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Resources Conference Suceava – Romania**

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**Forestry Faculty, "Ștefan cel Mare" University  
Suceava, Romania**

**BOOK OF ABSTRACTS**

Edited by:

Mihai-Leonard Duduman, Liviu Nichiforel, Ciprian Palaghianu

# Conference Program

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## Opening session

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10.00-10.30 Ciprian Palaghianu

Dean of Forestry Faculty, "Ștefan cel Mare" University of Suceava, Romania

Mihai Dimian

Vice Rector of "Ștefan cel Mare" University of Suceava, Romania

Lucian Curtu

Dean of Faculty of Silviculture and Forest Engineering, "Transilvania" University of Brașov, Romania

Serban Davidescu

Director of National Institute of Research - Development in Forestry "Marin Dracea", Romania

Ciprian Muscă

Director of Romanian Foresters Association (ASFOR)

## Plenary session

(Moderator Liviu Nichiforel)

10.30-10.50	Bioeconomy development and forest strategy: the Italian experience	Daide Pettenella <i>Department of Land, Environment, Agriculture and Forestry - University of Padova, Italy</i>
10.50-11.10	The forest-bioeconomy in Romania: present and future prospects	Alex Giurca <i>Heidelberg Center for the Environment (HCE), Germany</i>
11.10-11.30	Alien phytophagous insects in forest and urban stands of Ukraine	Valentyna Meshkova <i>Ukrainian Research Institute of Forestry &amp; Forest Melioration named after G.M. Vysotsky, Kharkiv, Ukraine</i>
11.30-11.50	Aboveground biomass of living trees depends on topographic conditions and tree diversity in temperate montane forests from Slătioara-Rarău area (Romania)	Duduman Gabriel <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
11.50-12.00	Conclusions	Liviu Nichiforel
12.00-13.00	Break	
13.00- 16.00	Parallel sessions	see detailed program for each session
16.00-17.10	Poster session	

## Forest Bioeconomy Session

(Moderator: Laura Bouriaud)

13.00-13.15	Can sustainable development goals be achieved without assessing ecosystem assets?	Laurențiu Ciernei <i>Center for Study and Research for AgroForestry Biodiversity "Acad. David Davidescu", Romanian Academy, Bucharest, Romania</i>
13.15 -13.30	Small and medium forest-based enterprises: organization of business processes in Južnokučajsko forest region	Jelena Nedeljković <i>University of Belgrade-Faculty of Forestry, Belgrade, Serbia</i>
13.30-13.45	Extending the application of the Private Property Rights Index in Forestry	Richard Rimoli <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania; Universidade de Lisboa, Portugal</i>
13.45-14.00	State Forestry Administration Development in Slovakia using Selected Theoretical Concepts	Zuzana Dobsinska <i>Technical University in Zvolen, Forestry Faculty, Slovakia</i>
14.00-14.15	Identification of risk factors for risk assessment at the subdivision level	Todor Nickolov Stoyanov <i>Forest Research Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria</i>
14.15-14.30	Comparative analysis between the proposal of Law on Forests in the Federation of Bosnia and Herzegovina and FSC Standards for Bosnia and Herzegovina	Mersudin Avdibegovic <i>University of Sarajevo, Faculty of Forestry Chair of Forest Economics, Policy and Organisation, Bosnia and Herzegovina</i>
14.30-14.45	Forest certification in the context of legal national frameworks: an analysis of the corrective action requests	Bogdan Buliga <i>Babeș-Bolyai University of Cluj Napoca, Romania</i>
14.45-15.00	Romanian forest governance: the Good, the Bad and the Ugly	Liviu Nichiforel <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.00-15.15	Strategic options for the development of a new forest strategy in Romania	Bogdan Popa <i>"Transilvania" University of Brașov Faculty of Silviculture and Forest Engineering, Brașov, Romania</i>
15.15-15.30	A contingency matrix-based approach of checking the compliance to the legal framework	Marian Dragoi <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.30-15.45	Ecology of communication and forestry environment	Artenie Tudor-Nicolae <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.45-16.00	Conclusions	Moderator

## Forest Biodiversity, Silviculture and Forest Health Session

(Moderator: Mihai -Leonard Duduman)

13.00-13.15	Preference of <i>Xylosandrus germanus</i> females for different deciduous tree species as oviposition substrate – Preliminary results	Nicolai Olenici <i>National Institute of Research - Development in Forestry "Marin Dracea", Câmpulung Moldovenesc Station, Romania</i>
13.15 -13.30	The role of tree pathogens in Old-growth forests.	Ecaterina Fodor <i>University of Oradea, Faculty of Environmental Protection, Oradea, Romania</i>
13.30-13.45	Study on the diversity of beetles captured in unbaited traps in Codrul secular Șinca, Brașov County, Romania - Preliminary results	Ionuț-Marian Dragomir <i>"Transilvania" University of Brașov, Faculty of Silviculture and Forest Engineering, Brașov, Romania</i>
13.45-14.00	Phytopathological aspects encountered in forest crops in 2021	Mircea Cristian Moldovan <i>National Institute of Research - Development in Forestry "Marin Dracea", Cluj-Napoca Station, Romania</i>
14.00-14.15	Comparison of the synthetic pheromone lures for <i>Ips duplicatus</i> , depending on the used solution for the release of the volatile mixtures.	Mihai-Leonard Duduman <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
14.15-14.30	Some aspects regarding forest ecosystems health in Calimani National Park, Romania	Claudiu-Cosmin Rogojan <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania; Călimani Național Park, Romania</i>
14.30-14.45	The presence and frequency of microhabitats on trees in natural reserve "Izvoarele Nerei"	Cătălin-Ionel Ciontu <i>National Institute of Research - Development in Forestry "Marin Dracea", Timișoara Station, Romania</i>
14.45-15.00	Analysis of the vascular flora from the Rososa Forest Nature Reserve	Dorin Florențiu Pălie <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.00-15.15	Assessing local people's perception of the recreational and social value of urban and peri-urban forests	Romulus Oprica <i>Brand Berry market research for business solutions, Brașov, Romania</i>
15.15-15.30	Insect species in relation with oak decline in North-East of Romania	Daniela Lupaștean <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.30-16.00	Discussions	Moderator

## Forest Ecosystems and Climate Session

(Moderator: Gabriel Duduman)

13.00-13.15	Influences of disturbance on chronology structure and temperature sensitivity of tree ring width and blue intensity in central-eastern European Norway spruce	Jiang Yumei <i>Czech University of Life Sciences Prague, Czech Republic</i>
13.15-13.30	Climate sensitivity in different <i>Pinus cembra</i> tree-ring traits in Retezat National Park	Marian-Ionut Ştirbu <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
13.30-13.45	Analyzing adaptive traits of Norway spruce provenances in relation to their place of origin in common garden trials across Romanian Carpathians	Alin-Madalin Alexandru <i>National Institute of Research - Development in Forestry "Marin Dracea", Voluntari, Romania</i>
13.45-14.00	Climate control on snow avalanche activity in the Ukrainian and the Romanian Eastern Carpathians	Dariia Kholiavchuk <i>Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine</i>
14.00-14.15	Norway spruce dendroclimatic models from Gheorgheni region (Eastern Carpathians)	Andrei Popa <i>National Institute of Research - Development in Forestry "Marin Dracea", Câmpulung Moldovenesc Station, Romania</i> <i>"Transilvania" University of Braşov, Faculty of Silviculture and Forest Engineering, Braşov, Romania</i>
14.15-14.30	Historical mixed-severity disturbances shape current forest structure of primary temperate mountain forests in Europe	Rodrigo Ruffy <i>Czech University of Life Sciences Prague, Czech Republic</i>
14.30-14.45	Planting good deeds in Romania	Mihai Enescu <i>EcoAssist Association, Bucharest, Romania</i>
14.45-15.00	Assessing surface runoff evolution under climate and land use change in a small forested watershed	Mirabela Marin <i>National Institute of Research - Development in Forestry "Marin Dracea", Voluntari, Romania</i>
15.00-15.15	Evolution of the natural regeneration from the territories adjacent to the forests of the Adâncata Forest District	Alexei Savin <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.15-15.30	Mixed silver fir, Douglas fir and Norway spruce plantations in the SW of Romania – growth and components of tree resilience to severe droughts	Ştefan Petrea <i>"Transilvania" University of Braşov, Faculty of Silviculture and Forest Engineering, Braşov, Romania</i>
15.30-15.45	Primary forest biomass dynamics across scales driven by natural disturbances.	Dheeraj Ralhan <i>Czech University of Life Sciences Prague, Czech Republic</i>

15.45-16.00	Contribution to a better assessment of the indicative growth under biotic and abiotic hazards	Ciprian Ceornea <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
16:00-16:15	Changes in rotation periods and tree species composition of forests in the Czech Republic during last 2 decades	Kateřina Holuřov <i>Mendel University in Brno, Czech Republic</i>
16.15-16.30	Discussions	Moderator

### Forest Assessment, Modelling, Forest Management Session

(Moderator: Ciprian Palaghianu)

13.00-13.15	How much does it take? A comparison of manual and LIDAR-based wood measurement options.	Stelian Alexandru Borz <i>"Transilvania" University of Brașov, Faculty of Silviculture and Forest Engineering, Brașov, Romania</i>
13.15 -13.30	Modelling species compositions changes and biomass evolution under different climate change scenarios and forest management strategies in Frasin Forest District	Cosmin Coșofreț <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
13.30-13.45	Age-independent diameter increment models for Norway spruce, European beech and silver fir in mixed-uneven aged stands	Albert Ciceu National Institute of Research - Development in Forestry " <i>Marin Dracea</i> ", Voluntari, Romania; <i>"Transilvania" University of Brașov, Faculty of Silviculture and Forest Engineering, Brașov, Romania</i>
13.45-14.00	A comparative study regarding deadwood amount between natural and managed forests from Strambu-Baiuț, Romania	Mihai-Gabriel Cotos <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
14.00-14.15	Terrestrial laser scanner used in short rotation poplar crops for biomass estimation. Case of study in NE part of Romania (methodology aspects)	Iulian Danil <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
14.15-14.30	Analysis of the organization of collection and processing of non-wood forest products in the Republic of Moldova	Gheorghe Novac <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
14.30-14.45	Aspects regarding the stray dog in the hunting legislation of different states in the world	Valerian Simioniuc <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>

14.45-15.00	Comparative analysis of structure of the forest stands managed by Steșeni forest enterprise after 30 years	Vladislav Grati <i>Moldova State University, Chișinău, Republica Moldova</i> <i>Institute for Forest Research and Management, Chișinău, Republic of Moldova</i>
15.00-15.15	Forest vegetation disturbance pattern in a complex ownership area: a case study in Brosteni Forest District	Cosmin Coșofreț <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.15-15.30	Tree size distribution and structural dynamics of the Humosu old growth-beech forest	Catalin-Constantin Roibu <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.30-15.45	Patterns of forest species association in sapling communities: a story of love and hate	Ciprian Palaghianu <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
15.45-16.00	The influence of past management on the current biodiversity of forests in Natura 2000 site Rarău-Giumalău, Romania	Cătălina-Oana Barbu <i>"Ștefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
16.00-16.15	Discussions	Moderator

### Poster Session 16.00-17.30

(Moderator: Cătălina Barbu)

5 min	EU Blueprint on Green Care	Sergiu Florea <i>Forest Design Brașov, Romania</i>
5 min	Analysing the sound speed through the wood of Norway spruce trees affected by root rot.	Pei Gheorghe <i>"Transilvania" University of Brașov, Faculty of Silviculture and Forest Engineering, Brașov, Romania</i>
5 min	Experimental and analytical models in Norway spruce stands from risk areas to the action of disturbing factors	Radu VLAD <i>National Institute of Research - Development in Forestry "Marin Dracea", Câmpulung Moldovenesc Station, Romania</i>
5 min	Monitoring of atmospheric deposition and soil solution fluxes in forests managed by the Forest District of Regime Gheorgheni S.A.	Curcă Marius <i>National Institute of Research - Development in Forestry "Marin Dracea", Câmpulung Moldovenesc Station, Romania</i>



5 min	Snow-avalanche activity documented by tree rings in the upper Prut river catchment (Chornohora, Ukraine)	Armelle DECAULNE <i>CNRS - Laboratoire LETG-Nantes, France</i>
5 min	Downy oak ( <i>Quercus pubescens</i> Willd.) phenology within an oak forest ecosystem in Eastern Romania	Ioana Maria PLESCA <i>National Institute of Research - Development in Forestry "Marin Dracea", Voluntari, Romania</i>
5 min	Identification of rare, endangered, and endemic trees in the National Park „Kopaonik” - Serbia: case study „Metodje”	Marina Nonic <i>University of Belgrade-Faculty of Forestry, Belgrade, Serbia</i>
5 min	Species-specific deadwood density and its controlling factors in a virgin European beech-silver fir mixed forest in the Southern Carpathians	Ion Catalin Petritan <i>"Transilvania" University of Braşov, Faculty of Silviculture and Forest Engineering, Braşov, Romania</i>
5 min	Effects of different treatments on the germination rate and growth of black locust ( <i>Robinia pseudoacacia</i> L.)	Dan Catalina <i>USAMV Cluj-Napoca, Romania</i>
5 min	The sample size in allometric biomass models	Ioan Dutcă <i>"Transilvania" University of Braşov, Faculty of Silviculture and Forest Engineering, Braşov, Romania</i>
5 min	Chemistry and trophicity of urban forest soils from metropolitan area of Brasov city	Raluca Enescu <i>National Institute of Research - Development in Forestry "Marin Dracea", Braşov Station, Romania</i>
5 min	How to increase the productivity of short rotation poplar crops? Case study in NE Romania	Iulian Dănilă <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
5 min	Peak-discharge frequency analysis in the Slătioara hydrographic basin, Suceava, Romania	Ioan Ciornei <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
5 min	Logs volume assessment using different measurements and error distribution according to the number of pieces	Florin Clinovschi <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>
5 min	Identifying the potential social impact of the forestry works adjacent to the Via Transilvanica route	Cerasela Acatincăi <i>"Ştefan cel Mare" University of Suceava, Forestry Faculty, Suceava, Romania</i>

# ORAL PRESENTATION

## **Bioeconomy development and forest strategy: the Italian experience**

***Davide Pettenella***

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Italy has recently revised its first version of a Bio-economy Strategy and meanwhile has prepared its 20-years National Forest Strategy trying to find a balanced compromise between the need of increasing the domestic production of wood raw material and respecting the international and EU commitments for biodiversity protection, reducing the embedded deforestation connected to the annual import of more than 70 Mm<sup>3</sup> eq. of wood products. The paper will present both the contents of the National Forest Strategy and the participatory process organized for finding a large consensus on the objectives and means of the strategy.

## **The forest-bioeconomy in Romania: present and future prospects**

*Alex Giurcă*

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This is the introductory presentation for the special session "Forest Bioeconomy". This session aims to bring together Romanian and international scholars whose research contributes to our understanding of developing a sustainable, circular- bioeconomy. This session is interdisciplinary, bringing together scholars from various fields ranging from forest management, biodiversity conservation, innovation studies to policy and governance. Most inputs to this session will come from authors involved in the forthcoming book-project: "The plan 'B' for Romania's forests and society", but other scholars whose research is broadly connected to the interdisciplinary topic of "forest-bioeconomy" are warmly welcome to join our session.

## Alien phytophagous insects in forest and urban stands of Ukraine

**Valentyina Meshkova**

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In the forests and urban stands of Ukraine, 20 alien species of phytophagous insects have been recorded. Some of them penetrated rather long ago and quite deeply researched, for example, *Hyphantria cunea* (Drury, 1773), *Cameraria ohridella* Deschka et Dimic, 1986, *Phyllonorycter issikii* (Kumata, 1963), *Parectopa robinella* Clemens, 1863, *Macrosaccus robinella* (Clemens, 1859), and *Phyllonorycter platani* (Staudinger, 1870).

Four bug species (Hemiptera): (*Leptoglossus occidentalis* Heidemann 1910; *Halyomorpha halys* (Stal, 1855), *Corythucha arcuata* (Say, 1832) and *Corythucha ciliata* (Staudinger, 1870)) as well as *Dryocosmus kuriphilus* Yasumatsu, 1951, *Dreyfusia nordmanniana* (Eckstein, 1890), *Obolodiplosis robiniae* (Haldeman, 1847), *Prociphilus fraxinifolii* (Riley, 1879), *Metcalfa pruinosa* (Say, 1830), *Igutettix oculatus* (Lindberg, 1929), *Aproceros leucopoda* Takeuchi, 1939, *Nematus (Pteronidea) tibialis* Newman, 1837, *Trichoferus campestris* (Faldermann, 1835), *Agrilus planipennis* Fairmaire, 1888 and *Cydalima perspectalis* (Walker, 1859) have been added to the list of aliens in recent years.

*Cameraria ohridella* and *Cydalima perspectalis* pose a great threat to *Aesculus* L., 1753 and *Buxus* L., 1753 respectively in urban stands.

Oak lace bug (*Corythucha arcuata*) and emerald ash borer (*Agrilus planipennis*) pose a great threat to forest stands.

Oak lace bug in 2017 first registered in the south-western part of the Kherson region of Ukraine. The highest infestation was assessed in oak (*Quercus robur* L.) stands near forest roads and the waterway. In 2021, an infestation moved to the north and to the eastern parts of the Kherson region. The development of three generations of oak lace bug was successfully completed in the study area during the season. The oaks were severely damaged in Askania-Nova (46°27'N /33°53'E).

Emerald ash borer was recorded in the Luhansk region in 2019, spread there in 2020, and in 2021 was recorded in the Kharkiv region. It inhabits both *Fraxinus pennsylvanica* Marsh. and *Fraxinus excelsior* L. It is possible that the invasion took place simultaneously on the border of the Russian Federation from Kharkiv and Luhansk regions in 2016-2017. The difficulty of EAB detecting is that it is not always possible to examine the tops of ash trees, although we see from the ground the signs of its presence. Therefore, we leave such trees under control and will monitor them in the future.

**Aboveground biomass of living trees depends on topographic conditions and tree diversity in temperate montane forests from Slătioara-Rarău area (Romania)**

*Gabriel Duduman, Ionuț Barnoaiea, Daniel Avăcăriței,  
Cătălina-Oana Barbu, Vasile-Cosmin Coșofreț, Iulian-Constantin Dănilă,  
Mihai-Leonard Duduman, Anca Măciucă, Marian Drăgoi*

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This research aims to describe the complex ecological relations developed within the temperate intact forests from Slătioara UNESCO site and its surroundings (Romania). We quantified tree size heterogeneity, species diversity, the aboveground biomass of living trees (AgB), and determined how the woody biomass is influenced by tree diversity and environmental factors like solar radiation, elevation, slope and aspect. We found that tree species diversity decreases with increased solar radiation and elevation. It reaches a maximum when slope is between 50 and 60 degrees, and it is not influenced by aspect. Tree size heterogeneity diminishes once the solar radiation increases, but it reaches its highest mean values at elevations between 1001 and 1100 m, on slopes between 50 to 60 degrees. AgB is not related to solar radiation, slope, and aspect, but it is strongly correlated with elevation; the highest mean AgB (293 tonnes per hectare) is registered at elevations between 801 and 900 m but then, it decreases to 79 tonnes per hectare at more than 1500 m a.s.l. AgB is also very much related to tree species diversity and tree size heterogeneity, the highest AgB being reached within complex forest ecosystems in terms of structural diversity.

## **Can sustainable development goals be achieved without assessing ecosystem assets?**

*Laurențiu Ciornei*

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A single sustainable development objective that has been included in the 2030 Agenda (fifteenth) envisages the transfer of the value of all-natural ecosystems to countries' national accounts, monitoring of progress must be carried out in line with the Nagoya Plan ("Aichi Biodiversity Objectives"), by 2020 at the latest.

However, globally, by the end of 2020, only two countries have managed to complete the assessment of ecosystem assets - physical and value - and publish in the national accounts the most complete situations (UK and Netherlands). Otherwise, about 40 other countries have made significant progress, with Romania not being part of this list. Most of the information on the value of ecosystem assets in our country is purely estimates that prevent the evolution of ecosystems and the efficient use of natural resources in general, and forestry in particular, which could compromise the attraction of funding to achieve sustainable development goals. assume.

Moreover, most of the studies undertaken in this regard have focused on the assessment of only certain ecosystems, without these assessments being based on established frameworks, projects and processes worldwide. Even in the report that Romania produced for the European Union, statistical data were taken from various institutions, no effective calculations were made based on the evaluation options that were described in the report.

For these reasons, in order to achieve the assumed sustainable development objectives, Romania must be interested in implementing that theoretical conceptual framework that offers benchmark solutions for the recognition of ecosystem assets and flows of ecosystem goods and services. Looking from this perspective, the present study represents a preview that launches a challenge for specialists and the decision-maker to implement the most comprehensive conceptual framework for assessing ecosystem assets - SEEA (System of Environmental-Economic Accounting) - in order to quantify physically and monetarily the Romanian biodiversity and to take over these values in the national accounts.

## **Small and medium forest-based enterprises: organization of business processes in Južnokučajsko forest region**

*Danilo Krgović<sup>1</sup>, Jelena Nedeljković<sup>2</sup>, Zoran Poduška<sup>3</sup>, Dragan Nonić<sup>4</sup>*

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<sup>3</sup> Zoran Poduška, research associate, Institute of Forestry, Kneza Višeslava 3, Belgrade, Serbia

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The business of small and medium enterprises (SMEs) is of great importance in all countries as it contributes to economic development, primarily through the development of individual sectors of the economy. Contractors for forest services have an important role in forest management and the implementation of the annual cutting rate, i.e. in the efficient management of the timber supply chain, and represent a link between forest owners and enterprises within the wood industry. This research aims to find out about the organization of business processes within SMEs in the forestry and wood industry in the Južnokučajsko forest region (JKFR). Primary data were collected in two phases. In the first phase, data were collected by conducting surveys with 43 representatives of SMEs from the forestry, primary and final wood processing sectors, which operate on the territory of JKFR. In the second phase, data were collected by conducting interviews with six representatives of “leading” enterprises, as well as four representatives of institutions and interest organizations in charge of the forestry, wood industry, and SME sector in Serbia. JKFR was chosen because it has a high forest cover, a large share of privately-owned forests, as well as because the largest primary wood processing company in East-Serbia is located within the region and developed furniture industry. Almost ½ of SMEs in forestry perform their activities in state forests, but they also cooperate directly with private forest owners (PFOs). Primary wood-processing enterprises usually procure raw materials from PFOs, and enterprises for final wood processing from sawmills. Representatives of leading enterprises, institutions, and business-professional and interest organizations believe that certain subsidies are needed to encourage the modernization of equipment, as well as enterprises' connection for the joint export of products.



## Extending the application of the Private Property Rights Index in Forestry

*Richard Rimoli*

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Forest owners can have very different rights and responsibilities depending on the part of the world they live in. This paper uses the Property Rights Index for Forestry (PRIF), developed by Nichiforel et al. (2018), and aims to extend its scope outside of Europe and to test the relevance of this index on a global scale. This paper also aims to assess and test the index on forest ownership freedom for several kinds of ownership in VARIOUS socioeconomic contexts. Accessing the texts of law necessary to achieve the purpose of this study (such as forestry, rural and civil codes) enabled us to calculate a PRIF score for community-managed Nepalese forests, private forests in the legal Amazon area (Brazil), private properties in Misiones province (Argentina) and private producers and owners in Quebec (Canada). This allowed us to compare the rights (access, withdrawal management, exclusion, and alienation) of different types of forest ownership accurately and efficiently in three continents with an integrative and standardized index. A Principal component analysis (PCA), using 10 sub-categories from the index, confirmed the relevance of the PRIF for the studied jurisdictions, and also permitted the comparison and correlation with NICHIFOREL ET AL data of European countries. Despite this index being designed for European legislations and for private property, this paper showed that not only it can be used for policies outside of Europe, but it has also proved potentiality to include other types of ownership, such as community forests. As there is only 1 example of community forest included in the index, further studies including this type of ownership are needed to consolidate this use case. Finally, In order to further analyse the potential of this index I would be interesting to compare it to existing governance indicators and assess how it would fare as an environmental governance tool.

## State Forestry Administration Development in Slovakia using Selected Theoretical Concepts

*Zuzana Dobsinska<sup>1</sup>, Zuzana Sarvašová<sup>2</sup>, Jaroslav Šálka<sup>1</sup>*

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The role of public administration is to provide public services and implement public policy measures. At the same time, it acts as the main interface between the state and society. A public administration or administration is a public institution that issues decisions on specific problems on the basis of general legal standards and solves problems in the implementation of these measures. There are several theoretical concepts of public administration: Weber's traditional model (Bureaucracy), New Public Management (NPM) and Governance. State Forestry Administration (SFA) is a specialized public institution which, by means of legislative norms, governs individual areas of forestry, game management, land communities and forest reproductive material, decides and implements specific measures by means of substantive solutions. Several models of SFA were applied during the existence of Slovak Republic. The specialized public administration was replaced by the general model. The aim of the contribution is to identify elements of individual models of state administration performance in historical and current SFA models in Slovakia. Results show that there is a shift from the hierarchical model to incorporation of selected governance elements in the SFA performance, especially due to the environmental concerns in forest management and economy.

## Identification of risk factors for risk assessment at the subdivision level

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Fires have a destructive effect on forests, cause damage to the organic layer of the soil and its erosion and pollute the atmosphere and water with combustion products. The present study aims to identify risk factors for the occurrence of forest fires to create a risk - register, thereby creating an opportunity to assess the projected risk of a smaller unit area (subdivision). In this way, the risk factors will be able to be weighed, assessed, and also preventive measures can be taken to transfer or eliminate the risk of forest fires. It is proposed to supplement the approved methodology with the inclusion of risk calculation of smaller units - subdivisions.

## **Comparative analysis between the proposal of Law on Forests in the Federation of Bosnia and Herzegovina and FSC Standards for Bosnia and Herzegovina**

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Based on requests from some municipalities and referring to the constitutionally guaranteed right to local self-government, the Constitutional Court of the Federation of Bosnia and Herzegovina, ruled in 2009, that the Federal Law on Forests from 2002 "... violated the right of municipalities to local self-government". This judgment also instructed the Parliament of the Federation of Bosnia and Herzegovina to harmonize the provisions of this Law with the Law on the Principles of Local Self-Government in the Federation of Bosnia and Herzegovina. As it did not happen within the set deadline, the Law on Forests was repealed, resulting in the long-term lack of a unified forest legislative framework in the Federation of Bosnia and Herzegovina. Only in September 2021, the Government of the Federation of Bosnia and Herzegovina sent the proposal of the new Law on Forests to the parliamentary procedure. In March 2020, national FSC standards came into force, making Bosnia and Herzegovina the first country in the Western Balkan to have its own FSC standards. The application of internationally accepted principles and criteria of sustainable forest management in forestry sector has influenced the content of certain provisions of the proposal of the new Law on Forests of the Federation of Bosnia and Herzegovina. This paper presents a comparative analysis between the proposal of this new Law and some principles and criteria of FSC Standards for Bosnia and Herzegovina. The results of this paper may be useful to forest policy makers in the public forest administration, but also to all other stakeholders and institutions that actively participate in the process of development and adoption of the new forest legislation in the Federation of Bosnia and Herzegovina.

<b>Forest certification in the context of legal national frameworks: an analysis of the corrective action requests</b>
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<b>Romanian forest governance: the Good, the Bad and the Ugly</b>
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<b>Strategic options for the development of a new forest strategy in Romania</b>
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## **A contingency matrix-based approach of checking the compliance to the legal framework**

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Illegal fellings and criminal wrongdoings in Romanian forestry sector has captured the headlines of media for the last three years or so, thus jeopardizing credibility of all important stakeholders, no matter on which side they act out: public authorities, wood harvesting or forest conservation. Two things have happened lately: a new wood-tracking system is being in place, getting more people involved in legality checking mechanisms, and a new and more detailed law of forest felonies. Our model is been inspired by the math behind the model of Analytic Network Processes, namely the limit matrix. We assumed the most of felonies discovered by officers of the public authority in a given area, are more or less intercorrelated due to terrain configuration, available infrastructure (i.e. transport network) or special legal claims in protected areas. In some places illegal transport is easier to track down, simply because more people are involved in checking the traffic, while seedlings injuries are more likely to be punished in protected areas. Having all these reciprocal matchings, properly plugged into a contingency matrix and further processed as Markov chains, we may figure out which are the most ‘sizable’ combinations of forest crime over a long period of time *ceteris paribus*. This information helps the public authority make better decisions on the assignment of human resources, having background data on competencies and integrity.



## Ecology of communication and forestry environment

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In this paper we developed a new concept i.e., ecology of communication, based on different inputs provided by social media. The key hypothesis is that whatever message posted on social media is public communication, and should bare the same social responsibility as any other message delivered by public authorities. Therefore, the ecology of communication assumes a minimal fairness and caution and decency, if the topic is not completely understood or explained by the one who conveys the message. However, what happens if the message is false? There must be a sort of personal satisfaction whenever we deliver a message, otherwise none of us would have done it. The default assumption is that a false message is being delivered by a clean conscience. The alternative assumption is sheer manipulation, and the ecology of communication addresses those situations when a faulty communication can be compared with an ecological disaster. The paper discussed at length all aspects of social responsibility pending on communication about forestry.

Forest Biodiversity, Silviculture and Forest Health Session

**Preference of *Xylosandrus germanus* females for different deciduous tree species as oviposition substrate – Preliminary results**

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The black stem borer (BSB), *Xylosandrus germanus* (Blandford, 1894), an East-Asian ambrosia beetle, which was introduced in Europe no later than the middle of the 20th century, arrived in Romania before 2009 and now is present in most of the country's forests located below 1000 m altitude. As the larvae and the adults feed on the symbiotic fungus introduced into the host plant by females, it can attack a wide range of woody plant species, both coniferous and broadleaved ones, mainly stressed plants or recently felled logs stored in the forests. There is no report concerning the damages caused by this new pest so far, but they will likely occur as populations become more numerous, as has happened in some Central European countries. Attack prevention is necessary where the infestation risk is high. That implies taking into account the species' preference for different habitats and woody species. There are some studies concerning the preference for different forest habitats in Europe and the presented research aims to reveal its preference for some tree species.

The experiment took place in a 130-year-old European beech tree stand, located at 775 m altitude, in the northern part of the Eastern Carpathians, in 2018-2020. Previous investigations showed that a large population of BSB was present in that place. We considered six tree species for the research, namely: European beech - *Fagus sylvatica* L., English oak - *Quercus robur* L., common hornbeam - *Carpinus betulus* L., European ash - *Fraxinus excelsior* L., sycamore - *Acer pseudoplatanus* L. and black alder - *Alnus glutinosa* (L.) Gaertn. We placed in the forest wood pieces (WP) of about 30 cm in length, made from thin stems or branches (2-4 cm in diameter) of living trees. There were five randomised blocks of 36 WPs located at least 50 m away from each other. In each block, the WPs were in a network of squares with a side of about 50 cm. In 2018 and 2019, we cut WPs just before the setting of the experiment. Then we treated them with ethanol before placing them in the forest. For 2020, we cut the stems and branches in the autumn of 2019. Then we left them over the winter in contact with the ground, in a place with high atmospheric humidity. In the 2020 spring, we put the WPs in the forest without treating them with ethanol. The experiment started on 1.05.2018, 20.05.2019 and 15.04.2020, respectively, and stopped every year after the end of the flight of BSB females. We assessed the species' preference based on the WPs infestation frequency and the average attack density (number of BSB entries/WP).

BSB colonised all WPs in 2018 and 2019, and numbers of 10,527 and 11,140 BSB entries, respectively, were registered. In 2018, the highest attack density ( $76.1 \pm 32.3$  BSB entries/WP) was noted in sycamore stems and the lowest one ( $23.4 \pm 9.4$  BSB entries/WP) in ash stems, while in 2019 the highest ( $79.6 \pm 24.5$ ) and the lowest ( $33.8 \pm 15.5$ ) attack density was in hornbeam and ash stems, respectively. The difference between the highest and the lowest attack density was statistically significant ( $p < 0.05$ ) in both years. At the same time, the attack density in oak and alder WPs was not statistically different from that of species with the highest density. In 2020, BSB infested 60% of oak WPs, but no one of ash. Infestation of the other species was only 10-13.3%. The oak was preferred by BSB females (Chi-square = 46.368; DF = 5;  $p < 0.0001$ ). The mean attack density (computed only for infested WPs) varied between  $14.0 \pm 14.3$  BSB entries/WP in oak and  $1.0 \pm 0.0$  BSB entries/WP in hornbeam, without statistically significant differences between species ( $p = 0.104$ , Kruskal-Wallis test).

The preliminary results of the present study suggest that BSB females prefer oak wood as an oviposition substrate and avoid ash wood. They also colonize the wood of the other species, but to a much lesser extent than oak wood.

**Forest Biodiversity, Silviculture and Forest Health Session**

**The role of tree pathogens in Old-growth forests**

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The change of the paradigm considering tree pathogens - main factors responsible for unhealthy forests, in tree pathogens - contributors to forest biodiversity and stability, opens new perspectives in disease ecology as well as in forests conservation. Old-growth forests (a loose term still prone to different interpretations and unclearly separated from similar terms such as virgin and near-virgin forests), in a larger context, forests characterized by high level of naturalness, are considered as benchmarks for stability and resilience when compared to managed forests. In the context of holobiome concept, the pathogens which are components of the tree microbiome, are drivers of biodiversity, with different population dynamics in natural versus man-managed forests. The role of wood pathogens and sapro-pathogens as biodiversity, naturalness and habitat quality indicators has gained more and more interest recently, also, the conservation value of some pathogens linked to vulnerable tree species. Therefore, the understanding of the role played by tree pathogens, especially considering the interaction niche with their hosts, vectors, facilitators, indirect opportunists and competitors in the model setting of old-growth forests may help the sustainable management of commercial forests, plantations and tree nurseries. Several examples of pathogens and sapro-pathogens considered species of conservation value are provided for Romanian near-virgin forests identified during the work for the inclusion in the Romanian Catalog of Virgin and Near-virgin Forests performed by the authors of the present synthesis.

Forest Biodiversity, Silviculture and Forest Health Session

**Study on the diversity of beetles captured in unbaited traps in Codrul secular  
Șinca, Brașov County, Romania - Preliminary results**

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The paper is part of the growing concern of recent years to study the biodiversity of forest ecosystems with a high degree of naturalness, having as a study area the "Codrul secular Șinca" (included in the UNESCO World Heritage List, as part of "Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe"). The diversity of insects that live in the shelter of the forest ecosystems is one of the important keys that characterizes the naturalness of these ecosystems. In this context, the research presented tried to highlight the diversity of beetles in the secular forest Șinca, as well as how it is affected by human intervention through the forest management.

Thus, in the second half of May 2021, 35 circular sample plots of 500 m<sup>2</sup> each were materialized, both in the intact forest (15 plots) and in the buffer zone in its surroundings, which is affected by low forestry interventions (20 plots). One transparent flight intercept trap and three pitfall traps have been installed in each plot for accidental capture of insects. During the current season (from June to October), 9 collections were made every two weeks.

Preliminary results after processing the insects from the first two collections (June) showed the presence in the catches from the wing traps of 95 species of beetles (65 in the virgin forest, summing 391 individuals and 64 in the managed forest, summing 284 individuals). They belong to 34 families, of which species of 5 families were found only in the virgin forest (*Catopidae*, *Cleridae*, *Silphidae*, *Trogossitidae*, *Zopheridae*). The families *Curculionidae* and *Elateridae* recorded the most individuals in both types of forests, and *Curculionidae* (13), *Elateridae* (11), *Ptinidae* (7) and *Staphylinidae* (11) were the families with the most species. The species with the highest number of individuals were *Ochestes fagi* (94), *Agriotes acuminatus* (91), *Trypodendron lineatum* (46) *Salpingus ruficollis* (45), *Melanotus villosus* (34). In pitfall traps, 49 species of beetles (29 in the virgin forest and 37 in the managed forest) were identified. 4486 individuals were collected from the virgin forest, and 6815 from the managed forest, approximately the same families being identified, 12 in number, 3 of which are present only in the virgin forest (*Leiodidae*, *Nitidulidae*, *Rhysodidae*). The families *Geotrupidae* and *Carabidae* recorded the most individuals in both types of forests, and *Carabidae* (27) was the family with the most species. *Anoplotrupes stercorosus* (8295) belonging to the family *Geotrupidae*, *Carabus cancellatus* (465), *Carabus coriaceus* (411), *Carabus linnaei* (320), *Carabus violaceus* (860) and *Pterostichus niger* (221) belonging to the family *Carabidae* and *Nicrophorus vespilloides* (392) belonging to the family *Silphidae* were the species with the largest number of collected individuals.

These preliminary results indicate a tendency to differentiate the studied ecosystems concerning the ground beetles diversity, which may or may not be confirmed after the identification of all collected insects. The research was supported by a grant of the Romanian Ministry of Education and Research, CNCS-UEFISCDI, project number PN-III-P4-ID-PCE-2020-2696, within PNCDI III.

Forest Biodiversity, Silviculture and Forest Health Session

**Phytopathological aspects encountered in forest crops in 2021**

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In the present paper, the health status of seedlings from forest crops was monitored, in order to identify the main pathogens, in the context of current climatic conditions.

**Materials and methods:** In order to identify the pathogens, the health status of the forest crops within the solarium from the Tisa Nursery, respectively from Production Unit III subcompartments 87F (1.7 ha) and 89 (0.3 ha), from the Răstolița Forest District. Also, samples were taken from the affected biological material, which were placed on CGA culture medium (potato-glucose-agar), respectively data on the temperature and humidity of the air inside the solarium were collected.

**Results:** In solarium, the seedlings show the reddening of the upper part on approximately 10-15% of their height, at the same time being observed fallen seedlings, on about 10% of the surface, located in clusters. The black pine plantations show the reddening of the upper part of the needles, and in the transition zone between the red and the green part, there is a brown or black ring, their proportion being 70% in subcompartment 87F, and in subcompartment 89, the percentage of affected seedlings being smaller (25%).

**Discussion and conclusion:** The pathogens identified, following laboratory analyzes, in the solarium are *Botrytis cinerea*, along with saprophytes of the genera *Mucor*, *Aspergillus* and *Alternaria*, which usually act on the affected seedlings, and in black pine plantations, the pathogen was identified *Lophodermium pinastri*. Control solutions by applying specific treatments were recommended.

## Comparison of the synthetic pheromone lures for *Ips duplicatus*, depending on the used solution for the release of the volatile mixtures

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*Ips duplicatus* is a boreal species of bark beetle that in the last century has expanded its area in central and southern Europe, where it has acquired an invasive character. Here it produces strong outbreaks especially in artificial spruce stands installed outside the natural area. To monitor the seasonal activity of this species in the last 20 years, specific pheromone lures have been developed, which are used to attract and capture these insects in pheromone traps. However, the differing seasonal activity of these lures (ID Ecolure) have been reported when the significantly higher catches were monitored in the overwintering I. *duplicatus* generation than in the offspring generation.

Two designs of lure dispensers are currently used (depending on the mode of release of volatile substances): dispensers with release by wick (Ecolure ID, Fytofarm, Slovakia) and dispensers with release by polyethylene foil (Pheagr IDU SciTech, Czech Republic; Atradup, etc.). In this context, we set out to develop laboratory and field experiments that would allow the comparison of the operation of the two types of dispensers. The practical output is to develop dispenser which will actively attract *Ips duplicatus* also in developed seasons, after first swarming, when activity of commonly used commercial dispensers decreased. Thus, in 2011 the release rates of the two types of dispensers were compared in laboratory conditions (20°C RH 50%), subsequently testing in the field, their attractiveness (in three locations in Romania). In 2017, the compositions of the pheromone mixture for the ID Ecolure, Pheagr IDU, and ID Ro, developed in Applied Ecology Laboratory, Forestry Faculty, "Ștefan cel Mare" University of Suceava, Romania). Dispensers were determined in the laboratory, following a new field test in a single experimental area in the Czech Republic.

The release rates of wick dispensers (ID Ecolure) are approx. 365 mg / day on the first day of testing and down to approx. 16 mg/day after 60 days of testing. In the case of polyethylene dispensers (ID Ro), the release rates remain relatively constant during the 60 days (varying between about 20 and 24 mg/day). All types of tested lures contain Ipsdienol and E-myrcenol in different ratio, but also spruce-specific terpenes. The content of compounds in dispensers is described by vendors, relative content of volatile compounds in headspace was found by the chemical analysis with using of SPME.

The measuring of volatile active compounds in headspace showed its highest overall content in ID Ro, then in other tested lures under the same conditions, the ratio of Ipsdienol/E-myrcenol was the highest in the Pheagr IDU.

The total catches obtained in the case of field experiments showed that to the traps baited with ID Ecolure were caught significantly more beetles than to those baited with ID Ro or Pheagr IDU. However, according to analysing of the catches dynamics, there is a more intense response of beetles to ID Ecolure then to ID Ro in the April/May, when overwintering generation swarmed. Later in June, when offspring generation of *Ips duplicatus* appeared, attractiveness of ID Ro remained high but catches to ID Ecolure were significantly reduced. This result is most likely due to a reduction in the release rates of ID Ecolure dispensers over time and due to different composition of volatiles emitted by tested lures.

**Forest Biodiversity, Silviculture and Forest Health Session**

**Some aspects regarding forest ecosystems health in Călimani National Park, Romania**

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Since 2009, NFA - Călimani National Park Administration monitored the bark beetle foci in the strictly and integral protection zones, conducting a study of trees affected by pest populations (mainly Norway spruce bark beetle). Each year, through the observations made, only data from recently affected trees was collected.

From the surface of 24,556 ha (national park), the surface of the forest fund covers 17.922,4 ha (73%), and it's divided in strictly protected zone (831,4 ha), integral protection zone (9.759,2 ha) and durable conservation zone (7.331,8 ha).

Following the centralization of data obtained from the field regarding the evolution of bark beetle populations in the area with strict protection and the integral protection area, zones exempted from anthropogenic interventions in total of 10,600.7 ha, in the period 2009-2020, a total number of 541 foci were identified and evolved, the effective area of the outbreaks (the sum of the affected tree clusters) being around 127 ha.

We conclude that in the period 2010-2011 the maximum level of the bark beetle population was reached. The foci of bark beetle in the stands of the integral protection zone, compared to the stands in which anthropic intervention took place (durable conservation zone), were extinguished by themselves, as a result of the natural process of evolution of the attacks and restoration of the state of balance. The bark beetle population has decreased due to the absence of anthropogenic factor, an important role being played by the biological factor due to the multiplication of insectivorous birds, especially woodpeckers and the evolution of the weather.

Knowledge of forest ecosystems and especially their evolution, over a long period of time, is essential for sustainable wildlife, forest and landscape management.

## The presence and frequency of microhabitats on trees in natural reserve "Izvoarele Nerei"

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The importance of research in virgin forests has been highlighted countless times by the possibility of applying the results obtained in the management of cultivated forests. Studying the correlations between the structure and dynamics of virgin forests, but also the links between species and environmental factors can lead to finding new solutions to improve regeneration techniques and tree composition. The study of virgin forests must be seen as a tool for understanding the processes and interactions between different species.

Microhabitats on trees are of particular importance in forest habitats, recent studies highlighting their use as a proxy for taxonomic diversity at the local level, being important features for the conservation of forest biodiversity. Although the number of studies of microhabitats on trees has increased recently, the determinants of microhabitat profiles in natural forests in different geographical regions remain unknown. Thus, this study sought to identify microhabitats on trees, as well as their frequency, in order to be used as indicators (proxy) of biodiversity.

The researches are located in the Natural Reserve "Izvoarele Nerei" with an area of 5028 ha, which partially includes the production units II Nergana and III Nergănița, and belongs to the Nera Forest District, Caraș-Severin Forestry Department, being mainly made up of beech trees, and consisted of the installation of 8 plots with an area of 0.25 hectares (2500 m<sup>2</sup>) each, distributed respectively 2 by 4 altitudinal levels: 800, 1000, 1200 and 1350 m. In order to make comparisons on the presence, frequency and qualitative characteristics of the microhabitats on the trees, the test areas were delimited, the diameters and heights of the trees in the studied surfaces were measured, and regarding the presence and frequency of the microhabitats, was used the classification proposed by the European Forestry Institute (EFI) through the Integrated + project, and materialized in the Catalog of microhabitats on trees. In the 8 plots, a number of 646 trees with 4303 microhabitats were identified.

This paper is one of the first attempts to address this research topic in our country. The main advantage consists in the certain natural value of the stands studied, the stands from Izvoarele Nerei, which have a very high degree of naturalness, and where they can be observed the characteristics and natural processes of beeches in the form least influenced by anthropogenic activities.



**Forest Biodiversity, Silviculture and Forest Health Session**

**Analysis of the vascular flora from the Rososa Forest Nature Reserve**

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Roșoșa Forest is a forest nature reserve, located in Obcina Feredeului Mountains (Suceava County, Romania) on slopes with North-East and South-East exposure, naturally grounded, specific to the FM2 phytoclimatic level in which anthropogenic activity is relatively reduced. The analyzed area consists of mixed forests (Norway spruce, beech, and other deciduous species) and a few mountain meadows. The purpose of this study is to aim identification of floristic elements, inventory, bioform analysis, phytogeographic elements, ecological analysis, and taxonomic classification, all possible by making observations and collecting data in the field during the growing season. From a scientific point of view, as a novelty, the work makes it possible to know the current composition of the cormophytes in this reserve. To conserve measures applied to these protected areas, it is necessary to know as thoroughly as possible all biotic and abiotic factors, the balance, and the relationships between the components of natural habitats. Knowledge of the cormophyte flora provides the main information in a forest reserve for the correct management of protection and conservation practices.

Forest Biodiversity, Silviculture and Forest Health Session

**Assessing local people's perception of the recreational and social value of urban and peri-urban forests**

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The present study aims to identify the perception of the population regarding the recreational and social value of the urban and peri-urban forests around the Municipality of Braşov. Performed between 1st October 2020 and 4th June 2021 the study targeted specific and non-specific stakeholders. To develop a comprehensive research, both qualitative and quantitative research methods were used.

The comparative analysis according to the residence and the type of heating used indicates that the inhabitants of Noua-Dârste neighbourhoods use wood or mixed heating in a significantly higher proportion than those living in other neighbourhoods. Respondents interviewed consider that forest means 'promenade', 'freedom' and 'life', 54% of them have been into the forest in the last 7 days. The most active inhabitants are those who live in the neighbourhoods located nearby forest. Forest visits are limited by factors such as accessibility (75%) and fear of wild animals (25%). On age groups, 12% of people under 25 years have not been in the forest in the last year, while 6% have never been. People who visit the forests prefer activities such as tourism, recreation and sports-recreational.

More than half of the participants appreciated that the influence of the forest on their health is a positive one. Therefore, the forest role is seen mainly as maintaining and improving health, and only ultimately as a supplier of raw materials (either food or wood).

Forest Biodiversity, Silviculture and Forest Health Session

**Insect species in relation with oak decline in North-East of Romania**

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Pedunculate oak and sessile oak are significant components of natural hardwood forests in Romanian lowlands. In the last decades, pedunculate (*Quercus robur*) and sessile (*Q. petraea*) oak trees have been affected several times by episodes of dieback. These episodes are more frequent lately and have very rich facets. The surveys were conducted in several oak forests in North – East Romania, region Botoșani, severely affected by the decline syndrome, during the last period of time. The aim of the study is to identify the influences on oak trees and the real position of each in the causative constellation, as to highlight the aspects similar and/or different to other reported oak decline episodes, with special reference to insect species influences.

Insect species play an important role in the decline phenomenon, starting with the defoliating species, especially spring defoliators, and continuing with the bark and wood boring insects which participate in the final phase of the causative chain that leads to mortality of oaks.

Although the recorded mortality is high, it is difficult to assess the complete consequences because the information is incomplete, as a part of the trees are cut during thinning.

## **Influences of disturbance on chronology structure and temperature sensitivity of tree ring width and blue intensity in central-eastern European Norway spruce**

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Tree radial growth is influenced by various climatic and non-climatic factors (e.g., disturbances), which can complicate the extraction of climate signals from tree rings. We investigated the influence of disturbance on tree ring width (RW) and latewood blue intensity (BI) chronologies of Norway spruce from the Carpathian Mountains to explore the extent to which disturbance affects the expression of the climate signal in tree rings. Overall, more than 14000 high-elevation Norway spruce tree cores from 34 sites grouped into four regions (Slovakia, Ukraine, North and South Romania) were collected and analyzed. RW chronology structure comparisons were performed among disturbance-uncorrected (RW\_dis) and disturbance-corrected (RW\_dis\_CID) chronologies at regional and site level. For five selected sites with strong identified disturbance trends, structure comparisons were also performed for both RW and BI parameters among chronologies developed from series grouped into disturbed and undisturbed sub-groups. Growth-climate relationships between chronologies developed from both parameters and monthly mean temperature of the subsets were assessed. Results showed disturbance trends can be observed in RW chronologies among different sample sets. Chronologies composed of a relatively small number of samples were most susceptible to the influence of disturbance trends. BI chronologies appeared to be mostly unaffected by disturbance compared with RW chronologies. The Curve Intervention Detection (CID) method can help to identify and remove disturbance trends; however, this treatment could also lead to over-correction in some cases. The BI parameter had distinct advantages in investigating growing season temperature history using Norway spruce. In general, evidence of this study indicates that influence of non-climatic factors on tree ring time series exists, which should be considered when undertaking dendroclimatic research, especially involving the reconstruction of past climatic conditions. Blue intensity is a promising alternative tree ring parameter for dendroclimatological studies with the chronology structure seemingly unaffected by disturbance.

## Climate sensitivity in different *Pinus cembra* tree-ring traits in Retezat National Park

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Marginal tree populations are usually the best target for studying climate-growth responses for their higher sensitivity to climatic factors. Swiss stone pine (*Pinus cembra* (L.)) is a key natural element for the mountain forests in Europe where is present at high elevation in the Alps and the Carpathians. In this study, we explored the dendroclimatic potential of Swiss stone pine in the Romanian Carpathians through a wide array of parameters spanning from the conventional tree-ring width to maximum density together with several xylem anatomical traits. For this, 28 mature living trees were sampled close to the treeline in the Retezat Mountains, South-Western Romania and nine were selected for anatomical analysis that was performed on the same cores as maximum density and tree-ring width measurements. For each parameter the association with climate have been tested at monthly level however, to improve the time resolution for the dendroanatomical traits, each ring was split into 10 intra-ring sectors and resulting chronologies were contrasted with daily climatic data.

Except for tree-ring width, all chronologies showed a strong positive or negative response to the climatic factors of the previous or current year. Cell wall thickness and maximum density featured similar climate associations mainly influenced by temperatures at the start of the growing season and during summertime, whereas lumen area seemed mostly affected by precipitations. The higher time resolution given by the ring partitioning allowed us to highlight that different tracheid rows, according to their position within the ring, can be influenced by distinct climatic time-windows. Moreover, the same anatomical traits can be sensitive to different climatic parameters along the seasons.

This study showed that the analysis of xylem anatomical traits at the intra-ring level and the use of daily temperature records along with customary dendrochronological parameters can provide insightful information into the long- and short-term climate influence on the xylem structure of Swiss stone pine.

## **Analyzing adaptive traits of Norway spruce provenances in relation to their place of origin in common garden trials across Romanian Carpathians**

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This study aimed to evaluate the genetic variability of several adaptive traits of 10 Romanian Norway spruce provenances and 71 from other European countries in three common garden trials established across Romanian Carpathians, at age 49. Given that a provenance, exposed to different environmental conditions can exhibit different phenotypes, the multi environment trials are used for selecting the most valuable and most adapted provenances. Total height, pruned height, diameter at breast height were measured, the volume per tree and the survival rate were determined in the spring of 2020. Associations between adaptive traits and the provenances' place of origin were evaluated. Negative and significant correlations were observed between provenances' latitude and diameter at breast height, pruned height, survival rate and volume. Northern provenances obtained lower values regarding these traits. Regarding the longitude, only the correlation with the total height was positive and significant, Romanian provenances - 72-Dorna Candreni, 66-Marginea, 74-Galu - being in the top in all three common garden trials. Provenances from higher altitudes had greater values for all traits, the correlations with altitude being positive and significant. We conclude that there is a significant association between the performance of the provenances and their place of origin. Our data may help the tree improvement program in Norway spruce in Romania.

## Climate control on snow avalanche activity in the Ukrainian and the Romanian Eastern Carpathians

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An increasing number of warming and extreme precipitation events has triggered changes in the snow environment areas in the Carpathian Mountains. The latter has contributed to the intensification of snow avalanches in subalpine areas. The Eastern part of the mountains stands out from the Carpathian system because of their specific geographic position, morphometric characteristics, and synoptic patterns. The massifs of Rodna, Maramureş, Chornohora and Borzhava in the Eastern Carpathians have a high predisposition to snow avalanches resulting in frequent ecosystem damages and accidents. Here, snow avalanches often outreach tree lines as witnessed in the tree growing disturbances. Hence, meteorological archives and tree-ring data are involved to interpret climate control on snow avalanche activity in the Ukrainian and Romanian Eastern Carpathians and related changes in forest ecosystems. The Avalanche Activity Index (AAI) is correlated with 50 monthly climate variables (1961 - 2015) to verify the set of climate factors responsible for major events. Two out of seven models obtained from multiple regression analysis are considered to be the most viable. Accordingly, the presence of very heavy precipitation at the beginning of the avalanche season leads to the occurrence of major snow avalanches. Besides, the destabilisation of the snow layer in February, the daily median temperatures above 0 oC, and the presence of a consistent snow layer in April are other climatic preconditions for snow avalanche activity. Instead, the accumulation of a medium-thick snow layer over a long period in January and the presence of very hot consecutive days at the beginning of the avalanche season are found unfavourable to the onset of snow avalanches. This work is a contribution to the project ACTIVNEIGE «Activité des avalanches des neige dans les Carpates Orientales Roumaines et Ukrainiennes» (Snow avalanche activity in Romanian and Ukrainian Eastern Carpathians), funded by AUF-IFA RO.

## Norway spruce dendroclimatic models from Gheorgheni region (Eastern Carpathians)

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In this study, it was analyzed the variability of Norway spruce tree growth response to climate in the Gheorgheni region (Eastern Carpathians). The general climate in the study area is specific to mountain regions with frequent thermal inversions. A number of 1119 tree-ring samples were analyzed from different age classes and altitudes levels. The detrending of the individual growth series was done using a spline function of 67% from the series length. For statistical analyses, the residual growth indexes series were used. Daily climatic data (minimum, maximum and mean temperature, precipitation) were provided by two local weather stations situated in the Gheorgheni region: Joseni (750 m) Bucin (1282 m). To surmount the subjective limits, impose by classical dendroclimatic analyses (correlation based monthly climatic data) we apply an innovative method based on daily climate measurements. Correlation between growth index and climate was analyzed on time periods varying from 21 to 120 days. Dendroclimatic models were calibrated for different age classes (under 80 years, between 80 and 100 years, over 100 years), and altitude levels (below 1200 m, between 1200 and 1400 m, above 1400 m). In the study area, there are frequent thermal inversions with high intensity during the winter. A negative and significant correlation between temperature and tree growth was found for the previous autumn. The correlation became positive and significant for winter periods. The explanation of the relationship, atypical for Norway spruce from mountain regions, can be linked with the high frequency and intensity of thermal inversions at this period of year, specific for the study area. Precipitations were positively correlated with growth index in the previous autumn, at the beginning of the growing season, and in the last part of the current growing season. We also investigated the link between pointer years and thermal inversion. Our study highlighted the importance of regional dendroclimatic studies especially in areas with particular climate conditions (e.g. thermal inversion).



## Historical mixed-severity disturbances shape current forest structure of primary temperate mountain forests in Europe

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Natural disturbances strongly influence forest structural dynamics, and subsequently stand structural heterogeneity and forest functioning. The impact of disturbance legacies on current forest structure can greatly influence how we interpret drivers of forest dynamics. However, without clear insight into forest history, many studies default to coarse assumptions about forest structure, for example, whether forests are even or unevenly aged. The aim of this study was to analyze the effects of past disturbances on the current diameter distributions of Norway spruce (*Picea abies* (L.) Karst.) and mixed beech (*Fagus sylvatica* L.) –fir (*Abies alba* Mill.)-dominated landscapes throughout the Carpathian Mountains. Our dendroecological dataset comprises tree cores from 475 plots, nested within 50 primary forest stands, known to vary greatly in the severity of historical disturbances. Our analyses revealed that historical disturbances had a strong and significant effect on the current diameter distribution shapes at the plot level. We demonstrated that mixed-severity disturbance regimes were more frequent and create a complex pattern of diameter distributions at the plot and stand scale. Here, we show that high severity disturbance was associated with unimodal diameter distributions, while low and moderate severity was associated with the reverse J-shaped distribution. This is a result of complex disturbance patterns, with structural biological legacies. Our results will have important management implication in the context of tree size heterogeneity, biomass storage, and productivity as influenced by natural disturbances. Lastly, these results demonstrate that structural changes may arise as consequences of changing disturbance regime associated with global change.

## Planting good deeds in Romania

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We plant good deeds in Romania (PFBRo) is a national initiative based on volunteering whose main purpose is to plant trees on public land on unproductive areas (degraded lands from intense agriculture, with risk of landslide, desertification etc.). Today, after 10 years of tree planting, we have over 1.800.000 planted seedlings on an area of 470 ha in 33 counties using the help of almost 44000 volunteers.

Starting from February 2021, PFBRo launched an online weekly conferences focusing on multiple aspects regarding forests and forest management such as: GIS and LIDAR technologies used in forestry, natural versus planted forests, wood logging, green washing, private and state forest administration, natural protected areas, forest protection, forest biometrics, forest soils and forest sites, silvobiology and silvotechnics, wildlife management, non-wood forest products, forest genetics, but also aspects regarding the role of trees in landscaping. Our guests originate from academia, research institutes, private initiatives, NGOs, private forest districts, forest certification bodies, wood harvesting companies, landscape planning units.

All recordings are available on PFBRo's Facebook and the impact reached from 1.000 to 10.000 views per meeting (some of them event to 15000 views). The vast majority of the videos received paid promotion and the mentioned views in Facebook statistics mean at least 3 second views of the video. Among the stats given to us we can see details like gender, county and country of origin of the viewers, age etc.

Our live Facebook conferences are part of our mission to bring information regarding forest management to everyone interested. Our intent is to use every tool available in social media to help people who love forest and forest products to have the necessary knowledge to judge for themselves the information available all over the internet. This way, with the help of everyone interested, we strongly believe we will have, in time, a civil society capable of playing an important part in the management of forests.

## **Assessing surface runoff evolution under climate and land use change in a small forested watershed**

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This study aims to explore the surface runoff evolution in the context of climate and land use change within the Upper Tarlung watershed (71.69 km<sup>2</sup>), located in the central part of Romania. Using the Soil and Water Assessment Tool (SWAT), we performed short (2020–2039), medium (2040–2069), and long term simulation (2070–2100) considering four local climate change scenarios (REMO4.5, REMO8.5, CLM4.5 and CLM8.5) and three land use change scenarios (maintaining the current land use, reducing by 25% of forested areas, and reducing by 50% of forested areas). The results were appraised on three level of analysis, namely monthly, seasonal and annual and compared with the baseline values recorded in the 1979–1988 period. The simulations revealed that, in all periods considered, the increasing trend is more pronounced in land use change scenarios that imply the reduction of 50% forested areas, while the sharpest decreases are mainly caused by climate change. This model, personalized for a small forested watershed, represents a tool that enables local decision-makers to design informed decisions for sustainable water and forest management.

## **Evolution of the natural regeneration from the territories adjacent to the forests of the Adâncata Forest District**

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The central purpose of the paper is to observe the evolution of natural regeneration in the lands adjacent to the forest fund.

Among the most important objectives we list: comparing the situation of natural regeneration in orchards and meadows bordering the forest in 2017 compared to 2015 and analyzing the evolution over time of vegetation adjacent to the forested area studied according to satellite images.

Among the more important conclusions we mention that the lack of sustained human activities around compact bodies of forest vegetation leads to its advance over lands occupied by other uses.

Luvosols, the zonal soils are soils of forest origin not being conducive to a sustained agriculture, as a result, alternatives to the forest are meadows and pastures.

The annual non-maintenance of the practical vegetation but also of the aged orchards represents an opportunity for the installation of the seedlings of the forest species from the hillside area (FD2 bioclimatic level).

The evolution of vegetation in two years of research has been encouraging, in the sense that the forest vegetation continues to sustain its progress in meadows or orchards, the average annual growth rate of the number of specimens inventoried is 20% in 2017 compared to 2015.

Most species with anemochoric spread are found in more distant plots (over 20 m away from the forest). Instead, quercinea species (sessile oak and oak) abundantly dominate the first two sections (0-20 m away from the forest).

Satellite images from Google Timelapse taken during 1996-2016 led to small, not very obvious increases in the forest fund. A clearer evolution has been observed in the last 10 years, when many landowners have given up cultivating or maintaining them.

## Mixed silver fir, Douglas fir and Norway spruce plantations in the SW of Romania – growth and components of tree resilience to severe droughts

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The future of many forests may be destabilized by climate change associated severe droughts. Forests therefore should adapt fast, if possible, in order to cope with these challenging conditions. As forests worldwide are currently facing worrisome drought associated tree mortality events, there is a whole debate on using or not non-native tree species in order to have the desired drought-resistant and productive forests of the future. In this regard, in Europe, a special attention is being given to Douglas fir, native to the west North American coast. We studied three mixed plantations of silver fir, Douglas fir and Norway spruce, all located in the SW of Romania: Ana Lugojana (AL), Rusca Montana (RM) and Otelu Rosu (OR). Considering the 1980 to 2020 period, the three species were compared in terms of growth (i.e., BAI, basal area increment) and growth responses to severe droughts (i.e., resistance, recovery, resilience and relative resilience indices), at each study site. Our main objective was to find differences between the three species in terms of growth and their resilience to severe droughts. Preliminary results indicate that, at the AL and RM study sites, all three planted species, show significant positive BAI trends. At the OR study site instead, the three species show different BAI trends: significant positive for silver fir, no significant trend for Douglas fir and significant negative trend for Norway spruce. Using the Standardised Precipitation-Evapotranspiration Index (SPEI), four severe droughts have been identified since 1980, i.e., 1983, 1994, 2000 and 2011. The three species showed no significant differences between them in terms of resistance, recovery, resilience and relative resilience to the four severe droughts, at any of the three study sites. To conclude, although the three species have different growth rates depending on the study site, no significant differences may be found between them in terms of resilience to severe droughts.

## Primary forest biomass dynamics across scales driven by natural disturbances

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Natural disturbances help promote ecological change to forest demography. However, it is lesser-known to what extent and how these interactions influence biomass at scales, particularly in temperate Europe. The distribution of primary, old-growth forests in temperate Europe is sparse and confined to remnants of their former structure. Primary, old-growth forests yield unique characteristics with an asymmetrical structure and age distribution. The absence of human activities allows for natural ecological processes to be the main drivers of disturbance. There is a precedence to understand the interactions between natural disturbances and environmental conditions as the primary mode of shaping the functional and ecological traits of an old-growth, uneven-aged forest. Underpinning the complexities of primary forest development is vital to quantify the current levels of biomass productivity and carbon storage potential accumulated for centuries.

We investigate total (live and dead tree) biomass in 724 plots, nested within 51 stands across Romania, Slovakia, and Ukraine. Our dataset consists of 32,640 live trees, 3,965 snags, and 10,812 dead, downed trees and deadwood from the REMOTE Primary forest network. We aim to explore (Q1) how the spatial variability in biomass varies across the primary forests; (Q2) how the interactions with age, natural disturbances and environmental conditions affect biomass? We assume that forest species type complements biomass dynamics and its asymmetrical distribution across the Carpathians. We hypothesise that age is the most influential driver of forest biomass, supported by mixed-severity disturbances and geographical conditions. We use mixed-effects generalised additive models (GAMs) to assess biomass dynamics and their interactions with biotic and abiotic factors. We use the model selection approach to test for live and dead biomass to better identify the variability in biomass types and their interaction with its biogeography.

**Contribution to a better assessment of the indicative growth under biotic and abiotic hazards**

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Numerous threats and hazards have been jeopardizing so many forests that forest planning is more and more doubtful. Therefore we have tried to take into account the effect of salvage fellings on the input data deployed for calculating the annual allowable cut by the indicative growth method, which is the most common and the most algorithmic method the Romanian forest planning relies on. Having a production unit as study area, we have demonstrated how a great deal of salvage fellings reduces the indicative growth, and, further on, the total allowable cut.

## Changes in rotation periods and tree species composition of forests in the Czech Republic during last 2 decades

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The Czech Republic (hereinafter CZ) is a country with a large proportion of non-native forest stands that are artificially. Although natural conditions in the CZ potentially correspond to more than 50 percent of deciduous forests. In the current tree species composition, coniferous trees are the most used and 50% of them are mainly Norway spruce. However, due to climate fluctuations, coniferous forests are rapidly decaying. Foresters now stay before a major changes and challenges, which also require legislation changes and current approaches to forest management planning.

In the second half of the 20th century, the rotation period (hereinafter RP) of forest stands was artificially extended in order to save quality forest stands for later economic use. Over the last 20 years, foresters have had to significantly reduce RP. Up to half of the previous planned length (e.g. from 120 to 60 years). On the other hand, the average RP of forests for the whole of the CZ is constantly lengthening or stagnating. For example, in 1920 the average RP was 93.4, in 1980 it was 108.1, in 2010 it was 115.8, and in 2020 it was 115.3 years. At the same time, the share of forest stands that are now in the new regeneration phase, or very young to be able to harvest, is increasing significantly. In addition, due to incidental harvesting caused by the occurrence of mainly biotic (but also abiotic) pests, there is almost a doubling of total harvesting for the whole CZ (from 17 million to 35 million m<sup>3</sup> wood per year, most of it is Norway spruce). How to solve a very complex issue now respecting, for example, the interests of nature conservation or, on the contrary, looking for a suitable optimal RP for productive forests is a great issue of foresters in the CZ.

Key words: Czech Republic, forest management plan, rotation period, Norway spruce, European beech



## Forest Assessment, Modelling, Forest Management Session

### **How much does it take? A comparison of manual and LIDAR-based wood measurement options.**

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Wood measurement and grading are important to forest science and practice. In practice, wood measurement is required to support inventories and wood transactions while in the science it is important for various applications such as developing models or running productivity studies. To support such applications, wood measurement may be required at different points throughout the supply, starting with the standing timber and ending with the delivery points to the customers. Developments in technology made it possible to change the approach of wood measurement from the manual (traditional) to sensor-based ones. While there are several platforms available to date to support wood measurement and the LIDAR-based ones have been proven useful in many forestry applications, their use in wood measurement is still limited. In addition, the resources needed to implement such technologies at large scale have been less approached by the science. This study evaluated the time resources needed to measure logs, bunches and piles of wood by the means of two LIDAR-based platforms, namely a smartphone running software developed specifically for wood measurement applications (hereafter S) and a Geo Slam Mobile Laser Scanner (hereafter MLS). Field research was carried out in a wood storage facility on 56 beech and 35 spruce logs, which were arranged mechanically in three groups (G1=27 beech, G2=29 beech and G3=35 spruce) and spaced in each group at ca. 1.5 m. As a first step, individual manual measurements (hereafter M) were implemented to provide a baseline for comparison and to produce the data required for the assessment of wood measurement efficiency. In each group, two researchers have used a tape and paint to mark each log at 0.5 m intervals and at the middle, then other two researchers measured the logs' diameters at each mark and at the middle as well. Each group was scanned by the MLS and each log was individually scanned by S in one replication. Following this step, the logs from the spruce group were arranged in 14 bunches (hereafter B treatment) of 2 to 4 pieces and scanned again by MLS in one turn and individually by S in two replications. Then the logs from all the groups were rearranged in 10 piles (hereafter P treatment) of 7 to 14 logs. Each pile was individually scanned by S (two replications) and MLS. All the fieldwork was monitored by video recording, then in the office phase a time study was carried out based on field-collected footage to account for the time consumption of each measurement treatment. Mid-diameters and the lengths of the logs were used to estimate the volume of each log, bunch and pile. By excluding the time needed to additionally move to the middle of the log and to measure the diameter at this point (which was required for volume estimation), the time needed for M was, in average, close to that required by S (ca. 92 seconds per log or ca. 161 seconds per cubic meter). In comparison, by MLS, the time per log and per cubic meter averaged ca. 25 and 45 seconds, respectively. In the B treatment, the time needed by S and MLS averaged ca. 167 and 68 seconds per bunch, 85

and 25 seconds per piece and 67 and 19 seconds per cubic meter, respectively; in the P treatment the same figures were of ca. 422 and 380 seconds per pile, 46 and 42 seconds per piece and 82 and 73 seconds per cubic meter. In conclusion, the S can be comparable with M for piece-by-piece measurements when the measurement time is to be accounted. Depending on the locations at which the diameters are measured and their number, M could require less time but it still requires at least two workers. MLS is operated by one worker, holds extended sensing capabilities (sensing distance) and takes the least time for measurement when groups, bunches or piles of logs are to be scanned in one turn. It is, however, comparable with S in terms of time resources needed when, for instance, bunches or piles of logs are to be scanned individually. B and P treatments, on the other hand, may restrict the usefulness of M option because many of the logs would not be reachable for manual measurement; in addition, the amount of information collected by scanning is typically much higher as compared to the M option. Since field measurement is just one component to produce volume estimates, the comparison in terms of time consumption should be extended also to the office phase of the study.

Forest Assessment, Modelling, Forest Management Session

**Modelling species compositions changes and biomass evolution under different climate change scenarios and forest management strategies in Frasin Forest District**

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For forestry, climate change is a challenge due to direct impacts on forest ecosystems. Forests adaptation to climate change has to be done by modifying traditional forest management to reduce stand susceptibility to disturbance and to improve forest resilience.

For identifying suitable management type in order to adapt forests to climate change was used LandClim model which was developed for studying the impacts of topography, climate change, forest management and disturbances on forest dynamics, composition and structure.

The results showed a strong decrease of forest biomass and a change in species composition, at low elevation, in extreme climate and adaptive management simulations. Instead, in no management simulation, only at low elevation and in extreme climate was affected the biomass stock and species composition.

## Age-independent diameter increment models for Norway spruce, European beech and silver fir in mixed-uneven aged stands

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Uneven aged forests are characterized by a high tree-growth variability making traditional growth models inoperative in uneven aged forests. Estimating site productivity is yet another impediment for modelling tree growth in uneven aged stands. However, uneven aged mixed-stand forests, are known for their resilience, resistance and productivity being promoted as suitable alternative to even-aged, pure forests for climate change adaptation and mitigation.

For this purpose, we used a permanent sampling network and 719 increment cores sampled in mixed-uneven aged forest from Retezat National Park to develop a diameter increment model for the most important tree species of the study area. The age-independent algebraic difference equation method and mixed effects modelling framework were used to obtain the model parameters. We used commonly known growth equations to test which model provides the highest accuracy in fitting and predicting the diameter increment. In order to evaluate the productivity of each sampling plot and species we developed a growth index. The growth index was further introduced in the model in order to explain the diameter growth variability for each species. The developed models accounted for the hierarchical data structure, the temporal correlation among successive tree-core observations, assuming autoregressive structures (ARMA(1,1) and AR(1)), and the possible heteroscedasticity. In order to test the predictive performance of the developed models, we used the permanent sampling network from Retezat National Park inventoried both in 2015 and 2020 as a test dataset. We predicted the 5-year diameter growth using the developed models and compared the predicted diameter growth with the diameter growth observed between 2015 and 2020.

The root mean squared error (RMSE) obtained with the most accurate model varied between 0.13 and 0.2 cm for spruce, beech and fir in the training/fitting dataset, while the bias varied between -0.01 and -0.006 cm. The accuracy for the testing dataset ranged between 1.05 and 1.14 cm; the bias between -0.01 and 0.22 cm.

The high accuracy obtained using age-independent models underline their suitability for predicting growth in mixed uneven aged forests. The developed models can be easily integrated into forest practice obtaining accurate diameter growth estimates for the study area.

Forest Assessment, Modelling, Forest Management Session

**A comparative study regarding deadwood amount between natural and managed forests from Strâmbu-Băiuț, Romania**

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The aim of this study is to highlight the differences of deadwood amount in relation to the management type. Data was collected from 40 circular sample plots of 0.05 hectares each, randomly placed, both in managed and natural forests. The deadwood was registered into two categories: standing deadwood (all snags within the sample plot) and lying deadwood (inventoried using the transects method in each sample plot). The minimum diameter threshold for standing dead wood (SDW) was 8 cm, and for the lying deadwood (LDW) was 7 cm. For each piece of deadwood, the degradation state was evaluated (classes from 1 to 5 - from fresh to mull wood). The volume of deadwood was calculated using different formulas, depending on its status.

Comparative analysis of the dead wood according to the management type revealed both quantitative and qualitative differences. An average amount of 26.16 m<sup>3</sup>ha<sup>-1</sup> SDW and 92.83 m<sup>3</sup>ha<sup>-1</sup> LDW, was obtained for the managed forest. Significantly higher values were obtained in the sample plots from natural forest: 69.3 m<sup>3</sup>ha<sup>-1</sup> SDW and 255.02 m<sup>3</sup>ha<sup>-1</sup> LDW, respectively. Regarding the SDW distribution by degradation classes, in the managed forest approximately 62% of the volume was found in the first class, compared to the one in the natural forest, where SDW was medium to highly degraded, with over 90% of the volume in the last three classes of decomposition. It was noted that LDW found in the managed forest is relatively evenly distributed in each of the five classes of degradation, compared to the natural forest, where almost 65% of the volume is represented by the medium and high classes of degradation. Differences were also observed in the proportion of stand biomass. Thus, in managed forest, SDW represents about 4.5%, and LDW about 16%, compared to the natural forest where SDW represents 6.7% and LDW about 25%. In conclusion, it was demonstrated that both the quantity and quality of dead wood are influenced by the management type.

## **Terrestrial laser scanner used in short rotation poplar crops for biomass estimation. Case of study in NE part of Romania (methodology aspects)**

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**Introduction:** Short-rotation crops are known as an important source of biomass in the temperate zone (Danila, 2019). At the present time in the NE of Romania are installed over 800 hectares of short rotation poplar crops. A precise instrument of biomass production estimation is necessary for the sustainable planning of forest resources for many investors. The use of the terrestrial laser scanner for aboveground woody biomass estimation brings an important high-tech jump among indirect (non-destructive) approaches. TLS technology is acceptable when destructive methods become difficult to achieve and the biomass equivalence equation does not give precise information (Coșofreț et al. 2018).

**Aims:** The main purpose of this study is to estimate the aboveground biomass production on tree parts in short rotation crops using TLS technology, comparing with gravimetric approaches.

**Results:** The researchers are carried out in NE Romania in the hilly area for the most productive hybrid poplar clone (AF8 and Pannonia) with different production cycles (5 to 7 years). Data processing involves: co-registration data is carried out on fixed spherical targets (200 mm), filtering data and extracting necessary parameters is done by using ZF Laser Control, CloudCompare, R and MathLab software. Measuring the hybrid poplars crops by TLS may have the following significances, corresponding to evaluation of above ground woody biomass, assessment of stem quality in short rotation forestry, and development of calibrated allometric equations in short rotation crops.

**Conclusion:** In Romania, TLS technology has never been used in short rotation woody crops, the few cases in forest inventories. In this regard, getting fast data at minimal cost became a necessity for stakeholders, especially when this is performed with great accuracy. Compared to the other methods, the use of TLS for biomass (volume) in such crops opens new paths for research. The gain will be both for the scientific side and for the investors in the SRC (economic side). The novelty is the development of the scanning protocol with TLS.

Forest Assessment, Modelling, Forest Management Session

**Analysis of the organization of collection and processing of non-wood forest products in the Republic of Moldova**

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The forest fund offers great opportunities for the collection, harvesting and processing of non-woody forest products (NWFPs). The rational use of NWFPs contributes to increasing the economic potential of the forest branch, population welfare, biodiversity conservation by providing ecological products.

Although the potential of the NWFPs sector is high, in terms of reducing poverty and improving the living conditions of the population, there is insufficient knowledge of their technological chain. This process takes place individually, unorganized, dispersed and participants lack sufficient knowledge to achieve performance. In the Republic of Moldova, due to heavy working conditions, insufficient labor force, lack of obsolete equipment and operating technologies, there are few economic operators specialized in the development of NWFPs.

Depending on the specific characteristics and destination of non-wood forest products, the harvest method, the inventory, the loading-unloading and the transport method shall be chosen.

The process of valorisation of non-wood forest products aims to supply consumers with products of good quality throughout the year. In order to be satisfied with the work done and the income from valuing NWFPs, there must be several steps to be taken: Harvesting, sorting, calibration, packaging, transportation and storage. The application of effective recovery methods is also conditional on the choice of technological operations, which will provide the shortest route to the consumer, thus ensuring that the quality of NWFPs is maintained.

The main purpose of this research was to produce information on the stages of the non-wood forest products technological chain in the Republic of Moldova. In addition to the above, a secondary aim of this study was to document and summarize knowledge about the processes and technologies applicable to the exploitation of NWFPs. This was fuelled by the lack of scientific literature in Romanian, on the subject.

In order to achieve the aim, the following objectives have been set: the establishment and description of the technological processes applicable to the development of non-woody forestry products; analysis of the organization of the collection and processing of non-woody forestry products; knowledge of labor productivity in the NWFPs sector.

The achievement of the objectives was achieved through direct comments with the NWFPs pickers, by carrying out the survey with the help of the questionnaire. The non-probabilistic sampling technique used is called snowball sampling. In addition to current practices observed

in the field or documented from other sources, practices reported by international scientific literature have also been taken into account.

On the basis of the results achieved and their discussion, but also on the basis of the unwritten practical experience, the following conclusions can be drawn: research and development of the technology chain at the NWFPs is particularly important in order to improve quality and meet quality standards. It differs depending on the species, location, method of processing and preservation of the products. The development of the technological process contributes to the sustainable supply of NWFPs by preserving resources, improving market value and increasing sales opportunities. Due to the technological process with many links, the non-wood forest products sector involves a large number of people (about 23000 people/year) of different ages, gender, studies, and is also a source of income, conclusions also supported by literature. Most people are involved in collecting rose berries (*Rosa canina* L.) (about 15000) and lime flower (*Tilia* sp.) (about 2000). The main methods used to collect non-wood forest products are by breaking (65%) and by cutting (30%). This indicates that the population is aware of and complies with the rules of collection, having a positive effect on the protection and perpetuation of the species.

The primary drying processing of NWFPs is preferred by most pickers and, of course, also preferred by direct buyers or recovery centers. NWFPs consumed fresh has a lower number of technological elements compared to those processed in dry, frozen or preserved form.

The distance between the resources of the FNL and the gatherers influences the number of people, the quantity of people, their effort and their performance. The existence of a network of optimally designed purchasing points, so that the average distance from forest to the primary collection center is not more than 5 km, a secondary network, with nodes located at distances of around 10 km, which would create a stream of collection centers across the country, would also help to maximize the value of non-wood forest products. The existence of collection points in the locality, gives a positive incentive to the gatherers aimed at selling NWFPs.



Forest Assessment, Modelling, Forest Management Session

**Aspects regarding the stray dog in the hunting legislation of different states in the world**

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Being "our best friends", stray dogs can become a threat to wildlife. Recent studies on stray dogs confirm that they have contributed to the extinction of over twelve species of wild animals and birds and endanger the survival of another 200 species worldwide.

Stray dogs are also a stressor for wildlife by disrupting the quiet, food and shelter. At the same time, they become food competitors for some predatory game (fox, wolf, lynx, bear).

Stray dogs are the main vector of transmission of various diseases among wild animals. Direct predation by dogs is not a priority threat. The main problem is the spread of diseases from dogs to wild animals, especially rabies and canine diseases, said Arnulf Koehncke, director of species conservation at WWF in Germany.

In order to sustainably manage wildlife, different countries of the world, in hunting legislation, provide for different methods of eliminating stray dogs from hunting grounds. In the current context of human evolution, the solution to stop this scourge is quite delicate. It is necessary to adopt human solutions, which eliminate the disputes for and against the various proposed solutions, so that there are no more stray dogs.

Forest Assessment, Modelling, Forest Management Session

**Comparative analysis of structure of the forest stands managed by Steșeni forest enterprise after 30 years**

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Implicarea omului în viața pădurii impune adoptarea de strategii la nivel mondial, național și local. În vederea unei planificări riguroase a intervențiilor umane în păduri vine în ajutor amenajamentul silvic, amenajamentul cinegetic și amenajamentul silvo-pastoral. Evidența în timp a lucrărilor proiectate de amenajament și realizate practic ne conferă un spectru larg de informații utile pentru a studia și analiza fenomenul „natură - intervenția omului”. Structura comparativă a arboretelor pentru ÎSC Strășeni într- perioadă de timp ne poate demonstra unde am greșit sau am intervenit corect astfel încât ulterioarele planificări ale amenajamentului și realizările pe teren ale personalului silvic să vină în strictă concordanță cu cerințele ecosistemelor forestiere. Potențialul stațional vs productivitatea arboretelor prezintă un mare decalaj astfel se constată că arboretele actuale nu valorifică condițiile naturale care-i sunt oferite.

Forest Assessment, Modelling, Forest Management Session

**Forest vegetation disturbance pattern in a complex ownership area: a case study in Brosteni Forest District**

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Forest disturbance pattern is a resultant of a complex of factors, both natural and human. The most frequent cases of disturbance in the study area are related to windthrows, insect attacks and illegal logging. The disturbance drivers mentioned have mutual interactions and tend to enhance their total influence on the forest ecosystems (windthrows are a start point for bark beetle attacks, illegal logging creates gaps in the canopy that increase the probability of windthrown etc). These interactions are related to the types of forest ownership present, and most important, to the moment of the restitution.

The aim of the case study is the mapping of the forest disturbances in the Broşteni Forest District using Landsat image series (1984-2014) and to compare the disturbance pattern with the forest ownership maps and the forest restitution types in certain forest districts that are representative for these processes. Analysis of satellite images over time serves as a powerful tool to track changes in forest cover, which short-term fieldwork cannot observe. The archive of LANDSAT images is practically the only accessible source of spatial information on forest cover around 1990, since no higher spatial resolution data (aerial images) were taken in the period 1978-2014.

The analysis showed a significant grouping of forest disturbance areas in the areas with very high percentages of Norway spruce as a general perspective, but also showed a complex disturbance pattern in the stands restituted on the basis of Law 18/1991. These stands were already affected by illegal logging in the previous decade and the massive windthrows in March 2002 just perfected the effect of previous disturbances. The forest disturbance maps represent a basis for further investigations related to the forest vegetation successions in the areas that were affected by forest vegetation loss in an effort to delineate the owners' approach to the continuous management of these areas.

## **Tree size distribution and structural dynamics of the Humosu old growth-beech forest**

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The main purpose of this study was the analysis of spatial pattern and structural diversity in a natural beech stands located on the Eastern limit. Strict observations regarding structural diversity and it's dynamics, structure simulations witch can show minimum surface needed for forest inventory, and also this study took a closer look into classic and synthetic indices used for diversity assessment. From the analysis of structure simulation for the year 2016 it was observed that for areas smaller than 0, 04ha, stand structure was irregular, and regression coefficients can't adjust it, nor have been introduced. Also we haven't been able to identify the predefined patterns for areas of less than 0.25 ha, while the area under about 0.36 ha appears concave structure and forsurfaces up to 0.49 ha we find negative exponential curve type. For areas of more than half a hectare (0.6 ha) included the type of structure, characteristic of natural forest stands, namely the rotated sigmoid. For areas greater than 0.64 hectares, diameter distribution structure is no longer dependent on the surface, while in the case of the smallerones, we can observe a significant relationship between the plot structure and surfaces. In conclusion, at first look we are tempted to say that, if we are dealing with a natural broad-leafed form distribution should automatically be a rotated sigmoid, we can easily mislead, fact demonstrated in this study. In the present study, we have also simulated structure for all sizes of areas without taking account of the significance of the coefficients, and the result was rotated sigmoid form for each individual case.

## **Patterns of forest species association in sapling communities: a story of love and hate**

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The importance of plant species interactions and competition in creating spatial patterns is widely acknowledged. Therefore, point pattern analysis and spatial abundance correlations were employed to examine the spatial distribution of saplings for seven forest species in ten fully mapped regeneration plots.

The spatial correlation analysis tests between the abundance of distinct species were used at different scales (0.5x0.5 m to 7x7 m cells) to quantify positive or negative associations of the species. In addition, the analysis of several dimensional variants allowed the study of the influence of scale on the results. The variation of the size of the cells undoubtedly influenced the outcome. Although calculations were performed for elementary cells smaller than 0.5x0.5 m, the results exposed negative correlations between almost every species, showing that the competition between individuals below this spatial threshold negatively influences the conclusion's relevance.

The results displayed clear pieces of evidence for positive and negative spatial association. Moreover, most of the results keep their statistical relevance in almost every variant, regardless of the scale (e.g. positive association between linden and ash or field maple and wild cherry). In contrast, other relations become significant only at specific scales (e.g. negative associations between hornbeam and oak, linden and field maple, or between oak and linden at reduced scales; respectively, positive associations between wild cherry and ash and linden for the medium and large dimensional variants).

Similar conclusions were drawn using Principal Component Analysis. Therefore, these association hypotheses were tested using methods based on the second-order properties of point processes (a bivariate version of Ripley's K function). The significance of bivariate second-order interactions (repulsion and attraction) were assessed by comparing the values obtained with those of the confidence envelope corresponding to the null hypothesis of independence, generated by Monte Carlo simulations. Analyses were performed for the distance of 350 cm with a scale step of 5 cm, and weighted corrections were used to remove the edge effect.

The results do not fully confirm the hypotheses previously formulated. Still, there is considerable evidence for positive and negative interactions among the tree species in the analysed plots.

Forest Assessment, Modelling, Forest Management Session

**The influence of past management on the current biodiversity of forests in  
Natura 2000 site Rarău-Giumalău, Romania**

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Knowing how forest biodiversity is affected by forest management is essential for the implementation of a proper forest management in the future, especially since the role of biodiversity is undeniable in ensuring the dynamic balance of forest ecosystems and their stability to disturbances, as the negative effects of climate change are becoming more frequent. Through this article we aim to analyse the impact of past management on the current biodiversity of forests in the Natura 2000 site Rarău-Giumalău, Romania. At present, 75% of the site is strictly protected, but in the past the strictly protection regime has been ensured only in the designated scientific reservations. The past management of these forests was assessed by analysing forest management plans, while the biodiversity was evaluated using data collected from the permanent inventory network installed in 2015. The results allowed us to quantify which type of anthropogenic activity significantly influenced the current level of biodiversity, the forest stands with the lowest level of species and dimensional diversity being those managed in the past for common wood assortments.

# POSTERS

## EU Blueprint on Green Care

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The EU Blueprint on Green Care, published by Green4C project, brings together for the first time four different emerging sectors – Forest-based Care, Social Agriculture, Urban Green Care and Green Care Tourism – and reports on the opportunities and challenges for supporting innovation and entrepreneurship in these thematic sectors. Using 20 case studies across Europe and Americas, the document looks at triggers, points of strength and weaknesses of Green Care innovation and business development and capitalizes on the extensive research experience of the project partners. The analysis reveals that Green Care initiatives are challenged by uncertainties in funding policies and regulation, low public awareness and recognition of the role of such initiatives, lack of standards and integration into health care policies and practices. Nevertheless, they found their strengths in collaborative and multi sectorial attitude, strong networks and partnerships, the ability to provide inclusive and adaptive services and the increasing interest and demand for sustainable, inclusive and green solutions to health and wellbeing. The Blueprint is an important knowledge tool containing recommendations addressed to the different stakeholders that need to take action to advance the role of Green Care initiatives for health, well-being and social inclusion.

Green Care initiatives provide benefits to people while also providing opportunities for new businesses and green jobs, sustainable management of natural resources and enhanced cross-sectorial cooperation and innovation. These and other additional social, economic and environmental impacts brought by Green Care initiatives make them important change agents for the green economy.



## **Analysing the sound speed through the wood of Norway spruce trees affected by root rot**

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The aim of this study was to analyze the way in which the sound propagates through the Norway spruce wood of standing trees affected by root rot. The research was conducted in the north of the Eastern Carpathians, where 84 Norway spruce trees (*Picea abies* L.) from six experimental plots. Sound speed data were collected using ARBOTOM® – Tree Impulse Tomograph. On the trunk of the trees were placed six sensors of the acoustic tomograph, at different levels. It was found that the sound speed has minimum values between 269 m·s<sup>-1</sup> and 552 m·s<sup>-1</sup> and maximum values between 602 m·s<sup>-1</sup> and 826 m·s<sup>-1</sup>. Also, it was found that the speed of sound is influenced by the proportion occupied by the root rot in the cross-section. Maximum number of cases in which the speed of sound is between 501-600 m·s<sup>-1</sup> is recorded up to 80% proportion occupied by the root rot in the cross-section. As the share of root rot in the cross-section increases, the maximum number of cases of speed of sound move into the lower categories (401-500 m·s<sup>-1</sup>, 301-400 m·s<sup>-1</sup> and 200-300 m·s<sup>-1</sup>). According with the recorded values of sound speed through the trees trunk, it was found that the wood is strongly degraded. Analyses undertaken by acoustic tomograph offer clues only on the quality and density of wood at the analyzed level, but not about the type of defect.

## Experimental and analytical models in Norway spruce stands from risk areas to the action of disturbing factors

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The transition to an ecologically based forestry, the conservation, protection and sustainable development of Norway spruce forest, is currently one of the major problems of modern forestry. This is due to structural and ecological fragility to the abiotic and biotic disruptive environmental factors, generated by an inadequate management in recent decades, of their economic and eco-protective importance. The research was conducted in two long-term experimental plots installed to study the effect of forestry work on the development of Norway spruce stands (control, moderate and strong variants) and in 61 Norway spruce stands located in the northern of Eastern Carpathians, in risk areas to disturbing factors (wind, snow, deer). The following research aspects were followed: (i) the study of temporal dynamics of some structural indicators in Norway spruce stands, in risk areas due to disturbing factors; (ii) establishing analytical models specific to the distribution of the number of trees by diameter categories. It was found that the evolution of biometric and qualitative parameters in Norway spruce stands is done under the influence of the complex of abiotic (wind, snow) and biotic (deer) disturbances factors, whose action can generate at certain times strong imbalances in the development of forests, in exposed areas. Also, the applied forestry works, specific to each stage of development, have a significant influence. The study of the structure dynamics in mountain forest ecosystems by the method of permanent experimental plots has the following benefits: (i) it is the main source of completing the database necessary for the elaboration of structural models in artificial Norway spruce stands in relation to environmental factors and forestry works; (ii) the results can be used to develop the complex mathematical model of the structure of Norway spruce stands in risk areas due to biotic and abiotic factors (wind, snow, deer); (iii) allows the automatic data's processing in order to develop optimal structure models in relation to the ecological, economic and social functions of the stands and of the forest as a whole. Structural analytical models that express the distribution of trees by diameter categories, depending on the value of the DBH and in relation to the stage of development of artificial Norway spruce stands, were quantified with the general expression of the theoretical Charlier distribution. The database created about the structural indicators temporal dynamics in Norway spruce ecosystems in risk areas due to disturbing factors, in relation to the current IT possibilities, for estimating specific values in higher conditions much more accurate compared to the old methods, must be constitutes in a new, integrative stage, on the line of assisting the decisions of sustainable management of the mountain forest ecosystems affected by disturbing factors. Computer-assisted decisions may be taken on the optimal medium- and long-term management of artificial Norway spruce stands installed in risk areas due to disturbing factors, in accordance with the principles of sustainable management of mountain forest ecosystems. This in the conditions in which the foundations of some forecast models will be laid lays taken into account the current and the probable state of Norway spruce stands in areas exposed to the negative action of abiotic and biotic disturbances (wind, snow, deer), in relation with the probability and need for forestry work imposed by the condition of the stands at a certain point in their development.

## **Monitoring of atmospheric deposition and soil solution fluxes in forests managed by the Forest District of Regime Gheorgheni S.A.**

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Monitoring of atmospheric deposition and soil solution fluxes in forests by measuring the precipitation quantity and analysis in the laboratory of collected samples (twice a month in summer and monthly in winter) represent a method of estimating the atmospheric pollutants inputs and highlighting the role of the forest in the "metabolism" of pollutants.

The purpose of the research was to know the processes of metabolism pollutants transported by precipitation in the forest canopy compared with the open field and on the soil profile down to the depth of 60 cm, so that we can quantify the role of the forest in the air and precipitation water "decontamination".

The objectives pursued were:

- determination of mineral ions concentrations in precipitation and soil solution samples according to the ICP Forests methodology
- quantitative evaluation of the flux of liquid and solid atmospheric precipitation considering the periodic samples (collected in the open field and under the forest canopy)
- water fluxes assessment on the soil profile at the depths of 10, 20, 40 and 60 cm.

The methodology of placing the collectors in the field, sampling and sample analysis in the lab was established according to the recommendations at European level of the ICP Forests and LTER programs.

The annual fluxes of pollutants ions (S-SO<sub>4</sub><sup>2-</sup>, N-NO<sub>3</sub><sup>-</sup> and N-NH<sub>4</sub><sup>+</sup>), assessed in the period 2019-2021 were compared to the most recently data concerning the intensity of atmospheric deposition in the level II ICP Forests plots. The annual deposition rate expressed in kg ha<sup>-1</sup>year<sup>-1</sup> or mol ha<sup>-1</sup>year<sup>-1</sup> offers useful information though the values themselves or by comparison with the values registered in other European regions. At European level, there were established thresholds of fluxes that allow the studied area to be framed in pollution levels, according to the measured fluxes.

The obtained results proved a good buffering capacity of acid ions from precipitation charged with sulfate, ammonium and nitrate ions, for the forest stands and soils in the studied area.

The obtained data from modeling and statistical processing of the measured of measured value strings can be used to extrapolate the results in areas and for similar periods as well as to identify some processes that could not be detected by monitoring. On this basis we can develop new interpretations concerning the role of the forest in modeling the water fluxes and pollutants ions and in the "metabolism" of pollutants in the ecosystem. Data processing by modeling will allow the establishment of rules regarding the distribution of pollutant ion fluxes at the level of a region or forest ecosystem.

## **Snow-avalanche activity documented by tree rings in the upper Prut river catchment (Chornohora, Ukraine)**

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The use of trees as a record of past geomorphic events has been a common practice in the study of surface processes since the 1970s-80s, and has seen a resurgence of interest since the 2000s. Indeed, reconstruction techniques are varied: analysis of the age structure of tree populations, their growth patterns, annual woody increments and morphological, anatomical and physical anomalies of annual growth rings. Dendrogeomorphology therefore offers relevant potentialities in the study of geomorphological processes, especially in the subalpine zones of mountains populated by conifers and deciduous trees that record throughout their life span the slope dynamics that, by hitting the trees during the vegetative seasons as well as during the dormant seasons, mark their growth pattern.

Snow avalanches are therefore among the slope processes that leave a lasting mark on the trees in their path. The main focus is obviously on the transport and the deposit zones, where the slope is less steep and human activities are possible. It is here that the conditions of vulnerability to the avalanche hazard are greatest for those involved, whether they are permanent infrastructures or people temporarily present during the avalanche season.

In the upper Prut River valley, living Norway spruce (*Picea abies* (L.) Karst.) trees disturbed by snow avalanches have been sampled. The sampled trees were located below Hoverlyanske Falls, on each side of the main hiking trail to Mt. Hoverla used year-round by hikers and skiers. An avalanche history was reconstructed based on the macroscopic analysis of growth anomalies found in annual rings of disturbed trees.

This study adds to the poor avalanche record of snow avalanches and their longest possible runouts in this area that has received little attention from geomorphologists to date.

This study is a contribution to project « Activité des avalanches des neiges dans les Carpates Orientales Roumaines et Ukrainiennes », funded by Agence Universitaire de la Francophonie (AUF) and Ministère pour la Recherche et l'Innovation de Roumanie (MRI) through Institut Roumain de Physique Atomique (IFA).

## **Downy oak (*Quercus pubescens* Willd.) phenology within an oak forest ecosystem in Eastern Romania**

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**Abstract:** Phenology is widely recognized as one of the most sensitive and reliable bio-indicator of climate change. Thus, evaluating the phenological response of plants in relation to environmental changes can serve in designing efficient measures for climate change adaptation. The research was conducted for a period of four consecutive years (2017-2020) and aimed to analyze the spring phenology (including budburst, leaf development and male flowering) and autumn leaf senescence of *Quercus pubescens*. The research area was established in the Eastern part of Romania, in a forest situated at the contact with the external forest-steppe in the ecological sector Thermophilous forests with grayish oak and downy oak. In order to relate the dynamic of spring and autumn phenophases in relation to the environmental condition at the site, was used a data logger to record air temperature and relative humidity. During this period, the phenological data revealed that budburst occurred on average after DOY 100. Among the spring phenophases, the flowering timing varied less than either budburst (15 days) and leaf development (19 days), all monitored trees release the pollen within a week. On the other hand, the highest inter-individual variability was observed for the autumn leaf senescence, which occurs within a range of 29 days. Moreover, the statistical analyses did not indicate any significant correlation between budburst and current, respectively previous year autumn senescence. These phenological results can help to improve the management of downy oak genetic resources in the context of climate change.

## Identification of rare, endangered, and endemic trees in the National Park „Kopaonik” - Serbia: case study „Metodje”

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Conservation of forest genetic resources in protected areas, such as national parks, presents the important aspect of in situ conservation in Serbia. There are five national parks in Serbia that represent an important way of in situ conservation of forest genetic resources: National Park „Fruška gora”, National Park „Djerdap”, National Park „Tara”, National Park „Kopaonik”, and National Park „Šar-planina”. National Park „Kopaonik” is located in the central part of Serbia, with a total area of 11,969.04 ha, where three protection regimes have been established: the first, strictest, regime covers 1477.79 ha (12.23% of the total area of National park), the second 3,604.74 ha (29.84%), and the third 6,886.51 ha (57.93%). There are 13 localities with the protection regime of the first degree, one of them is „Metodje”, which was the subject of this research. The locality „Metodje” covers an area of 117.62 ha. It is located at an altitude of between 1190 and 1840 m. The basic value of this locality is the ecosystem diversity of plant communities, as well as the floristic complexity. The site has a large number of different and very interesting spruce and beech communities with noble deciduous trees, as well as some rare and relict species. This research aimed to identify rare, endangered, and endemic species of forest trees in the National Park „Kopaonik”, at the locality „Metodje”, and to propose a program for their conservation and sustainable use. Forest genetic resources are affected by various biotic and abiotic threats which lead to genetic erosion, and there is a need to conserve them. Some of the threats to biodiversity are habitat degradation and habitat loss, deforestation, fragmentation, pathogens, invasive species, environmental pollution, global climate change, as is the case with the area of Kopaonik. Identification of rare, endangered, and endemic species of forest trees in the areas with a first-degree protection regime is the basis for their conservation and further sustainable use. Based on the results of research at the locality „Metodje”, measures for conservation and monitoring of the available genepool have been defined, with a special focus on rare, endangered, and endemic forest tree species. A total of 19 forest tree species were recorded at the locality „Metodje”. The conservation area at the locality „Metodje” will include sites where the following species occur: *Acer heldreichii*, *Acer platanoides*, *Betula pendula*, *Sorbus aucuparia*, and *Ulmus glabra*. Special attention should be paid to this genepool to conserve them, through the application of specific measures. Long-term goals of genetic conservation are defined: assessment of the degree of genetic variability of populations of rare, endangered, and endemic species, using genetic markers; designation of in situ conservation units; defining clear guidelines for target production of planting material of rare, endangered, and endemic species.

## Species-specific deadwood density and its controlling factors in a virgin European beech-silver fir mixed forest in the Southern Carpathians

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Deadwood is a fundamental structural and functional component of virgin forests, playing a crucial role in enhancing forest biodiversity and nutrient and carbon cycling. Accurate estimates of deadwood density are urgently needed to assess biomass and carbon stored as deadwood. More knowledge about decay rate of wood and how it is influenced by environmental factors will further improve our understanding of deadwood dynamics in natural forests. In this study, we attempted to estimate dry deadwood density for two economically and ecologically important European tree species on different decay classes to assess the influence of its related factors (moisture, rottenness, position of the sampling along piece, the contact with the ground, elevation, slope, aspect) in a virgin mixed beech-silver fir forest in the Southern Carpathians. For both species the dry density decreased significantly with increasing of decomposition level, the decrease being more pronounced for beech (484-326 kg m<sup>-3</sup> for snags (only 3 classes) and 486-151 kg m<sup>-3</sup> for logs (5 decay classes), than for silver fir (374-319 kg m<sup>-3</sup> and 359-161 kg m<sup>-3</sup>, respectively). Mass moisture varied slowly in the first three decay classes (around 60-80%), while it increased sharply in the last two decay classes of logs (> 140% in the fourth classes and > 350% in the last one). The rottenness increased with the degree of decay in a similar way for both species. Contact of logs with the soil positively influenced the moisture, while sampling position along the log played no role in the variation of wood moisture or density. The resulting density estimates for each decay class can be used to estimate carbon sequestered in deadwood for the respective species in similar conditions.

## Effects of different treatments on the germination rate and growth of black locust (*Robinia pseudoacacia* L.)

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*Robinia pseudoacacia* is used for soil stabilization, proper for sandy soil, is well known as a melliferous species, has fast vegetative growth and the wood is qualitative. The aim of current study was to investigate the germination seeds obtained from plus trees selected from different provenances of Romania: (1) Galați, (2) Iași, (3) Botoșani, (4) Bihor, (5) Râmnicu Vâlcea, (6) Satu-Mare, (7) Bistrița-Năsăud, (8) Arad. Seeds were morphologically analysed (i.e., weight, length, diameter), so that empirical data can be correlated with further results. The morpho-phenotypic analysis show that Bihor provenance had the largest seeds, while Satu-Mare had small values compared with the other ones. Two experiments were undertaken to test germination: treatment (1) implied water soaked seeds and heat treatment; treatment (2) was based on sulphuric acid treatment at different concentrations (50, 70, 90%). The results were correlated with the morphological traits of the seeds. Bihor provenance had the highest germination rate when seeds were soaked in water. Satu-Mare had the lowest germination rate within both treatments. It was noted that sulphuric acid did not improve seeds' germination as much as the first treatment, thus further investigation is needed in regard with the duration and concentration of the treatment.



## The sample size in allometric biomass models

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Estimation of forest biomass, expressed per unit of forest area, is an important step in demonstrating the forest-based mitigation of climate change, with accuracy and precision of estimates playing a critical role. Usually, for all trees within a sample of plots the diameter at breast height (D) and tree height (H) are measured, then, allometric biomass models are used to predict the biomass of each tree, to obtain estimates of individual plot biomass. Allometric biomass models are nonlinear regression models that predict individual aboveground tree biomass (AGB) as a function of D and H. Deciding the sample size used to develop the allometric biomass models is important because will affect the uncertainty of individual tree AGB estimation, affecting further the accuracy and precision of AGB estimates per unit of forest area. Here, we provide a method to estimate the optimal sample size for any given allometric biomass model, to predict the biomass of the target population within a predefined margin of error. The method consists in (i) defining of a virtual population, (ii) set the sample size and extract the sample from the population (iii) fit an allometric model to data (iv) use the fitted model to predict biomass of population, (v) calculate the margin of error for the estimated biomass, (vi) compare the margin of error with the desired margin of error and adjust the sample size at step ii. The optimal sample size is determined as the largest sample size for which the calculated margin of error is lower than the desired margin of error. The method uses a step-by-step application; an initial sample of a predefined number of trees is used to produce estimates about population characteristics, which will be used as predictors of sample size. The sampling continues until reaching the estimated optimal sample size.

## Chemistry and trophicity of urban forest soils from metropolitan area of Brasov city

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In urban forests, soil plays a very important role in providing ecosystem services. Human activities cause major disturbances in the morphology of the soil profile and in the general processes and functions of the soil. However, the protection of urban soils is fairly taken into account in the planning and development of urban areas. The aim of this paper is to have an overview of the edaphic factor from the urban forests located in Brasov metropolitan area (central Romania). In the area between the city of Brașov and Postăvaru Mountain 20 long-term experimental plots were installed where samples were taken from different soil horizons in order to study the physical and chemical properties. The following ecopedological indicators were determined: soil reaction, total organic carbon (humus), total nitrogen content, the sum of exchangeable bases, the total exchangeable hydrogen, the content of carbonates and granulometric analysis. All the properties mentioned above led to determine the global potential trophicity index. The 5 soil types identified namely: lithosol, phaeozem, rendzina, eutric cambisol, dystric cambisol. The reaction of the soils in the 20 experimental plots is mainly acidic. All soils in the experimental plots are humus-rich soils, belonging to the excessively humiferous to moderately humiferous categories. The base saturation degree is very different for the 20 profiles, ranging from oligomezobasic soils (dystric cambisols) to eubasic soils (eutric cambisols, phaeozems). Total exchange cationic and base saturation degree have bigger values in the urban forest from present study and nitrogen content has similar values with other studies. Correlation coefficient between soil properties and stand volume, orographic characteristics was determined. Taking into account the global potential trophicity index, the dystric cambisols and lithosols are approximately similar - oligomezotrophic soils. The richest soils are phaeozems and eutric cambisols, which reach megatrophic soils (TV). Taking into account the calculated values of the correlation coefficient for the analysed soils, the volume of the stand correlates mostly with the edaphic volume.

## How to increase the productivity of short rotation poplar crops? Case study in NE Romania

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Cultivation of hybrid poplar to produce biomass as a renewable energy source in short rotation crops (SRC) is supported by current environmental policies. Biomass production is influenced by a multitude of factors, among which, aside from clone and planting material type, the following are highlighted: (i) density and systems of planting, (ii) length of production cycle, and (iii) growing conditions (like soil quality, temperature, precipitation, fertilizer administration).

The main purpose of this study was to evaluate the possibility of increasing the productivity of biomass in a short rotation poplar crop from NE of Romania.

The study was conducted on hybrid poplar crops installed in a hilly area with two clones (AF2 and AF8) at different density and years.

Biomass production was estimated by destructive method according to relative moisture for stump/trunk and branches. For each growing season were measured the tree's heights, diameters at different height and volume. The data analysis was carried out using XLStat 2012.

For the 5-years crops installed at the 3 x 2 m scheme, it is recommended to raise the production cycle to 6 - 7 years in order to obtain an average annual aboveground biomass of approx. 10 odt·ha<sup>-1</sup>. In the same growing conditions, the 3 x 1,25 m spacing is recommended, which permits for the studied area, the obtainment after 5 years a biomass productivity of approx. 10 odt·ha<sup>-1</sup>year<sup>-1</sup>;

Based on the desired biomass assortments, the production cycle can be reduced to 3 years when density grows to at least 3000 trees·ha<sup>-1</sup>, namely to a 3 x 1 m scheme, this density assuring a productivity of approx. 30 odt·ha<sup>-1</sup>.

## **Peak-discharge frequency analysis in the Slătioara hydrographic basin, Suceava, Romania**

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The outcome of the torrent control works along the hydrological network cannot be analyzed without studying the whole watershed from a hydrological point of view, from torrential rains, which are the triggering events, to flood events.

Since 1969 the study area has turned out into a representative watershed, with appropriate hydrometric gauges allowing continuous measurements on flow and runoffs for more than 30 years. Out of the nine initial gauges, only six have been maintained as rainfall and hydrometric gauges: Valea Ursului, Valea Lui Ion, Slătioara 3, Gemenea 5, Gemenea 1, Gemenea 2, Stulpicani and Ursoaia, last one installed in 2010.

The peak flow quantile corresponding to the return period was estimated using the highest annual flows gauged within the basin. We showed which distributions best fit the chronological series of the highest flows gauged in the watershed and a strong correlation between the highest flows with 1% occurrence likelihood and the watershed area.

The values produced by frequencies analyses are validated at the regional level by the analyses carried out by Diaconu (1990).

## **Logs volume assessment using different measurements and error distribution according to the number of pieces**

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In the light of wood processing advanced technology of up-dated at the level of 2020, the big economic wood processors face the appearance of some volume differences of raw round wood found with the occasion of the reception of the log transports. In a summary analysis, these differences result from the application of automatic methods measurements (used by wood sawmills, methods based on laser scanning) compared with the application of basic cubage methods. In this context, this paper highlights the differences between volume estimated using modern methods and the volume estimated applying various established methods (Simple Huber, Huber compound, Smalian, Newton-Reike) - both using the actual lengths and the nominal lengths of the wood material supplied to large wood processors by economic agents. The measurements were performed with classical instruments: for measuring the diameters, the caliper with a gradation of 0.5 cm was used, and the length of the logs was measured with the invar tape (without distortions) with an accuracy of 1 mm.

Based on a large number of measurements - 1775 logs, the results highlight the distribution of errors relative to the numbers of logs and to the cubage method. In order to establish the differences between the cubage methods, the significance of the errors between them, specific statistical analyzes such as the simple analysis of variance (ANOVA) and the Tukey HSD test was applied. To capture how the number of selected trees influences the volume calculation error, random selection logs were applied. Thus, pieces were randomly selected, with an iteration of 100 times for each sample, according to the following algorithm: from 10 to 100 from 10 to 10, and from 100 to 1000, from 100 to 100. In the end, a number resulted of cc. 583000 pieces.

## **Identifying the potential social impact of the forestry works adjacent to the Via Transilvanica route**

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Via Transilvanica is an opportunity to discover on its route all the important stages and relief floors in Romania. The forests adjacent to the route represent a natural heritage of great importance. The forestry works are necessary for a good management of the forest. In terms of social impact, the most sensitive works are those that require exploitation works. In stand initiations the works have a lower social impact, but already from steady state especially the treatments have an important social impact through this exploitation activity. The impact of the exploitation is also important through the extraction routes, which can interfere with the tourist routes, the removal through the stream that can affect the water quality, the risks to accidents, which can appear by felling the trees. The purpose of the analysis is to identify the social impact of forestry works for the stands adjacent to the Via Transilvanica route and to calculate the opportunity cost of functional zoning, from the perspective of integrating these stands in forests with a social role. The goals:

- identifying the characteristics of adjacent stands of Via Transilvanica route;
- identifying the forestry works proposed for these stands;
- calculation of the opportunity cost.

The Via Transilvanica route in .shp format was obtained through the agreement between the university and the Tășuleasa association, based on a collaboration protocol that integrates the objectives of this analysis. The entire database was created in the ArcMap program, following a series of steps:

- a. The layers were loaded in ArcMap, separately on the 6 forest districts: Putna, Marginea, Iacobeni, Pojorâta, Tomnatic and Vama.
- b. For each forest district, a buffer was created with the areas that directly intersect the Bucovina route Via Transilvanica: 25 meters from the route, respectively 100 meters.
- c. Each buffer has been assigned a code:  
code 1 for the buffer that directly intersects the forest district within radius of passing the route;  
code 2 for the 25 meter buffer;  
code 3 for the 100 meter buffer.

In the toolbar, with the "Search" function, the three buffers were combined, through "Merge (Data Management)".

After creating the final merge, we export the data in an Excel © document, from where we will extract the following column headings: parcela, subparcela, UA, UP, SUP, spr, gf, fct1, fct2, fct3,

inc, tp, cns, ta, te, lx1, lx2, lp1, lp2, lp3, vol, vex, compozitie, cod, on the basis of which we will perform all the necessary calculations.

The data were analyzed from the perspective of:

- analysis of the structural characteristics of the stands, using tables in Excel;
- for the analysis of the proposed works, a map of their distribution along the route was made, using the ArcMap program;
- for the opportunity cost a database was created starting from the executed works and the volumes necessary to be extracted.

To calculate the opportunity cost were considered three scenarios:

- 1: All stands will be integrated in SUP E
- 2: All stands will be integrated in SUP M
- 3: Buffer zones of 25 m and one of 100 m along the route in which there are no interventions

In conclusion:

- The Via Transilvanica route will lead to the increase of social tourism, with an increased social role;
- Promoting forestry education, the route being an opportunity to present forestry works
- The transformation of all subplots in SUP M conservation, area in this situation the impact of the opportunity cost would be smaller
- The transformation of all subplots in SUP E area->very high economic cost, there is the problem of giving up a renewable resource in areas where local communities supply themselves with wood
- Creating a buffer remains the problem of reducing the social impact of exploitation.