75 YEARS

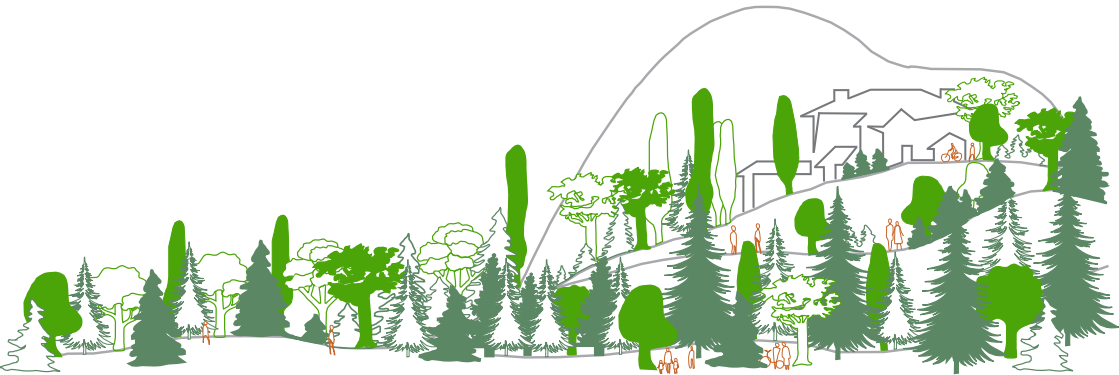
International Conference
on the occasion of the 75th Anniversary
of the University of Sarajevo - Faculty of Forestry

Sarajevo, December 1st, 2023

BOOK OF ABSTRACTS

Sustainable Legacy: Education, Research and Perspectives in Forestry and Urban Greenery

Sarajevo 2023



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Sustainable Legacy: Education, Research and Perspectives in Forestry and Urban Greenery

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International Conference on the occasion of the 75th Anniversary of the University of Sarajevo - Faculty of Forestry
Sustainable Legacy: Education, Research and Perspectives in Forestry and Urban Greenery

The authors are fully responsible for the content of their abstracts included in the Book of Abstracts published by the University of Sarajevo - Faculty of Forestry.

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Preface

Welcome to the book of abstracts for the international conference, "Sustainable Legacy: Education, Research, and Perspectives in Forestry and Urban Greenery." From a scientific, national, international and social standpoint, this conference is extremely important since it offers a special forum for the exchange of cutting-edge information and research in the domains of forestry and urban greenery. The University of Sarajevo's Faculty of Forestry is celebrating its 75th anniversary of founding and devotion and this conference is a significant occasion. By organizing this international gathering, the Faculty emphasizes the critical role of sustainable forestry and green urban areas in ecological well-being, economic growth, and societal resilience. Bringing together researchers, academicians and experts the conference facilitates discussions on strategies, policies, and best practices for enhancing forest resources and urban green spaces at the national level. It acts as a catalyst for the development and implementation of sustainable practices in forest management, urban planning and green infrastructure. The diverse focus areas include education, research, and perspectives in forestry, as well as in urban greenery. Targeting scientists, professionals, decision-makers, and stakeholders the conference aims to create a common understanding, fostering collaboration for the development of holistic, context-specific solutions that can be applied globally.

This book of abstracts provides insights into the historical development and showcases the expertise and contributions of key chairs within the University of Sarajevo - Faculty of Forestry. Each chair has played a significant role in shaping the scientific disciplines and knowledge related to forestry and urban ecosystems in Bosnia and Herzegovina. These chairs

have been integral in advancing education, research, and professional activities, contributing to the evolution of forestry as a vital economic sector in Bosnia and Herzegovina. As you delve into the abstracts presented in this book, you will gain a comprehensive understanding of the Faculty's contributions to forestry science, ecological conservation, and the sustainable development of urban environments. The conference's collective efforts, fuelled by international networking and collaboration aim to shape a sustainable and resilient future for forests and urban areas.

We extend our gratitude to the organizers, participants and contributors for their dedication to advancing knowledge and fostering collaboration in the pursuit of a sustainable legacy in forestry and urban greenery. May this conference and its abstracts inspire further research, dialogue and action toward a greener and more sustainable world.

Editors

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HISTORICAL DEVELOPMENT, EDUCATION, RESEARCH AND PERSPECTIVES – CHAIR FOR FOREST MANAGEMENT AND URBAN GREENERY

Aida Ibrahimspahić[1]*, Besim Balić[1], Azra Čabaravdić[1], Ahmet Lojo[1], Admir Avdagić[1], Ismet Fazlić[1]

Abstract

This paper presents the historical development of the Chair of Forest management and urban greenery from its inception to the present day, the structure of teaching subjects by departments and study cycles, a list of teaching and non-teaching staff who have been permanently or temporarily employed or are still employed at the Chair, and the most important bibliographic data from published research results conducted at the Faculty of Forestry, University of Sarajevo, in the field of forest management. The purpose of this paper is to familiarize the wider scientific and professional community more familiar with the activities of the Chair members from its inception to the present day, with a special emphasis on the most important steps forward that have had a significant impact on the development of forestry as an economic branch and the broader field of forest management in Bosnia and Herzegovina. This especially applies to the results of older research findings that were published in local journals and are generally not known and unavailable to the larger professional community. Some of these findings are still used today, or

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recent research relies on them, the good and negative aspects of these researches are analyzed, corrected and augmented through the use of modern data collection and analysis methods. The paper also presents the most significant changes that occurred in the teaching process, such as the introduction of new teaching disciplines and the updating the existing ones, to deliver the most efficient solutions to the requirements of practical forest management.

Keywords: Chair of Forest management and urban greenery, Field of forest management, Historical development, Production and structural characteristics of forests.

HISTORICAL DEVELOPMENT, EDUCATION, RESEARCH AND PERSPECTIVES - CHAIR OF SILVICULTURE AND URBAN GREENERY

Dalibor Ballian[1]*, Sead Ivojević[1], Mirzeta Memišević Hodžić[1], Mehmed Čilaš[1], Ćemal Višnjić[1]

Abstract

The Chair of Silviculture and Urban Greenery an organizational unit of the Faculty of Forestry at the University of Sarajevo, is dedicated to excellence in both education and scientific research. Our focus encompasses silvicultural systems, natural and artificial regeneration, forest genetics, and urban greenery. Informed by natural processes our Chair plays important role in shaping decisions related to forest management. We are dedicated to exploring the complexities of old growth forests, emphasizing biological and genetic diversity. Furthermore, our interest extends to the dynamic realm of urban greenery. Through its history, the Chair has undergone transformative phases, culminating in its nomenclature established in 1996. At present our Chair comprises five accomplished professionals - a distinguished academician, full professor, associate professor, senior Ph.D. assistant and a dedicated assistant. The Chair of Silviculture and Urban Greenery is organized into two distinct scientific fields. One field concentrates on forest seed collection, forest

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nurseries, reforestation (both natural and artificial) and various silvicultural systems. Simultaneously, the second field deals with forest genetics. Both scientific fields converge to address the multifaceted aspects of urban greenery.

Driven by a clear mission, our Chair is resolute in its commitment to educating students and advancing scientific knowledge. This dedication is evident from our efforts ranging from writing textbooks to publishing impactful scientific papers. In alignment with our vision for the future, we actively monitor scientific trends in the field of silviculture and forest genetics globally, implementing these insights at the Faculty to stay at the forefront of academic excellence.

Keywords: University of Sarajevo, Faculty of Forestry, Chair of Silviculture and Urban Greenery.

HISTORICAL DEVELOPMENT, EDUCATION, RESEARCH AND PERSPECTIVES - CHAIR FOR FOREST UTILIZATION, PLANNING AND BUILDING IN FORESTRY AND HORTICULTURE

Jusuf Musić[1]*, Dževada Sokolović[1], Muhamed Bajrić[1], Velid Halilović[1], Dino Hadžidervišagić[1], Jelena Knežević[1], Amina Karišik[1]

Abstract

The Chair for Forest Utilization, Planning and Building in Forestry and Horticulture as an integral organizational unit within the University of Sarajevo - Faculty of Forestry serves as a hub for educational, research and professional activities. It focuses on various aspects including the significance and prospects of forest utilization, soil erosion and flash floods and their mitigation methods, development of crucial machines for mechanized work in forestry and horticulture, anatomical structure, technical properties and use of wood, as well as planning and projecting forest communications and projecting urban greenery projects. This paper presents an overview of Chair's historical development, highlighting key research results that have shaped forestry science and the profession in Bosnia and Herzegovina. Additionally, it provides a comprehensive list of the Chair's members from its existence, along the most important bibliographic data created as a result

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of their research work. The primary objective is to inform the scientific, professional and general communities about Chair's contributions, instrumental in improving forestry as vital economic sector in Bosnia and Herzegovina. Furthermore, the paper outlines the current structure of teaching courses by departments and study cycles at the Faculty and the most important changes in curricula to integrate new disciplines and update existing ones in alignment with the technical-technological and scientific development of the associated teaching and scientific disciplines.

Keywords: Chair for Forest Utilization, Planning and Building in Forestry and Horticulture, Curriculum, Forestry, Historical development.

HISTORICAL DEVELOPMENT, EDUCATION, RESEARCH AND PERSPECTIVES - CHAIR FOR ECONOMICS, POLICY AND ORGANIZATION OF FORESTRY AND URBAN GREENERY

Mersudin Avdibegović[1]*, Sabina Delić[1], Dženan Bećirović[1], Amila Brajić[1], Bruno Marić[1]

Abstract

With minor organizational changes, the Chair for Economics, Policy and Organization of Forestry and Urban Greenery has existed at the Faculty of Forestry in Sarajevo since it was established, as an organizational unit integrating a group of related teaching disciplines dealing with economic, organizational, political and social aspects of forest and urban greenery governance. This paper presents the development of human resources, the evolution of educational process and research activities, as well as future perspectives of the Chair. The methodological approach used in this paper is based on analysis of the educational process evolution, a comprehensive review of research topics covered through scientific publications and evaluation of implemented research and professional projects. Growing alongside with the Faculty, the Chair has played a significant role in the Faculty's organizational and strategic development, the continuous advancement of teaching and scientific research activities and

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strengthening its competitiveness, leading to an enhanced international visibility of the Faculty. Members of the Chair have held prominent positions at the Faculty, serving as deans in six mandates. Professor Šukrija Šaković played a particularly exceptional role, making an indelible mark on the Faculty's post-war personnel and material reconstruction efforts. Currently, the Chair offers 22 courses within 3-cycles study according to the Bologna education system. The Chair's members organized a series of international scientific events, among which the symposiums of several IUFRO working groups (Forest law and environmental legislation, Cross-sectoral policy impacts on forests and environment) stand out, as well as the first conference of the IUFRO Division 9 (Forest policy and economics). The Chair's commitment to research is evident in its active involvement in numerous projects, both domestically and internationally. These includes several COST projects, as well as those undertaken in collaboration with esteemed institutions in Bosnia and Herzegovina and abroad. With its strong track record of excellence, the Chair is poised to become a regional hub for innovation and knowledge-sharing in the fields of economics, policy and organization of forestry and urban greenery. This aligns with the contemporary trends in high education in forestry and horticulture, and the evolving needs of society and the economy in relation to forest ecosystems.

Keywords: Forest, Urban greenery, Policy, Economics, Education, Research.

HISTORICAL DEVELOPMENT, EDUCATION, RESEARCH AND PERSPECTIVES – CHAIR OF FOREST ECOLOGY AND URBAN GREENERY

Sead Vojniković[1]*, Neđad Bašić[1], Fatima Pustahija[1], Alma Hajrudinović-Bogunić[1], Zahida Ademović[1], Mirsada Starčević[1], Mirel Subašić[1], Faruk Bogunić[1], Emira Hukić[1]

Abstract

The Chair of Forest Ecology and Urban Greenery at the University of Sarajevo - Faculty of Forestry, has been a cornerstone of scientific disciplines and knowledge in the field of forest and urban ecosystems ecology in Bosnia and Herzegovina for several decades. The dedicated scientists and academic professionals associated within the chair have contributed significantly, producing some of the nation's most crucial knowledge concerning the characteristics and processes of forest ecosystems, widely utilized by researchers and professionals.

In the mid-1980s, the integration of the Forestry Institute into the Faculty expanded the, Chair responsibilities to encompass teaching, research and professional activities in forest ecology. Subsequent organizational developments occurred with the establishment of the Department of Horticulture in 1996, broadening the chair's scope to include research on the ecology of urban environments. Presently, with a team of eight members comprising four full professors, three associate

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professors, one senior assistant, and one senior independent laboratory assistant the chair's diverse and dynamic research activities focus on forest ecology, levels of diversity in forest trees, soils, ecosystems, and urban environments.
Our ongoing research efforts are multi-faceted, with a particular emphasis on forest biodiversity and conservation, the development of vegetation and pedological databases, the functions of green infrastructure, monitoring invasive species, and studying plant physiology stress. Collaborative international initiatives with research groups across Europe play a central role in most of our activities, fostering a rich exchange of ideas and expertise. Our overarching goal remains the pursuit of research excellence and the dissemination of knowledge concerning the vegetation, flora, physiology, pedology, and chemistry of forest and urban landscape ecosystems.

Keywords: Forest Ecology, Diversity, Urban Greenery.

SESSION

Education, Research and Perspectives in Forestry

WHAT KIND OF SUPPORT WOOD-PROCESSING COMPANIES ARE PREFERRING IN REPUBLIKA SRPSKA

Dženan Bećirović[1]*, Dragan Čomić[2], Branko Glavonjić[3], Mersudin Avdibegović[1], Bruno Marić[1]

Abstract

Bosnia and Herzegovina have one of the highest forest cover in Europe, encompassing over 50% of its land territory. The forestry sector and wood-processing industry are significant contributors to economic growth and export revenues. At the local scale, wood-processing companies play a pivotal role in stimulating economic growth and providing employment opportunities in rural areas. Recognizing the importance of wood-processing companies, it becomes evident that strategic approach and different types of support are essential. Such measures are needed for fostering their continuous growth and enhance abilities to use available resources and export opportunities on more sustainable manner. The aim of this paper is to present the basic business information on the wood-processing companies in Republika Srpska and their expectation for support from different institutions. In this

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regard, the survey among wood-processing companies, that are registered as buyers of wood raw material from the Public Forest Company *Šume Republike Srpske* was conducted, obtaining n=70 interviews. The findings of this paper focus on the key business information about companies, their production capacity, as well as sources of the raw material by tree species and procurement type. Additionally, the paper explores the attitudes of these companies toward raw material sourcing issues and outlines their preferences for support measures. Potential strategic approach and support measures tailored to the wood-processing companies are proposed and elaborated, based on the findings of this research. Understanding the necessities for business development support of the wood-processing companies, based on presented approach, can serve as valuable inputs for policy and strategic planning in forestry and wood-processing industry.

Keywords: Wood-processing companies, Survey, Raw material sourcing, Business support measures, Republika Srpska.

IS THERE A DIFFERENCE BETWEEN THE PAYMENT AND THE LEVY FOR FOREST ECSYSTEM SERVICES?

Lejla Lazović-Pita[1]*, Dženan Bećirović[2]

Abstract

Efforts to reach the UN 2030 Sustainable Development Goals, growing climate change pressures and increased concern about the environment worldwide has put environmental economists into academic spotlight. At the same time, the concept of the payment for ecosystem services (PES) and specifically payment for forest ecosystem services has been gaining academic prominence over the last two decades. The purpose of the study is to examine and elaborate theoretical and practical difference between the payment for forest ecosystem services as understood in forestry and a levy for ecosystem services in economics, particularly in financial theory and practice. For such purposes, the multidisciplinary analysis of the available literature and legal framework was conducted covering both topics. Our research is practically examined in the example of Croatia and Bosnia and Herzegovina (BiH), both sharing similar legal background in the field of forestry especially regarding the levy for forest ecosystem services. Our results indicate that there is a

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difference between PES concept and its practical applications as a levy for forest ecosystem services in Croatia and BiH. The levy for forest ecosystem services as it is currently applied in the selected two countries requires a clearer conditionality since it is legally defined as a compulsory payment. In the European context or worldwide, introduction of levy for forest ecosystem services could contribute towards the protection and sustainable management of forest resources, as defined in the environmental protection activities under the System of Environmental-Economic Accounting Central Framework.

Keywords: Tax, Payment for ecosystem service, Levy for forest ecosystem services, Croatia, Bosnia and Herzegovina.

TRENDS OF DEVELOPMENT OF FOREST VEHICLES AND MACHINES

Marijan Šušnjar[1]*

Abstract

The paper describes the characteristics of the development of forest machines in order to meet economic, environmental, energy and ergonomic requirements, and presents the principles, examples and advantages and disadvantages of hybrid drives (electric and hydraulic hybrid forest machines), fully electric drives, and considers the introduction of machine operation automation and the possibilities of applying robotics in the execution of timber extraction works. The review of various hybrid drives and energy storages (battery, supercapacitors, hydraulic accumulators) of forest vehicles will be given on the example of newly developed harvesters, forwarders, chippers, forest trucks for transporting wood. Special emphasis will be given to the development of the electric hybrid skidder drive.

Keywords: Development, Energy storage, Forest vehicle, Forest machine, Hybrid drive.

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European Union Operational Program “Competitiveness and Cohesion «under the grant KK.01.1.1.04.0010» (Development of hybrid skidder—HiSkid”) within the scope of European Union Operational Program “Competitiveness and Cohesion” 2014–2020 (2014HR16M1OP00-1.2).

ASSESSING THE POTENTIAL FUTURE PLENTER FOREST AREA OF STYRIA, AUSTRIA USING DYNAMIC FOREST SITE CLASSIFICATIONS

Mathias Leiter*[1], Christoph Pucher[1], Michael Kessler[1], Harald Vacik[1], Manfred J. Lexer[1], Hubert Hasenauer[1]

Abstract

The province of Styria, often called the 'green heart of Austria' covers 1.68 million hectares of land where 61.8% are forests – making it the Austrian region with the highest forest coverage. While there is a growing discussion about converting age-class forests into more diverse or continuous cover forests, such as Plenter forests, little is known regarding the potential suitable area for Plenter forest management. The purpose of this study is to create a map showing the potential area for Plenter forest management in Styria according to the current and future socio-economic and climate conditions. Our study integrates tree species suitability data under two different climate scenarios, slope inclination, forest, and road accessibility data. The datasets are modified and then combined in a GIS platform to generate the predictive map for the RCP 4.5 and RCP 8.5 scenario for the year 2050 and 2085. Preliminary results show that on slopes lower than 30% (guaranteeing the usability of skidders and agricultural tractors for wood extraction), 51% of forests are suitable for Plenter forest management under current climate conditions. Under climate change scenarios,

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the area may increase by 3% under RCP 4.5 and stay the same under RCP 8.5, with a shift of potential areas from lower to higher altitudes, due to changes in the tree species suitability. The resulting map aims to serve as a tool for both policymakers and the forest managers in Styria when facing the challenging task of transitioning towards Plenter forest management.

Keywords: Forest management, Plenter forests, Tree species suitability, Silviculture, Sustainability.

MODELING PLENTER FORESTS IN BOSNIA & HERZEGOVINA USING THE TREE GROWTH MODEL MOSES

Mehmed Čilaš*[1], Mathias Leiter[2], Ćemal Višnjić[1], Hubert Hasenauer[2]

Abstract

In Bosnia and Herzegovina, most forests are managed as uneven-aged Plenter forests, which differ substantially from even-aged or age class forest management found in many other European countries. However, there is a growing interest in adopting Plenter forest management across Europe because it increases forest resilience and resistance. This study employs MOSES (MOdeling Stand rESponse) a tree growth model explicitly designed as diagnostic tool for managing Plenter forests in central Europe. We apply the model to forests in Bosnia and Herzegovina and demonstrate the practical application potential for sustainable forest management. The model validation using independent plot data from uneven-aged beech-fir-spruce forest along the Dinaric Mountain range exhibited no bias or inconsistency in the resulting predictions even though the growth functions were calibrated with central European data of similar ecosystems. The performed simulations scenarios showed that the model is an important tool to

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assess future Plenter forest stand development and that Plenter forests need a continuous management intervention to preserve their diversity and stand structure.

Keywords: Bosnia and Herzegovina, Continuous cover forestry, Modeling, MOSES, Plenter forest.

EDUCATIONAL FRAMEWORK OF EROSION AND TORRENT CONTROL: THE PATH TO LIFELONG LEARNING

Nada Dragović[1]*, Tijana Vulević[1], Mirjana Todosijević[1], Katarina Lazarević[1]

Abstract

Education of experts for soil erosion and torrential flood protection in Serbia has been continuously carried out for more than 60 years through study programs of undergraduate, master, and doctoral studies at the Faculty of Forestry, University of Belgrade. In other European countries (Austria, Czech Republic, Bosnia and Herzegovina, North Macedonia, etc.), the education of experts in solving problems in this field is carried out at forestry faculties through several subjects at undergraduate or master academic studies. In the last decades, frequent torrential floods have caused enormous material damage to all sectors of the economy and society as a whole, and frequent loss of human life. For graduate engineers to have the necessary knowledge for soil protection and torrential control, it is necessary not only to improve the study programs at universities but also to improve themselves through various forms of training during their working life, i.e. lifelong learning. All levels of lifelong learning (formal, non-formal, and informal) can be applied for the continuous development of employed engineers for erosion and torrent control. Some of the engineers' training forms are constantly being held in the Serbian Chamber of Engineers, such as seminars, trainings, lectures, etc. After obtaining a license to design and

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execute works on erosion and torrent control, engineers are required to attend or organize training. In 2000, the European Union adopted the Memorandum on Lifelong Learning and through many programs, such as Tempus and Erasmus+, encouraged the development of this concept. The Erasmus+ project ''Soil erosion and torrential flood prevention: Curriculum Development at the Universities of Western Balkan Countries-SETOF'' (2018-2022, project coordinator Faculty of Forestry, University of Belgrade) aimed at improving the knowledge of graduate engineers through modernization of existing and formation of new study programs, but also through training of employed engineers in water management and forestry enterprises. This project, through training on new approaches to solving the problem of flood protection, included over 200 engineers from Serbia and Bosnia and Herzegovina.

The results of the research on continuous professional development conducted for the first time in Serbia in 2021, show that 40.8% of the surveyed companies conduct professional development of their employees. Training of experts and education of employed engineers, including experts in erosion and torrent control, is one of the priorities in the framework of human resource management in water management enterprises. Research conducted in 2019 shows that employees (47% of respondents) in PWE "Srbijavode" recognize the efforts of the management of the company investing in professional development and that 75% of respondents participated or currently participate in education programs. In the face of increasing challenges in the fight against catastrophic torrential floods, education after graduation becomes the obligation of future engineers.

Keywords: Erosion and torrent control, Forestry, Employees, Engineers, Training, Lifelong learning.

WHAT ARE THE WINNERS AND LOSERS FROM THE FOREST POLICY REFORMS IN NORTH MACEDONIA?

Vladimir Stojanovski[1,2]*, Makedonka Stojanovska[1]

Abstract

The Republic of North Macedonia, a candidate for European Union membership, is currently engaged in the critical process of aligning its national policies with those of the EU. This research delves into extensive forest policy reforms in North Macedonia, with the overarching objective of assessing the winners and losers resulting from the implementation of these reforms. In terms of methodology, the research employs a mixed-method approach, incorporation qualitative and quantitative analysis. The results are poised to shed light on the intricacies of the reform's impacts, enabling policymakers and stakeholders to make informed decisions. The implications of this research extend to a nuanced understanding of the consequences and outcomes of reshaping the forest sector in North Macedonia, thus contributing to the broader context of EU integration and sustainable forest management.

Initiating under IPA project, these transformative changes have reshaped the forest sector in North Macedonia. A pivotal innovation has been the establishment of the Forest Agency, representing a substantial departure from the historical approach to forest management. Concurrently, the conversion of the Public Enterprise Nacionalni Šumi into a holding State

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Forest Company is fundamentally altering the landscape of forest governance. With these reforms the Forest Agency assume numerous obligations that were previously held by the Public Enterprise Nacionalni Šumi, as stipulated in the Law on Forest (2009). Responsibilities encompassing forest planning and provision of advisory services to private forest owners will now fall under the jurisdiction of the Forest Agency. This transfer of responsibilities signifies a fundamental shift in forest governance. While the reform involves the transfer of obligations, it also introduces new opportunities. Although the Public Enterprise Nacionalni Šumi (transformed into State Forest Company) with the reforms is without several activities, the restructures policy framework provides access to a diverse range of financial resources. This strategic maneuver, in the long term, promises potential benefits for the newly formed State Forest Company.

This research offers a comprehensive perspective on the multifaceted interplay of interests, advantages, and challenges stemming from the forest policy reforms in North Macedonia. The winners and losers in this transformation are not confined to specific entities; they are emblematic of the broader dynamics shaping environmental conservation, economic sustainability, and governance.

Keywords: Forest governance reforms, EU integration, Transformation of public enterprise, Forest policy.

SESSION

Education, Research and Perspectives in Urban Greenery

URBAN AGRICULTURE AND URBAN-TO-RURAL CONTINUUM – PATHWAY FOR MORE RESILIENT COMMUNITIES IN BOSNIA AND HERZEGOVINA

Alen Mujčinović[1]*, Aleksandra Nikolić[1]

Abstract

Urban agriculture and urban agroforestry initiatives are gaining importance globally as nature-based solutions that creates new opportunities while creating multifunctional, highly innovative, and attractive spaces for all stakeholders. The Plethora of benefits associated with urban agriculture may be achieved through promotion and raising awareness among the general population, while also providing a detailed understanding of necessary transformation patterns to support such transformation. Bosnia and Herzegovina is making some efforts to make cities more green and smart, but still, a big gap in terms of understanding the need for lifestyle transformation, people's level of knowledge, willingness to engage in urban agriculture activities, etc. exists. Therefore, barriers and constraints to urban agriculture in Bosnia and Herzegovina are discussed, followed by opportunities that might be achieved. Firstly, mapping of the existing UA value chain in Bosnia and Herzegovina has been done, followed by an assessment of the stakeholder's (general public group, common goals group, decision-making group) attitudes toward urban agriculture by applying the ABC approach – affection,

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behavior, and cognition, together with behavioral control. This paper sheds light on legal, social, and economic constraints and opportunities associated with urban agriculture development pointing out the necessity to reduce the gap between urban and rural areas, thus fostering resilience of both communities. Future studies should focus on strategically identified principles of urban agriculture integrated into educational programs, new food paradigms, new public policies, solidary economy networks, and markets.

Keywords: Development, Food policies, Resilience, Transformation, Urban agriculture, Urban agroforestry.

RECOGNIZING THE BENEFITS OF GREEN ROOFS AS STRATEGIC APPROACH TO IMPROVE THE QUALITY AND ACCESSIBILITY OF GREEN INFRASTRUCTURE IN SARAJEVO

Amila Brajić[1]*, Ajla Hota[2], Bruno Marić[1], Mersudin Avdibegović[1], Sabina Delić[1], Dženan Bećirović[1]

Abstract

Green infrastructure provides various benefits that can greatly enhance quality of life in urban spaces. These benefits range from mitigating of air pollution and urban heat island effect, to multi-dimensional benefits to human wellbeing, indicating that local authorities should broadly promote and support the investments in green infrastructure. However, the expansion of green infrastructure in the urban areas often faces significant challenges. In general, there is a widespread decreasing trend of available spaces for new green infrastructure. In light of these constraints, it becomes imperative to explore alternative solutions for new green infrastructure investments which can bring positive changes and improve the quality of life in urban spaces, such as the green roofs. This paper aims to investigate citizen's perceptions regarding green roofs in one residential area of city Sarajevo. The research is based on survey among citizens in residential area Hrasno (n=342), and qualitative text analysis of legal framework that regulated construction and

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maintenance of green infrastructure. The analysis focuses on citizen's awareness on green roofs, benefits and the obstacles hindering their development. Furthermore, this study identifies gaps in the legislative framework concerning installation of green roofs in residential areas of Sarajevo. The research findings reveal that more than half of respondents are familiar with the concept of green roofs. Most of the respondents are familiar with social benefits, while economic and ecological benefits are less known. Respondents expressed interest for additional information about green roofs, while their willingness to participate in green roofs establishment and maintenance is dependent on another residents' involvement. Having in mind that green roofs have potential to become a major component of green infrastructure in densely populated urban areas, the results underscores the importance of intense promotion of green roofs and associated benefits. Additionally, there is a pressing need for the enhancement of the legal framework related to green roofs and greater government involvement in this domain especially in the information sharing and promotion of multidimensional benefits of the green roofs concept.

Keywords: Green infrastructure, Green roofs benefits, Citizen's perception, Legal framework, Information sharing and promotion.

VISITORS' PERCEPTIONS OF TOURISM RECREATIONAL OPPORTUNITIES IN THE TREBEVIĆ AND SKAKAVAC PROTECTED AREAS

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Abstract

The increased global interest in recreation and "nature-based" tourism has led to new and complex issues for the management of protected areas. Although there are numerous ecological, economic and social benefits associated with growing tourism, there are also readily apparent negative aspects, such as an excess of tourists and frequent activities at conflict with the primary goals of nature protection. To effectively address these challenges, protected areas must be managed with application of adaptive and innovative mechanisms that aligns the needs of visitors with the primary goals of nature protection and the interests of local population. These mechanisms should be developed based on information about visitors' preferences, interests, and expectations, while their implementation should be focused on enhancing tourism capacities that allow the growth of

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recreational activities corresponding to the principles of sustainable tourism. This paper deals with the attitudes of visitors to protected areas (n=352) regarding tourist facilities suitable for various forms of nature-based recreation. The research was conducted using a combined research approach through an online and face-to-face survey of visitors in the Trebević and Skakavac protected areas. The results show that there are differences in the basic socio-demographic profile of visitors in these two protected areas, which can be explained by differences in the accessibility of the area, access infrastructure and the quality of touristic offer. On the other hand, the respondents have consistent attitudes regarding the importance of specific recreational activities in both protected areas and the existing capacities of infrastructure to support various nature-based recreational activities. The findings of this study may be helpful in the development of a methodological framework for the design of visitor management plans, tailored to the needs of visitors and the particular features of the protected area, with the goal of managing tourism-related activities in line with the objectives of nature conservation. In addition, the continuous research of visitors' habits and requirements, as well as the comparison of mutual results between different protected areas could serve as a basis for creating strategic guidelines for the management of protected areas and their integration in various types of touristic activities at different administrative levels of the country.

Keywords: Nature-based tourism, Protected areas, Recreation, Visitors' perceptions, Visitor management plans.

THE ROLE OF STANDARDS IN URBAN GREEN SPACE PLANNING: INSIGHTS FROM SARAJEVO CITY

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Abstract

The purpose of this research is to provide arguments for establishing standards in the planning of green spaces in the city of Sarajevo. In the local urban planning practice, green spaces are still predominantly treated as a spatial-aesthetic component of design, or their function for recreation is over emphasized. Consequently, a functional role of green spaces does not have treatment like other infrastructures, and they are being lost to built-up land. The only data on the value of green space per capita is held by the Institute for Development Planning in Sarajevo Canton, and they were reported in cantonal environmental action plans. However, the method of obtaining these values is unclear and information about the green space classes' surface area are not reported. Therefore, the study included a) classification of green spaces, b)

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evaluation of green space indicators and c) exploration of greening standards to be implemented in Sarajevo, based on other relevant research. Two method approaches were used for green space quantification: total green area obtained through photo interpretation (research area of 10-meter channels were used: green, blue, red and infrared on Satellite images Sentinel S2) and manual vectorization (orthophoto image on katastar.ba, taken on June 23, 2009), in the Q-GIS program. The second was necessary for green space classification. The main results revealed average green to build space of 64.2%, total green area per capita of 203.6 m2, public green area per capita of 28,0 m2, 21 urban green categories, green space categories of limited use of 49.05 km2, or 83.9% and public green areas of 10%. Based on the obtained results, a clear insight was obtained about the state of green space in Sarajevo. Previously established norms have not been reached for Sarajevo. Considering all categories of green areas, study suggests that there is still a potential to achieve an optimal level of green space for sustainable city.

Keywords: Green space classes, Public green space per capita, Sustainable city, Satellite images interpretation, Sentinel S2, Manual vectorization.

ENHANCING URBAN RIPARIAN AREA MANAGEMENT BY UTILIZING INNOVATIVE TECHNOLOGIES AND NATURE-BASED SOLUTIONS: THE CASE STUDY OF DRAMA, GREECE

George N. Zaimes[1]*, Valasia Iakovoglou[1], Paschalis Koutalakis[1], Georgios Gkiatas[1]

Abstract

Citizens in urban areas face many pressures and the goal should be to develop plans and implement actions to improve their living environment by providing clean air, clean water but also recreation and relaxation areas. Urban riparian areas can support such services for its citizens; thus, efforts should be made to either establish new ones or conserve the already existing ones. The aim of this study was to utilize new technologies that should enhance the assessment of the current conditions of urban riparian areas. Such datasets should help land and water managers develop better plans to mitigate the anthropogenic pressures that these areas face. In addition, these datasets can showcase the main anthropogenic pressures of the study area and allow to recommend proper nature-based solutions and their optimal placement. The case study was the Agia Varvara Park of Drama city in Greece. The Park is a unique riparian area with litter one of the main problems in its water bodies. The innovative tools used were unmanned aerial vehicles with high resolution regular and

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thermal cameras, unmanned underwater vehicles. In addition, a GPS tracker, was also used to record the potential movement route of litter and a sonar device to develop cross-sections of Agia Varvara's stream. The produced orthomosaics, digital surface models, cross-section and litter route showcased that litter traps could be a suitable nature-based solution. In addition, the optimal location for litter trap placement was determined. This simple measure could sustainably minimize litter pollution in the Park.

Keywords: Litter trap, Nature-based solutions, Unmanned aerial vehicles, Un-manned underwater vehicles.

TRANSFORMING BIOCITIES: DESIGNING URBAN SPACES INSPIRED BY NATURE

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Abstract

After 200 years of unprecedented urbanization and economic growth based on a fossil-based economy, we have arrived at a tipping point. Our urbanized world has become too big for our planet. This is clearly exemplified by climate change, biodiversity loss and the degradation of our natural resources. Cities, our economic and innovation hubs, need to take the lead in rethinking our economy and its relationship to nature. Cities need to lead a transformational change, not only in replacing fossil energy by renewable energy but also by taking the lead in replacing non-renewable materials like plastics, steel, or concrete with renewable biobased materials, and replacing grey infrastructures with green ones, making nature a basic urban infrastructure. Trees, forests, and wood have a crucial role to play.

EFI has launched the Biocities Facility with the aim to create an informed dialogue on how trees, forests and wood can contribute to rethinking our cities, so they can lead the transformation towards a climate-neutral and nature-positive economy. It works across scientific disciplines and actors to connect knowledge to action to transform the way we create and live in cities.

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Biocities are smart, attractive, and sound cities, interconnected with the forest and forestry approaches, and where human communities adopt nature-based solutions and develop a circular bioeconomy for the mutual wellbeing of environment and people, while contributing to climate change mitigation and adaptation. The fields of application of the Biocity concept include the provision of ecosystem services from urban trees and forests, the use and re-use of bio-materials from forests and other ecosystems, the diffusion of engineered timber buildings also as efficient carbon sinks, a new urban metabolism using renewable systems in the field of energy, the water cycle, the production of food in cities, the balance between urban biodiversity and resident perception, and the improvement of air and soil quality.

Keywords: Bio(based)Cities, Climate Change, Circular Forest Bioeconomy, Nature Based Solutions, Urban Forest, Ecosystem Services

SESSION

Posters

MODELS TO ESTIMATE A QUALITY AND STRUCTURE OF WOOD ASSORTMENT OF STANDING TREES OF BEECH (*FAGUS SYLVATICA L.*) IN BOSNIA AND HERZEGOVINA USING BAS EN STANDARDS

Admir Avdagić[1]*, Besim Balić[1], Ahmet Lojo[1], Jusuf Musić[1], Velid Halilović[1], Jelena Knežević[1]

Abstract

The management of forests is a critical endeavor, requiring detailed information about both the quantity and quality of resources within them. This includes a thorough understanding of the structure and quality of wood assortments that can be derived from standing trees. In a concerted effort to enhance forest management practices, this paper introduces a novel approach to estimating the quality and structure of wood assortments, using European standards adopted in Bosnia and Herzegovina as BAS EN standards.

The methodology employed in this study involves the utilization of logarithmic functions to calculate the average assortment percentage and the proportion of assortment within standing beech trees in the forest. The resulting data provides valuable insights for the development of assortment tables for beech wood or the creation of models tailored to specific assortments. These models are designed with practicality in mind, offering forest management professionals in Bosnia and Herzegovina a straightforward and efficient

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means of applying this newfound knowledge to their day-to-day operations. This is the first research in Bosnia and Herzegovina that use a European standard for estimate a quality and structure of wood assortment.

Keywords: Beech, BAS EN, Quality and structure, Assortments.

MODELS TO ESTIMATE QUALITY SITE INDEX OF CHESTNUT FORESTS (*CASTANEA SATIVA* MILL.) IN WESTERN BOSNIA AND HERZEGOVINA

Ahmet Lojo[1]*, Amina Deljo[1], Admir Avdagić[1]

Abstract

Chestnut is an ecologically and economically important tree species of the forest ecosystem in Southern Europe, North-Western Europe, Western Asia, North Africa, and the Caucasus. The distributional range of chestnut in Europe has been highly modified by humans since ancient times. In Bosnia and Herzegovina there are three natural forest sites of chestnut (Castanea sativa Mill). within area of more than 8000 ha. We established 79 experimental plots within four concentric areas, where we measured the diameter at breast height (DBH) and the height of all the trees. In this paper with tested more different regression models for estimation of quality site index depending on dominant height and age. All collected data are processed in MS Office to prepare a database. All analyses were conducted using Statgraphics Centurion XVII software. To select the best model, analyses of variance were employed. Regression analysis and analysis of variance will serve as the fundamental procedures in researching the optimal form of development of the average height of dominant trees in the stand, dependent on the age of the stand. According to residual distribution and coefficient of determination and

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coefficient of correlation the best model were Prodan model: Hdi=t/(0,637087+0,0379898*t+0,0000901529*t2.
The developed model can be easily applied in practical forest management planning.

Keywords: Quality site index, Dominant height, Chestnut, Prodan.

CHARACTERISTICS OF THE BROWN SOIL ON LIMESTONE AT THE "MRKONJIĆKO" FOREST MANAGEMENT AREA

Ilija Čigoja[1]*, Marijana Kapović Solomun[1]

Abstract

Brown soil on limestone is one of the most widespread types of soil in Bosnia and Herzegovina, occupying an area of about 38%. It develops as an evolutionary stage from mollic leptosol or rendzina. The aim of this work is to analyze the properties of brown soils on limestone, in the forest management area "Mrkonjićko". Two basic pedological profiles were opened in two different forest management units: “Dubička gora”, compartment 55 and “Ovčara”, compartment 18. The profile in compartment 55 is 30 cm deep, while the profile in compartment 18 is 26 cm deep. The textural class is loam, except for the (B) horizon in compartment 18, where it is clay. Structural aggregates are spheroidal or polyhedral. The pH reaction of the soil solution of the humus-accumulative horizons of both profiles is very acidic (5.17-5.45), while the cambic horizon in the profile in compartment 18 has a moderately acidic reaction (5.82), and the same horizon in compartment 55 has a very acidic reaction. The degree of base saturation differs significantly between profiles. In compartment 18, it is around 60%, while in compartment 55 it is from 30 to 33%, depending on the horizons. They are deficient in readily available

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phosphorus, while the content of readily available potassium is variable and ranges from poor to good availability. The aforementioned analyzes indicate that brown soil on limestone in compartment 18 has a better ecological and productive potential.

Keywords: Soil, Physical-chemical properties, Brown soil on limestone.

CHEMICAL PROPERTIES OF MOLLIC LEPTOSOLS AT THE "MRKONJIĆKO" FOREST MANAGEMENT AREA

Ilija Čigoja[1]*, Marijana Kapović Solomun[1], Saša Eremija[2], Goran Češljar[2]

Abstract

Forest management area "Mrkonjićko" is located in the northwestern part of Bosnia and Herzegovina. It is located in the area of the Mrkonjić Grad municipality, with a total area of about 30,000 ha. The geological and pedological cover is extremely heterogeneous. Mollic leptosols is one of the most widespread soil types in this area. The aim of this research is to determine the chemical properties of mollic leptosols in two forest management units. A total of three basic pedological profiles were opened, in three different compartments. Morphological characteristics were studied in the field, and then a total of three soil samples were taken from the humus-accumulative horizons in a disturbed state for the examination of chemical properties. The research was conducted in the period of June 2022. The pH reaction of the soil reaction in H_2O of the investigated profiles is neutral (6.66-7.16). The degree of base saturation is very high in all profiles (86.66-92.61%). The humus content is the highest in mollic leptosol in compartment 64 (45.11%), while it is the lowest in the same type of soil in compartment 18 (18.66%). According to the content of readily available phosphorus, they are poor (3.26-4.73 mg/100g),

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while the content of readily available potassium ranges from medium supply in compartment 64 (19.90 mg/100g), to good in compartment 18 (22.50 mg/100g) and 60 (21.40 mg /100g). The obtained laboratory results of chemical properties indicate the existence of certain differences in the investigated chemical properties of mollic leptosols. The most favorable chemical properties are shown by mollic leptosol in compartment 60, while they are significantly less favorable in mollic leptosol from scompartment 18.

Keywords: Soil, Mollic leptosol, Chemical properties.

SPATIAL PREDICTION OF GROWING STOCK CLASSES USING MACHINE LEARNING ALGORITHMS

Ismet Fazlić[1]*

Abstract

The objective of this study was to impute and evaluate predictions of growing stock for conifers, broadleaves and total on area of productive forests on Forest management unit "Igmansko", central Bosnia.
Here are used orography data (altitude, slope, aspect), inventory data collected in regular forest inventory in 2013, and Sentinel S2A satellite data from August, 2017. Used spectral bands were: blue (B2), green (B3), red (B4), vegetation red edge (B5), vegetation red edge (B6), vegetation red edge (B7), near infrared-NIR (B8), narrow NIR (B8A), SWIR 1 (B11) and SWIR 2 (B12). Sample contained local estimates for conifers, broadleaves and total growing stock from 13909 sample plots. Here were analyzed different nearest neighbour search algorithms: Mahalanobis (MA), most similar neighbour (MSN), gradient nearest neighbour (GNN), independent component analysis (ICA) and subsequent imputation techniques expanded with random forest algorithm (RF). Statistical analysis was performed using "yaImpute" R package. Then, the best imputation technique was used to map predictions.

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Analysis reviled as the most important predictors: blue, vegetation red edge (B6), SWIR 1 and SWIR 2 bands. The lowest root mean square difference between observed and imputed data was determined for RF imputation method (0.81) while MA, MSN and ICA reached higher error of 0.97. The highest root mean square difference was determined for GNN (1.03). Mapped RF predictions for conifers and broadleaved growing stock were used to create predictions for total growing stock. Mapped predictions were classified in three growing stock classes (low, moderate, high) and area percentage structure determined.
Here is demonstrated the methodology for imputation prediction as well for mapping and reclassifying predicted values that could be used on other forest management units. Also, described procedure could be used to predict area percentage structure after actual forest inventory and contribute to spatial change analysis of growing stock.

Keywords: Growing stock, Sentinel S2A image, Mahalanobis, Most similar neighbour, Gradient nearest neighbour, Independent component analysis, Random forests, Mapping predictions.

ANALYSIS OF INFLUENTIAL FACTORS DURING WOOD SKIDDING BY ECOTRAC 120V AND ECOTRAC 55V CABLE SKIDDERS

Jelena Knežević[1]*, Jusuf Musić[1], Velid Halilović[1], Muhamed Bajrić[1], Azra Čabaravdić[1], Dževada Sokolović[1], Amina Karišik[1]

Abstract

Forest harvesting in Bosnia and Herzegovina is performed using chainsaws and tractors, mostly cable skidders. Considering that Forest enterprises purchase skidders Ecotrac manufactured by the company „Hittner" Ltd from Bjelovar, Croatia in recent years, the aim of the research was to analyze mentioned skidders' productive work time dependence on organizational, stand and terrain factors. The research was conducted in uneven-aged mixed stands in the area of Igman and Donji Vakuf, Bosnia and Herzegovina. The work and time study was performed. Various organizational, stand and terrain factors were determined: work organization, wood processing method, skidding mode during loaded travel, skid road surface, skidding distance, winching distance, number of pieces in the load, load volume and skid road slope. During 151 transport cycles 738.78 m^3 nett volume of wood was skidded to landing site, 522.20 m^3 softwood, predominantly fir (*Abies alba* Mill.) and spruce (*Picea abies* (L.) Karsten) and 216.58 m^3 hardwood, predominantly beech (*Fagus sylvatica* L.). Productive work time ranged from 5.74 min to 86.95 min, 38.43 min in average. The

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performed analysis showed that productive work time depends on skidding distance, number of pieces in the load, load volume, work organization and winching distance (R^2=88.62%). The most significant differences in productive work time between different levels of statistically significant factors was found for skidding distance, which is expected considering that skidding distance is the most important factor in wood extraction by tractors. The smallest influence on the productive time had winching distance observing only statistically significant factors. The performed analysis showed that work organization is statistically significant influential factor which could be a guideline for Forest enterprises when planning the costs of wood extraction.

Keywords: Skidding, Ecotrac, Productive work time, Organizational, Stand and terrain factors.

TRAINING NEEDS ASSESSMENT OF WOMEN IN THE FORESTRY SECTOR IN SERBIA

Jelena Nedeljković[1]*, Dragan Nonić[1], Marina Nonić[1]

Abstract

Regularly evaluating and adapting training programs of women is essential for the long-term success of the forestry sector. This paper aims to investigate women's needs for training in the field of forestry expertise, social-, IT- and management-skills in Serbia. The study employs a mixed methods design and integrates both quantitative and qualitative data collection and analysis techniques. Structured online questionnaires were administered in the period March-May 2021 to 32 female forestry students and 64 female forest professionals and private forest owners. In-depth interviews with 13 respondents further explored training experiences of women in the forestry sector. Key findings from the survey indicate a strong need for nature conservation and forest protection, with over 60% of forestry professionals and 70% of students expressing interest in such programs. Additionally, forest adaptation to climate change (61% of forest professionals and forest owners) and silviculture and forest maintenance (47% of students) training emerged as a priority. Respondents highlight the need for training that fosters communication (50% of forest professionals and forest owners and 63% of students), teamwork, and cooperation (70% of forest professionals and

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forest owners and 56% of students). Findings also underscore the urgency of designing training programs that address technical skill gaps, as most respondents showed interest in IT skills development. The results stress the need for management training initiatives that are geared toward building diverse leadership skills (time management, managing teams and projects, planning and goal setting). Qualitative analysis reveals the significance of mentorship, networking, self-confidence and soft-skills development. By addressing the training needs of women, forestry organizations can contribute not only to gender equality but also to enhanced workplace performance and innovation.

Keywords: Education, Forestry, Training needs, Women, Serbia.

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REVITALIZING SUSEDGRAD PARK: INNOVATING WITH MODERN FIELD SURVEYS FOR ENHANCED COMMUNITY-CENTRIC PARK INFRASTRUCTURE

Kruno Lepoglavec[1]*, Andrija Barišić[1], Iva Murgić Lepoglavec[1], Branko Ursić[1], Hrvoje Nevečerel[1]

Abstract

This study focuses on the development of a conceptual design for the renovation of Susedgrad Park through the application of cutting-edge field survey techniques, using state-of-the-art geodetic GPS technology, notably the GNSS device Stonex S900A. After field surveys, the collected data were processed using the QGIS software. The subsequent visualization of both the park's existing state and the proposed conceptual solutions was accomplished through the utilization of BIM software, Edificius.

One of the primary objectives of this research was to investigate and evaluate the myriad benefits derived from the use of modern geodetic equipment in the design and planning process for the park's landscape. The study also delved into the integration of contemporary software solutions, highlighting their role in streamlining and enhancing the design process.

Furthermore, the direction and planning of park infrastructure improvements were heavily informed by insights derived from an online survey that engaged park visitors. This incorporation of public feedback is instrumental in aligning the park's future

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amenities with the actual needs and preferences of its community.

In sum, this research not only showcases the innovative techniques employed in conceptualizing the park's transformation but also underlines the crucial role of advanced geodetic tools and software solutions in the field of landscape architecture. Moreover, it emphasizes the significance of community input in creating a park environment that caters to the specific requirements of its visitors.

Key words: Conceptual Solution, Arrangement of Urban Greenery, Collection of Field Data by GNSS, Susedgrad Zagreb.

LORANTHUS EUROPAEUS (JACQ.) – SEEDS GERMINATION IN DIFFERENT THERMAL CONDITIONS – PILOT STUDIES

Marlena Baranowska[1]*, Adrian Łukowski[1], Robert Korzeniewicz[1], Wojciech Kowalkowski[1], Mirzeta Memišević Hodžić[2], Magdalena Ślachetka[3], Jiří Souček[4], Pavel Kotrla[5]

Abstract

Loranthus europaeus is a semi-parasitic plant that affects mainly oaks. Heavily infested trees react with premature crown aging, which can eventually lead to their death.
This study aimed to analyze the germination of various seeds of L. europaeus from Czech Republic, and Bosnia and Herzegovina in two other terms and conditions.
The study was conducted in 2023. *Loranthus europaeus* seeds were collected in March 2023 in Opočno, Kunovice, and Bosanska Krupa. The research was conducted in climatic chambers. Before sowing, the seed viability was determined

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by dyeing using the indigo carmine method. The seeds were placed in Petri dishes on sterile paper, 10 pieces per dish (on 24 March 2023). The following experience variants were created: Opočno +8°C, Kunovice +8°C, Bosanska Krupa +8°C, Opočno +13°C, Kunovice +13°C and Bosanska Krupa +13°C. In total, 70 seeds were used for one variant of the experiment. The research was completed on June 3, 2023.
The viability of seeds collected from various locations was as follows: Opočno 86,98%, Kunovice 88,64% and Bosanska Krupa 93,29%.
The seeds collected in Bosanska Krupa were characterized by the highest emergence efficiency. In variant Bosanska Krupa +8°C germination capacity was determined at 14,29%, in Bosanska Krupa +13°C – 17,14%, in Opočno +8°C and +13°C – 1,43%, Kunovice +8°C – 1,43%, Kunovice 0%.
The seeds from Bosnia and Herzegovina were of the best quality, which was confirmed by the test results. Considering the threat posed by *L. europaeus* to oak stands, it is important to create a model of the potential occurrence of this mistletoe in the event of the following climate changes.

Keywords: Climate changes, Deciduous stands, Oak mistletoe, Semi-parasitic plant.

DETECTING ALDER HABITATS ON FORESTED RIPARIAN ZONE OF CRNA RIJEKA RIVER IN CENTRAL BOSNIA BASED ON SENTINEL S2 TIME SERIES

Mirsada Starčević[1]*

Abstract

Alder (*Alnus* spp., family *Betulaceae*) are broadleaved tree species commonly found in riparian zones supporting unique habitat micro-climate exposed to changeable water levels and different effects of climate change and anthropogenic pressures. In Bosnia and Herzegovina mainly appear as fragments or patches rarely as forest stands usually not covered in regular taxation surveys.
The aim was to differentiate alder sites from other present forest types on the riparian zone of Crna Rijeka River in central Bosnia.
Here are identified 120 temporary sample plots for the classification of four classes (conifers, beech, oaks and alder). The multi-temporal Sentinel satellite imagery covering all phenological stages is used for classification. Firstly, non-covered areas are excluded by applying the threshold of normalized differentiated vegetation index (NDVI) (0.60). The classification was based on a random forest algorithm using sample subsets to train (70%) and to evaluate results (30%). The most important variables were identified: short wave

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infrared (SWIR1), green, red and blue spectral channels from summer months (May, June, July). It seems that vegetation water content and the spongy mesophile structure differentiated beech/oaks and alder canopies. Classification revealed an overall accuracy of 0.80 and a substantial Kappa index of agreement (KIA=0.73). Producer accuracy (PA) confirmed perfect alder sites separation (PA=0.90).
The obtained results could be used in the identification of alder habitats useful for further environmental management and research.

Keywords: Alder habitat, Alder differentiation, Multitemporal imagery, NDVI, Random Forest.

DIFFERENCES IN CARBON SEQUESTRATION OF DOUGLAS FIR (*PSEUDOTSUGA MENZIESII* MIRB. FRANCO) PROVENANCES

Mirzeta Memišević Hodžić[1]*, Dalibor Ballian[1,2,3]

Abstract

Forest tree species are very important in terms of carbon sequestration. Douglas fir is forest tree species native to North America, but shown successful growth and high productivity and quality in Europe. It is also considered as a species with high carbon sequestration. This research aims to select the best provenances of Douglas fir for carbon sequestration in the provenance test in Bosnia and Hercegovina.

The material used in the research were Douglas fir trees in the provenance test Rosulje, near Sarajevo. The provenance test was established in 1966. by seedlings 2+2 y-o, in three blocks, with 250 plants per provenance and block. Breast height diameters and heights were measured on 60-year-old trees. Basal areas and volume of trees, and sequestration of C and CO_2 per tree were calculated. Variance analysis and descriptive statistics was performed using SPSS 20.0.

Results of ANOVA analysis showed no statistically significant differences among provenances for any of investigated traits. The average height of 60-year-old trees for all provenances was

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25.7 m, average breast height diameter 38.3 cm, average basal area 0.123 m^2, and average volume 1.118 m^3 (382.43 m^3/ha). The average 60-year-old Douglas fir tree in the Bosnian-Herzegovinian provenance test binds 0.239 tC (81.84 t/ha) and 0.872 tCO_2 (298.29 t/ha).
This research confirmed that Douglas fir is favorable tree in terms of growth and carbon sequestration, and is recommended for afforestation in suitable habitats. Since the results of other research showed statistically significant differences among provenances for morphological traits, the research should be continued.

Keywords: Carbon sequestration, Douglas fir, Provenance test.

CHEMICAL ANALYSIS OF SWEET CHESTNUT (*CASTANEA SATIVA* MILL.) FRUITS FROM NATURAL POPULATIONS IN BOSNIA AND HERZEGOVINA

Vanja Daničić[1]*, Željka Marjanović-Balaban[1], Mirzeta Memišević Hodžić[2]

Abstract

The paper presents the results of the examination of the chemical composition of sweet chestnut fruit from six natural populations that include the southern, northwestern, and northeastern parts of the sweet chestnut area in Bosnia and Herzegovina (Bužim, Kostajnica, Prijedor, Banja Luka, Bratunac, and Konjic). The chemical composition analysis was performed on two types of samples - peeled and unpeeled fruit. The research included the determination of the content of moisture, ash, protein, starch, fat, and total sugars. Results for peeled fruit, the water content ranged from 39.3% (Bratunac) to 54.9% (Banjaluka), while for unpeeled fruit, it ranged from 37.7% (Bratunac) to 52.5% (Banjaluka). The ash content for peeled fruit ranged from 0.6% (Bužim) to 1.3% (Kostajnica), and for unpeeled fruit, from 0.6% to 1.1% (Kostajnica and Prijedor). The protein content ranged from 2.9% to 4.5% (Kostajnica) for peeled fruit and from 2.7% to 4.0% (Kostajnica) for unpeeled fruit. For the peeled fruit category, the proportion of fat ranged from 1.0% to 2.6% (Bratunac), for starch content from 22.0% to 42.0% (Bratunac), and total sugars from 0.4% to 0, 8%

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(Prijedor, Bratunac, Kostajnica, and Konjic). For the unpeeled fruit category, the proportion of fat ranged from 0.6% to 1.9% (Bratunac), for starch content from 20.7% to 36.0% (Bratunac) and total sugars from 0.4% up to 0.8% (Prijedor, Kostajnica, and Konjic). The values of all analyzed parameters were significantly higher in the peeled fruit than in the unpeeled fruit category.

Keywords: *Castanea sativa,* Sweet chestnut, Chemical composition.

DENDROCHRONOLOGICAL ANALYSIS OF SILVER FIR (*ABIES ALBA* MILL.) IN THE KLEKOVAČA MOUNTAIN AREA OF BOSNIA AND HERZEGOVINA

Vojislav Dukić[1]*, Jelena Velaga[2], Danijela Petrović[1], Srđan Bilić[1]

Abstract

On the mountain Klekovača, the dendrochronological method studied the radial growth of Silver fir trees, the most important species of conifers in this area. Samples were taken from trees at two sampling sites with different altitudes in mixed stands of Silver fir, Norway spruce and beech. Cross-dating was done by using visual on-screen techniques with CDendro software and statistical methods with the use of Cofecha software. Standardization of series of tree ring widths was performed using the Arstan program. A chronology of 61 years was obtained at the first site, and a chronology of 98 years was obtained at the second site. A comparison of the obtained chronologies by sample areas (GLK = 0.64; $p < 0.01$) showed that a master chronology can be formed for the area of the Klekovača mountain, which covers the period from 1919 to 2016. The relationship between climatic parameters, ie SPEI and FAI index and the formed chronology was analyzed. The results of the application of the drought indices for these purposes have shown that more intense droughts in the

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summer months can cause a significant reduction in Silver fir growth in the area. A comparison of the obtained chronology with the chronologies of Silver fir for the mountains Kozara and Borja was performed. The calculated t-values according to Baillie and Pilcher, t_{BP} = 6.5 (Klekovača - Kozara) and t_{BP} = 5.7 (Klekovača - Borja), show a good match of the formed chronologies in the northwestern part of Bosnia and Herzegovina.

Keywords: Dendrochronology, Tree ring width, Silver fir, Bosnia and Herzegovina.

CROWN STRUCTURE OF SILVER FIR TREES IN UNEVEN AGED STANDS ON BORJA MOUNTAIN (BOSNIA AND HERZEGOVINA)

Vojislav Dukić[1]*, Srđan Bilić[1], Danijela Petrović[1], Goran Jović[2]

Abstract

Knowledge of the crown structure in the stands is of great scientific and practical importance. In pure Silver fir stands and mixed Silver fir and beech stands on the Borja mountain, the basic elements of tree growth were measured on fifteen sample plots (50 m x 50 m). For fir trees, average values of crown projection area by sample plots in the interval from 15.9 m^2 to 27.8 m^2 were determined. The average value for trees in all stands is 22.7 m^2. According to biological positions (I, II, III), the crown projection area are 33.6, 16.6 and 9.7 m^2, respectively. For Silver fir trees, average values of crown length in the interval from 7.6 m to 11.7 m were determined, i.e. the average value for trees in all sample plots was 9.7 m. Analysis of the dependence of the crown projection area and the crown lengths on the diameter of the fir trees showed that there is a strong relationship (coefficients of determination are 0.70 and 0.78, respectively). A statistically significant regression model was obtained to estimate the diameter increment of the tree based on the breast diameter and the crown projection area (p

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<0.0000; Std. Error of estimate: 1.3846 mm). The distribution of trees according to the degree of individual tree stability (crown length / tree height), shows that more than 60% of trees are in the categories of unstable and very unstable.

Keywords: Crown, Silver fir, Bosnia and Herzegovina.

INFLUENCE OF THE METHODS OF SEEDLINGS PRODUCTION OF SILVER FIR ON DIVERSITY OF ROOT FUNGI IN FOREST CROP

Wojciech Kowalkowski[1], Jolanta Behnke-Borowczyk[2], Natalia Kartawik[2], Marlena Baranowska[1]*, Adrian Łukowski[1], Władysław Barzdajn[1]

Abstract

The study aimed to determine the biodiversity of fungi colonizing small roots of 5-year-old fir seedlings produced using various nursery methods in the Międzylesie Forest District (16°66'23˝ E50°14'86˝N). We compared the obtained results with research results from 2017. It has been assumed that mycorrhizal fungi will be dominant in small-root communities of fungi of silver fir. DNA extraction was performed using Plant Genomic DNA purification (Thermo Scientific) according to the manufacturer's protocol. The ITS½ rDNA region was used to identify species of fungi. The analysis was carried out using specific primers. The product obtained was purified and sequenced using SBS technology (Illumina). The sequences obtained were compared using the BLAST algorithm with reference sequences from the NCBI database. The fungal function in the plant is based on literature data and

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the Fungal Trails and DEEMY database. Including 80.23% (2017) and 86.48% (2019) of the fungal sequence was obtained. The taxa: Thelephoraceae (0.016%-28,271%), *Tuber* sp. (0.003-32,034%), and *Acephala* sp. (0.003%-9.793%) had the largest share in the communities of fungi of small roots of firs. In 2019, the community was dominated by fungi of the genus: *Cadophora* (0.00%-29,66%; pathogen), *Tuber* (0.00-21.45%; mycorrhizal fungus), and *Utharomyces* (0.00%-16.56%). The obtained results in 2017 indicate the dominance of mycorrhizal fungi in the communities of root fungi first, which proves the good quality of seedlings. This situation changed in forest crops. An increase in the share of pathogenic fungi, as well as the entomopathogenic genus *Beauveria*, was observed, indicating the appearance of insect pests.

Keywords: *Abies alba,* Mycorrhizal fungi, Pathogenic fungi, Seedlings from container production, Seedlings from the ground.

CONFERENCE PROGRAMME

THURSDAY EVENING, NOVEMBER 30TH, 2023	
Participants arrival and desk registration	
FRIDAY DECEMBER 1ST, 2023	
08:00-09:00	Registration
09:00-09:30	**Opening and welcome addresses** Representative from Ministry of Science, Higher Education and Youth of Sarajevo Canton Representative from Ministry of Economy of Sarajevo Canton Rector of the University of Sarajevo Prof. dr. Rifat Škrijelj Dean of the University of Sarajevo - Faculty of Forestry Prof. dr. Ahmet Lojo
09:30-11:30	**SOLEMN ACADEMY** Classical Music Concert Presentation of the achievements of the University of Sarajevo - Faculty of Forestry Promotional Video of the University of Sarajevo - Faculty of Forestry Awarding of Charter, Plaques and Certificates of Appreciation Awarding of best students
11:30-12:00	Coffee break

12:00-13:15	**Plenary session** Moderator: Prof. dr. Muhamed Bajrić and Prof. dr. Zahida Ademović	
12:00-12:15	Aida Ibrahimspahić, Besim Balić, Azra Čabaravdić, Ahmet Lojo, Admir Avdagić, Ismet Fazlić	Historical development, education, research and perspectives - Chair for Forest and Urban Forest Management
12:15-12:30	Jusuf Musić, Dževada Sokolović, Muhamed Bajrić, Velid Halilović, Dino Hadžidervišagić, Jelena Knežević, Amina Karišik	Historical development, education, research and perspectives - Chair for Forest Utilization, Planning and Building in Forestry and Horticulture
12:30-12:45	Mersudin Avdibegović, Sabina Delić, Dženan Bećirović, Amila Brajić, Bruno Marić	Historical development, education, research and perspectives - Chair for Economics, Policy and Organization in Forestry and Urban Greenery
12:45-13:00	Sead Vojniković, Neđad Bašić, Fatima Pustahija, Alma Hajrudinović-Bogunić, Zahida Ademović, Mirsada Starčević, Mirel Subašić, Faruk Bogunić, Emira Hukić	Historical development, education, research and perspectives - Chair for Forest Ecology and Urban Greenery
13:00-13:15	Dalibor Ballian, Sead Ivojević, Mirzeta Memišević Hodžić, Mehmed Čilaš, Ćemal Višnjić	Historical development, education, research and perspectives - Chair for Silviculture and Urban Greenery
13:15-14:15	**Lunch, break**	

14:15-16:00	**Parallel Session** Education, research and perspectives in forestry Moderators: Prof. dr. Sead Vojniković and Doc. dr. Jelena Knežević	
14:15-14:30	Mathias Leiter, Christoph Pucher, Michael Kessler, Harald Vacik, Manfred J. Lexer, Hubert Hasenauer	Assessing the potential future Plenter forest area of Styria, Austria using dynamic forest site classifications
14:30-14:45	Mehmed Čilaš, Mathias Leiter, Ćemal Višnjić, Hubert Hasenauer	Modeling Plenter Forests in Bosnia & Herzegovina using the Tree Growth Model MOSES
14:45-15:00	Marijan Šušnjar	Trends of development of forest vehicles and machines
15:00-15:15	Nada Dragović, Tijana Vulević, Mirjana Todosijević, Katarina Lazarević	Educational framework of erosion and torrent control: the path to lifelong learning
15:15-15:30	Lejla Lazović-Pita, Dženan Bećirović	Is there a difference between the payment and the levy for forest ecosystem services?
15:30-15:45	Vladimir Stojanovski, Makedonka Stojanovska	What are the winners and losers from the forest policy reforms in North Macedonia?
15:45-16:00	Dženan Bećirović, Dragan Čomić, Branko Glavonjić, Mersudin Avdibegović, Bruno Marić	What kind of support wood-processing companies are preferring in Republika Srpska

14:15-16:00	**Parallel Session** Education, research and perspectives in urban greenery Moderators: Prof. dr. Giuseppe E. Scarascia-Mugnozza and Mr. Amila Brajić	
14:15-14:30	Giuseppe E. Scarascia-Mugnozza, Davide Pettenella, Marco Marchetti, Fabio Salbitano	Transforming Biocities: Designing Urban Spaces Inspired by Nature
14:30-14:45	Dženana Tatlić, Azra Čabaravdić, Melisa Ljuša, Muhamed Bajrić, Sanela Klarić, Alma Hajrudinović-Bogunić, Emira Hukić	The Role of Standards in Urban Green Space Planning: Insights from Sarajevo City
14:45-15:00	Alen Mujčinović, Aleksandra Nikolić	Urban agriculture and urban-to-rural continuum – pathway for more resilient communities in Bosnia and Herzegovina
15:00-15:15	Dženan Bećirović, Lejla Muminović, Emina Kešmer, Mersudin Avdibegović, Sabina Delić, Amila Brajić, Bruno Marić	Visitors' perceptions of tourism recreational opportunities in the Trebević and Skakavac protected areas
15:15-15:30	George N. Zaimes, Valasia Iakovoglou, Paschalis Koutalakis and Georgios Gkiatas	Enhancing urban riparian area management by utilizing innovative technologies and nature-based solutions: The Case Study of Drama, Greece
15:30-15:45	Amila Brajić, Ajla Hota, Bruno Marić, Mersudin Avdibegović, Sabina Delić, Dženan Bećirović	Recognizing the benefits of green roofs as strategic approach to improve the quality and accessibility of green infrastructure in Sarajevo

16:00-16:30	POSTER SESSION / Coffee break Moderator: Dr. Mirzeta Memišević Hodžić
16:30-17:00	General discussion Poster ranking Conference Conclusions Closing Remarks

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