TREDAFILOV, Ivan MINCEV
blinkov@sf.ukim.edu.mk, bbojcovski@yahoo.com, trendafilov_a@yahoo.com,
bozint@gmail.com, i_mincev@yahoo.com

¹ University Ss.Cyril and Methodius, Faculty of forestry – Skopje, Dept. of Land and Water - , bul."Alexandar Makedonski "bb. 1000 Skopje, Republic of Macedonia ,fax: +389 2 3164560 ;

Abstract: Erosion is a very complex problem that couldn't be understood using simple methods. Forest fires in the mountain regions cause huge damages. Related to the erosion processes it could be noticed 2 main effects of forest fires: worsening of soil characteristics and radical land cover changes. The aim of the study is to analyze erosion processes after forest fire. Objectives of this study are: Erosion factor analyses (before and after fire), Monitoring of changes on the terrain after fire (appearance of erosion forms etc), Erosion monitoring on experimental plots and GIS based modeling of erosion and estimation of influence of forest fire on erosion on a small catchment and a large catchment. For fulfilling these tasks were carried out various activities: field work (recognition of the terrain, GPS measuring, mapping, continuous monitoring and photo recording, collection of material for laboratory analyses); laboratory analyses (pedological laboratory); GIS-lab activities (scanning, georeferencing, digitizing, creation attribute database, modeling) etc., Various approaches, methods and instrumentation for erosion monitoring exist. Contemporary approaches predict organizing of sample plots stored as grid cells or on transect but it depends on available finances. Erosion plot studies were started at the University of Missouri in 1915. Later, a network of 10 soil erosion experimental plots was established in 1928. The form of these plots was rectangle. The dimension varies and the Wischmeyer established standard dimensions 22,1x4 m. Gavrilovic (Serbia) in 1970 established square formed erosion plots having an area of 100 m² (10x10m). Besides it, these plots are previously aimed for agriculture land where sheet and rill erosion processes are dominant. Mountain terrain is rough, dissected and these plot forms are not enough for getting relevant results. For this purpose were established two experimental plots: one with square form and dimension 10x10m, and the additional plot with irregular form stored around a small gully. These plots are established on the locality „Parkac” on the Malesevski Planini in East Macedonia on 960 m asl. This is the mountain region where two years ago were burned about 1000 ha forests. Gullies cover a significant part of the terrain. Pluviometer station is near by the plots. Observer checks the plots after each rain, notices the level of runoff (level in the barrels) and collects samples for further laboratory analysis of

the sediment. The results of this research should contribute to better modeling of the erosion processes in mountain region. GIS-based modeling of erosion intensity has been in pioneer period because of late appearance of GIS technology. Various erosion methods/models for erosion modeling could be used, but according to previous research for modeling on a level of watershed in Macedonia, the Garilovic approach is the most appropriate. Modeling was carried out on a level of small catchment (Kolacinski Andak) where 1/3 of the area was burned and a level of catchment of upper part of Bregalnica where beside up mentioned fire there were smaller fires split on the area. Result from comparative monitoring of plots with different land cover (forest or burned forest area) show that forest fire has a big influence on run off and erosion processes too. While on the forest cover plots there was neglected runoff and sediment load, on the other plot (burned forest) there were recorded several times run off values of more then 90 liters up to 220 liters with significant sediment concentration. Field observation show appearance of various forms even activation of formed gullies. Monitoring activities are carrying on permanently and continue in future. Appearance of various pioneer plant species are noticed during the permanent monitoring. Related to the GIS – based modeling results hasn't been finished yet because this is an on-going project. Part of the data necessary for erosion modeling was found in a raster format, part of data was in a paper format but no one in a vector (shp) format. Beside it, significant time was spent for remote sensing analyses. It means that modeling of erosion processes started from "zero" (0), because of absence of vector data in appropriate scale. This is a huge problem in Macedonia especially in forestry where no data exist even in raster format.

Key words: erosion monitoring, plots, GIS-based modeling erosion processes

First Serbian Forestry Congress - Future with Forests -

Topic B - Ecological Engineering in Protection of Soil and Water

Topic C

**LANDSCAPE ARCHITECTURE AND
HORTICULTURE**

Papers

First Serbian Forestry Congress under slogan: - Future with Forests -

Topic C - Landscape Architecture and Horticulture

**A METHOD APPROACH WITH THE AIM OF SUSTAINABLE
LANDSCAPE PLANNING (CILINGOZ BAY EXAMPLE)**

Hakan ALTINÇEKİÇ, İ. Müge ÖZGÜÇ ERDÖNMEZ, Sanem ÇINAR,
Nilüfer KART AKTAŞ, Alev P. BEKDEMİR
niluferk@istanbul.edu.tr
Istanbul University, Faculty of Forestry, Department of Landscape
Planning and Design

Abstract: Humankind which intended development and improvement throughout the history has always improved and changed either itself or the environment for safer and cozier living as a consequence of increasing requirements and technological development. Besides having positive effects, technological development has brought problems as environmental pollution and depletion of raw materials.

It is noticed that renewal and replacement of resources are due to a process along with understanding the consumption of resources by improper usage and universality of environmental pollution problems. This shows that today's problems will be active in the next generations. In this context, the concept of sustainability can be defined to provide continuity of efficiency in the optimal conditions for many years.

By ensuring sustainability, not only the existing environmental problems will be solved but also the life quality of the current population will be increased and livable places will arise so that future generations may continue living safely. Within the scope of this study; in order to establish the human-environment-economy triangle in the healthiest way, a planning proposal in accordance with the principle of sustainability is intended to be brought to Cilingoz Bay, which is located on the Istanbul's Black Sea coast with a remarkable natural and cultural richness.

Within the context of this study;

- Inventories of Cilingoz Bay's natural and cultural resources are covered.
- A conservation-usage model is stated to establish ecological-economic balance in a healthy way.
- Alternative land uses are designated by providing the continuity of natural ecosystems and preservation of biodiversity.
- All phases of landscape planning process are elaborated in the study area by a detailed analysis of its natural and cultural features.

As a result, a planning model is put forward not only for Cilingoz Bay, but also for the potential recreation areas in the vicinity of urban areas.

Key words: sustainability, landscape planning, Cilingoz

**INVASIVE PERENNIAL SPECIES ASTER NOVI-BELGII L.
IN THE BELGRADE AREA**

Marija MARKOVIĆ, Marija POPOVIĆ

marija.markovic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: The aim of this study was to determine the presence and degree of naturalization of ornamental species *Aster novi-belgii* L. in the Belgrade area. This species was recorded in many countries as invasive. It is a very common perennial species, and because of that public green areas as well as private gardens in Belgrade could represent important centre of its expansion. During our research this species was present in a great number near the flower beds, but also on localities which are more or less distant from the place of divergence, on unmaintained areas, sometimes in extremely adverse conditions. It is concluded that *Aster novi-belgii* is successfully naturalized in the Belgrade area. As this species regenerates easily and quickly, it is very important to replace it with some other non - invasive species before starting with measures of its eradication.

Key words: *Aster novi-belgii* L., invasive species

**THE ANALYSIS OF ACCESSIBILITY OF OPEN SPACES AS PART
OF SUSTAINABLE ENVIRONMENTAL DESIGN**

Ana GAČIĆ

anagacic@sbb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Urban renewal as an integral part of the planning process should include common social, economic, educational, health, cultural needs, and needs in the area of services, supplies, production activities, rest and recreation. It is necessary to preserve, stabilize and further develop the quality of life for all residents. Also, it is important to ensure the social integration of population and special requirements of persons with difficulties in mobility and special needs. Equalization of living conditions and needs of the whole population is considered from the point of sustainability. Raising the quality of life is clearly formulated – according to the concept of sustainable development, to meet the needs, it is not an individual right, but a fundamental right of entire social groups of people. In that regard, one of the basic needs of people is the ability of independent and free movement, without obstacles and barriers. A large group of people who have difficulty in mobility (people with disabilities, senior citizens, families with children...), in terms of inaccessible open space, is hindered completely equal participation in almost all aspects of life. This paper deals with the research of accessibility of open space for people with problems in mobility and orientation. Analysis of the school yard for visually impaired students “Veljko Ramadanović” in Zemun has been made. Given the specificity of space and users (blind and visually impaired children and youth) a check list for analyzing different elements of open space that affect the mobility and orientation has been made. The checklists were produced in order to analyze in detail different elements of the open spaces – pedestrian areas, the entrances to the buildings, functional units, urban furniture and equipment and green areas. The results showed that the analyzed elements were partially accessible for visually impaired children, specifically related to the independent movement, overcoming space and orientation. Analyzed data show that the open spaces of school “Veljko Ramadanović” were not constructed according to the standards of accessibility. The technical standards for planning and constructing of public places have not been met fully and consistently. It can be concluded that in order to achieve the process of inclusion, among other things, the properties must be regulated so that all people can use them with minimal effort, while respecting the principles of accessibility and universal design. For the purpose of social integration, in sustainable environmental planning, it is necessary to take into account the needs of all people, and customize the environment to be available to present and future generations.

Key words: accessible open space, people with disabilities, social integration

**NURSERIES AS THE SOURCE OF *PHYTOPHTHORA* SPP.
IN FORESTS AND HORTICULTURE**

Leszek B. ORLIKOWSKI, Magdalena PTASZEK,

Tomasz OSZAKO, Justyna NOWAKOWSKA

leszek.orkowski@insad.pl

Res. Institute of Pomology & Floriculture, Pomologiczna 18,

96-100 Skierniewice, Poland

Forest Res. Institute, Sękocin Las, Braci Lesnej 3, 05-090 Raszyn, Poland

Abstract: *Phytophthora cactorum* and *P. plurivora* were isolated from seedlings of *Abies alba*, *Fagus sylvatica*, *Picea abies* and *Sorbus aucuaria* showing discoloration of leaves, stem base and/or root rot. Seedlings of these plant species are used as rootstocks for grafting of tree cultivars in hardy ornamental nursery stocks. Growing of seedlings of beech, spruce and rowan in substratum infested with *P. cactorum* resulted in the development of stem base and root rot on the most of plants within 3 weeks. Most seedlings of silver fir, beech and spruce growing in substratum infested with *P. plurivora* died within 3 week-incubation. Losses of plants grafting on seedlings taken from forest nurseries varied from 1 to 7%.

Key words: nursery, seedlings, *Phytophthora*, grafting, symptoms, losses

**OCCURRENCE AND ISOLATE DIFFERENTIATION OF *PHYTOPHTHORA*
SPP. IN POLISH ORNAMENTAL NURSERY STOCKS**

Leszek B. ORLIKOWSKI, Magdalena PTASZEK,

Aleksandra TRZEWIK, Teresa ORLIKOWSKA

leszek.orlikowski@insad.pl

Res. Institute of Pomology and Floriculture, Pomologiczna 18,

96-100 Skierniewice, Poland

Abstract: *Phytophthora cambivora*, *P. cinnamomi*, *P. citrophthora*, *P. cryptogea* and *P. plurivora* were the most frequently isolated species from diseased plants in hardy ornamental nursery stocks. *P. cambivora* and *P. citrophthora* were mainly detected from deciduous plants whereas *P. cinnamomi* was especially found on coniferous and ericaceous species. *P. cryptogea* was isolated mainly from perennial plants and also together with *P. cinnamomi* and *P. plurivora*. All or most of isolates of *P. cambivora*, *P. cinnamomi*, *P. citrophthora* and *P. plurivora* from different plant species had a more or less different host range, but none were host specific. The pathogenic variability was observed among isolates of *P. cryptogea*. Even plants from the same family showed different reaction on the tested isolates.

Key words: ornamental nursery, survey, *Phytophthora*, symptoms, isolates, pathogenicity, variation

CONTEMPORARY TRENDS IN DESIGN AND USE OF OPEN URBAN SPACES IN LANDSCAPE ARCHITECTURE AND HORTICULTURE

Ljiljana VUJKOVIĆ, Nevenka GALEČIĆ
ljiljanav19@gmail.com

University of Belgrade, Faculty of Forestry, Department of Landscape Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: When speaking about different approaches in the design process and the use of open urban spaces in landscape architecture, there is obvious presence of a new trend - the one which has been expanding recently. It is based on giving importance to humane and social aspects of human behavior (behavior of the space users). Nowadays, the compatibility of various aspects of social behavior, as well as the extent and method by which the space is used by the visitors, ie. the space users, not only represent one of the central aspects of the design process, but are also among the most important categories in the evaluation of success and quality of landscape architecture solutions. The new concept also comprises the study of optimal connections between the human civilization and the environment, ie. between the process and character of peoples' everyday life and the environment in which these processes take place. The affirmation of contemporary cultural and other social aspects of landscape architecture (appropriate open urban spaces, concept and aesthetics) does not have to be done at the expense of the optimal functioning of natural systems. In fact, one of the key ideas of a new orientation in landscape design is not to exclude the components and structures (omnipresent in our modern environment) from the composition, which bear witness to the various development stages of human civilization, but they find their place and a specific function in it. Modern landscape designers have been trying to connect and intertwine past, current and future development trends of human civilization in an inventive way. They also try to solve the visual aspects of a composition (with respect to the form, proportion, line, color, selection, processing and combining materials), which will be shown in the paper by giving numerous examples of open urban spaces in landscape architecture in America, China and France which are solved in a modern way. Spatial composition should represent an authentic cultural product of its time with the need to establish cultural relations between the human species and the environment (the awareness of sustainable development). This includes the movements in which the landscape design today is far more widely used with respect to numerous aspects of various sciences (natural and social), art, architecture, design, and other related disciplines. Because of this increasingly intensive process of intertwining and sharing information between the field of landscape design and the above mentioned areas, landscape architects explore different possibilities of creating a completely new kind, a new pattern and form of a spatial composition, which should represent the spatial materialization of a modern man's lifestyle on an urbanized planet in the XXI century.

Keywords: open urban spaces in landscape architecture, landscape design, contemporary trends, sustainable development

**STATE AND PRINCIPLES OF INVASIVE PLANT SPECIES CONTROL IN
SOME PROTECTED NATURE AREAS IN BELGRADE AS POTENTIAL
“CORES” OF FUTURE ECOLOGICAL NETWORKS**

Jasminka CVEJIĆ, Stojanka RADULOVIĆ, Andreja TUTUNDŽIĆ
jasminka.cvejic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: This paper has presented investigations of the presence of invasive species in the urban forests of the middle Belgrade zone, which are under, or in the process of protection: Košutnjak with the forest around the Courts of Dedinje, Miljakovac forest and Banjica forest. Thanks to their position and relative preservation, these forests will, by all means, present “the core” of the ecological network of Belgrade and, therefore, a question have arisen will these areas be centres for the future spreading of invasion, and what measures of risk reduction ought to be undertaken before and after the establishment of the future Belgrade ecological network? On the base of the Map of Belgrade Biotopes, locations where by field investigation presence of invasive species was studied were chosen. Twenty of invasive species were recorded, mainly in open areas and along forest edges. Maintained recreation fields and areas near surrounding roads were recorded as potential biotopes of invasive species which are, for the moment, suppressed by the measures of maintenance. The study results have shown that these forests are effective barriers of spreading of invasive species and that they do not present sources of dispersion. Therefore, it is desirable to include the investigated forests in the ecological network of Belgrade.

Key words: Invasive species, Ecological networks, Nature protected areas

**THE ANALYSIS OF GREEN STRUCTURES OF THE SUBURBAN AREA
VELIKI MOKRI LUG AND THEIR ROLE IN THE FORMATION
OF THE URBAN GREEN SPACE SYSTEM**

Nataša MITIĆ, Ana GAČIĆ

natasa_mitic@yahoo.com

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: The paper is about the research and analysis of green structures of the suburban area Veliki Mokri Lug (Urban unit 28) in Belgrade with the aim to identify types of biotopes (habitats), their characteristics and their importance in the formation of the urban green space system.

Using the method of manual photointerpretation and “The key for biotope mapping” all habitats on the whole field of research were identified and defined and afterwards analyzed from the aspect of their incidence. From the data base resulting from the research we particularly distinguished and analyzed biotope types of the Group of green structures in the built area and Group of hedges, undergrowth, the group of trees and forests outside the city, most of which, conditionally speaking, belong to spatial zones Stepin Lug and Mokroluski potok. We established and described their characteristics, incidence, position, connection, as well as their importance in the urban green space system. The results of this research should be the base for the future planning and using of this space which should be aimed at their development, protection and preservation.

Key words: green structures, suburban areas, biotope mapping

LINKING PROTECTED AREAS MANAGEMENT AND LOCAL COMMUNITIES – EXAMPLE OF SERBIA

Jelena TOMIĆEVIĆ, Margaret A. SHANNON,
Ivana BJEDOV, Dragica OBRATOV-PETKOVIĆ
tomicevicj@yahoo.com

University in Belgrade, Faculty of Forestry, Department for Landscape Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Generally, protected areas are primarily viewed in biological or ecological terms, but they provide numerous functions beneficial to humans, and even essential to human welfare. Increasingly, they are seen as drivers and providers of social and economic change. Furthermore, it is now widely assumed that participation of local communities is an important element in protected area management in order to achieve sustainable and effective conservation in protected areas.

Despite the international principles for participatory management, and thus the need for local community participation and cooperation, Serbia has a long history of centralized planning and management of protected areas.

Considering the importance of local community cooperation for conservation within parks, how effective is the local participation process in creating cooperative relationships with local communities in Serbian protected areas?

In order to explore this question in Serbia, Tara National Park and Kopaonik National Park were selected as case studies.

The aim of this paper was to understand the relationships between local communities and national park administration in two selected case studies. The results indicate that local people have positive attitudes towards cooperation with the national park authorities. The implementation of participatory approaches is proposed as a means of promoting sustainable resource use and helping to ensure the involvement of local people in protected area management.

Key words: protected area, local communities, participatory approaches, attitudes, Tara National Park, Kopaonik National Park, Serbia

**HARMONY OF DESIGN IN LANDSCAPE ARCHITECTURE ON
THE EXAMPLE OF PARK UŠĆE IN NEW BELGRADE**

Jasmina JAKŠIĆ

jaksic.jasminajaksic.jasmina@gmail.com

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Interaction and co - evolution of human and natural ecosystems are the main driving force for current and future systems on Earth. Total human world and all ecosystems on Earth are based on natural, social and humanitarian principles, in order of their own sustainability. Nature ecosystems are based on sustainability of its own elements. Element in this sense, can be thought of as a physically measurable phenomenon, or as a metaphysical concept or a thing. Proper and timely use of land as one of the basic elements of existence on our Earth is one of the important items of sustainability. Yet the harmony and balance between all the constituent elements of the Earth, giving us the opportunity to explore and achieve their own sustainability.

Park Ušće is located in New Belgrade and was created by the work of human activities sixty-two years ago. Park Ušće which is the subject of this work covers approximately 141.00 hectares. Border areas of the park to the north mouth are: the river Danube and protected areas Great War Island, to the east it is the river Sava, in the south of the Highway Mihailo Pupin Boulevard residential blocks 21, 26 and 30 and in the west apartment blocks 11 and 12. The park is located in the narrow and wide area of water supply source protection New Belgrade and it is among other things, the cultural - historical monument in the Park of Friendship. As you can see from the enclosed, the park belongs to the cultural - historical and a transit point, very important for the entire city of Belgrade and beyond. Development of conceptual design for this space requires the implementation of the main approach to sustainability in landscape architecture, which is that content and all following elements must be constantly in proportional relationships.

The whole situation of the area can be evaluated as well. Degradation took hold and continues to spread. Degradation is primarily reflected in the physical and biological condition of water quality, the existence of certain plant communities as bioindicators. For these reasons the whole idea is to establish this park and area as Scientific - Research Center, as an independent nonprofitable organization that is intended for supplementary training of students, scientist and pupils. The main directions of its development and operation are education, conservation, and recreation.

Key words: Park Ušće, harmony, design, sustainability, landscape architecture

**POSSIBILITIES FOR THE IMPROVEMENT OF CULTURAL LANDSCAPE
PROTECTION AND ARRANGEMENT IN SPATIAL AND
ENVIRONMENTAL PLANNING IN SERBIA**

Marija MAKSIN, Saša MILIJIĆ

sasam@iaus.ac.rs

Faculty of Tourism and Hospitality Management, Singidunum University
Institute of Architecture and Urban & Spatial Planning of Serbia

Abstract: The paper presents an overview of the expected role of spatial and environmental planning in coordination with and integration into various plan bases, particularly relating to the open space and landscape protection and development. Application of the integrated approach to sustainable territorial development planning and management in the European Union is also analyzed in the context of problems associated with and the possibilities to enhance ECL implementation. Contribution of reforms in current legislation and plan basis to the establishment of coordinated system of sustainable territorial development planning and management in Serbia and to obtaining support for the integration of landscape planning and management into the process of spatial, environmental and sectoral planning, are considered. The approach to and problems associated with landscape protection and development in practice in spatial planning are analyzed through several examples of a new generation of spatial plans in Serbia. Through the example of mountain Stara planina, the role of strategic environmental assessment in coordination between spatial and sectoral planning is analyzed, as well as potential contribution to landscape integration into the process of planning. For including landscapes in the Serbian system and practice of spatial, sectoral and environmental planning, it is essential to identify regional diversification of landscape types, as well as to establish appropriate recommendations and measures for planning and managing of the identified landscapes. Starting from this assumption and experiences in implementation of the European Landscape Convention, as well as from the necessary redefinition of the planning system in Serbia, the possibilities for landscape integration into the process of spatial, environmental and sectoral planning is indicated.

Key words: landscape planning and management, legal basis, coordination of plan basis, landscape integration into spatial, environmental and sectoral planning, implementation

**COMPARATIVE ARTHROPOD FAUNA IN MATURE FORESTS IN THE
AREA OF “OBEDSKA BARA”**

Milka GLAVENDEKIĆ, Zoran TOMOVIĆ

milka.glavendekic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia
Public Forest Enterprise “Vojvodinašume”, Petrovaradin, Serbia

Abstract: “Obedska Bara” was protected as a strict nature reserve (SNR) in 1951. The reserve area is 1001.52 ha. Together with the surrounding forest complex it constitutes a whole and it is located between the villages of Obrež and Kupinovo. The area of “Obedska Bara” is the remains of former typical floodplains of Vojvodina and it constitutes a specific marsh-swamp ecosystem. The area of “Obedska Bara” has sociological and historical significance, because it testifies of the life in this region in the medieval town of Kupinik, as well as of the events of recent history. Forestry is an important industry of the area in the vicinity of the SNR „Obedska Bara”. The risk of adverse human impact on natural biodiversity is present, and it is reflected in the illegal forest thinning, watering, uncontrolled urbanization and air and water pollution.

Comparative studies of arthropod fauna were conducted in mature mixed stands on the locality Kupinske grede, compartment 2 in the first zone of protection, at the locality Kupinske grede, compartment 29 – oak stand in the second zone of protection and at the locality Matijeveca- Kadionica, compartment 14 which is governed by the principles of sustainable development.

Through a comparative study of the qualitative composition of arthropods in mature stands of oak no difference was found in the diversity of individual groups of arthropods. The numerous populations of Collembola in the locality Kupinske grede, compartment 2 stand out. Collembola settlement was also very rich in the localities Matijeveca - Kadionica, compartment 14 and Kupinske grede, compartment 29. The lowest number of Collembola was, as expected, in the last site given that the settlement of the surface layer of soil and litter was disturbed by removing of the plant cover and performing of preparatory operations for the planned forest regeneration at the time of the research.

In the oak forest which was being prepared for regeneration at the site Kupinske grede, compartment 29, the settlement of beetles was the richest. Ground beetles were dominant. In spite of chemical control, arthropod populations living in crowns of trees in managed forest were the most widespread

Chemical measures of forest protection using non-selective insecticides drastically disturb the population of arthropods. After the aerial application of chemical insecticide, reduction of populations of some groups of arthropods was greater than the one that the population of arthropods suffered in the flooding years.

Topic C - Landscape Architecture and Horticulture

Some groups of arthropods in the area of "Obedska Bara" are closely linked with food chain relationships and a disorder of a member in the food chain causes the disruption of other members which are trophically linked. In the area of "Obedska Bara" there are valuable habitats of arthropods birds and mammals, which are trophically linked, and therefore the preservation of the diversity of arthropods is important for the survival of other members of the community.

Key words: Arthropoda, mature oak forests, Obedska bara, nature conservation

WINTER MOTH OUTBREAKS IN FENNOSCANDIA AND CONTINENTAL EUROPE

Olle TENOW, Arne NILSSEN, Helena BYLUND, Milka GLAVENDEKIC
milka.glavendekic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: The winter moth (*Operophtera brumata*) is a serious broad leaf defoliator with recurrent outbreaks on species of oak, fruit trees and ornamental plants in Europe. Since the 1980's, it has locally also adapted as a defoliator of introduced Sitka spruce. Its outbreaks are often synchronized with related early-season feeding geometrids, tortricids and noctuids. Its status as a pest makes it economically important.

In the middle and south-east Europe frequent outbreaks of chronic type are characteristic for the following forest types: *Quercetum petraeae-cerris* on brown and lessive brown soil on serpentinite, *Quercetum montanum typicum* on acid brown soil, *Quercetum frainetto-cerris carpinetosum orientalis*, *Orno-Quercetum pubescentis-virgilianae*, *Fageto-Quercetum*, i.e. *Querceto-Fagetum* and *Ulmeto-Fraxinetum*. The winter moth occurs regularly, but it does not outbreak in the forest of *Carpino-Quercetum petraeae-cerris* if the percentage of Turkey oak is higher.

O. brumata's outbreak history in Fennoscandia is well known. In this presentation we compare Fennoscandian data with historical data on outbreaks in continental Europe and analyze the combined information for spatio-temporal patterns in outbreaks.

It has been shown previously that outbreaks in Fennoscandia are periodic with an average interval of 9-10 years between peaks. Outbreaks have sometimes been asynchronous between northern and southern Fennoscandia and between east and west Fennoscandia, sometimes they were synchronized all over the region. We find that also outbreaks in continental Europe have been 9-10-year periodic. Similarly, outbreaks in continental Europe have occurred asynchronously with populations in Fennoscandia as well as with populations in different parts of Europe. Sometimes, however, outbreaks in Europe have been

synchronous over regions and with those in Fennoscandia. The analysis makes possible a holistic view of the outbreaks and highlights the relationship of outbreaks in different parts of Europe. The regular spatio-temporal behavior of outbreaks makes it a possible predictive instrument. A detailed description of this spatio-temporal behavior will be given in the presentation.

Key words: *Operophtera brumata*, spatio-temporal patterns in outbreaks, *Quercus* spp., Fennoscandia, Europe

***ASTERETUM LANCEOLATI* - A NEW INVASIVE COMMUNITY ON WET AND RIPARIAN HABITATS**

Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV, Dragana SKOČAJIĆ,
Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Matilda ĐUKIĆ, Mihailo GRBIĆ
dragica.obratov-petkovic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Invasive species *Aster lanceolatus* grows on moist habitats on the whole territory of Serbia. In Belgrade, this species is recorded with higher presence degree at a number of localities. With the aim to investigate the community in which this species is dominant, wide area of Serbia was investigated, and 8 localities on the territory of Belgrade were chosen for analysis of the community. Floristic structure of the community was carried out by standard Braun-Blanquet method (1964), phytogeographical analysis was done according to Gajić (1980, 1984), and determination of life forms according to Raunkier (Ellenberg & Mueller-Dombois, 1967). pH soil analysis and electric conductivity (EC) was performed at all investigated localities.

It was established that the community dominates on moist habitats of Belgrade, composed of 104 species and the most frequent of them are *Aster lanceolatus* Willd., *Cichorium intybus* L., *Agropyrum repens* (L.) Beauv., *Calystegia sepium* (L.) R. Br., *Cirsium arvense* (L.) Scop., *Symphytum officinale* L. and *Rumex obtusifolius* L. In relation to life forms, the community has chemocriptophytes character, and in relation to phytogeography Eurasian and Middle Europaeen floral elements are dominant, with high presence of cosmopolitan and adventive floral elements. On the localities Veliko Ratno ostrvo (island) and Makiš, EC values point to the amount of nutrient in the soil higher than at other localities.

Key words: invasive community, *Aster lanceolatus*, Belgrade

PRESOWING TREATMENTS TO BREAKING SEED DORMANCY OF SMALL-WINGED WINGNUT (*Pterocarya stenoptera* C. DC) AS AN INDICATOR OF POTENTIAL INVASIVENESS

Mihailo GRBIĆ, Dragana SKOČAJIĆ, Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV, Matilda ĐUKIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ
grbic.mihailo@gmail.com

University in Belgrade, Faculty of Forestry, Department for Landscape Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Small-winged wingnut is a 12 to 20m tall, deciduous fast growing tree with large, substantial branches which spread as wide as the tree is tall. The 15 to 30 cm long winged fruit catkins are suspended below the branches which turn brown in autumn. The species is unknown in Serbia and seed was introduced from Sofia (Bulgaria), and subjected to stratification (classical and naked) during 1 and 2 months. Germination capacity was varied among the treatments. The greatest number of germinated seeds was observed in the shorter stratifications (1 month) the classical (56.5%) and the naked (51.0%) with significant difference. The values of real germination of these treatments were 88.0 and 85.0% respectively with no significant difference. However, the results of control as well as other parameters of seed germination clearly point out that practically no deep embryo dormancy was observed, but that the seed is recalcitrant and microbotic. The results indicate the non-invasive character of the species in terms of reproductive potential.

Key words: *Pterocarya stenoptera*, seed dormancy, stratification

**STOMATA PROPERTIES OF THE INVASIVE PLANT *Reynoutria japonica* Houtt.
IN THE AREA OF TOPCIDER RIVER SIDES**

Matilda DJUKIĆ, Danijela DJUNISIJEVIĆ-BOJOVIĆ,
Dragica OBRATOV-PETKOVIĆ, Mihailo GRBIĆ,
Ivana BJEDOV, Dragana SKOČAJIĆ, Milica MILOJEVIĆ
matildadj@gmail.com

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: *Reynoutria japonica* Houtt. (*Poligonaceae*) is one of the most invasive plants with great spreading potential and it was ranked in a group of 100 most invasive organisms by the International Union for Conservation of Nature (IUCN). It is very common and with luxury growth on the sunny, open and wet habitats. It can be found near roads, railways, river banks and on degraded urban areas. The paper presents the results of spreading of this plant in the area of Topcider River sides, as well as some eco-physiological properties such as stomata density and stomata index of leaves of various age, physiological vitality and ecological conditions. It was found that stomata index was significantly different between chlorotic and vital leaves but there were no differences between young, undeveloped and totally developed leaves. It was also found that stomata index was significantly higher at plant leaves that grew on more sunny sites compared with the plants in shade. Number of stomata was larger on the lower side than on the upper side of leaves in all populations and ecological conditions. Stomata analysis can help in better understanding of physiological processes, water regime and photosynthesis. The damages of invasive plants are a great challenge in environmental protection and for that reason it is important to have detailed information on their ecological and physiological properties, reproduction, spreading, taxonomy and other characteristics which can help find the best measures to control and destroy them.

Key words: *Reynoutria japonica* Houtt., invasive plants, spreading, vitality, stomatal density and index

**BIOLOGICAL ACTIVITY OF *Reynoutria japonica* RHIZOME
EXTRACTS – EFFECTS ON SEED GERMINATION
AND EARLY SEEDLING DEVELOPMENT**

Danijela ĐUNISIJEVIĆ-BOJOVIĆ, Matilda ĐUKIĆ, Dragana SKOČAJIĆ,
Mihailo GRBIĆ, Ivana BJEDOV, Dragica OBRATOV-PETKOVIĆ,
Neda ŠARIĆ

danijela.djunisijevic-bojovic@sfb.rs

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: *Reynoutria japonica* (Houtt.) is a herbaceous plant species native to East Asia. This invasive plant contains relatively high concentrations of biologically active substances. Dominant compounds of rhizomes are mainly stilbenes. Our objective was to test the biological activity of rhizome extracts on seed germination and early seedling development of *Ulmus pumila*, *Platanus acerifolia*, *Ailanthus altissima* as well as on *Lactuca sativa* as standard bioassay (*Lactuca* test). The seeds were incubated with the extracts for 48 h and germinated at 25°C at 16/8 h night/day regime for 7 days. The allelopathic activity of rhizome extract was analyzed on the basis of differences in germination parameters, length of radicles, hypocotyls and root/shoot ratio between the control and experimental samples. The results show strong (*Lactuca sativa*) to moderate (*Ulmus pumila* and *Ailanthus altissima*) inhibition of seed germination and early seedling development by Japanese knotweed rhizome extracts, while for *Platanus acerifolia*, seed germination and other observed parameters were slightly higher in the treated samples. These results may contribute to understanding of invasive strategy of this highly successful competitor for landscape space.

Key words: *Reynoutria japonica*, invasive exotic plant, rhizome extract, allelopathy

THE ZAGREB GREEN HORSESHOE

Vjeran MAJNARIĆ

vjeran.majnaric@zagreb.hr

City of Zagreb, City institute for preservation of monuments of culture
and nature, Kuševićeva 2, 10 000 Zagreb, Croatia

Abstract: The 'Zagreb Green Horseshoe' or 'Lenuci Green Horseshoe' is the framework of parks of the Donji grad (the Lower Town) central city district. Its sides comprise eight squares: Trg Nikole Šubića Zrinskog (Nikola Šubić Zrinski Square), Trg Josipa Juraja Strossmayera (Josip Juraj Strossmayer Square), Trg kralja Tomislava (King Tomislav Square), Trg Ante Starčevića (Ante Starčević Square), Botanički vrt (the Botanical Gardens), Trg Marka Marulića (Marko Marulić Square), Trg Ivana, Antuna i Vladimira Mažuranića (Ivan, Antun and Vladimir Mažuranić Square) and Trg maršala Tita (Marshal Tito Square). The name 'green horseshoe' speaks of its main attribute, i.e. its parks. The 'Green Horseshoe' was planned and carried out from the 1880s to the 1920s. It is the biggest and most monumental urban achievement of Historicist culture in Zagreb and Croatia. The 'Green Horseshoe' is an original achievement which, as a complete, urban, architectural and park shaped area of the center of the city of Zagreb which documents an important period of time in the city's development. The squares mark a high level of aesthetic shaping which makes them a highly representative area of the city of Zagreb and a key feature of its urban identity, a true monument to an epoch which made it into a modern city.

Key words: The 'Zagreb Green Horseshoe', Milan Lenuci, parks

**HABITAT AND COLLECTION RECONSTRUCTION IN THE
BUDAPEST ZOO & BOTANICAL GARDEN 2010**

Agnes SZABO, Attila VINCZE

kerekliget@gmail.com

Kerekliget Garden and Landscape architectural Firm,
Berkenye stny 3, 1201 Budapest, Hungary

Abstract: The Budapest Zoo and Botanical Garden (BZGB) is the most visited attraction in Hungary. Apart from the primary function of the Garden - which is to introduce animals -, the introduction of its botanical treasure has gradually strengthened over the past decade, as major developments have taken place, and are actually being executed. Apart of this introductory function the BZGB is one of the main pillars of the nature-protective and ecological education. The living botanical collections have a leading role in education and in the environmental paradigm shift as in the institution BZGB as in the whole word. The reconstruction of Great-Lake and the Rock Garden in BZGB is one ongoing project sponsored by EU. The whole project was co-ordinated by landscape architectural experts and planned with co-operation of botanical - and water management experts in a very unique way. This presentation concentrates on habitat and collection reconstruction from landscape architectural sight. Habitat and collection reconstruction works have been done on to different sites the Great Lake area and the newly formed Rock Garden area, and they are of unprecedented scale. The wetland habitat reconstruction tasks of the Great-Lake included:

- Historic garden reconstruction, rebuilding of the more than 150 year old lake, research of its landscape sight remains and create new ones.
- Creation of an energy- and water saving complex economical water supply system, that helps to improve the ecological conditions of the lake.
- The near-natural reconstruction of the basin and the shore of the Lake, the creation of lakeside zonation and colonisation with endangered and critically endangered natural habitats.
- The schedule and gradual change of the invasive tree species, taking the needs and life-cycle of the birds on the lake into consideration.
- Improving the nesting possibility of the Zoo's own birds.

The special habitat-reconstruction tasks of the Rock Garden include:

- Introduction of rocky grassland habitats, as the main habitat type of the hilly parts of the region.
- Creation of region wide unique rock garden using local limestone type. With limestone forming places suitable for ex situ plant protection and their colonization with endangered and disappearing natural habitats.

The unique and innovative project aims to meet the expectations of many aspects: attractive landscape-architecture, historic garden reconstruction, ideas of greater spaces, improvement of the botanical collection, introduction of indigenous species and their habitats and by ex situ nature-protect ional gene preservation as well as at the same time it concentrates on sustainability, economical water-and energy-management, and biologically balanced technical solutions.

This project in BZBG has many unique planning and construction techniques. In our presentation besides introducing the project we try to introduce these unique techniques to you as well.

Key words: habitat reconstruction, landscape architecture, ZOO, education and environment, historic garden

PLANNING OF GREEN AREAS IN THE SKOPJE REGION

Dusica TRPCEVSKA-ANGELKOVIK², Aleksandar TRENDAFILOV¹,

Lidija TRPENOSKA-SIMONOVIC², Ivan BLINKOV¹

www.sf.ukim.edu.mk; d.trpcevska@app.gov.mk; blinkov@sf.ukim.edu.mk

¹ University "Ss.Cyril and Methodius" – Skopje, Faculty of forestry – Skopje
bul."Alexandar Makedonski "bb. 1000 Skopje , Republic of Macedonia,

² UKIM – Faculty of forestry - Skopje , PhD candidate

Abstract: The vast technological and industrial development, busy traffic and big concentration of population in the Skopje region disturb the quality of environment. Therefore reservation of space, planting greenery and revitalization of green areas with wider significance is required. Spatial and urban planning, as a complex interdisciplinary activity, based on principles of sustainable development, treats suburban and urban green areas with special care. The purpose of this research is to establish a corresponding, optimal approach in spatial and urban planning and protection of green areas. The objectives are: analysis of planned solutions in the spatial plan of the Skopje region and the Master plan of the city of Skopje, as two strategic, hierarchically correlative and successive documents. Throughout systematical approach, comprehensive planning and protection of green areas is assured, as a precondition for adjusting the variety of solutions in different levels of planning thus providing sustainable development.

Key words: spatial planning, urban planning, comprehensive planning, suburban and urban greenery, forests

Topic C - Landscape Architecture and Horticulture

**TIME OF WEEP – TIME OF LAUGH
(Memorial center on the river Sava's bank)**

Dejan Popov, Jovana Majović, Nikola Nikolić
dejanpopov@live.com

University in Belgrade, Faculty of Forestry, Department of Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia
student paper

Abstract: Group work of Forestry faculty students, in the section of Landscape architecture and horticulture gives a preliminary design of an Old Fair grounds and a part of the river Sava's bank in Belgrade. It includes the outline from the "Gazela" bridge to the "Brankov" bridge. The history of the Old Fair ground has been studied through literature, documents and documentary movies and with a detailed space consideration a proper landscape – architectural solution has been offered. Devastated and abandoned space has been revived and suffering of Serbs and Jews in concentration camps has been properly noted, as well as previous stages in the Old Fair's history. Through this work exterior has been formed with the elements of urban recycling, green space planning in the city lines, revitalization, ecological laws, landscape – architectural interventions and socio–economical conditions. In an exceptional way the concept and the context have been integrated, and by that the space gets not only a very good functional solution but also exceptional visual characteristics told through the symbolics and history. The project is based on opposites, painful past – future, quotes from the letters of the prisoners, Bible, and the word of the Pope. Before the consideration itself and resolving of the narrow space, this green area has been placed into a system of greenery and linked by corridors along the roads and New Belgrade's blocks. It has been a spot that connects the newly projected green area with the neighboring areas along the rivers Sava and Danube (the blueway) and forms a new greenway. The relevance of this work is certainly consideration of cultural – historical and tourist spots of Belgrade. This green area, and Memorial center in particular, is going to have an exceptional significance for Belgrade and beyond. By following a tradition of other European countries, a place that should warn future generations and pay tribute to the lost ones is prominent. By no means, this area of ex concentration camp should not be neglected by the city and state government, and homeless people should not be allowed to dwell in it. Less important and special places in the world are properly valued, and this work proves that our people catch a sight of history, place and the man. That is what certainly needs to be a model.

**THE EVALUATION OF THE CHANGE IN VEGETATION
AROUND THE WALKS IN THE ABANT NATURE PARK**

Haldun MÜDERRİSOĞLU^{1*}, Necmi AKSOY^{2**}, Serir UZUN¹, Neval G. ÖZKAN²
Serdar ASLAN², H. Samet AŞIKKUTLU¹

¹ Düzce Üniversitesi Orman Fakültesi Peyzaj Mimarlığı Bölümü\DÜZCE

* Tel:03805421137/3101 Faks:03805421136 haldunm@duzce.edu.tr

² Düzce Üniversitesi Orman Fakültesi Orman Mühendisliği Bölümü\DÜZCE

** Tel:03805421137/3212 Faks:03805421136 necmiaksoy@duzce.edu.tr

Abstract: Natural Parks are the protection areas reserved for meeting the recreational needs of the local community. Therefore, when its characteristics that constitute the source of recreation are used, there must be a possibility for them to be protected. The Abant Nature Park (ANP) is one of the significant floral gen centers of Turkey with its 10% endemism and plant taxons. Floral and vegetation characteristics are the primary recreational utilization resource values of ANP which nestles inside water, waterside mud, wet meadow, forest, and subalpine vegetations. Thus, ANP is preferred intensively for the recreational purposes. The objective of this study is to determine the pressures on vegetation around the walks in the ANP. In the study, surface coverage proportions of the vegetation layers (tree, bush, grass layer and moss-lichen layer) will be evaluated according to the cover-abundance scale applied in the vegetation studies of Braun-Blanquet by taking sample areas of 1-5 m² as to the available vegetation type in a random area at a distance of 5-10-15 m from the walk of every 500 m of the walks in the Wet Meadow, Forest and Subalpine vegetations in April and May during which the recreational activities are intense. One unit control sample will be taken from around every measurement area for control purposes. ANOVA test will be applied for the purpose of statistically comparing the distance-dependent change in the vegetation and properties of the walks. As a result of study, the amount of effect caused by the walks on the vegetation and required measures that must be taken in order to prevent impairments will be demonstrated.

Key words: Protected Area, Recreation, Endemic, Vegetation, Walks

EFFECTS OF RED AND FAR-RED LIGHT ON SEED GERMINATION OF CERCIDIPHYLLUM JAPONICUM SIEBOLD ET ZUCC.

Dragana SKOČAJIĆ, Mihailo GRBIĆ, Danijela ĐUNISIJEVIĆ-BOJOVIĆ,
Matilda ĐUKIĆ, Dragica OBRATOV-PETKOVIĆ, Ivana BJEDOV

dragana.skocajic@sfb.rs

Faculty of Forestry University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Katsura (*Cercidiphyllum japonicum*) is a woody plant native in Japan and China, introduced into Europe because of its ornamental value. On the female katsura plants the flowers turn into clusters of small capsuls, which open and release winged seeds. Seeds of katsura germinate promptly without pretreatment but light is necessary. As it can succeed in our climate (hardy in USDA Zones 4 to 8) the subject of this research is seed germination testing of katsura seeds. The paper examined whether the pulse of red light induces germination compared to darkness and subsequent pulse of far-red light reverts the effect of red (a LFR response). According to the results the seeds require light for germination and the percentage of germination at white light was 74%, and in darkness 0%. Phytochromes are involved in the control of germination - the red light induces germination on 72% and immediately after red treatment pulse of far red light inhibited seed germination - germination percentage was 5%.

Key words: phytochromes, red far-red light, germination

**GYROMITRA FR. SENSU LATO (DISCINCEAE BENEDIX 1961, PEZIZALES)
IN MONTENEGRO**

Branislav PERIĆ, Olgica PERIĆ

branislav@mycolmonten.org

Univezitet Crne Gore, Biotehnički fakultet, Bul. Mihajla Lalića 1, Podgorica

Abstract: The paper presents 11 species from the genus *Gyromytra* Fr. sensu lato, which are determined in Montenegro: *Gyromytra esculenta* (Pers.) Fr., 1849; *G. gigas* (Krombh.) Cooke, 1878; *G. geogenius* (Rahm) Harmaja, 1976; *G. fastigiata* (Krombh.) Rehm; *G. infula* (Schaeff.) Quél., 1886; *G. martinii* Donadini & Astier, 1974; *G. megalospora* Donadini & Rioussset, 1976; *G. neuwirthi* Velen., 1922 (= *G. esculenta* var. *fragilis* A. Marchand ex Réaudin, 2008); *G. parma* (J. Breitenb. & Maas Geest.) Kotl. & Pouzar, 1974; *G. perlata* (Fr.) Harmaja, 1969 and *G. tasmanica* Berk. & Cooke, 1878. The material was collected in the Mediterranean, sub-Mediterranean and continental region of Montenegro. Investigation was conducted on fresh material while verification was done, on several occasions, on herbarium specimens. The macroscopic descriptions of species and photo illustrations were done in situ with Fg20 reflex Nikon camera and digital cameras Nikon 100 and C5D. The microscopic analysis was performed using the optical microscope (Leica DMLS). Micro illustrations were made with a digital camera (Dc300). Drawings of microelements were done using pen and ink and processed, as well as micro illustrations in Adobe Photoshop CS4. Preparations for microscopic examination, prepared by hand with razors, were observed in the water, Congo Rouge, Melzer's reagent (to monitor amyloid reaction of ascus), Cotton blue and lacto phenol (to monitor ascospore ornamentation). Ascospore dimensions from measurements of 30 ascospores, from different apothecia, are presented. The material is stored in the herbarium of the Mycological Centre, of the Biotechnical Faculty in Podgorica. Short reviews of environmental and taxonomic characteristics are given. It appears that species of this genus are not quite so widely distributed on our mountains as is the case with the central European and north European area. Predominant number of species was collected in the conifer stands on different substrates: lignicolous tericolous, sand, or humus. Some of them were found in mixed forest stands and only two species were found exclusively related to the beech substrate. For *G. geogenia* the southernmost point of its range is given. For *G. megalospora* and *G. martinii*, apart France, there are merely these data from Monte Negro. *G. neuwirthi*, *G. fastigiata* and *G. tasmanica* are rare entities, new ones for Montenegro. The latter is a mycological element of the southern hemisphere, on the northern part of our planet and it is observed only in Spain and Montenegro. It is interesting that *G. gigas*, which is otherwise related to conifers, was found in a meadow of a clearing of a deciduous forest. According to data insights *G. perlata* and *G. martinii* apply to the broader distributed species. That could be said for *G. gigas*. We assume that *G. megalospora* is present in our coastal forests of pine trees, although we have not visited these sites in the winter.

Key words: *Gyromytra sensu lato*, *G. neuwirthi*, *G. fastigiata*, *G. tasmanica* Montenegro

**INFLUENCE OF RE-URBANIZATION PROCESS ON TRANSFORMATION
OF TWO POSAVINA LANDSCAPES SINCE 18TH CENTURY TILL TODAY**

Stojanka RADULOVIĆ, Aleksandar BOBIĆ

stojanka.radulovic@sfr.rs

Faculty of Forestry, University of Belgrade,

Department of landscape Architecture and Horticulture,
teaching assistant

Abstract: The phenomenon of uncontrolled spatial changes on the landscape level is often closely related to the unplanned expansion of settlements. The period of political transition in Serbia, especially during the disintegration of former Yugoslavia, in a very short time has led to major social changes caused by political and economic crises, wars and great migrations of population. These complicated political and social processes have led to the expected weakening of control mechanisms in the sphere of implementation of complex planning regulations, which resulted in a spontaneous and often very chaotic expansion of settlements. At the landscape level, these processes can be understood as the basis for generating different spatial patterns in terms of their various degree of orderliness, form, organization and functioning. The paper is exposing research on the transformation of two naturally and ethnically similar landscapes of Posavina - Lower Srem and Obrenovacka Posavina landscape, but also very different ones according to the historically established cultural and social values as a consequence of the rule of two different political systems - the Ottoman and Austrian (Austria-Hungarian) Empire. The focus is on the comparative and contrastive analysis of plans, regulations, planning practices and key political events related to the observed territory, since eighteenth century up until the present, with special emphasis on the period of the eighteenth and nineteenth centuries. This study came to the conclusion that the process of urbanization formed two distinct spatial patterns of settlements with varying degrees of orderliness, regardless the similar natural and ethnic characteristics. In that sense, two main processes of the settlements re-urbanization have been noticed: a formal process - established in a relatively short period in the Lower Srem landscape, started in the eighteenth century, during the reign of Maria Theresa of Austria; and informal process in Obrenovacka Posavina landscape - with slow and gradual changes in a long-term period related to the liberation from Turkish rule. One of the most important results of the research is reflected in the conclusion that during the settlements re-urbanization on the selected territory, the two recognized patterns with special characteristics and differences in topography and organizations. These differences are mostly kept up to date, no matter the same political order that they belong to, since the beginning of the twentieth century. Consequently, it can be concluded that these social and spatial phenomena significantly influenced the landscape transformation of the observed territory, which is additionally characterized by the paradox of increased entropy caused by increased complexity of planning regulations. In this sense, the process

Topic C - Landscape Architecture and Horticulture
of landscape transformation can be put in direct connection with the process of re-urbanization as a consequence of the established social values and political commitment to the certain mode of implementing the planning doctrine and practice.

Key words: settlement, spatial pattern, re-urbanization, spontaneous transformation, landscape, social value

MAKSIMIR – PARK OR FOREST?

M. Poje, I. Vršek, S. Morić

poje@agr.hr

Faculty of Agriculture, University of Zagreb, Svetosimunska cesta 25, Croatia / Zagreb

Abstract: Park Maksimir beyond doubt holds its position among the significant landscape monuments in Croatia. It is known as the first public park in this part of Europe and holds by this an important position in garden art in general.

The style of the park design has changed over the years depending on who ran the park. Still the major influences came from bishop Maksimilijan Vrhovec and archbishop Juraj Haulik de Varallya, who became the manager of the park in 1838. Today we have a park characterized by two styles of design: baroque style by M. Vrhovac and landscape style by J. Haulik. The park is divided into two parts: the southern part with its forest community of *Querco roboris-Carpinetum betuli* and a northern part dominated by a forest community of *Querco petraeae-Carpinetum betuli*. According to the park usage and maintenance, Maksimir can be divided into a park area (southern part) and forest area (northern part). Natural forest communities, meadows and water flows, dominate the park area. In addition to indigenous plant species used in the park design, there are also some imported plant species. Once exuberant animal and plant variety has been considerably impoverished through time. Out of about 300 ornamental plant species planted in the park, only a small number is still present today. Because of natural, therefore uncontrollable plant material growth and neglect, areas where meadows held an important part were reduced, while the existing ones are being choked with the elements of natural growth.

The goal of this paper is revitalization proposal of plant material, with respect to the history matrix and conservatory criteria.

Keywords: public park, forest community, natural growth

**STUDY OF ASSESSMENT OF THE CULTURAL LANDSCAPE
OF KOTOR-RISAN BAY/REMINISCENCE - EVOLUTION**

Semka Đurić, Jovana Majović, Nikola Nikolić, Nevena Pantović, Dejan Popov

dejanpopov@live.com

University in Belgrade, Faculty of Forestry, Department for Landscape
Architecture and Horticulture, Kneza Višeslava 1, 11030 Belgrade, Serbia
student paper

Abstract: The Natural and Culture-Historical area of Boka Kotorska bay is a World Heritage Site located in Montenegro which was inscribed in 1979. This fjord is characterized by distinct, clearly visible structural elements that give to it the particular landscape identity. Specific and diverse natural values (morphological and autochthonous vegetation characteristics) and valuable architectural heritage permeate each other, and with the occurrence of the wealth of details, such as the exotic flora, make a harmonious and integrated whole. However, the processes, that are in progress, such as unplanned urbanization, devastation of Mediterranean vegetation, location of industrial facilities and other, threaten to endanger the most valuable landscapes of Montenegro. This was the reason why the international and interdisciplinary students' workshop with the theme „Assessment of landscape and spatial planning in protected areas – Boka Kotorska bay” was organized under the auspices of the Office of German Technical Cooperation (GTZ), Montenegro in 2009. The aim of the workshops was to educate students in the means and methods of environmental observation and in the greater understanding of the working process involved. This paper presents the results of landscape character assessment which was made by landscape architecture students. The students were also asked to make proposal for sustainable planning, design and management of the area. Landscape character assessment was made according to the Landscape Character Assessment - Guidance for England and Scotland, 2002. Assessment included: a) character of the landscape, b) value of the landscape; c) present state of the landscape, and d) sensitivity of the landscape. An important step in the overall concept of assessment was the separation of different landscape character types and subtypes. The typology process was based on: identification of physical environment (desk study), and identification of visual units (field study). The result of this analysis is a set of maps, photographs and descriptions that represent the character of the landscape. The value of the landscape was another important component which was estimated. Several aspects of the landscape value were involved: value as a natural resource; value as a site; value as cultural heritage; value as scenic resource. Sensitivity of the landscape varied in relation to the character and importance of each individual value or combinations of values, which were attributed to the given landscape types or subtypes. Based on previous analysis, the landscape management model has been established. The proposed model includes protection of the mapped features of Mediterranean cultural landscapes, protection of the long prospects, improvement of tourism potentials

Topic C - Landscape Architecture and Horticulture and environmental conditions. Seven landscape types with fourteen subtypes were allocated in the research area. For each landscape type the set of different measures is proposed, such as: revitalization of the terraces with vineyards and olive orchards, designing pedestrian and bicycle paths, biotechnical measures for erosion control, creation of green wedges, protection of native Mediterranean vegetation, and other. The importance of this workshop and achieved results lays the fact that, after the ratification of the European Convention by Montenegro, it is the first time that a complex assessment of such important landscapes as Boka Kotorska bay is carried out.

Key words: students' workshop, UNESCO World Heritage Site, landscape character, cultural landscape, cultural heritage, landscape management

SUBOTICA - SYSTEM AND DEVELOPMENT OF GREEN AREAS IN HISTORIC PART OF THE CITY AT THE BEGINNING OF XX CENTURY

Agnes SZABO

kerekliget@gmail.com

Kerekliget Garden and Landscape Architectural firm, 1201 Budapest, HUN

Abstract: When the railway station was built in Subotica, at the beginning of the XX century the way and a scale of urbanization in the city changed. There were new social requirements, new needs and new conceptions about the organically developed city layout. Subotica nowadays has a special alluring ambient, wide green streets in the historic city center. This heritage revalues the lots in the city center and borrows them great economic value. Around 1900 the cityscape changed under the control of special association (Architects, landscape architects, gardeners, doctors, layers etc. Were member of this association), the task was to supervise and mark the future development of the city. The architectural image of the city was as important as the open spaces (squares, green areas, enclosed gardens) system. By this conception the city could develop harmoniously. The disharmony nowadays is that the urbanism emphasizes the buildings more, structures as the open spaces (squares, green areas, enclosed gardens). In the research I reveal these problem areas not only by studying past but giving answers for the present urban requirements. This paper was based on archive researches on the existing studies and on interviews with practicing urbanists in the city. The short overview of heritage green areas gives an all-around picture. Analyzing the development the function and regulation of these green areas in the city and enlightens their nowadays situation. What makes the city livable, how can it satisfy the need of citizens, what is heritage, how can the city layout help to solve the problem of sustainable development and add more economic value in the city? – These are the questions. To answer these questions, we need to study and understand the development of Subotica. From the side of developers and from the side of citizens it is impor-

Topic C - Landscape Architecture and Horticulture
tant to identify the value of Subotica urban area. One of the keys to identification is in the open spaces (green areas) and their system within the urban texture.

Key words: Subotica, system of green surfaces in urban areas, historic city center

THE IMPACT OF GLOBAL CHANGES ON THE FLOWERING PHENOPHASE OF THE AUTOCHTONOUS DENDROFLORA IN THE URBAN CENOSES OF BELGRADE

Đ. Stojičić, ¹, M. Ocokoljić², D. Obratov- Petković²
djurdjastojicic@gmail.com

¹ Scholarship holder of the Ministry of Science and Technological Development, Nemanjina 22-26, Belgrade 11000;

² Faculty of Forestry, Kneza Visaslava 1, Belgrade 11030

Abstract: Global changes, especially changes in temperature, insolation, air humidity, precipitation, winds and pollution - have an impact on the physiology, phenology and distribution of plant and animal species. The World Meteorological Organization estimates that global changes can cause many European plant species to become vulnerable (22% of the species will become critically endangered, while 2% will become extinct), which will change the competition among species or change the structure and type of the vegetation. Keeping all these facts in mind, this work analyzes the impact of climate changes on the flowering phenophase of 30 species of the autochthonous dendroflora belonging to the Magnoliophyta group in the urban cenoses of Belgrade. Their flowering times were recorded during four consecutive years and brought into correlation with the flowering times for the same species as given in the scientific literature (for the city of Belgrade). Noticeable discrepancies were observed in the majority of species, consequently influencing the fruit bearing times. The results of this research can be used to help verify the reaction of autochthonous dendroflora of the Magnoliophyta group to global changes, as well as to assess the level of influence these changes have on different plant species. The obtained results are of value for the practical horticulture, namely for the planning of the transplant production: by knowing how physiological processes react to limitations imposed by the environment, it is possible - applying selection programs - to produce plants with well-defined, favorable properties, resistant to environmental stresses.

Key words: landscape architecture, horticulture, climate changes, phenological observations

**THE INFLUENCE OF DENDROFLORA ON THE
STABILITY OF WET ECOSYSTEMS**

D. Čavlović, M. Ocokoljić, D. Obratov-Petković,

spaceviolet@gmail.com

Faculty of Forestry, Kneza Višeslava 1, Belgrade 11030, Serbia

Abstract: Since wet ecosystems are among the most endangered ones - due to accelerated drainage, land melioration, pollution, land use - this work analyzes the influence of dendroflora on the stability of Zasavica, Labudovo Okno and the Pešter Field, which are on the Ramsar list of wet ecosystems of exceptional importance. During the research in the three wet ecosystems, autochthonous and allochthonous ligneous taxa of the Magnoliophyta group were identified and used as specimens in order to gain knowledge on their eco-physiological properties and their ability to compete in wet ecosystems. A comparative analysis of the properties of dendroflora in the three wet ecosystems confirmed their good adaptability and their high influence on the stability of the ecosystems. Furthermore, it was noted that the ligneous taxa spread spontaneously, and in some cases - invasively. In the Zasavica and Labudovo Okno ecosystems this applies to the following species: *Amorpha fruticosa* L., *Rosa canina* L. and *Vitis sylvestris* L.. In the Zasavica ecosystem this also applies to *Prunus cerasifera* Ehrh., *Prunus spinosa* L. and *Crataegus monogyna* Jacq.. In the Pešter Field ecosystem, no invasiveness was noted. This was expected, since the Pešter Field represents a rare karst landform serving as a refugium for plant and animal species which survived the last glacial period. The research conducted so far suggests the need for further research with the aim of verifying the influence of dendroflora on the vulnerability of wet ecosystems, as well as making a management plan for maintenance of the stability of wet ecosystems.

Key words: ligneous taxa, wetlands, competition, wise use

URBAN RECREATIONAL AREAS

Jovana Stevanović¹, Nenad Stavretović^{1,2}

¹ The Faculty of Forestry, University of Belgrade

² Institute for Nature Conservation of Serbia, Belgrade

Abstract: Urban recreational areas should simultaneously meet functional, ecological, socio-cultural and aesthetic requirements that must be harmonized with the environment in which these areas are established in order to ensure its improvement. This paper highlights both the role and important impact of urban recreational spaces on human life and well-being, and their structure and basic principles of planning and management of sporting-recreational areas in the urban environment from the perspective of landscape architecture. Proper selection and adequate combining of plants would enable the establishment of proper recreational areas that will attract more users.

Key words: recreational areas, urban recreation, urban ecology, landscape management

**POSSIBILITY OF BRINGING ROOF GARDENS
INTO BANOVO BRDO IN BELGRADE**

Jovana STEVANOVIĆ¹

¹ Faculty of Forestry, Belgrade

Abstract: One of the modern ideas of landscape architecture is roof greening which is of special importance in an urban environment. Roofs are often abandoned and can be categorized as most unused parts of buildings, therefore, putting green spaces on them has even more significance. The benefits of raising the roof gardens are numerous: ecological, economic, aesthetic, psychological and sociological, providing a wide range of positive effects for buildings, population and environment at the same time. The study was conducted with the aim to determine and map the buildings which are suitable for roof gardens. For the study area an urban part of Belgrade, Banovo Brdo, was chosen, due to its uniqueness, specific position compared to other parts of the city and the favorable microclimatic conditions. Studies have included a detailed review and analysis of the general environmental conditions as well as an analysis of the existing buildings in this territory. Having that in mind physical-geographical and climatic features of the area as well as socio-demographic, physical and functional structure of Banovo Brdo were analyzed. With mapping the entire territory of Banovo Brdo detailed information bases, about the objects which have a possibility for greening and have the most appropriate type of roof garden, was obtained. Also, research results present a basis for future work and guidelines for environmental planning and creation of more green areas in the city. Large-scale roof greening and well implemented regulations can have a significant role for sustainable development in future.

Key words: roof garden, green roof, urban planning, urban greening, landscape architecture

Topic D

WOOD SCIENCE AND TECHNOLOGIES

Papers

**ACETYLATION REGARDING PHYSICAL AND TECHNOLOGICAL
PROPERTIES OF SOME ALBANIAN WOODS**

Dritan AJDINAJ, Entela LATO, Hektor THOMA, Doklea QUKU
dajdinaj@ubt.edu.al

Agricultural University of Tirana / Faculty of Forestry Sciences
Universiteti Bujqësor i Tiranës, Fakulteti i Shkencave Pyjore, Kodër-Kamëz 1029

Abstract: A study was carried out to evaluate the influence of acetylation regarding to physical properties and gluing ability of some of the most important Albanian woods.

Acetylation is a chemical modification of wood which consists in the reaction of acetic anhydride with hydroxyl groups of hemicelluloses and lignin of wood. For every acetyl group reacted, one hydroxyl group is blocked from hydrogen bonding, so modifying the properties of wood.

Three woods, beech, poplar and fir were studied. The samples were prepared with dimensions $1 \times 1 \times (0.5 \div 1)$ cm, presenting clear radial, tangential and cross-sections. All samples were marked with numbers, taking into account their positions in pieces. Samples with odd number were acetylated, respectively 48 for beech, 44 for fir and 38 for poplar.

Acetylation was performed according to the laboratory procedure for small dimension samples with weight 150 gr. There were used 900 ml pyridine 99% concentration and 500 ml acetic anhydride 95% concentration. The system wood-liquid was kept in 90°C for 4 hours. After that, all the samples were conditioned in 100% relative humidity of air and were measured according to radial and tangential directions. The fir was measured only in tangential direction for technical reasons. Then, the samples were dried till to 0% moisture content and were measured again, calculating the shrinkage. After this, the samples were reconditioned again in 100% relative humidity of air and the swelling was calculated.

The volumetric shrinkages of acetylated poplar and beech resulted 4.05% and 8.5%, meanwhile for non acetylated samples they were 9.8% and 16.5%. Tangential shrinkage of acetylated fir was 2.2% and for non acetylated 6.5%. About volumetric swellings, acetylated poplar and beech resulted 4.2% and 9.3%, meanwhile non acetylated resulted 10.8% and 19.8%. Tangential swelling of acetylated fir wood was 1.7% and 5.8% for the non acetylated. It seems that acetylation reduced moisture-related dimensional changes of wood for more than 50%.

Only beech was studied regarding gluing. Pieces with dimensions $5 \times 2 \times 1$ cm were produced and selected in such a manner that pieces with approximate density can be glued together. PVA, 200 gr/m² was used. With regard to angles of annual rings, EN 205, 30° ÷ 90° was respected. Pressure was applied with a hand grip vice. Time of pressure was 24 hours. 32 acetylated test pieces and 37 non acetylated were tested. The shear strength of acetylated beech was 2.79 N/mm², 2.4 times less compared with the non acetylated one.

These modifications regarding wood properties are caused by the reduction of wet ability from fewer available hydroxyl groups, which means lower affinity of acetylated wood for water and poorer adhesion too.

Key words: wood acetylation, acetic anhydride, shrinkage, swelling, gluing strength.

ANATOMY AND PROPERTIES OF REACTION ZONES IN BEECH

Maks MERELA^{1*}, Primož OVEN¹

maks.merela@bf.uni-lj.si

University of Ljubljana, Biotechnical Faculty, Department
of Wood Science and Technology

Rožna dolina c. VIII/34, SI 1000 Ljubljana

Abstract: Reaction zone (RZ) as defined by Shain (Shain, 1971) is a relatively thin layer of usually colored xylem between infected wood and sound sapwood. Modified xylem inside RZ represents a protective barrier against invasive fungi. The aim of several of our past studies was to characterize RZ of beech.

We investigated its anatomy by light and UV microscopy, its physical properties like density and radial gas permeability, its water content (by 3D magnetic resonance imaging) and also elemental composition of RZ by PIXE (Proton-Induced X-ray emission).

Anatomically, RZ was characterized by tyloses in vessels and high accumulation of colored deposits in parenchyma cells, fibres and vessels. Pit apertures were filled and closed with deposits as well. Tyloses and parenchyma cells were abundant suberized. Basic density of RZ was approximately 1.2 times higher than in normal beech wood and radial gas permeability of RZ was 3-times lower than in normal sound sapwood. Moisture contents of reaction zones were from 1.3 - 1.8-times higher than in normal wood. Compared to normal sound sapwood PIXE analysis revealed 2.4-times higher concentration of potassium in RZ.

All listed anatomical, histochemical and microenvironmental changes inside reaction zone in beech represent successful modification of xylem tissue as an active dynamic response to injury and later fungal invasion. Based on its characteristics, reaction zone in beech presents moisture barrier against the dehydration of healthy intact tissue as well as protects the tissue against infections with its antifungicide and antimicrobial nature.

Key words: beech, reaction zone, anatomy, moisture, 3D MRI, gas permeability

**BONDING OF WOOD WITH ADHESIVE MIXTURES MADE OF
LIQUEFIED WOOD COMBINED WITH TANNIN
OR PHENOLIC RESIN**

Ales UGOVSEK¹, Mirko KARIZ¹, Milan SERNEK¹
milan.sernek@bf.uni-lj.si

¹ Department of Wood Science and Technology, Biotechnical Faculty, University
of Ljubljana, Rozna dolina, C. VIII/34, 1001 Ljubljana, Slovenia

Abstract: Wood-based composites and solid wood are often bonded with synthetic adhesives, which contain formaldehyde or other chemicals that are harmful to human health and the environment. In the past decades, several attempts have been made to develop environmentally friendly adhesives, which will be comparable to existing synthetic adhesives. The liquefaction of wood, which is a novel procedure, used to convert solid wood into the liquefied state. It is a promising procedure for such a purpose. The objective of this research was, therefore, to develop: (1) an adhesive made from liquefied wood, which was liquefied with different solvents, (2) liquefied wood with an addition of condensed tannin, and (3) an adhesive in which part of the synthetic resin was replaced by liquefied wood. Wood of black poplar (*Populus nigra* L.) was liquefied with different solvents (glycerol and ethylene glycol). Wood liquefied with glycerol was used in an adhesive mixture with a synthetic phenol-formaldehyde adhesive. Liquefied wood was added in different proportions, ranging from 0 % to 100 %, with increments of 25%. Two beech (*Fagus sylvatica* L.) lamellas were then bonded together with these adhesive mixtures. The bonding was carried out in a hot press at 180 °C for different pressing times. The test specimens were tested according to the standard EN 12765 and EN 205. Wood liquefied with an ethylene glycol was used as an independent adhesive and in a combination with condensed tannin. These specimens were bonded in a hot press at 200 °C. The test specimens were tested according to the standard EN 205 immediately after bonding and after 7, 30 and 50 days in standard climate. It was found that the bond shear strength of the dry specimens increased if 25 % of the phenol-formaldehyde adhesive was replaced by wood liquefied with glycerol, but decreased if a higher proportion of liquefied wood was used. When testing the specimens after immersion or boiling in water, the bond strength decreased rapidly in the case of the samples which had been bonded with adhesive mixtures containing more than 25 % of liquefied wood. In the case of wood liquefied with ethylene glycol bond shear strength of the specimens conditioned in a standard climate for 1 week was higher as in case of wood liquefied with glycerol. The shear strength values of the specimens bonded with liquefied wood containing ethylene glycol did not change significantly during the following period of time (50 days). It can be concluded that, in the case of solid wood to be used for non-structural applications in dry conditions, up to 25 % of the synthetic phenol-formaldehyde resin can be replaced by wood liquefied with glycerol,

if satisfactory bonding is to be achieved. The specimens bonded with the adhesive mixtures made of wood liquefied with ethylene glycol exhibited higher bond shear strength than those made of wood liquefied with glycerol.

Key words: adhesive, liquefied wood, phenol-formaldehyde, shear strength, tannin

CHARACTERISTICS OF THE INTERIOR DECOR OF A HUNTING LODGE IN JULIN

Irena SWACZYNA, Anna RÓŻAŃSKA,
Zofia RŻEWSKA, Agnieszka SZYMCZYK

Department of Construction and Technology of Final Wood Products, Faculty
of Wood Technology Warsaw University of Life Sciences – SGGW

Abstract: The work consists of a historical description of the monument and the characteristics of certain interiors. The decor and furniture were under research. The photographic documentation and state of the art of those were acquired.

Key words: staircase, paneling, doors, windows, decorative wooden flooring, parquet, castle, hunting lodge, construction

CONTEMPORARY FURNITURE DESIGN

Milorad JANIĆ , Dragomir GRUJOVIĆ,
Gordana ĐUKANOVIĆ , Vjaceslava MATIĆ
gordana.djukanovic@sfb.rs
Faculty of Forestry, Kneza Visislava 1, Belgrade

Abstract: Engineering Graphics as a course at the Faculty of Forestry in Belgrade includes modeling of laminated furniture. Our students study methods and acquire skills of producing 3D objects. They are also taught how to use AutoCAD software tools, necessary for their presentation. This paper presents the process of designing a cabinet, which is a task done by the students of Wood Processing. The importance of this paper lies in the presentation of the experience we have gained by introducing modeling, which helps the students get a better perception of space and spatial relations.

The paper will also include the initial definition of drawers as blocks, diversity of materials and their usage in the process of designing a wardrobe (3D).

Key words: Engineering Graphics, 3D modeling, laminated furniture, software tools, AutoCAD

EFFECTS OF CURING TIME ON BENDING STRENGTH OF FINGER-JOINED BLACK PINE AND MACEDONIAN FIR LUMBER

Dimitrios TSALAGKAS¹, Vassilios VASSILIOU²

dtsalag@for.auth.gr

Aristotle University of Thessaloniki, Faculty of Forestry and Natural Environment,
Department of Harvesting and Forest Products Technology, Thessaloniki 2010

Abstract: Curing time of an adhesive constitutes one of the most important factors on the performance of finger-joined wood. Any further handling of the joint, should occur, after most of the curing has been completed. The object of this study was to investigate the effect of curing time (2 ½, 7, 24 and 168 hours) on the bending strength properties of finger jointed Macedonian fir (*Abies borisii regis*) and black pine (*Pinus nigra*), with two different finger lengths (12.5 and 20 mm). An emulsion polymer isocyanate adhesive cured at room temperature was used for this purpose.

MOR of all specimens of Macedonian fir ranged from 18.22 up to 56.27 MPa, which corresponds to a percentage level of 27.43 % up to 84.71 % of the solid wood (66.42 MPa) and MOE mean values fluctuated from 8726.25 to 12246.11 MPa, which corresponds to a percentage level of 111.99 % up to 157.17 % of the solid fir wood (7791.39 MPa). On the other hand, MOR mean values of black pine wood specimens were from 16.79 up to 64.35 MPa, which correspond to a percentage level of 18.76 % to 71.92 % of the solid black pine wood (89.47 MPa) and MOE mean values of black pine wood specimens fluctuated from 7559.83 to 12990.4 MPa, which correspond to a percentage level of 61.57 % up to 105.8 % of the solid black pine wood (12277.3 MPa). Results showed that curing time had a statistically significant effect on the bending strength properties of finger joints. After 24 hours finger joints obtained more than 65 % of the reference MOR of 168 hours.

Key words: black pine, bending strength, curing time, EPI adhesive, finger joint, Macedonian fir

**EFFECT OF LIGNIN AS A COMPATIBILIZER ON LONG-TERM
WATER ABSORPTION AND THICKNESS SWELLING OF
WOOD FLOUR-POLYPROPYLENE COMPOSITES**

Rabi BEHROOZ , Hamed Younesi KORDKHEILI , Saeed Kazemi NAJAFI
Rabi.behrooz@modares.ac.ir
Tarbiat Modares University
Faculty of natural resources and marine science- wood and paper Department
Iran/Noor

Abstract: In this study, the effect of lignin as a compatibilizer on long-term water absorption and thickness swelling of wood-plastic composites (WPCs) was investigated. The degree of lignin loading percentages was 0, 2, 5 and 10 percent (based on the dry weight of wood flour). The samples at present and absent of maleic anhydride-polypropylene (MAPP) were manufactured by flat hot press method. The long-term water absorptions of manufactured WPCs were evaluated by immersing them in water at room temperature for several weeks. Results indicated that water absorption and associated thickness swelling decreased through increasing of lignin addition to 10%. Also, the composites which have both MAPP and 10 percent lignin exhibited the least water absorption and thickness swelling. Water absorption of the studied composites was proved to follow the kinetics of a Fickian diffusion process.

Key words: Wood plastic composites, Compatibilizer, Kraft lignin, Water absorption, Thickness swelling.

**EFFECTS OF HARDENER TYPE AND PARTICLES SIZE ON PHYSICAL
AND MECHANICAL PROPERTIES AND FORMALDEHYDE
EMISSION OF UF BONDED PARTICLEBOARD**

Mohsen SAFFARI¹, Komeyl SAJEDI²,
Ramin VAYSI³, Abdollah HOSEYNZADEH⁴
saffarimohsen1@gmail.com

Islamic Azad University (IAU), Chalous Branch.

Iran-mazandaran province-Chalous-Islamic Azad University- Agriculture faculty

Abstract: Urea formaldehyde composes more than 90% of resins used in manufacturing of particleboard in the world, but it is harmful for human health. In this research, homogenous particleboard having 0.7 gr/cm^3 density was manufactured with poplar chips (*Populus nigra*) and UF resin. Variables included hardener type and particles size and other conditions were constant. Hardeners used were Ammonium Chloride, Ammonium Sulfate and Magnesium Chloride, and the amount of hardener used was 2%. Particles prepared with a drum chipper were divided into two groups of small and large chips. After particleboard manufacturing and conditioning, their formaldehyde emission, physical and mechanical properties were determined. Formaldehyde emission was measured by WKI method, using acetyl acetone and photometric method (according to the revised standard EN 120). According to the results, formaldehyde emission of particleboards made of Ammonium Chloride was significantly lower than in particleboards made of Magnesium Chloride, but formaldehyde emission of particleboards made of Ammonium Sulfate had no difference compared to formaldehyde emission of particleboards made of Ammonium Chloride. Particles size had no effect on formaldehyde emission of boards. According to the results, water absorption and thickness swelling of particleboards made of Ammonium Sulfate and small chips was significantly lower than in other samples. Moreover, internal Bonding of particleboards made of small chips was higher than in particleboards made of large chips. Modulus of elasticity of particleboards made of Magnesium Chloride was significantly higher than in other samples.

Key words: Particleboard, Hardener, Particles size, Formaldehyde emission, Physical and Mechanical Properties

**INFLUENCE OF THE MOLAR MASS OF UREA-FORMALDEHYDE
ADHESIVES ON THE SHEAR STRENGTH OF ADHESIVE JOINTS**

Ivana GAVRILOVIĆ-GRMUŠA^{1*}, Manfred DUNKY²,
Jovan MILJKOVIĆ¹, Milanka ĐIPOROVIĆ-MOMČILOVIĆ¹
ivana.grmusa@sfb.rs

Univerzitet u Beogradu, Šumarski fakultet, Kneza Višeslava 1, 11030 Beograd

Abstract: The objective of this study was the evaluation of the influence of the molar mass (degree of condensation) of urea-formaldehyde (UF) adhesives on the shear bond strength of wood joints.

Radially and tangentially cut beech (*Fagus Moesiaca*) and fir (*Abies Alba*, Mill.) plies were bonded by hot pressing using three types of UF resins with different molar mass together with extender, hardener and safranin as the coloring agent.

The results show significant correlation between the shear strength of the adhesive joints and the molar mass of the adhesives; bond strengths decrease with the increase of the molar mass of adhesives.

As expected the shear strength of the adhesive joints was higher for beech compared to fir, based on different wood strength itself and reflecting mainly wood failure. Shear strength of tangentially cut wood and hence showing radial penetration was higher than for radially cut surfaces, enabling tangential penetration; these results were the same for both wood species investigated and for all three applied adhesive mixes.

Even the portion of wood failure was high, still different shear strength was observed due to a certain fortification effect of the interphase by the penetration of the adhesive. The higher the penetration, the thicker the interphase, the higher was the achieved shear strength.

Key words: shear strength, beech (*Fagus Moesiaca*), silver fir (*Abies alba* Mill.), molar mass, degree of condensation, urea-formaldehyde (UF) adhesive, radially and tangentially cut wood

**MOISTURE CONTENT PROFILES AND STRESSES IN
BEECH TIMBER DURING CONVENTIONAL DRYING**

Matija PARUN, Goran MILIĆ, Branko KOLIN

branko.kolin@sfb.rs

Faculty of Forestry, Dept. of Wood Processing,

Kneza Višeslava 1, Srbija, 11030 Beograd

Abstract: During timber drying, stresses which appear in timber cause it to deform. These deformations cause problems in further processing, as they decrease the volume of useful wood. Therefore, the stresses in timber need to be minimized. In this paper, moisture content profiles and stresses in beech timber during conventional drying were determined. Moisture content profiles were determined by using five slices, whose moisture content was measured by gravimetric method. Maximal differences between moisture contents of inner and outer slices were around 11%, while at the end of drying, the differences were around 3%. Gap was measured by EN14464 standard. Maximal gap values were 5-6 *mm*, and they were, on average, around 3 *mm* at the end of drying. Also, at the end of drying, strong correlation between moisture content profiles and stresses was noticed. This means that, at this most important moment of drying, the stresses can be determined just by determining the moisture content profiles, even without measuring the gap.

Key words: moisture content profiles, stresses, gap, beech, conventional kiln drying

**NATURAL DURABILITY OF TROPICAL TIMBERS AGAINST
WHITE ROT (*Trametes versicolor*) FUNGUS: Part 1. DURABIL-
ITY CLASSIFICATION OF SIX LESSER USED HARDWOODS**

Elisha NCUBE

elisha.ncube@cbu.ac.zm

Copperbelt University, School of Natural Resources, Kitwe Zambia

Abstract: Environmental groups, such as the International Tropical Timber Organization, increased consumer awareness and certification schemes have not halted over exploitation of popular tropical hardwoods. Lesser used tropical timbers provide an opportunity for relieving pressure on commercial hardwoods to ensure sustainable supply of tropical timbers. If the lesser used species are to have any impact on the world market, their properties (e.g. natural durability) have to be specified. This is important because both professionals and consumers consider properties as selection criteria in choosing timber for particular end uses. Since fungi is a major cause of decay in the UK and other European countries, selected lesser used tropical hardwoods were exposed to a white rot (*Trametes versicolor*) fungus to determine the effect of density on decay resistance and classify them into durability classes. Ipe (*Tabebuia serratifolia*) and guariuba (*Clarisa racemosa*), bitterwood (*Vatairea lundellii*) and paquio (*Hymenaea courbaril*), and ironwood (*Dalium guianense*) and male grape (*Poulsenia armata*) were classified into natural durability class 1, 2 and 4 respectively. Wood species such as bitterwood although being of lower density (795 kg/m^3) than both ironwoods (905 kg/m^3) showed higher decay resistance which indicates that other factors, such as extractives may enhance natural durability of timber. This study indicates that ipe and guariuba, bitterwood and paquio, and ironwood and male grape have a good potential for use in marine, ground contact and above ground under cover conditions respectively.

Key words: Natural durability or decay resistance, Lesser used tropical timbers, Wood extractives, Density

**SOME MECHANICAL PROPERTIES OF SIBERIAN LARCH
(*Larix sibirica*) WOOD**

Elif TOPALOĞLU¹, Nurgül AY¹

¹ Forest Industrial Engineering Department, Forestry Faculty,
Karadeniz Technical University, 61080, Trabzon, Turkey

Abstract: The purpose of the study was to determine some mechanical properties of Siberian Larch (*Larix sibirica*) wood. The sample trees supplied from Bahçekapılı Lumbering Industry Company in Trabzon, Turkey. The preparation of the test specimens and application of the test procedures were done according to Turkish standards. Siberian larch wood's compression strength parallel to grain, bending strength, modulus of elasticity in bending, impact bending and shear strength were determined as 473.91 kp/cm^2 , 920.1 kp/cm^2 , 150538.5 kp/cm^2 , 0.41 kpm/cm^2 , 51.2 kp/cm^2 , respectively. According to dynamic quality value it has fair quality characteristics.

Key words: Siberian larch, *Larix sibirica*, Mechanical properties

**STRENGTH PROPERTIES OF THE MOST FREQUENT CORNER
AND MIDDLE JOINTS OF UPHOLSTERED FURNITURE FRAMES
CONSTRUCTED WITH BEECH AND POPLAR SOLID WOOD**

Vasiliki KAMPERIDOU¹, Vassilios VASSILIOU²

vkamperi@for.auth.gr

Aristotle University of Thessaloniki, Faculty of Forestry and Natural
Environment, Department of Harvesting and Forest Products Technology

Abstract: This study was carried out to evaluate the strength of the four most frequent joints in the upholstered furniture frames, made of beech and poplar solid wood. The research included the following joints: Mortise and Tenon, double Dowel, Corner Blocks and double Gusset Plates, which were constructed and tested both in corner and middle joints. In the corner joints we examined the compression strength and the modulus of elasticity of the joints and in the middle joints the tension strength was thoroughly investigated. The results of the first test (compression strength) indicated that the strongest corner joint was the double Dowel joint of beech wood (1179.6 *N*). The strength of Mortise and Tenon joint was proved to be less powerful (1063.6 *N*) and the joint with wooden Corner Blocks resulted in even weaker values (683 *N*). The joint with double Gusset Plates appeared to have the lowest strength (529.6 *N*). The highest modulus of elasticity proved to have derived from the joint with wooden Corner Blocks. The double Dowel joint resulted in slightly lower elasticity values and the joint with double Gusset Plates in even lower modulus of elasticity, whereas the Mortise and Tenon joint resulted in the lowest elasticity values of all. On the other hand, the highest tension strength appeared to have been a feature of the Mortise and Tenon joint (5438.4 *N*). Lower tension strength values were measured in the joint with Corner Blocks (4974.5 *N*) and even lower tension strength proved to have come from the double Dowel joint (4542 *N*). The last one in tension strength was the joint with double Gusset Plates (3863.5 *N*). Generally, in most cases beech wood resulted in stronger joints compared to poplar wood.

Key words: Corner Block, corner joint, Dowel, Gusset, middle joint, Mortise and Tenon, upholstered furniture

STRESS DISTRIBUTION IN CHAIR CONSTRUCTION

Igor DŽINČIĆ, Dušan SKAKIĆ

igor.dzincic@sfb.rs

Faculty of Forestry, Dept. of Wood Processing,

Kneza Višeslava 1, Srbija, 11030 Beograd

Abstract: Development of a new product in contemporary production is a very expensive economic activity. The process of furniture construction is in shortage of exact data which refer to the measurements of certain parts, as well as the measurements and strength of certain construction joints. Consequently, in the course of dimensioning the constructor is guided by his own experience based on traditional craft and engineering practice, as well as the use of test pieces (prototypes), until load options of both certain joints and each separate element of a chair have been established. With the introduction of the finite element method, as a new method in the analysis of furniture construction appeared a need for the investigation of certain parameters which are necessary in product modeling. A review of the published papers on the application of the finite element method in chair and stabile furniture construction in general, creates an impression that few researchers made recommendations on a specific type of a finite element which provides the truest description of the real model. In this paper a comparative analysis of experimental results and results obtained on the basis of chair modeling was carried out using the finite element method. Based on the results of the performed researches recommendations on the type of a finite element were obtained, as well as recommendations on other parameters which should be defined in chair analysis using the finite element method.

Key words: chair, finite element method, joints, strain gauges, type of a finite element

**POSITIVE CORRELATION OF TECHNOLOGY MODERNIZATION
AND MARKETING AS A FACTOR IN THE DEVELOPMENT OF
PRIMARY WOOD PROCESSING INDUSTRY IN ALBANIA**

Alketa GREPCKA, Leonidha PERI, Edlira KUKALI

alketa_grepcka@hotmail.com

Agricultural University of Tirana, Faculty of Forestry Science, Department of Wood Processing Industry, Koder Kamez , Tirana, Albania

Abstract: The identification of the links between technology and marketing activities in the Albanian primary wood processing industry and their positive correlation is seen as an important factor for the development of this industry.

After years of working mainly for the local markets, the primary wood processing companies in Albania now have to face the problem of increasing of efficiency of their production processes. Increased competitiveness caused by the extension of timber global markets and decreasing availability and quality of local round wood supply are forcing the companies to use alternative raw materials and at the same time to modernize their production processes.

In order to enter and survive in highly competitive international markets, there is a strong need for product differentiation strategies and to implement these strategies the companies should improve the technology, which will allow them to also increase the efficiency of production and better optimize the sale revenues.

The investments in technology should be strongly linked with investment in professional training, R&D and marketing activities, as well as with measures reducing the negative factors that can impede the success of these investments.

Key words: technology, processes efficiency, competition, investments, marketing, sector policies, SWOT analysis;

**TENSILE STRENGTH BY COMPRESSION LOADING OF SOME
HARDWOODS BONDED WITH PVAc AND CASEIN ADHESIVES**

Andromachi MITANI, Ioannis BARBOUTIS

jbarb@for.auth.gr

Aristotle University of Thessaloniki, Faculty of Forestry and Natural Environment,
Department of Harvesting and Forest Products Technology

Abstract: In this research, the shear strength of beech (*Fagus sylvatica*), common Lime (*Tilia europaea*), and oak (*Quercus robur*) woods, bonded with Polyvinyl Acetate (PVAc) and casein adhesives of D3 type, were studied, according to ISO 6238:2001. Two different ways of glue application were tested: a) a single-face glue application and b) double-face glue application. The results showed that Modulus of rupture (MOR) of all joints ranged from 14.90 N/mm^2 to 21.05 N/mm^2 , and these values corresponded to from 105.6% to 107.7% of that of the control solid wood. It was found that the mean MOR values of the bonded samples did not differ significantly from the mean MOR values of the corresponding solid wood samples, except for the oak wood samples bonded with casein adhesive, single face applied. Furthermore, it was found that beech wood resulted in higher average MOR compared to common Lime and oak wood samples, whereas, common lime samples resulted in the lower values in both the bonded samples and the corresponding solid wood samples. Also, it was found that the PVAc adhesive resulted in higher MOR values compared to the corresponding casein adhesive values. It was found that the double face glue application resulted in higher MOR values, in comparison with the corresponding samples bonded by single-face glue application in beech and common lime woods.

Key words: shear strength, PVAc, casein, beech, common lime, oak

THE INFLUENCE OF SURFACE FINISHING OF *PAULOWNIA SIEBOLD ET ZUCC.* ON THE DECORATIVE PROPERTIES OF A LACQUERED SURFACE

Milan JAIĆ¹, Tanja PALIJA², Jovan DOBIĆ³

milan.jaic@sfb.rs

Faculty of Forestry, University of Belgrade, Kneza Višeslava 1, 11030 Belgrade

Abstract: This paper presents a research of the influence of the system of surface finishing on the most significant decorative properties of dried film: color and gloss. The samples were made of two species of Paulownia (*Paulownia elongata* and *Paulownia fortunei*). System of surface finishing included the preparation of surface by planing and sanding, and the technology of lacquering. Number of stages of processing, grit of sanding papers and direction of sanding, in relation to wood grain orientation, were varied during sanding. For lacquering of samples, two types of coatings were used: two-component polyurethane coating (2K PU) and UV acrylic coating. The polyurethane coating was applied by air-spray application process, and the drying was performed under unforced conditions. UV acrylic coating was applied by rolling operation, and curing of coating was performed under UV light. Components of color: L^* , a^* and b^* (in accordance with the CIELab system) and gloss were measured on all samples after sanding and lacquering. Values of components of color and gloss were analyzed by the wood species, quality of sanding (expressed by parameters of surface roughness) and the parameters of lacquering technology.

Key words: Paulownia, sanding, lacquering, color, gloss

THICKNESS SWELLING OF JUVENILE WOOD PARTICLES HOT PRESSED IN TRANSVERSE DIRECTION

*Elisha NCUBE¹, Hugh Mansfield WILLIAMS², Mark IRLE³

elisha.ncube@cbu.ac.zm

The Copperbelt University, P O Box 21692, Jambo Dr, Riverside, Zambia/Kitwe

Abstract: The properties of juvenile wood lumber are poor, but those of juvenile particleboards are not necessarily so. To study this, individual Scots pine (*Pinus sylvestris* L.) particles were hot pressed at conditions used for commercial particleboard manufacture. The pressed particles were conditioned at various relative humidities to observe the effect of wood maturity on compression behavior, stress relaxation and strain recovery. Experimentation followed a randomized design and results were analyzed by ANOVA in conjunction with Fisher's protected Least Significant Difference method. Results for peak stress show reduced energy requirements in the hot pressing of juvenile and mature wood radial particles. Analysis of the first 60 s of stress relaxation curves showed that juvenile wood relaxed its stress at a faster rate than mature wood. It is possible that the internal bonding strength of particleboard constructed using a large fraction of juvenile wood could benefit from low stress due to increased stress relaxation rate. This interesting observation requires verification. Irreversible swelling showed that juvenile wood retained most strain at press exit and was therefore more stable than mature wood. The ability of juvenile wood to retain most of the applied strain was explained by the high proportion of plastic deformation and minimal cell wall damage. These results suggest that increased stress relaxation rate together with reduced cell wall damage contributes to improved dimensional stability of particleboard made from raw material with a large proportion of juvenile wood.

Key words: Juvenile or mature wood, Stress relaxation, Irreversible swelling, Permanent strain, Hygroexpansion, Strain recovery, Particleboard.

VARIABILITY IN CONTENT OF TOTAL PHENOLS IN BEECH STEM

Viljem VEK¹, Primož OVEN^{1*}

viljem.vek@bf.uni-lj.si

¹ University of Ljubljana, Biotechnical faculty, Department of wood science and technology, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract: The distribution of total phenol content was examined along the stem height and in radial direction across stem discs in two beech trees. Total phenols were examined in methanol extracts spectrophotometrically by use of Folin-Ciocalteu reagent. Pattern of radial distribution in total phenols content differs among discs with discolored core and discs without discoloration. Higher amount of the total phenols was observed in the reaction zones delimiting red heart and sapwood. The content of total phenolic compounds was lower in the red heart than in sapwood. Obvious variability of total phenols content was found in sapwood, where younger parts of the stem contained lower concentrations of total phenols than older parts of sapwood adjacent to reaction zones. Discs without red heart exhibited higher concentration of total phenols in the central part of the stem than in peripheral ones. Our results suggest that variability in distribution of total phenolic content within the stem reflects a physiological function of different categories of wood tissue.

Key words: Total phenol content, UV-VIS spectrophotometry, Folin-Ciocalteu reagent, *Fagus sylvatica*, sapwood, discolored wood

WOOD ANATOMY OF EVERGREEN OAKS IN TURKEY

Nesime MEREV¹, Ziya GERÇEK¹, Turgay BİRTÜRK¹, Bülent AKGÜN¹
bakgun@ktu.edu.tr

¹ Karadeniz Technical University Forest Faculty, Department of Forest
Engineering, 61080 TRABZON, bakgun@ktu.edu.tr

Abstract: This poster presentation aimed to examine the anatomical features of three evergreen oak species in Turkey. These are *Quercus ilex* L., *Quercus coccifera* L., *Quercus aucheri* Jaub. Et Spach.. Wood materials of the study were supplied from the taxa planted in Turkey. Sample preparations were obtained through there sections of wood. Vessel groupings, type of perforation plates, features of vasicentric tracheids, vascular tracheids, type of axial (wood) parenchyma, helical (spiral) thickening, feature of rays and type of rays, feature of annual rings and arrangement of intervessel pits were determined.

Key words: Evergreen Oaks, Wood Anatomy, Turkey

**INFLUENCE OF THERMAL MODIFICATION AND PROCESSING
TECHNOLOGICAL PARAMETERS ON CUTTING
POWERS IN MILLING WOOD PROCESSING**

Marija MANDIĆ, Nebojša TODOROVIĆ, Ranko POPADIĆ, Gradimir DANON

marija.mandic@sfb.rs

Faculty of Forestry, Kneza Visislava 1, Belgrade, Serbia

Abstract: This paper presents the comparative results of the influence of thermal modification on cutting power required for processing. The experiment was conducted for different technological parameters of processing (feed speed u and cutting depth a). The measurements were conducted on a combined milling machine on four groups of samples of beech wood dimensions 35x16x400 mm, separately for false heartwood and sapwood. The first three groups consisted of heat-treated samples at different temperatures (170 °C, 190 °C, 210 °C) and the fourth group consisted of thermally untreated samples, and then the results were compared. In examining a device used for monitoring and displaying cutting power was the measuring device SRD 2 for measuring, developed at the Center for machinery and tools in the Faculty of Forestry in Belgrade, which is used in laboratory exercises with students and scientific - research work. The results indicate the existence of differences in the powers required for processing heat-treated wood compared to untreated wood.

Key words: cutting power measurement, thermal modification, cutting force, specific cutting resistance

**ERGONOMIC, ECOLOGICAL, ESTHETIC, AND ECONOMIC
ASPECTS (4E) OF FURNITURE DESIGN IN THE CASE
OF PRESCHOOL CHILDREN FURNITURE**

Kristina ZUBOVIĆ, Aleksandar IVANOVIĆ

Alexander College of Arts, Business & Management, Belgrade; student of doctoral studies at the Faculty of Forestry; Dr Ivana Ribara 62 / 16; 11 188 Novi Beograd
iati@open.telekom.rs

Abstract: Beside functionality and technical-technological feasibility, furniture design and production have four key aspects (4E): ergonomic, ecological, esthetic, and economic one, which refers in particular to the effectiveness of design, as well as to the efficiency and profitability of its production. In the case of furniture design for preschool children, there is another, fifth E-aspect – entertainment, as one of the basic needs of this age. The fulfillment of the elementary criteria comprised in the above-mentioned aspects has been analyzed on the example of the prototype of a furniture line for kindergarten.

Key words: design effectiveness, children entertainment, kindergarten furniture

**RESISTANCE OF THERMO-VACUUM MODIFIED
WOOD AGAINST WOOD PESTS**

Gregor REP, Miha HUMAR, Franc POHLEVEN

gregor.rep@bf.uni-lj.si

University of Ljubljana, Biotechnical faculty, Department of Wood Science and Technology, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract: Thermal modification is one of environmentally friendly (non-biocidal) processes, developed in order to improve natural durability and dimensional stability of wood. Beside wood species mainly treatment time, temperature and atmosphere affect the product properties. In commercial thermal wood modification processes an inert atmosphere (nitrogen or steam), hot oil or vacuum has been used for the reduction of oxygen content in the reactor atmosphere. Recently, an original thermal treatment process with initial vacuum has been developed in our laboratory. In the present work, resistance of modified Norway spruce wood (*Picea abies*), beech wood (*Fagus silvatica*) and oak wood (*Quercus sp.*) against wood destroying fungi (*Gloeophyllum trabeum*, *Poria monticola*, *Deadelea quercina*), blue-stain fungi (*Aureobasidium pullulans*, *Schlerophoma pityophila*), the house longhorn beetle (*Hylotrupes bajulus*) and the yellownecked dry-wood termite (*Kaloterme flavicollis*) was determined. All tests were performed according to EN standard procedures, except the test with termites, where the Becker's compulsory feeding test was used. High resistance of modified wood against blue-stain fungi and the house longhorn beetle was observed, while improvement of the resistance against wood-destroying fungi and termites was limited. The results indicate that spruce wood thermally modified under described process parameters cannot be used in permanent liquid water and/or ground contact and areas, where termite attack is possible.

Key words: thermal wood modification, vacuum, durability, wood-destroying fungi, blue-stain fungi, *Hylotrupes bajulus*, *Kaloterme flavicollis*

**TRANSVERSE COMPRESSION BEHAVIOR OF
WOOD IN SATURATED STEAM**

Andreja KUTNAR, Frederick A. KAMKE
andreja.kutnar@iltra.si; andreja.kutnar@upr.si
Organization ILTRA d.o.o.; University of Primorska, PINT

Abstract: Hydrothermal treatment has a strong influence on the mechanical behavior of wood during compression/densification. Softening and degradation will occur depending on the conditions such as temperature, moisture, steam, and time. An increase of temperature or moisture content decreases the compressive modulus of wood. Densification of wood by compression requires that cell walls are in a rubbery phase in order to obtain the compression deformation by cell wall buckling without cell wall fractures. The compression behavior of wood at high temperature and pressurized steam environment has not been extensively studied. Therefore, the aim of this paper was to characterize the compressive behavior of wood in transverse compression in saturated steam from 150 to 170 °C. The study used hybrid poplar (*Populus deltoides* x *Populus trichocarpa*), which was obtained from a plantation certified by the Forest Stewardship Council in Northeast Oregon (GreenWood Resources, Boardman Oregon). The boards were cut from 11 years old logs with a diameter of 25 to 30 cm. The effect of the temperature on the stress-strain response, non-linear strain function, and relative density change was examined. Based on a modified Hooke's law, the compressive stress was modelled as a function of elastic modulus of cell wall substance and a non-linear strain function. For strain levels lower than 0.63 the results confirmed the assumption that the non-linear strain function only depends on the cellular structure of the wood and is independent of temperature and moisture. At higher strains differences in the non-linear strain function were assumed to be the consequence of thermal degradation reactions of some wood components during the compression process. Furthermore, it was found that the temperature and moisture content affected the compression modulus of wood as a result of change of the cell wall modulus. The results of this study have significant importance for production of densified wood as well as hot-pressing of wood-based composites.

Key words: Cell wall modulus, densification, wood modification, thermal treatment

ACTUAL DEVELOPMENTS OF THE WOOD PANELS INDUSTRY

Marius C. BARBU

marius.barbu@holz.uni-hamburg.de

“Transilvania” University of Brasov / University of Hamburg

Abstract: Current social and economic situation of the world has a direct impact on the forestry and wood industry. The forecasts for the next decades point out new centers of economic development, which will change the balance of today’s situation. The unprecedented demographic growth in Asia and the aging of the European population will also result in the occurrence of controversial scenarios for the whole region in terms of economical evolution. China and Russia seem to become the world leaders also for wood products and furniture manufacturing. The expansion of the European Community to 27 members opened up not only new perspectives, but also bring about completely new aspects, in spite the lack of previous experience and adequate regulations.

Wood markets and trade worldwide are changing rapidly because of the booming production capacities of the last decades, the new energy policy based on biomass, the increased demand for wood especially in Asia and Europe and of course the actual economical crises. A new development related to the energy production from biomass starts hardly to compete the raw material market for European wood based panel producers.

High productivities may be obtained by means of the new wood working technologies, with low raw material and power consumption. The new requirements for low emission panel products will increase the competition between the European producers. More than a half of the panel production capacity belongs to the top 10 of the European wood based panels producers. Also the environmental issues continue to differ from one country to on other and involve different investment levels and production costs having an immediate impact on market competitiveness.

Key words: world wood markets, wood based panels developments

**AN ENVIRONMENTALLY FRIENDLY ENGINEERED WOOD
PRODUCT FOR BUILDINGS: CROSS LAMINATED TIMBER**

Marius C. BARBU, Helmut SPIEHS, Christoph RICHTER

marius.barbu@holz.uni-hamburg.de

“Transilvania” University of Brasov / University of Hamburg

Abstract: The climate change step forwards inexorably. Many activities on national, as well as at the international level with regard to CO₂ saving, CO₂ storage and climate protection were lately initiated. Countries continued to sustain different opinions with regards on „climate goals” during the UN-climate summit of Copenhagen. These goals must be reached in a certain period. The minimum consensus of the climate summit is to limit the worldwide global warming to maximum two degrees centigrade in this century. Thus 27 states of the European Union agreed on the aim to reduce her CO₂ issues till 2020 by about 20 % towards the level of 1990. To reach this new given aims, the participant countries initiated different strategies regarding the climate protection and the achievement of the climate goals which are anchored legally. Thus the greenhouse gas issues should be lowered above all in the area of traffic, private households and agriculture clearly and the share of renewable energy should be increased. Also in the civil engineering the energy loss and the CO₂ output should be reduced. This can be achieved by using energy-efficient and carbon-efficient raw materials and products. Besides, the natural, with lasting effect grown and CO₂ neutral raw material and products, wood has in all his processing variations a prominent role. So renewable materials i.e. wood and timber based products will be used in future increasingly, because these are sustainable provide a positive energy and carbon balance. An example of such a sustainable building product is the cross laminated timber (X-lam), which on the one hand, fulfils all ecological advantages and on the other hand is a high-tech product which allows modern and economical buildings according to the new habitat and energy saving requirements.

Keywords: cross laminated timber, ecological building, CO₂ reduction

**CHANGING WOOD MARKETS - CHALLENGES
FOR THE TIMBER INDUSTRY**

Arno FRÜHWALD, Marius C. BARBU

marius.barbu@holz.uni-hamburg.de

“Transilvania” University of Brasov / University of Hamburg

Abstract: Wood markets in Europe are changing rapidly since the turn of the century because of the booming production capacities, the new EC energy policy, fuel price developments, international trade especially with Asia and increased demand for wood products in almost all European countries. Germany is a typical example for the developments on the wood markets in Europe: its market and production capacities in many fields are also among the biggest. The volume of harvested roundwood doubled during the last two decades, the consumption of logs for sawmill is twice bigger. In the wood based panels sector the request of wood raises by 50% and in pulp and paper industry by 30% (fresh wood fiber, the amount of recycled paper increased enormously). Energy generation from wood was also rapidly booming; it is estimated that almost 50% of fresh wood from forest and other sources outside the forest are converted into energy in combined heat and power plants and for domestic heating. National energy policies favour the energy generation from wood in all European countries called biomass or green energy. The EFSOS Study of UNECE (Geneva, 2005) predicts for 2020 a market growth in Western Europe less than 2% per year, in the Eastern part between 3 to 5% and in the CIS region up to 6%. European and Paneuropean wood products trade will increase further

Key words: EC wood markets, EC energy policy, wood products consumption

ENVIRONMENTAL IMPACT OF THE WOOD BASED PANELS INDUSTRY

Marius C. BARBU, Martin STEINWENDER

marius.barbu@holz.uni-hamburg.de

“Transilvania” University of Brasov / University of Hamburg

Abstract: In the last few years the production of wood panels and in particular of MDF, PB and OSB went through a dramatic growth period worldwide. The rapidly increasing production capacities forced a dynamic mechanization and automation of this industrial sector. The environmental aspects of this development have just recently become in the focus of public interest due to increasing environmental requirements. In the past different technologies to reduce environmental impact have been developed, while due to the practical experiences only some of them can be stated as “state of the art”. The regulations for air emissions in Central European countries required the conception of a new treatment plant, which established a new state of the art in the environmental technology. For the production of PB the wet electrostatic precipitator has been recognised to be the most effective system in terms of investment as well as running costs and also in terms of environmental benefits for the cleaning of the gas coming from direct fired driers. For MDF factories it was possible to combine the advantages of known technologies for waste air and water and to develop them further firstly to a pilot plant and later to the state of the art. This new system completely closed all water cycles of the production site and minimized the exhaust of air pollutants. During more than five years operation this system clearly proved its economical and technical advantages. The development of this treatment plant prevailed new experiences and know-how, which are very helpful for the design and optimization of new equipment generation for reducing the environmental impact of the wood based panels industry.

Keywords: wood based panels, waste water and air cleaning, environment

WOOD SCIENCE EDUCATION IN EASTERN EUROPE

Marius C. BARBU, Peter NIEMZ
cmbarbu@unitbv.ro
“Transilvania” University of Brasov

Abstract: The former regions of the Austrian-Hungarian Empire hold a tradition of more than 120 years of higher education in forest science, including wood processing. After 2nd WW, with all the political changes and separation from Central Europe, each country established a Faculty of Forestry, including wood processing technologies. Departments of wood science were also included, which allowed educating the first generations of wood engineers, specialists in processing technology and furniture manufacturing, all following five year diploma programs. Some of these forestry and wood science faculties also established state research centers for forest management, harvest and transportation, primary processing of wood, and furniture manufacturing. The socialist states built a number of wood processing centers, which covered the entire processing line from logs to timber, boards and finally half-products and furniture. The demand for highly qualified engineers between the 70ies and the 90ies was enormous and more than 100 students graduated each year from the study program. Higher education in wood processing included anatomy and chemistry of wood, physics and mechanical processing of wood, chemical processing, adhesives, wood preservation, panels and half-products technologies, furniture design and manufacturing, wood finishing and marketing.

After the political reforms in 1989 with all the economic changes, the large integrated production centers were not able to survive. The pressure from western countries was high and resulted in a decline of the paper and wood processing industries. Better paid jobs in other sectors had a major impact on quality and number of students. The effects of these developments during the past two decades have been dramatic for the wood-based industries. Imports from multinational corporations, combined with low exports of own products and furniture at low margins impacted the industry. Many of the traditional production centers had to close. The number of students and faculty reduced to one half; governmental support declined. Political changes during the past decade, and the expansion of the European Community improved the situation, as foreign companies invested modern processing facilities and created new jobs. The impact of the Bologna agreement required continued reformation of the state institutions, and the quick preparation for the job market requires highly motivated students.

Key words: Eastern Europe, Curricula, Political change, Wood processing, Forestry

**SCIENCE AND WOOD BASED PANELS: AN INTERDISCIPLINARY
APPROACH**

Manfred DUNKY

Manfred.dunky@gmx.at

Institute of Wood Science and Technology, University of Natural
Resources and Applied Life Sciences, Vienna, Austria

Abstract: The production of wood based panels needs input based on the knowledge and experience of various sciences, like wood anatomy, wood physics, wood technology, wood chemistry, chemistry of adhesives and processing technology, as well as ecological and economical sciences. Only such an interdisciplinary approach of the influence of the various individual sciences can describe and optimize wood based panels in their entirety and guarantee their best possible performance. This is also based on the fact that the quality of bonding and hence the properties and the performance of the panels are determined by the three main parameters (i) wood (especially wood surface, including the interface between the wood surface and the bond line), (ii) the applied adhesive, and (iii) the working conditions and process parameters. Bonding of wood also is often described as a chain of several links, comprising wood, wood surface and its boundary layer, interphase of wood and adhesive and interface between wood and adhesive, and the adhesive bond line itself.

The close contact and cooperation of the various fields of science as performed for decades will certainly continue in order to guarantee the best possible success of this industry and to strengthen its future in technical, chemical, ecological, and economic views. The examples, which will be demonstrated within this key note should also show the great influence of scientific efforts and results on the welfare of this industry and shall stimulate even further and deeper cooperation between science and industry on the one hand and the interdisciplinary mode within the scientific world on the other.

Key words: wood based panels, forestry, wood sciences and technology, chemical sciences, ecology and economy

**OPEN WOODLANDS THROUGH PASTURE: GENESIS, RELEVANCE
AS BIOTOPES, VALUE IN THE LANDSCAPE AND IN NATURE
CONSERVATION IN SOUTHWEST-GERMANY**

MATTIAS RUPP

mattias.rupp@landespflege.uni-freiburg.de

Albert-Ludwigs-Universität Freiburg, Germany; Institution
for Landscape Management

Abstract: Open woodlands through pasture (owp) play an important role as a landscape component rich in ecotones and biodiversity, but slowly vanishing due to intensified or abandoned land use and forestry. Pasture with livestock can sustain the open character, but wood pasture has been banned in Germany for 176 years. In the project “Open woodlands through pasture” the spatial dispersal, genesis, local diversity in plants and surface structures and the socio-economic situation of still existing and lately initiated owp's are examined. Main objectives are to find out, whether wood pasture can support the demands towards protection and sustainable use of biodiversity. The research connects socio-empiric and field methods. The frequency analysis is applied using frames (1 m^2) which are put into the owp's as well as in the adjacent non-pasture woodland. In these frames all plant species are recorded and afterwards statistically compared. Additionally, vegetation and surface structures are registered in 2500 m^2 plots. Ensuing, specific structural elements are recorded along 2 transects crossing each square using the step-point method. Through interviews with farmers and members of the forestry and nature conservation managements, different pasture and management systems can be identified. First results show multiple use of recent wood pasture, successful if done together with the forestry administration, supporting the appropriate herding of livestock. The flora reflects the mechanical influences and leads to a species composition in the herb layer. Plant diversity nearly triples, the richness of surface structures increases and habitat qualities that accumulate inside the pasture woodland are initiated.

Key words: Biodiversity, structural diversity, open woodlands, wood pasture, frequency analysis, disturbance hypothesis

**SOME TECHNOLOGICAL PROPERTIES OF ORIENTAL
BEECH (*Fagus orientalis* Lipsky.) WOOD GROWN
IN THE ARTVIN REGION IN TURKEY**

Abdulkadir MALKOÇOĞLU*, Nurgül AY*, Elif TOPALOĞLU*
kmalkoc@ktu.edu.tr

* Karadeniz Technical University, Faculty of Forestry, Department
of Forest Industry Engineering 61080 / Trabzon – Turkey

Abstract: In this study, some physical and mechanical properties of naturally grown Oriental beech (*Fagus orientalis* Lipsk) in the Borçka/Artvin in the Eastern Black Sea Region of Turkey were investigated. The experiments were carried out on the test specimens obtained from randomly selected 5 sample trees taken from that region, according to the relevant Turkish standards.

According to the results, density values of air and oven dry, volume density value, compression strength parallel to the grain, static bending strength and modulus of elasticity, impact bending, tensile strength parallel to grain, tangential and radial direction tensile strength perpendicular to grain, tangential and radial direction cleavage strength perpendicular to grain, tangential and radial direction shear strength parallel to grain, values of Brinell-hardness in transversal, tangential and radial sections were 0.584 gr/cm³ and 0.610 gr/cm³, 0.493 gr/cm³, 501 kp/cm², 1024 kp/cm², 115730 kp/cm², 82 kp/cm², 1152 kp/cm², 35.50 kp/cm² and 33.29 kp/cm², 9.94 kp/cm² and 7.7 kp/cm², 91 kp/cm² and 87 kp/cm², 4.52 kp/mm², 2.52 kp/mm² and 2.33 kp/mm², respectively.

Usually, Oriental beech showed lower technical properties. It can be related to growth conditions. Especially, high altitude of this region is an important factor.

Key words: Beech wood, physical properties, mechanical properties

DIMENSIONAL STABILITY OF PARTICLEBOARDS

Sergej MEDVED¹, Milanka ĐIPOROVIĆ-MOMČILOVIĆ,
Mladen POPOVIĆ, Alan ANTONOVIĆ, Vladimir JAMBREKOVIĆ
sergej.medved@bf.uni-lj.si

¹ University of Ljubljana, Biotechnical faculty,

Department of wood science and technology, Slovenia

Faculty of Forestry, University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: When exposed to water or moist environment particleboards tend to swell and expand in all directions. The most visible is swelling in thickness that is higher than horizontal expansion. Thickness swelling of particleboards is influenced by many factors. Among the most important are raw material used, type and share of adhesive used and density of the produced boards. The purpose of this paper is to present the impact of wood species used, share of adhesive and board density on thickness swelling after 24-hour immersion in water. Several three-layer and single-layer particleboards bonded with urea-formaldehyde adhesive were made in laboratory conditions where wood species (three-layer made from spruce, beech, oak and poplar particles), resin content (three-layer, core layer: 6 to 9%; surface layer: 10 to 13%) and density of board (single-layer with density between 0.7 and 1.0 g/cm^3) were altered. In boards where resin content and density was altered industry made particles were used. Thickness swelling was determined with 24-hour immersion test. It was determined that the highest swelling was determined when beech particles were used, and the lowest when oak and spruce particles were used. The biggest changes in swelling and pressure were observed when the resin content was changed in the core layer. The swelling was also influenced by the density of boards. It was determined that the highest swelling was observed in boards with the highest density.

Key words: particleboard, thickness swelling, wood species, resin content, density

**PAULOWNIA ELONGATA S. Y. HU - ANATOMICAL AND
CHEMICAL PROPERTIES OF WOOD FIBERS**

Jasmina POPOVIĆ, Gordana RADOŠEVIĆ

jasmina.popovic@sfb.rs

Faculty of Forestry, Kneza Višeslava 1 , Belgrade/Serbia

Abstract: Shortage of wood raw material strengthens the ever growing interest for the cultivation of fast growing species in short rotation plantations. In recent years in the whole world species of the Paulownia genus have been drawing a lot of attention. Paulownia elongata S.Y.Hu was introduced into Serbia from tissue culture and it is cultivated on a sample plot in the vicinity of Bela Crkva. This paper presents the results of the research of both anatomy and chemical constitution of the species Paulownia elongata S.Y.H, aged 11 years, from the area of Bela Crkva in the aim of getting an insight into the quality characteristics of wood and its applicability as a raw material in the wood processing industry.

Key words: Paulownia elongata, growth rings, wood fibers, lignin, cellulose, extractives

**SOME PROPERTIES OF POLYPROPYLENE-WOOD
COMPOSITES PRODUCED BY DIFFERENT
PROCEDURES**

Milanka ĐIPOROVIĆ-MOMČILOVIĆ¹, Sergej MEDVED²,
Ivana GAVRILOVIĆ-GRMUŠA¹, Mladjan POPOVIĆ¹, Jasmina POPOVIĆ¹
milanka.djiporovic@sfb.rs

¹ Faculty of Forestry, University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia

² University of Ljubljana, Biotechnical faculty,
Department of wood science and technology, Slovenia

Abstract: Properties of wood plastic composites largely depend on mass ratio and chemical composition of individual components, as well as on the mixing methods and mixing sequence of the components. Significantly higher values of the properties of polypropylene - wood flour (PP-WFlo) composites indicated that two-step procedure of the composite preparation is more favorable. Maleic anhydride (MA) in the form of maleated polypropylene (MAPP) was frequently used as a coupling agent for the production of PP-WFlo composites. It was found, that MA reliably improves adhesion at the wood - polypropylene interface, thus creating composites with better mechanical properties. The achievement of effective coupling action already at 1.7 % - 2% of MA addition, together with its favorable accessibility and relatively low price, recommend it for this purpose. However, the addition of MA, at the same time reduced impact resistance of the resulting composites. This study was conducted to examine the influence of MgO addition (1% and 2%, by mass of composite) on the impact resistance, tensile strength, elongation, modulus of elasticity of PP-WFlo composites made with the MAPP coupling agent. Matrix to filler mass ratio of above mentioned composites was 50: 50 (PP vs. beech WFlo). It was found that addition of MgO created better conditions for the coupling action and for improved adhesive bonding between PP matrix and wood filler and improved, tensile strength and impact resistance of composites. Also it was found, that MgO addition of 1% is optimal in composite. At the same time, the effects of isobutyl caoutchouc (i.e. isobutene-isoprene-copolymer, IBC) on some mechanical properties were studied, too. The results indicated that addition of IBC at 12% by mass of composite increased Izod impact resistance, while somewhat decreased tensile strength and modulus of elasticity of composite filled with 40% of beech WFlo and fiber (WFib) in this case. The addition of MAPP or amido-acrylic acid (AMACA) as a coupling agents however, improved both tensile strength and IZOD impact resistance of such composites.

Key words: wood plastic composites, polypropylene matrix, coupling agents, beech wood fillers, properties

**BENDING STRENGTH AND MODULUS OF ELASTICITY
OF THERMALLY MODIFIED BEECH WOOD**

Nebojša TODOROVIĆ, Ranko POPADIĆ, Zdravko POPOVIĆ, Uroš ĐUKIĆ

nebojsa.todorovic@sfb.rs

Faculty of Forestry, Kneza Višeslava 1 , Belgrade/Serbia

Abstract: The process of thermal modification leads to increase of dimensional stability and biological resistance of wood, but also reduces its mechanical properties. This paper presents the results of the effects of high temperature treatment on mechanical properties of beech wood: bending strength (modulus of rupture – MOR) and modulus of elasticity (MOE). The samples were divided into two groups: sapwood and red heartwood. Both groups contain the control (untreated) and heat-treated samples. For this study samples were treated at a temperature of 190 °C for 4 hours. This regime was selected as the most frequently used in industrial plants for thermal modification of hardwood tree species in Serbia. The results show the level of reduction of the properties of heat-treated beech wood, but also the possibility of equal application of thermally modified red hardwood, thus greatly increasing the value of these cheap assortments.

Key words: thermal modification, beech, bending strength, modulus of elasticity

**CHARACTERIZATION OF WOOD BASED PANELS WITH
SUB-MICRON COMPUTED TOMOGRAPHY**

Gernot STANDFEST, Bernhard PLANK,
Alexander PETUTSCHNIGG, Manfred DUNKY
gernot.standfest@fh-salzburg.ac.at

Salzburg University of Applied Sciences, Markt136a, 5431 Kuchl, Austria

Abstract: The microstructure of different wood based panels has attracted much interest, because it determines most of the properties during production as well as during the use of this type of board. A non-destructive method, sub-micrometer computed tomography (sub- μm -CT), was used in order to achieve threedimensional image stacks of the panels investigated, specifically from oriented strand board (OSB), particleboard (PB) and medium density fiberboard (MDF). One of the biggest challenges was the sample size and with this the maximum achievable resolution. The different sizes of the structuring elements in the three panel types (strands, chips, fibers) request different representative sample sizes. Also the presence of different densities (for example earlywood and latewood in strands and particles) makes an exact image segmentation complex. The reconstructed images from the CT data then enable both, qualitative and quantitative characterization of wood materials and the reconstruction of volume models. The data obtained can be used for analyzing the structure of the panels. Additionally, the virtual data enable splitting of the existing sub-volumes in the samples into smaller and representative sub-volumes without destroying their edges by mechanical cutting forces. With operations from mathematical morphology and image analysis information on the distribution of voids can be obtained. Resulting distributions were found to follow Γ -law which was confirmed using the maximum likelihood estimation. Eventually the results of such analysis enable to find correlations between e.g. physical properties and properties related to the pore structure.

Key words: 3D, Computed Tomography, Image Analysis, Wood based panels

**COMPRESSIVE STRENGTH AND BRINELL'S HARDNESS
OF THERMALLY MODIFIED BEECH WOOD**

Nebojša TODOROVIĆ, Ranko POPADIĆ, Zdravko POPOVIĆ, Uroš ĐUKIĆ
nebojsa.todorovic@sfb.rs
Faculty of Forestry, Kneza Višeslava 1, Belgrade/Serbia

Abstract: Beech wood is characterized by the presence of red heartwood. Lumber from this part of the trunk has a lower value on the market. Increasing the value of beech products, primarily from red heartwood, can be achieved through the process of thermal modification. This paper presents the testing results of compressive strength parallel to the grain and Brinell's hardness of thermally modified beech wood. Testing samples are made from sapwood and red heartwood and treated at a temperature of 190°C for a period of 4 hours. The results show the level of reductions of compressive strength and Brinell's hardness by thermal modifications, but also the possibility of application of thermally modified beech wood from red heartwood, which significantly increases the value of these cheap products.

Key words: thermal modification, beech, compressive strength, Brinell's hardness

**INFLUENCE OF THERMAL TREATMENTS ON WETTABILITY
AND WATER SPREAD ON THE SURFACE OF POPLAR VENEER**

Vladislav ZDRAVKOVIĆ, Aleksandar LOVRIĆ
vladislav.zdravkovic@sfb.rs
Faculty of Forestry, Kneza Višeslava 1, Belgrade/Serbia

Abstract: In the paper results of the influence of thermal modification on water spreading on the surface of poplar veneer are presented. Samples of veneer are thermally treated on 180°C, 190°C, 200°C, 210°C and 220°C, with the time of every treatment varied from one half to three hours. Five drops of water, using the pipette, were dropped on the prepared material every 10s. The influence of the thermal treatment was determined through the wetting angle changes and changes in the spreading surface during the proposed time. Results show that with the increase in temperature and treatment duration, wetting of the treated material decreases.

Key words: thermal modification, wettability, spreading surface, poplar veneer

**INVESTIGATION INTO THE COMBUSTION PROPERTIES OF
BRIQUETTES PRODUCED FROM TRIPLOCHITON SCLEROXY-
LON, TERMINALIA SUPERBA AND AFEZILIA AFRICANA**

I.A Adegoke, S.O Badejo, R.A Baiyewu, K.S. Aina, B. O. Fatade
adegokeabimbola4u@yahoo.com
Forestry Research Institute of Nigeria, Forestry Research
Institute of Nigeria, p.mb. 5054, Jericho Ibadan , Nigeria

Abstract: This study investigated the combustion related properties of briquettes for energy generation. Wood briquettes were successfully produced from air-dried sawdust of three wood species (*Terminalia superba*, *Triplochiton scleroxylon* and *Azelia Africana*) that were collected from Forestry Research Institute of Nigeria (FRIN) sawmill. The briquettes were produced at 66% weight of binder to wood. Combustion related properties of the briquettes: heating value, water boiling test, the percentage of volatile matter, the percentage of ash content and the percentage of fixed carbon were determined. The results show that briquettes made from *Afezila africana* boiled water faster than others as the result ranged from 3:59 *min:sec* for *Afezila africana* to 5.02 *min:sec* for *Triplochiton scleroxylon* . Briquettes produced from *Afezila africana* have the highest calorific value of 32268.50 *kcal/kg* followed by *Terminalia superba* with 26267.16 *kcal/kg* while *Triplochiton scleroxylon* has the least calorific value. The analysis of variance showed that there was significant difference in % fixed carbon, % ash content and the heat of combustion. The use of wood residue for briquette production should be encouraged as this would provide employment for the people and reduce deforestation by optimizing the efficient use of exploited trees.

Key words: Briquette, wood residue, calorific value, combustion properties, Binder

**NECESSARY CHANGES IN APPROACH FOR TECHNOLOGY
SELECTION IN WOOD PROCESSING INDUSTRY IN SERBIA**

Milan NEŠIĆ, Branko GLAVONJIĆ, Dragoljub IVKOVIĆ, Marija NEŠIĆ
nesicmilan@yahoo.com

University of Belgrade, Faculty of Forestry, Kneza Višeslava 1, Belgrade, Serbia

Abstract: Serbian wood processing industry has not invested enough in its technology base yet, to be competitive. The aim of this study is to determine the reasons for the low capital expenditure and investments in research and development in this area of production. The paper also includes data about the directions for changes in the approach for technology selection. The role of management in business is particularly analyzed. Management did not sufficiently contribute to the necessary investments in the equipment. The results showed that technology selection is a process of complex decision making. This decision should be based not only on the present value of the technology, but should take into account the effects of technology on production goals, the labor and the environment.

Key words: technology, selection, competitiveness, management, environment

POSSIBLE APPLICATION OF CHP IN THE WOOD INDUSTRY IN SERBIA

Mladen FURTULA, Gardimir DANON

mladen.furtula@sfb.rs

University of Belgrade, Faculty of Forestry, Wood Processing, Kneza Višeslava 1, Belgrade, Serbia

Abstract: Electric power production in enterprises in the wood industry using the rest of the wood has several advantages. The first reason is the economic profit which is reflected through a positive difference in the price between the electricity which is produced and provided to the distribution network and the one of which used from the network for their needs. The second reason is energetic independence in critical situations, the stability of its own production and efficiency of use of available wood resources. The third reason is that it contributes to better reputation of the company itself and the timber industry as producers of energy from renewable and environmentally friendly energy sources. With all the above stated it is necessary to analyze the applicability of use of the combined production of heat and electricity. First of all, to analyze capacities of enterprises, followed by the analysis of time-fuel supply and the need to produce heat and electricity, and finally economic viability or profitability threshold of introducing cogeneration.

Key words: wood residues, heat, electric power, cogeneration

**WOOD STRUCTURES AS CONSTRUCTION ELEMENTS
IN LANDSCAPE ARCHITECTURE**

T. KOCETOV-MISULIC, K. HIEL, R. STULIC

tanya@uns.ac.rs

Faculty of Technical Sciences, Novi Sad ; Trg Dositeja Obradovica 6, Serbia, Novi Sad

Abstract: Materialization of architectural and building assemblies in landscape architecture is most often based on a combination of wood with other traditional building materials. Forms of wooden structures may easily fit into landscapes and probably produce the most beautiful effects, because of its origin and nature, as well as its global properties.

In this paper, examples of various functions and forms of wooden assemblies from elements of urban furniture to different park structures up to architectural and civil engineering structures will be analyzed. The main criteria of this analysis are based on the wood and wood-based products as primary material of the assembly, as well as the obtained geometric forms being dependent on different structural systems.

Key words: wood, landscape architecture, geometric forms, construction

FUNDAMENTALS OF TESTING OF FUNGAL PHYSIOLOGICAL REQUIREMENTS

Milenko MIRIĆ, Snežana IVKOVIĆ
milenko.miric@sfb.rs

University in Belgrade, Forestry faculty, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: The essential fungal requirements for growth besides the water, as a medium in which all metabolic processes are performing, are appropriate temperature, pH of substrate and available sources of basic nutrients. Investigation of impact of these factors should be methodically established very carefully in order that gained results could be useful for further research of bioecological characteristics of certain fungi. That is why it is necessary that investigation methods have to be very precise and carefully performed. The optimal temperature for the growth of mycelia should be performed in standard Petri dishes containing i.e. 2 % Malt / 2 % Agar. This relatively simple test should show results which one must respect for certain strain, using its own optimal temperature for each fungi in different tests. If one intended to compare results gained for different strains, than each single fungi has to grow on its' optimal temperature, but not on standard 21 °C. The concentration of H⁺ ions in nutritive media is of extraordinary significance for fungal growth and all other metabolic activities, such as consumption of nutrients or decomposition of substrate. The test has to be run with unbuffered media to define the impact of the fungus on the changes of initial pH value of liquid media during the test, while the test with buffered media should show the influence of stabile pH value of substrate on the fungal growth. Nutritional requirements should be the most correctly investigated in liquid media as the convenient one for measuring of mycelial mass yielded after i. e. 30, 60 and 90 days of incubation. The basal media should contain: glucose, L – glutamic acid, KH₂PO₄, MgSO₄, CaSO₄, solution of oligoelements: B, Mn, Zn, Cu, Mo, Thiamine – HCl and Fe – EDTA in distilled water solution. Certain substances which provide necessary amount of carbon, nitrogen and phosphorus, as the most important elements for fungal growth, should be excluded from the test – series and substituted with tested substances – sources of certain nutrients. In C – test necessary quantity of nitrogen in basal media should be provided by L – glutamic acid, while in N – test the necessary quantity of carbon should provide glucose. The appropriate quantities of tested sources of nutrients should be calculated based on molecular and atomic weights of substances and elements, so that in all test – series exactly the same concentration of nutritive elements should be provided. Using the prescribed model, one could gain very useful and correct results, which is exactly the main target of any scientific investigation. Original methods are described precisely in the article itself with the aim to be helpful to researchers.

Key words: fungi, nutrients, physiology, method, pH, temperature, carbon, nitrogen, phosphorus.

**DETERIORATION OF WOOD TISSUE DUE TO
IMPACT OF DECAYING BASIDIOMYCETES**

Milenko MIRIĆ, Snežana IVKOVIĆ

milenko.miric@sfb.rs

University in Belgrade, Forestry faculty, Kneza Višeslava 1, 11030 Belgrade, Serbia

Abstract: Deterioration of wood tissue due to the impact of decaying Basidiomycetes has been investigated on Oak wood samples by estimating mass loss due to the impact of some steroid fungi (*Stereum hirsutum*, *Chondrostereum purpureum*, *Stereum rugosum* and *Xylobolus frustulatus*) occurring most frequently on oak wood, as well as by using sophisticated technique of microscopic analysis. This unique technique provides the fixation of all part of tissue or its content regardless to their delicate structure i.e. fungal hyphens in plant vessels or cell – lumens, and stability of their positions and dimensions. On the other hand, by using specific reagent in combination with different types of light (provided by universal microscope with blue illumination, cross filter for lengths of 450 – 490 nm, chromatic diffusion lenses FT 510 and filter LP 520) different parts of tissue show different colors. Samples of plant parts have to be fixed in 4% buffered Formol during 24 hours in order to prevent the collapsing of soft elements. Drying in Ethanol, than goes step by step, starting with 10%, ranging for each from 10% up to 96%. Exposition in each concentration use was 15 minutes. Dried samples were then impregnated with solution 2 – hidroxiethyl – metacrilate (HEMA, Glycol – metacrilate) for 3 days. Fully saturated samples were transferred into the special Teflon forms and flooded into a mixture of HEMA and the strengthener in the ratio 15: 1. Polymerization at room temperature finished after 60 minutes. Plasticized wooden blocks were fixed on plastic holders and prepared for cutting on a rotating microtome – knife. Micro preparations should be 5 µm thick. In order to get plain surfaces they should be flooded in distilled water, positioned on the glass without any adhesive and dried on the hot plate at 30 °C. Staining was performed with Giemza – and Acridin orange. For permanent preparations covering glasses should be fixed by special Eukitt glue. By changing conditions of observations and analyzing of micro preparations (type of light, filters and reagents) greater number of data could be gained. One single detail in preparation could be observed in an unlimited number of combinations of colors in certain parts of plant tissue. All deformations could be more clearly visible if preparing micro preparations of plant tissue using this recommended method. Inbuilt camera provides recording directly from micro preparations in order to save some discovered phenomena. Results of observations for the tested fungi show the progress, intensity and chronology of deterioration of different Oak wood anatomical elements and they are clearly emphasized in the article.

Key words: Basidiomycetes, anatomical changes, wood decay, *Stereum hirsutum*, *Chondrostereum purpureum*, *Stereum rugosum*, *Xylobolus frustulatus*

**PERFORMANCE OF COPPER-ETHANOLAMINE
BASED PRESERVATIVES**

Miha HUMAR^{1*}, Boštjan LESAR¹, Franc POHLEVEN¹

* miha@bf.uni-lj.si

¹ University of Ljubljana, Biotechnical faculty, Department of Wood Science and Technology, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract: Copper based wood preservatives are one of the most important solutions for protection of wood in outdoors applications. However, there was significant change in the past years. Copper-ethanolamine based preservatives successfully replaced classical copper-chromium based preservative solutions. Copper compounds have fungicidal role, while ethanolamine enables fixation of copper ingredients in wood. Besides these two compounds, there are other ingredients present as well, namely: co-biocides and water repellents. In order to elucidate performance of copper-ethanolamine treated wood, leaching studies (ENV 1250), fungicidal testing (EN 113) and field testing (TS CEN/TS 12037) was performed. The results showed, that addition of ethanolamine significantly improved copper fixation, but on the other hand addition of co-biocides negatively influenced copper fixation. Those ingredients are on the other hand essential to achieve sufficient efficacy against wood decay fungi. This was evident during laboratory testing as well as during five year field test trial.

Key words: wood preservation, copper based preservatives, amines, ethanolamine, fixation, leaching, fungicidal properties

**PERFORMANCE OF COPPER-ETHANOLAMINE
BASED PRESERVATIVES**

Miha HUMAR^{1*}, Boštjan LESAR¹, Franc POHLEVEN¹

* miha@bf.uni-lj.si

¹ University of Ljubljana, Biotechnical faculty, Department of Wood Science and Technology, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract: Copper based wood preservatives are one of the most important solutions for protection of wood in outdoors applications. However, there was significant change in the past years. Copper-ethanolamine based preservatives successfully replaced classical copper-chromium based preservative solutions. Copper compounds have fungicidal role, while ethanolamine enables fixation of copper ingredients in wood. Besides these two compounds, there are other ingredients present as well, namely: co-biocides and water repellents. In order to elucidate performance of copper-ethanolamine treated wood, leaching studies (ENV 1250), fungicidal testing (EN 113) and field testing (TS CEN/TS 12037) was performed. The results showed, that addition of ethanolamine significantly improved copper fixation, but on the other hand addition of co-biocides negatively influenced copper fixation. Those ingredients are on the other hand essential to achieve sufficient efficacy against wood decay fungi. This was evident during laboratory testing as well as during five year field test trial.

Key words: wood preservation, copper based preservatives, amines, ethanolamine, fixation, leaching, fungicidal properties