Terrestrial forest monitoring in the age of remote sensing and forest modelling

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Abstract:

The last decades have been characterized by the rapid development of remote sensing for forest resources (e.g. Boyd and Danson, 2005) and the even faster growth of forest dynamic models at tree, stand, and landscape scales (e.g. Shifley et al., 2017). There were good motivations for these two processes: as for the first, the value (in ecologic, societal and economic terms) of forests and related services, the diversity and multi-scale dimension of forests and related issues (e.g. from local forest management to global carbon cycle) makes remote sensing crucial for monitoring of the global forest on a frequent and continuous basis (Running et al., 2004). As for the second, forecasting forest change and response to biotic and abiotic pressures is more and more requested by forest- and resource managers, policy- and decision-makers.

Over the same time window, however, also terrestrial forest monitoring and inventorying has been considerably developed. Large-scale international initiatives were put in place: for example, within the UNECE Air Convention (i.e. the first international the first international treaty to address air pollution on a broad regional basis) internationally co-ordinated forest monitoring was developed (Ferretti and Fischer, 2013). Besided providing a number of information on basic forest attributes, trend and processes, the resulting augmented data availability for model calibration was arguably one powerful boost for the tumultuous development of dynamic forest modelling (Shifley et al., 2017).

Here nature, origin, development, results, current status and future perspectives of terrestrial forest monitoring are presented, reviewed and put in the context of global environmental changes and challenges place by interaction, integration - and sometimes competition - with forest remote sensing and modelling.

While considerable effort is necessary to keep research and monitoring infrastructures in place and open to new technologies, terrestrial forest monitoring is - and will continue to be - essential for providing ground truth data, favour model development, calibration and validation, and promoting understanding of forest ecosystem processes and dynamics. In such a context, internationally co-ordinated programs using comparable methodology over large-scale and in the long-term may have a central role.

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Climate change effects on tree growth from Romanian ICP-Forests Level II plots

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Abstract:

The forest health status is mainly influenced by the negative action of air pollution and climate changes of different biotic and abiotic factors, and other disturbances. Growth dynamics at trees and forest stand levels was considered as the main indicator on structure, stability and productivity of forest ecosystems. In this context, results obtained by transdisciplinary investigations in the Romanian forest monitoring Level II plots, revealed the distribution of the radial increment and basal area increment (BAI) in relation to the tree crown defoliation and the uniformity of the biomass accumulation recorded by the healthy trees compared with the damaged trees, respectively. Using basal area increment as a synthetic indicator, the main climate drivers for tree growth were identified. Temperature and precipitation were used as climate indicators as well as several derived indexes like: SPIE, growing degree days – growing season length, number of warm and wet days derived from daily climate date of EOB-S grid dataset. According with species and region different climate response pattern was quantified. In comparison with Norway spruce and beech, sensitivity of Q. species is much higher and their reaction to variation of climatic factors is more intense. Temperature has a positive influence on BAI index for spruce and beech situated at high altitudes and a negative influence for oak species. Reaction to cumulated deficit of water is different for Q. species: the most resistant are oak and sessile oak; the most sensitive are *Q. cerris* and *Q. frainetto*, where reducing BAI percentage is more than 50%. Recovery capacity of tree growth after drought event was lower for oak and sessile oak and higher for *Q. cerris* and *Q. frainetto*. At species and plot level, resilience components emphasized that in 2002 was observed a low resistance and high recovery and resilience of BAI. Also, we can notice that 1994 was an extreme year which is marked on defoliation dynamics at national level. A maximum percentage of damaged trees was recorded and it ends a long drought period begun since 1981. The growth reduction due to extreme climate years is significant only in case of oak species from south-eastern Romania where growth is constrained by drought and high temperature during the summer.

Key words:

tree growth, tree health, air pollution, climate changes, forest monitoring, Level II plots climate response

Are critical levels of NH_3 and NO_2 exceeded at the ICP Forests level II plots in Romania? Preliminary results using the passive sampler measurements

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Abstract:

In the framework of the ICP Forests programme, concentrations of ammonia (NH_3) and nitrogen oxide (NO_2) were determined at 4 level II plots beggining with 2009. The Ogawa passive samplers were installed in the forest ecosystems, according to the recommandations of the ICP Forests Manual (Schaub et al., 2016) (updated 05/2016).

In 2009 and 2010, the colorimetric method based on Nessler reagent was used for NH_3 determination in lab. From 2011, the indophenol blue method began to be used until 2017.

For NO_2 determination in lab, the method with sulfanilamide and N-(1-Naphthyl)-ethylenediamine dihydrochloride was used from 2009 to 2017.

The levels of mean annual measured concentrations were compared to the national mean values reported in the framework of EMEP for the studied period.

The preliminary results suggest that the critical level of NH_3, established for lichens and bryophytes, which is of 1 µg m^{-3} $year^{-1}$ (Cape et al., 2009, cited by Calatayud and Schaub, 2013), was exceeded, but not that for higher plants.

For NO_x, expressed as NO_2, the measured annual means were below the critical level.

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Nemoral Deciduous Forests under Climatic Extremes – Ecosystem Adaptations along Climatic Gradients in SW Romania and Central Germany

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Abstract:

Global climate change will have a significant ecological effect on European forests in the next decades. Therefore, the newly launched NEMKLIM (Nemoral Forests under Climate Extremes) research project focuses on a deeper understanding of the ecological effects of increasing summer drought and heat stress, on the nemoral deciduous forests in W and SE Central Europe. Its main aim is to investigate the ecological range and adaptation width of forest plant species, interspecific competition, biodiversity and ecosystem services in selected beech and mixed oak forest types using a "space-for-time substitution" approach. The current habitat gradient in Romania serves as a reference for changes in Central German forest habitats, expected to be produced within the next decades (until 2060-2080). The tipping points of the beech to mixed oak-dominated ecosystems will be identified and characterized, considering that Fagus sylvatica forests provide habitat conditions which are different than most other broadleaf forest types, characterized by deep shade, leaf litter durability and accumulation, and a rather poor shrub and moss layer. Moreover, we will analyze in detail the phytosociology, genetic diversity and morphological variability of *Quercus petraea* and its close relatives *Q. dalechampii* and *Q. polycarpa*, as one of the most important drought-tolerant and versatile species groups. The impact of short-term disturbances and medium to long-term extreme events on biodiversity, and its consequences for nature conservation and forest utilization (lumber, fuel and firewood) will be analyzed. Hence, NEMKLIM will contribute to environmental issues of currently high relevance, and on the basis of the scientific results of the project will be formulated recommendations for decision makers in different fields - politics, administration, business and research.

The Romanian Scots pine forests vulnerability to the extreme climatic events influence

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Abstract:

At European level, it has been underlined the fact that the influence of climate changes on the productivity and vitality of the Scots pine forests will have a significant negative impact, which will lead to important economic losses. According to the IUCN classification, in some vegetation areas from Romania, the Scots pine forests presents a high vulnerability to climate changes. Taking into account the large-scale mass withering of the Romanian Scots pine forests observed in the last years and the special silvicultural and ecological importance in Romanian forest fund, the necessity of the understanding and the assessment of the impact of extreme climate events on the radial growth of the Scots pine are mandatory. So far, in Romania, there are no studies concerning this aspects. To achieve that, we developed and use a Scots pine dendrochronological network consists of thirty-four basal area increment chronologies. The results obtained show that the appearance of prolonged drought periods in the future, such as those in the spring and summer of 2000 and 2012, will affect all of Scots pine forests in Romania, regardless of their age, composition or spatial location. Monocultures of less than 50 years of age, located at an altitude of less than 1000 meters in the western half of the country will be the first affected by drought conditions in the summer, being the most vulnerable. Stands in which the pine forests are mixed with other species and have the age over 50 years will be much more adapted and will suffer far less from negative climate impact. Taking into account that all the climate scenarios predict a rapid increase in temperature over the next decades, the lack of practical measures of adaptive management to the climate changes will lead to the decline of Scots pine forests.

Frosts tolerance and growth of Oak in changing climate - are drivers of oaks forest vulnerability archived in tree rings and genotypes?

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Abstract:

Selecting frosts-tolerant planting stock for reforestation program may help to adapt forests to climate change. We tested *Quercus robur* L. and *Quercus pedunculiflora* K. Koch. population response to frost, drought and insects' outbreaks in southern Romania ecosystems. In this area the adaptation to expected future climate change is high. Dendroecological analysis may provide information on the response of trees to environmental stressors over time. In association with genetic studies we can improve our knowledge on the adaptation of different oak forest stands and single trees.

In this study we (1) linked dendroecology and association genetics in natural population to evaluate the influence of internal predictors over the responses of trees to environmental drivers, (2) present an analysis conducted in three extreme sites with contrasting aspects regarding genotypes, (3) evaluating the influence of climate and outbreaks on tree-ring growth, (4) ask for a wider collaboration of dendroecologist and forest geneticists to integrate individual tree-level dendrophenotypes in genetic association studies to respond to the current needs of adapting individuals to environmental conditions.

The working hypothesis consisted in testing the possibility for trees dispersed in isolated groups to evolve differently as tree-ring response to environmental factors. Specifically, we derived dendrophenotypic measurements from 82 trees from Craiova county near to Danube River that characterize the resistance, recovery, resilience and relative resilience during the years with growth depression. In this study we focused on individual level response to the stress episode to estimate variation among trees.

At the same age we distinguished two categories of diameters: large to tardive tree genotype and small diameter to precocious tree genotype. From the beginning we noticed that large diameter trees start vegetation stage later- about two weeks compared with low diameter trees. The statistical analysis expresses the fact that later genotype is more protected from late frosts and outbreaks and in the end the productivity and wood quality is higher comparative with early genotypes. The preliminary results attest that internal factors that boundary tree-growth can generate variation induced by microscale environmental differences.

Acknowledgements:
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Response Function Analysis using (TreeClim) package, A tree ring study on the Siberian pine (*Pinus sibirica*) in the Altai Mountains, northwestern China

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Abstract:

The Altai Mountains in Northwest China has a great potential for dendroclimatological studies. The dendrochronology and the climatological response analysis potentials and gaps of northwest China in the Altai Mountains ranges are therefore, unexplored. In this study, we develop for the first-time chronology statistics and climate response growth analysis of Pinus sibirica using (dplR) and (Treeclim) packages of the R program, with the overall goal of documenting baseline information for future research. The chronology covered a span of up to 203 years in the study site. The results highlighted that the chronology showing highly significant negative correlation to the previous year June and highly positive significant correlation to the late winter March, Maximum, Minimum and average temperature respectively. The results further revealed negative responses for the previous year March in term of Palmer Drought Severity Index (PDSI) value (-0.027) but positive PDSI values (0.035, 0.014, 0.027) in April, May, and June. These results indicated that tree ring widths are not responding positively to the previous year growing season at the current chronologies of 203 years. These findings suggest more extensive research on the climate-growth reconstruction and Response Function Analysis of the trees for longer chronologies up to their natural age of 800 years.

Keywords:
Dendroclimatology, Response Function Analysis, Siberian pine (*Pinus sibirica*).

Optimal structures adaptable to climate change for sessile oak stands

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Abstract:

In the last decades, the effects of climate change have become increasingly visible in forest ecosystems. The stands created outside the natural area are greatly affected, but the stands in the area with simplified structures, such as the sessile oak stands, have also become vulnerable. Sessile oak stands are spread in all hilly regions, and frequently at altitudes of up to 700 m. Stands located in the upper third of the slopes, on sunny exposures, are more susceptible. Such conditions favor mixed species which can adapt faster to climate change, such as linden and ash, hornbeam, maple, elm, and cherry. In the existing clearings within the stands, these species regenerate fast and tend to crowd the sessile oak seedlings, despite the fact that they are small or only disseminated. The stands become unstable and evolve naturally into linden stands, hornbeam stands, ash stands, maple stands or mixtures. At the lower limit, beech is the less favored species, with the limiting factor of lower water quantities, which is why it grows at higher altitudes. Sessile oak stands with hornbeam and linden facies and those with beech, hornbeam, and linden facies are also threatened. Unlike sessile oak, the other deciduous species regenerate faster and can evolve into mixed stands in which, from a majority proportion, the sessile oak can have reduced proportions, be present only disseminated or even be absent in future structures. A particular case is represented by sessile oak-beech stands. Because the limiting factor for beech is the lower water quantity, such stands occur predominantly on shaded slopes, at the intersection boundary of the area of the two species. Beech and other mixed species find particularly favorable conditions, and maintain their vitality and regeneration capacity. Sessile oak becomes threatened, has lower growth rates, is not as vigorous, and regenerates at a slower pace. Its seedlings cannot compete with the youth of the other species, especially beech, which becomes abundant. Similarly, to sessile oak stands, the type of habitat changes, and in the absence of management work, the stands grow naturally into mixed beech stands or even into pure beech stands. As a result of climate change, the natural evolution of the stands changes the structure of the sessile oak stands to a great extent. But in the case of sustainable management, the mixed species play a determining role in the existence of the stands. They obtain the dense stand usually by forming the second story, they protect the soil, increase the quality of the sessile oak species, and become, in turn, susceptible to new uses in the future. However, in order to preserve these stands, it is necessary to tend them into sustainable, adaptable structures. These structures must be defined using models with the following main biometric parameters: the proportion of species with their dendrometric characteristics, the distribution ratio of the trees in relation to the diameter, the basal area and the volume per hectare, the optimal density, and others. These parameters ought to be applied by doing management work on the stands. The aim of this study is to develop functional models for mixed sessile oak stands, which are capable of

adapting to climate change. They will become future structures, ideal for guiding current stand structures. These optimal structures are based on research done on real structures in different stands, located in various stational conditions.

Adapting the planning and management of spruce forests in mountain areas to the challenges of climate change

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Abstract:

The expansion of spruce to the altitude levels normally occupied by deciduous and mixed forests in the Romanian Carpathians, generated by forest management work, has led to changes in the natural structure of forests. Over time, spruce forests have become vulnerable to destabilising factors. To reduce the risks generated by these environmental factors, urgent measures to improve biodiversity, increase stability, and reconstruct the natural composition of these monocultures are necessary. Concern for the evolution of spruce monocultures arose when climate change and its effects on forests became visible. The forest management planning regulations create the necessary framework for measures which must be applied in these forests to restore the natural ecosystems. The composition of natural forests and their structure should become models for the current composition of stands, as they represent the key for reaching stability in the context of climate change. The forest management planning analyzes the conservation status of stands, their productivity, regeneration capacity, and vitality, and adopts the necessary measures to guide the stand and forest structure to a normal state. Resinous/coniferous forests are a particular case where the forest management planning regulations must be adapted to climate change. Adaptation measures are possible by researching the natural environment with the purpose of correctly categorizing stands, analyzing the structure of stands, and reviewing the management objectives and forest functions. These are the elements underlying the management aims and decisions of the forest management planning regarding the measures which must be applied. In the case of young and middle-aged spruce monocultures, the management measures proposed in this study consisted in conducting maintenance work to save mixed species and to create conditions favourable for growth and development. In forest compositions where mixed species are absent, they must be introduced in biogroups. In high-density stands, the dimensions of the clearings where mixed species are introduced differ depending on the development stage of the stands, respectively the stand structure, because these factors influence the light, temperature, and humidity necessary for the development of the saplings. In exploitable spruce stands, clear cuts were excluded and replaced with treatments favourable for regeneration. In pre-subalpine spruce stands, which are ecologically vulnerable and have important antierosion and hydrologic functions, the projected forestry measures were aimed at conservation. The spruce stands surrounding the alpine gaps were excluded from any forestry interventions allowing them to evolve naturally. This study emphasizes the arguments of the forest management planning and its regulations regarding the sustainable management of spruce forests vulnerable to changes in structure, caused by climate change. The research proposes the adaptation of the measures in the forest management planning to spruce forests in the Făgăraș Mountains, but they can be applied more or less to all spruce forests vulnerable

Situation and Problems of Urban Forests in Turkey

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Abstract:

Urban forests are one of the most important working areas of urban forestry discipline. Urban forest concept as scientific and technical can be described to an area as locate in and around the city, have to renew itself in forest character and a certain covered in establish as a natural or artificial, contribute to the aesthetic and functional to urban structure, offering recreational and health-related facilities to the urban residents, and accessible in a short distance. In general, the main objectives of urban forests In Turkey are accepted as provide of services and contributions in terms of recreational, ecological and to improve of physical structure of the city.

Nowadays, the urban forest projects in 80 provinces have been made by General Directorate of Forestry (the Ministry of Forestry and Water) under this law in Turkey. However, established urban forests have not been done of ideal location choice, planning, and management according to the objectives. The legal frameworks and the means to implement the new laws and regulations need to be developed at national and sub-national levels. However, legislation needs to clearly define the responsibilities of the different should be authorities directly or indirectly responsible for urban forests.

A case study for forest fire risk assessment for Romania developed within the framework of RO-RISK project

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Abstract:

Effective prevention and management disaster policy strategies requires up to date and unitary disaster risk assessment in order to identify the probabilities of hazards occurrence and the associated potential impact. At EU level, each member states have to provide the European Commission the risk disaster management capabilities and a national risk assessment. In this respect, Romania has carried out the RO-RISK project aimed to developed a first national risk assessment for ten major disasters within a unitary framework, one of them being the forest fires risk. In Romania forest fires became an increasing concern mostly since year 2000, when their frequency and impact begun to raise steadily as a consequence of prologue drought periods coupled with land use and land cover changes and the perpetuation of damaging anthropogenic practices like vegetation waste burnings. We present hereby the forest fires risk assessment developed within the unitary RO-RISK methodology which consisted in step-by-step chain processes, based on geospatial analysis, aimed to evaluate the forest fire risk at local administrative unit (LAU2 level): hazard analysis and maps, forest fires scenarios building and scenarios prioritization, exposure and vulnerability analysis, impact evaluation and probability calculation, ending with the global impact and risk assessment. Geolocated fire ignition events and corresponding metadata for the 2006 - 2015 time period was used for modelling the hazard assessment of the main three constructed risk scenarios at national level (i.e. for 10, 100 and 1000 years probabilities) along with two local high-risk scenarios. The main driving factor for fire ignition is the human presence and activity whilst the climate conditions act as contributing factors to fuels flammability. The results indicated that wildfire risk in Romania have a medium-low occurrence probability and the global impact is generally low, excepting some areas which are fire danger hot-spots, like drought prone South-Eastern counties, or other regions where forests are interweaved with populated areas.

Acknowledgement:

This research was undertaken within the framework of the project" National Risk Assessment – RO RISK" (SIPOCA code: 30), co-financed under European Social Fund through the Operational Program Administrative Capacity 2014–2020 under the coordination of the General Inspectorate for Emergency Situations

Analysis of the structure of forest stands of Scoreni Forest district

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Abstract:

The forest history and the forest management practice develop our *decision-making* skills for the *future* problems solving. The record of the forests on the territory of the Republic of Moldova began to be practiced in the second half of the XIX century. The first forestry arrangement was made in 1882-1883. By comparing the descriptions made in 1907 and the field studies of 2017 it was found that no major changes were identified in the vegetation conditions on the territory concerned. Climatic, geomorphological, geological conditions have remained the same. This study attempted to find more answers. What was the reason for the degradation of forests according to the 1907 data? How they influenced state policies to improve tree structure at the beginning of the 20th century and the beginning of the 21st century. It was found that the main factor influencing the degradation of the forests was the faulty state policy, including the lack of qualified forestry personnel and the limitation of the functions assigned to them, application of grooming treatments, racing cuttings followed by abusive pasture. The regeneration of the forests was vegetative even if the provisions of the arrangement made in the years 1903-1904 provided natural regeneration or seeding below the massif. The nationalization of forests in the years 1925-1926 has contributed essentially to the change of state policy towards the way forest management is concerned. At present the forestry of the Republic of Moldova is ensured with a well-defined legal framework and successfully implemented in the forestry fund.

Status and evolution of pine forests on degraded lands - a case study for Vidra Expertimental Forest base

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Abstract:

In the area managed by Vidra Experimental Forest Base (for the structure of INCDS "Marin Drăcea"), starting with 1937, but especially after 1950, it was afforested about 3000 hectares of degraded lands and the main species used was pines (*Pinus nigra and Pinus sylvestris)*.
The afforestation mentioned above were carried out in several stages on land with difficult conditions (lack of soil, large slopes, excessive climate, etc.) and also using specific works of land consolidations, afforestation technologies, compositions and mixing schemes and moreover their evolution has been carefully monitored over throughout time.

In this research we present the results regarding the dynamics of the structure and also the one about the biometric and qualitative parameters of the forest plantations/stands from two representative experimental perimeters (Pr. Sarat-Valea Sarii and Caciu-Barsesti). The perimeters are characterized by different: ages of tress, environmental conditions and afforestation technologies.

The evolution of the pine forests is closely related to: environmental conditions, silvotechnics works carried out, abiotic factors (drought, wind, snow, etc.) and biotic distubers factors, whose actions have become stronger over last times. The consequence of these factors (stationary and disturbing) has often lead to the degradation of forest tree, such as: reduction of the consistency, destabilization of the structure, the regeneration of species of low ecological value, the deterioration of health leading to lower ecosystem stability, with negative ecological and economic consequences (Constandache C., et al., 2017). At the same time, the quality of the surviving trees is considerably reduced; the consistency of the forest decreases and health, biological diversity and regeneration capacity are diminishing (Constandache et al., 2015).

Pine stands between 50 and 60 years located on degraded land, close to the physiological limit and sometimes severely destructured require specific intervention to ensure their regeneration and continuity. For trees close to 60 years old, the issue of regeneration / transition to the next stage is a problem and the necessary methods and measures are little known. Loosening of the stands allowed the natural installation of valuable local species (oak, beech, cherry, maple etc.) which indicates the improvement of the vegetation conditions and the possibility of transition to the zonal ecosystems.

Based on the research results have been made recommendations regarding the regeneration of the pine trees on degraded lands. The afforestation works have been differentiated in relation to the environmental conditions, to the damage degrees of land, to the floors of lower vegetation.

The results obtained are very useful for the scientific substantiation of the management and regeneration of forest ecosystems on degraded lands, so as to ensure: vegetation continuity, ecological diversity and stability to fulfill its protective role.

Key words: pine forests, degraded lands, environmental factors

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Back to the future: Forecasting the trajectory of temperate forests using a landscape simulation model

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Abstract:

Forest ecosystems provide essential services to human societies. However, in the past decades, environmental and anthropogenic factors have caused serious threats to forest ecosystems integrity, functions and processes, leading to habitat degradation and the related loss of forest services. Furthermore, changes in the frequency, intensity, spatial extent, duration, and timing of extreme events such as droughts and heat waves can lead to tree mortality events, changes in recruitment success and eventually changes in forest types. Climate change effects will likely interact with other disturbance drivers (e.g. insect outbreaks, logging) which might intensify their impacts. Yet, the outcome of these interactions is still unclear.

Forest management practices can be implemented to ameliorate the impacts of environmental drivers on forest growth and resilience. But the effectiveness of forest managements to mitigate such impacts will vary across forest types and the intensity of disturbance drivers.

We used the forest landscape simulation model LANDIS-II to understand the effect of disturbance factors on forest composition, structure and productivity and to forecast the trajectory of temperate forests in southeastern Australia over the next century. We also assessed the effectiveness of forest management practices to mitigate the negative impacts of disturbance factors.

The results provided meaningful indicators of trends and likely changes in forest structure and dynamics under different scenarios. Our findings were highly valuable for land managers and policy makers as they contribute to evidence-based management decision making for Australian temperate forests. We are currently working on implementing this model for Romanian forests.

Synergies and trade-offs of variable retention harvesting in *Nothofagus pumilio* Patagonian forests: Overview after 18 years of implementation

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Abstract:

Forests provide several ecosystem services, but traditional its management focus only in provision disregarding other services and conservation. Variable retention harvesting (VR) was proposed to maintain some characteristics of primary forests and diversity in the managed areas (Martínez Pastur et al., 2009). VR applied in Nothofagus pumilio forests in Southern Patagonia (Argentina) combines two types of retention: aggregates of original forest (AR) (60 m diameter, one per hectare) and dispersed single trees (DR) in the harvested areas (10-15 m^2/ha basal area). The proposal starting with a permanent plot (50 ha) in San Justo ranch, and continued to date in more than 3000 ha. Different studies were conducted with this management umbrella including: (i) yield, (ii) economics, (iii) microclimate, (iv) natural cycles, (v) forest stability, (vi) forest dynamics, and (v) biodiversity conservation (e.g. birds, plants, invertebrates, fungi, mammals). This study assesses the assumption that VR maintains mature forest conditions after harvesting in the aggregates, and reduces the negative effects or harvesting with an economic sustainability. We synthesizing 18 years of research in different harvested with VR and without management (control areas) trough univariate and multivariate methods, as well as meta-analyses. We found that aggregates had no effect on microenvironmental variables and forest structure, but increased the values of forest reproduction. Dispersed retention did not affect microclimate and forest reproduction, but negatively affected forest structure. Species richness and abundance of native plants were significantly increased in the aggregates and in dispersed retention richness of native plants increased while their abundance slightly decreased. Alien plants significantly increased in both treatments, with particularly strong effects in the dispersed retention. Insect richness and abundance were hardly affected by the treatments, whereas birds were significantly increased in harvested areas. Species of primary forests were maintained in the aggregates, whereas species of neighbouring environments were positively affected by harvesting. We conclude that the ecological conditions of N. pumilio forests were influenced by VR, but direction and magnitude of the effect depend on the treatment and the kind of variable. Inside aggregates several primary forest components and conditions were maintained (Soler et al., 2015; 2016). Beside the positive synergies and the detected trade-offs with conservation, we analysed the economic feasibility of their implementation in large-scale forestry operations. The economic and yield indicators showed that there are no significant differences with traditional harvesting (e.g. shelterwood cuts), and several advantages were added to the operations (e.g. logging and yield), decreasing their implementation costs.

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Forest increment assessment in Romanian National Forest Inventory. Methods and Models used

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Abstract:

The Romanian National Forest Inventory (NFI) is a continuous forest inventory with a 5 years period cycle and use a sistematic grid of both permanent and temporary sample plots. NFI is at the end of the second cycle and it has to provide information on the actual state of forest and, for the first time, to estimate the increment of the forest, based on the data collected from trees on permanent sample plots. The increment can be estimated with no problem for trees that were measured in both NFI cycles, using information on simple volume diference of the trees between T2 and T1. A difficulty occurs when estimating the increment of trees that were measured only once, as tree recruts, measured at T2 only, or cut trees, measured at T1 only. Three methods were used for estimating missing data: simple imputation of the mean, multiple imputations and regression, of wich the multiple imputations were selected, as a means to reduce a potential bias. Crossvalidation tests showed that multiple imputations and simple imputation had similar performance. Regression resulted in important biases. Multiple imputation had overall a lower bias and can be recommanded as a routine method.

Keywords:

forest increment, tree volume, multiple imputations

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Socio-environmental survey of a forest hamlet proximate to *Neora Valley* National Park in the Eastern Himalayas, India

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Abstract:

The Eastern Himalayas have significant impact on the climate and biodiversity of the Indian Subcontinent. The Himalayan region has shown consistent warming trends in recent times, which can significantly affect the biodiversity, agriculture and local livelihoods. Many scattered hamlets are found in this zone and some of them are proximate to the forests enriched with endemic biodiversity. Extensive study is necessary in the Eastern Himalayas to explore the socio-ecological conditions in the context of climate change. Due to its strategic location between Nepal, India, Bhutan and China, the Himalayan landscape is an important area for biodiversity conservation and needs transboundary cooperation to make conservation efforts effective. *Icchey Gaon* (27.1336^{o}N, 88.5657^{o}E; Altitude 5,600 feet) is a small village situated in *Kalimpong* district, India in the Eastern Himalayas. *Icchey Gaon* is situated proximate to *Neora Valley* National Park, which is located in the Eastern Himalayas as a global 'biodiversity hotspot'. The village is one of the newest tourist destinations in the Eastern Himalayas. The village area is also a centre of Cinchona plantation since 19th century. The adjacent areas of *Icchey Gaon* have extensive coverage of *Cinchona* plantation. The survey work was done in April, 2017 by visiting *Icchey Gaon* village in *Kalimpong*, West Bengal. The study focuses on an interdisciplinary understanding of the physical and cultural environment of the forest and mountain areas. The survey work integrates the perspectives of human and social ecology, ecosystem services and sustainable development. Primary data were gathered through field survey and direct contact with common people and authorized centres of the region. Structured questionnaires and semi-structured interviews supplemented by field notes were arranged to collect data from the village areas in *Icchey Gaon*. The length of each interview was about 40–50 minutes and was supplemented by field notes. The interviews were conducted in the local dialects (which comprised of mixture of Bengali and Hindi languages). Focuses were given on demography, agriculture, livestock management, traditional water management, education, culture, health, waste management, disaster management, biodiversity, joint forest management, ecosystem services and human animal conflict. Biodiversity of the region was documented by visiting the forest areas and the nature interpretation centre situated in *Neora Valley* National Park. There is an urgent need for implementing an integrated sustainable development system for the conservation of forest ecosystems and traditional human settlements in and around *Neora Valley* forest. Management strategies have been suggested for conserving the forest biodiversity and socio-economic condition of the hamlet. Bringing local communities into protected area management can have significant positive impact on long-term biodiversity conservation in the transboundary Himalayan landscapes.

Actual concerns about agroforestry systems in Romania

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Abstract:

Agroforestry systems, as forms of association between trees and crops, have long been practiced in our country, as elsewhere in the world. As independent science, worldwide, is born at the end of the 70's of the last centuries (MacDicken and Vergara, 1990).

In our country the study of agroforestry systems started in 2006 by financing a project by the Ministry of Agriculture, Forests and Rural Development and carried out by the Forest Research and Management Institute (Mihăilă, 2010). Also, at the same time, higher education institutions with the forestry specialty included agroforestry systems discipline in the curriculum.

Concerns about the association between the components of agriculture and forestry are manifested through the study and realization of certain types of agroforestry systems. The most common are the forestry shelterbelts for crops protection, which are more widely known as having the largest expansion and development in the last century, even though the periods of development (especially in the interwar period) alternated with periods of abandoning them (from the 50s to the 60s) (Lupe, 1995). The taungya system have developed more until the late 1980's and, isolated, are still present in the south of the country, being mainly carried out to reduce the cost of forest establishment and stimulate the development of the trees. In the pastures with forest vegetation, silvopastoral management are made, but the planting of the trees on the pastures as well as their care where they exist does not happen so that the pastures with trees are in an obvious decline. Studies conducted so far have shown that pastures with forest vegetation provide much better conditions for their sustainable development and conservation of herbaceous vegetation present within this type of agro-forestry system (Maruşca, 2006). To prevent flooding, the discharge of many residues into the water, are useful forest belts for protection of the water courses. The fact that along the watercourses the presence of the neighboring forest vegetation is low makes it even more necessary to develop these types of agroforestry systems, which are currently very poorly represented (Mihăilă et al., 2010).

Except for the types of agroforestry systems presented above, other types of agroforestry systems such as: forest farms and production of non-timber food products in forest (e.g. the harvesting of seeds, flowers, resin from trees, honey by bee-keeping), achieved following the private initiative can be found in our country.

For the promotion of agroforestry systems, it is necessary to implement some financing support measures, followed by good practice manuals for their application. Also, the latest research project proposes to develop models of agroforestry systems in representative agricultural farms in the plain, hill and mountain in order to present the potential beneficiaries the advantages of their realization compared to the material and financial effort involved.

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Using mushrooms in favor of both the forest and the human

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Abstract:

Fungi are organisms that have been on Earth for more than 2 billion years. During this period, they created a naturally strong position, which will stay sovereign for millenia. People are observing, recognizing and using them for several thousand years. Despite the fact that in some parts of the world the tradition of cognition and use of mushrooms is very long and strong, the knowledge of mushrooms is still insufficient. The significance of fungi is substantial, considering their irreplaceable position in ecosystems in nature and positive effects on human life.

A spectrum of mushroom species on a given area reflects the environmental factors. Presence of symbiotic, parasitic and saprophytic species shows ecological stability of a location. Their spectrum, or ratio of the species belonging to various ecological types is the sign of ectothrophic stability of the forest. That makes the evaluation of the number of mushroom species e.g. "mycorrhizal percentage" an important stability indicator of a given biotope or forest.

Mushroom research under natural conditions of forests brings basic information on their way of life, physiology and ecology. Their abilities, along with the positive effect on human health are closely tied with the environmental conditions. Knowledge on those is the elementary basis for their successful cultivation and subsequent utilizing of their properties and abilities.

Mushrooms are no longer just a pleasant addition to our man's diet. We are looking for ways to use much of the mushroom ability not only to decompose waste wood material but also to clean soil, water and the environment from various other wastes and toxic substances.

Reaserch on the determination of the main indicators that characterize the production fund of a forest using the National Forest Inventory (IFN) network

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Abstract:

The National Forest Inventory (IFN) program of the I.N.C.D.S.” Marin Drăcea” institute is the main tool in assesing forest resources across the country. Having a complex preview, both from the sky, with orto-photo plans, and on the ground, using plots that are spread in a grid all over the forested area, it can be very precise when it comes to forest resources and determining the main indicators to characterize a production fund and applying a sustainable management. The fact that the inventory finished two full cycles we can also see growth indicators. This papper discusses the main aspects of the inventory in a surface of forest fund composed of two distinct production funds from the mountain area. Taking in consideration the following: the measurment methods that it uses in the field, the gathering of data and the proccesing method. For the characterization of the forest fund there were multiple methods to determine the main indicators, in particular the volume of wood material on foot. The results of the determination highlight the rightness of the mathematic models that explain the volume of trees and stands, but also highlight the superiority of the regression equation model used for determining the tree volume, adopted at a national level in Romania. In the applied calculation procedures information recorded in the IFN plots were used. The IFN network used for evaluating forest resources in Romania is a rich database to characterize the romanian forest fund. The results of the determination are close to results from other projects that refer to the same production fund in study, but at the same time, in regards to increasing the precision of the evaluation, they highlight the necesity to review the network of plots. One of the main parameters that condition the precision of the evaluation is the stands structure. In the conditions of different structures of the stands, relatively close under the report of the dimensional variaton of trees, of species that participate in the stands composition, even a redused number of IFN plots can faithfully characterize the production fund. It's the case of structures obtained by applying regeneration cuts that lead, in every stand, to a diverse structure from the point of view of dimensions and ages of trees such as specific structures of the gardened forests. On the contrary, results of the determination which rely on information gathered in regular forests, where stands with different age and composition exist highlights the necesity to optimise the plot network in order to increase the acuracy of the evaluation. For this production unit it is required to adopt a more stratified aproach to differentiate structures and characterize through variation coeficients that underpin the optimization of the network. Thus, a more stratified approch in regards of the structure and age classes could improve the outcome of the results. In this case, the solution that is already adopted by the IFN, to overfill the network of plots, can lead to an increased precision of the evaluation.

New aspects on establishing indicator increment as a way to control structural management of growing stock in forest management planning

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Abstract:

With successive improvements, the determination of the prescribed/allowable cut via the indicator increment - specific to the yield regulation method by indicator increment - has been applied in the management planning of Romanian high forests with even aged stands for almost 60 years. Indicator increment (Ci) is the current increment of a model forest made up of stands equivalent to those in the real forest in terms of composition, yield classes and densities, but having age classes with equal areas. The paper presents two essential features of Ci: i) it reflects the real production conditions of the managed unit, without being influenced - between two successive management plans - by the modification of the stands age; ii) calculated at a normal age structure, the Ci volume gains special valences regarding the continuity of the harvests. Hence – the quality of Ci as a basic element for controlling stands productivity and for the determination procedure of the prescribed/allowable cut.

In the opinion of prominent forest management specialists, the main advantages of the Ci procedure are highlighted in relation to the other procedures applied in the concerned forest management system.

Due to the second particularity mentioned above (ii), in the case of a forest with a normal growing stock, harvesting an allowable cut equal to Ci ensures the maintenance of the normal structure and the continuity of the crops. To this end, it is necessary to have a full concordance between the harvesting process of wood according to the adopted silvicultural systems and the regeneration process of the stands under regeneration cutting. But often, such a concordance does not exist in practice. In terms of forest management planning, it can be ensured by a simple and efficient correction: in calculating Ci, for all stands under regeneration cutting, to the density of the mature stand - expressed by the density index – one must add the proportion of the area occupied by the elements and groups of regeneration capable of being integrated into the future stand structure. This correction is presented in the paper, alongside the necessary restrictions. The analysis of the data from the numerical/table example demonstrates that the application of the proposed correction avoids structural and prescribed cut/harvest imbalances, because it imposes that the reduced density of stands under regeneration cutting to be compensated by their viable regeneration.

The worth of Ci as a structure determining element at stand level is treated in the fourth part of the paper. By renouncing the anticipated distribution of stands on various periods and being focused on all the growth conditions in the unit, the Ci-based allowable cut represents a free unlocated volume. This creates the opportunity for the nature and intensity of the interventions to be differentiated from stand to stand, in relation to the regeneration conditions and to the functions of the stands.

Finally, it is worth pointing out that at the basis of the proposed correction is the fundamental idea that the Ci value must accurately reflect the effects of the silvicultural measures applied in the interval between two successive management plans. By strengthening the control - including the evolution of the regeneration process - and by transmitting the respective effects on the allowable cut, emphasis is given to the role and the

importance of the indicator increment as feedback element in the forest management planning, considered as a cybernetic system for the structural management of the forest and its component stands.

Keywords:
Indicator increment (Ci); prescribed/allowable cut; yield capacity control; growing stock.

Methods and priciples applied in Forest Management Planning in a Romanian Experimental Forest District, Mihăești – a case study

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Abstract:

The planning of the production process in forests owned by the Romanian State, managed by the Forest District "Carol I Mihăeşti – Muscel" was outlined for the first time in the forest planning developed by C. N. Boşoancă and G. Ştefănescu requested and coordinated by the distinguished forester I. Moldovan between 1903 – 1904.

This forest management plan was applied until 1948. In this period the foresters were applied Lorentz and Parade method which mean wood cutting in similar forest area with period of regeneration between 24-30 years. Beginning with year 1942 this forest district entered under the Forest Research and Management Institute administration, as material resources and was applied a classical method, with low results. To fulfill the demand of material resources, it was elaborated in 1964 the first experimental forest management plan for these forests, through one integrated action: forest research – forest management – forest production. As a result, all the forests which belong to this forest district were divided in two experimental forest areas (S.E. I and S.E. II), comparable between them, as follows:

S.E. I Râul Târgului (6200 ha) with seven management series, arranged on sites series ecologically homogeneous, but wide spread territorially.

S.E. II Argeșel (5800 ha) with four management unit, ecologically heterogeneous but on a limited territory, was managed according to official rules. Elaboration and reviews of this experimental management plan was supported by the conclusions of many studies which assured the required scientific foundation. The general method was elaborated by improved criteria regarding to validity the proposed solutions applied in forestry practice. The criterion chosen was applied by natural growth (ecological) conditions and not by type of vegetation how was until 1964. The research undertaken concluded that subplot represent one part of forest with similar ecological conditions and own socio-economic functions, becoming the object to manage forest in complex and sustainable form.

This spatial and complex organization was preserved without relevant changes during five decades (1974, 1984, 1994, 2004, 2014) if that, after year 1990, the total forest area was diminished by the national new laws, when the private forests took an important part on national forest. During the revision process, the experimental forest areas incurred objective changes. Therefore, in year 2014, the forests on S.E. I Râul Targului had a surface of almost 4800 ha and S.E. II Argeşel had a surface of almost 3700 ha.

A comparative analysis after the first revisal (1974) demonstrated that the organizational system based on these series presents significant advantages compared with the system based on forest production units. The organization system based on management series is focused on optimum structures with better possibilities for ecological management. The comparative analysis after five decades experimentation complete

the organization methodology based upon management ecological series. This analysis, over five decades, can be valuable information to clarify better the advantages and disadvantages for those two distinct experimental forest areas.

This situation created it's unique at national level and can be a good opportunity to expended or created new forests with similar ecological conditions for different species. Further, incorporating climate change adaptation consideration in management plan in these forest ecological series can be a new perspective for conservation and sustainable of these ecosystems.

Keywords:
experimental forest management planning, ecological series, subplot

Development phases and their structural characteristics in Penteleu Viforâta virgin forest in Southern Carpathians

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Abstract:

The paper refers to a virgin forest stand structure in the Milea Viforâta Nature Reserve, situated in Romania's Southern Carpathians at an average altitude of 1128 m. The purpose of the research was to determine in detail the specific development phases to the virgin forests, as well as to understand how they influence the development of forest stand, in order to offer optimum solutions and structural models for a sustainable forest management. The research was carried out in 2014, in a plot of one-hectare area with circular shape (r = 56,41 m). All the trees with dbh> 7 cm were inventoried, and the main dendrometrical characteristics were measured (diameter, height, quality class, cenotic class etc.) and space distribution was recorded. For more in-depth research, radial increment cores were taken from all the trees and they were subsequently processed and analysed using the CooRecorder Plus and Cofecha software. A number of 317 trees were identified from European beech (*Fagus sylvatica*), Silver fir (*Abies alba*) and Norway spruce (*Picea abies*), situated in different development stages (Youth, Initial, Optimal, Terminal, Disaggregation and Regeneration). They cover different percentages of participation within the forest stand. Most trees are found in the terminal and optimal phases and the tree age varies between 11 and 365 years with an average volume per tree between 0.11m^3 and 3.28 m^3, respectively. The spatial identification of trees and their development phases allowed analysing various theoretical and experimental structures, including the age of the trees. The research has revealed a series of structural models specific to these forest ecosystems, which can also be used in forests managed under the selection system. A high biodiversity has also been noticed which confirms a very good stability of the surveyed virgin forest stands.

Keywords:

virgin forest, development phases, uneven aged forests, Carpathians natural forest

Individual tree detection and dendrometric characteristics assessment for mixed Norway spruce – beech forests in Romanian Southern Carpathians using Airborne Laser Scanning and Unmanned Aerial Vehicles data

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Abstract:

The study aims to investigate the potential use of Airborne Laser Scanning (ALS) and Unmanned Aerial Vehicles (UAVs) data together with field measurements for individual tree detection and to assess the main dendrometric tree and stand characteristics. Research are located in South West Romania and are refer to the analysis of data collected from three mixed plots of one hectare each (100 x 100 m). The main tree species within each plot are Norway spruce (*Picea abies*) and Beech (*Fagus sylvatica*). Field inventory system (Field Map), high accuracy GNSS receiver and Vertex inclinometer were used in order to collect the reference ground truth data within the plots. Airborne laser scanning data were collected using a Light Detection and Ranging (LiDAR) Riegl device. Very high spatial resolution images were captured using an UAV device (eBee real time kinematic-RTK) equipped with a CanonS110 NIR camera.

The ALS data were used to extract the digital terrain model (DTM), the digital surface model (DSM) and the normalized canopy height model (CHM). Structure-from-Motion (SfM) software was used to create the orthorectified aerial color-infrared (CIR) images and Object Based Image Analysis (OBIA) classification was performed to automatically detect and separate the main two tree species.

A local filtering algorithm with a canopy-height based variable window size (Popescu et al., 2002), implemented in FUSION software (McGaughey, 2018) was applied to identify the position, the height and the crown diameter of the trees within each plot, considering the OBIA species classification and the local significant correlation ($p<5\%$) between the field measured tree height and the calculated crown diameter.

A root means square error (RMSE) between field measured Norway spruce tree heights and their corresponding heights identified using the ALS data was 0.69-0.91 meters. In the case of beech trees, the RMSE was slightly higher, with values of 0.83-1.46 m. Moreover, the DbH regression analysis showed an RMSE of 5.7-7 cm for Norway spruce trees and an RMSE of 4.1-7.8 for beech trees. The total volume of the identified trees based on ALS data represented 67-71% (Norway spruce) and 25-41% (beech) from the total volume of each tree species calculated by field measurements and specific methods. The results indicate a higher individual tree detection rate and subsequently a more precise estimation of dendrometric parameters for Norway spruce compared to beech trees.

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Hydrological modeling of stream flow through the SWAT model in the Tarlung river basin (upperstream Sacele Lake)

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Abstract:

Complex and numerous parameters influence the hydrological systems, triggering difficulties in understanding their linkages and functions. Therefore, hydrologists have developed various hydrological modeling techniques (Xu, 2002, Woessner, 2012) and more than that, recently, inverse hydrological modeling. A major reason for applying inverse models is to estimate parameters that cannot be measured directly due to many inconveniences (Abbaspour et al., 2004). The objective of this study was to model the stream flow through a forested watershed by applying the SWAT model (Soil and Water Assessment Tools) on the Tarlung river basin, upperstream Sacele Lake. The basin is characterized by an average altitude of 1119 m a.s.l., 389 km total length of the stream network, with average slope of 38% and 186 km2 drainage area. Soil and Water Assessment Tool model integrated with Geographic Information System were used to simulate the discharge and sediment concentration of Tarlung basin for the period 1961 – 2013. Model calibration and validation were performed for monthly time periods using Sequential Uncertainty Fitting 2 (SUFI-2) within SWAT-CUP. The calibration and validation outputs for monthly simulation showed a good model performance for discharges. Thus, the mean annual sediment within the Tarlung basin to be deposited in the Sacele Lake, was estimated at 11 t/ha^{-1}.

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Evaluation of available forest roads: a case study

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Abstract:

Because of the wide, scattered and large part of the forest areas being located far away from the settlement areas, transportation can only be realized through forest roads and the importance of transportation of forest roads has been emphasized. The grading method and the quality classification were made based on the criteria of the study.

In this study, for each of the forest roads, technical characteristics, economic characteristics, characteristics of the road through which the road passes and disturbances on the roadside were assessed., the forest roads of the Gerede Management Directorate Aktaş Operation Chief affiliated to the Bolu Forest Regional Directorate in Turkey were handled in terms of "scoring and evaluation of existing forest roads".

According to the findings obtained, the forest roads selected for the evaluation and evaluation of the existing forest roads subject to the survey; the names of the area in which they are located, the status of the existing roads are classified according to the reasonableness of the criterion of the criterion of work, by supporting the photographs and graded by considering the positive and negative situations. In the light of this information, 6 (B type) forest roads in the study area with a total length of 29 km have been investigated. In the results of working; one of ecological, economic, social and technical aspects of the forest roads in this planning unit III. quality class and 5 of the II. forest roads have been identified.

Keywords:

forest, forest road, technical, mapping, Turkey

Variable retention forestry in *Nothofagus pumilio* Patagonian forests as a strategy to conserve native bird species

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María Vanessa Lencinas	Laboratorio de Recursos Agroforestales, CADIC-CONICET	Argentina

Abstract:

Biodiversity assemblage changed across landscape, especially birds (Martínez Pastur et al., 2015, 2016), being necessary developed land-sharing strategies. Variable retention was proposed as an alternative to achieve both timber and conservation purposes in the management of Nothofagus pumilio forests of southern Patagonia (Martínez Pastur et al., 2009). This system allowed to maintain biodiversity in managed stands (Soler et al., 2015; Lencinas et al., 2017), however is not clear which is the impact of different retention types over sensitive or generalist species that reach from open-lands (Lencinas et al., 2009; Soler et al., 2016). The objective was to analyse the use of retention (inside, edge or outside aggregates) and niches (canopy, stem, debris, and floor) within different management strategies (aggregates and dispersed retention or clear-cuts) by different bird species. We used five years observation data of a permanent plot belongs to PEBANPA network (Peri et al., 2016) located in Tierra del Fuego (Argentina). We also used understory plants variables of the same plots. Statistics included uni- and multivariate analyses (detrented correspondence analyses - DCA) and comparisons with primary unmanaged forest bird data. We analysed nine Passeriform bird species, where six of them presenting different use pattern of the retention (Carduelis barbata, Phrygilus patagonicus and Tachycineta leucopyga in aggregated and dispersed retention, and P. patagonicus, T. leucopyga, Zonotrichia capensis, Enicognathus ferrugineus and Troglodytes aedon in aggregated and clear-cuts). Beside this, all the species presenting special niche requirements, and some changes were observed when we compared the results with the primary unmanaged forests. DCA showed that the studied species differently used the retention types (e.g. Elaenia albiceps were it is more related to aggregates and P. patagonicus to harvested areas), and also showed that the behaviour changed according to the harvesting system employed. Birds used more the dispersed retention when it was present, and move to edges when clear-cuts were employed. These data support the effectiveness of the variable retention strategy to conserve bird species with different habitat requirement inside the managed stands.

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Silvopastoral systems in native forests of *Nothofagus antarctica* in Southern Patagonia, Argentina

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Abstract:

Many challenges and opportunities arise for scientific institutions, rural extension agencies and public policies aiming to promote more sustainable and diversified land use systems in native forest areas. The problems associated with forest product harvesting, processing and marketing, together with the strategy of producing added-value wood and animal products also are key factors for silvopastoral system development. In this context, in Argentina, National Law No. 26,331 for the Environmental Protection of Native Forests promotes the conservation of indigenous forests through land planning, sustainable management and tightening the regulations associated with land-use change. This requires all the provinces to develop a Land Use Planning Process (LUPP) with respect to native forests in a participatory fashion. Native forests have been classified according to three conservation categories (colors in maps) determined based on a number of technical and social criteria: Red (high conservation value forests for ancestral uses, gathering of non-timber forest products, scientific research, "respectful" tourism, conservation plans, ecological restoration), Yellow (medium conservation value forests for sustainable productive activities and tourism under the guidelines of management and conservation plans) and Green (low conservation value forest where land-use change is allowed). A general agreement named "National Forest Management with Integrated Livestock (MBGI)" aims mainly to: (i) contribute sustainable use of native forests as a tool of development and according to sustainability criteria and minimum standards established by Law No. 26,331, (ii) strength the provinces by promoting capacity building for implementing MBGI plans, and (ii) establish a monitoring system. Silvopastoral systems in *Nothofagus antarctica* (ñire) forest became an economical, ecological and social productive alternative in Patagonia (Peri *et al*., 2016, 2017). The productivity and nutritive value (crude protein content and dry matter digestibility) of understorey grassland was dependent on the interaction of environmental (mainly soil water availability and light intensity) and management factors under the trees, and in turn determined animal performance. A method has been developed for carrying capacity estimation at paddock level based on the Potential Aboveground Net Primary Production (PANPP) that ranged from 85 to 2200 kg DM ha-1 yr-1. Planned thinning in secondary forest stands provide wood production and also improve the undestorey DM production by increasing incoming radiation. Within a Management

Plan, two thinning intensities depending on stands water stress conditions are proposed as well the use of Reineke's Stand Density Index (SDI) to assist in the definition of thinning intensities for different canopy covers. Livestock production is the main annual income of silvopastoral systems in N. antarctica forest where cattle and mixed livestock production (cattle+sheep) are the main activity. Animal management at the whole farm scale include strategic separation in homogenous areas (grass steppe, forest and riparian meadows), stocking rate adjustment to grassland net primary production and the protection of regeneration from herbivores browsing by using individual tree guard. Also, in the region we improve the knowledge of litter decomposition, nutrient dynamic, carbon storage and aspects related to criteria and indicator (C&I) to assess ñire forest's sustainability under silvopastoral use and biodiversity conservation. To expand silvopastoral land use systems and farmer adoption, a multi-agency, interdisciplinary and participatory strategy is required.

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Forest Conservation and Implication on Rural Society in Kaimur Forest Reserve in India

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Abstract:

Degradation of forest resources in India due to increasing demand of agricultural land, grazing area for livestock, urbanization, settlement for growing human population and overall economic development has brought into sharp focus on forest conservation in recent years for sustaining the forest resources. Understanding the importance of livelihood dependence on forest areas, Forest Conservation Act (1980) was enacted to protect and through establishment of reserve areas, which also formulated forest policy in 1988 with the objective of ensuring environmental stability and maintenance of ecological balance. In the perspective of intense harvesting of forest area by surrounding population, the institutional management of forest area with the help of the local community has had a positive effect. This paper deals with the issue of forest conservation and its impact on rural society in Kaimur wildlife sanctuary established in July 1979 under the provisions of the Wild Life (Protection) Act, 1972 in state of Bihar, India. Also, an additional element that is added to the enquiry is the way conservation of forests leading to abundance of forest-based resources impacts the patterns of dependence across various social groups in protected area. Change in forest area since last four decades has been calculated through Land Use Land Cover (LULC) and Normalized Difference Vegetation Index (NDVI) analysis using remote sensing technique and examination of different economic activities carried out by the households that are forest-based was collected by primary survey in Kaimur reserve forest of state of Bihar in India. The general finding indicates that the recent conservation process of protected area has improved the quality of forest and increased the total forest cover under dense category. In last four decades, conservation of forest made a direct impact on rural community mediated through the socio-economic structure, resulting in a shift from forest-based occupations to cultivation and manual labour in agricultural and non-agricultural activities. Scheduled Tribe and Scheduled Caste communities, the most socially and economically deprived sections of the rural society are still involved in a significant sustainable way in collection of fuel wood, fodder and fruits, both for self-consumption and sale in the market while other group of society uses fuel wood, fruit and fodder for self-use only. Thus, there is a need to review the policies with respect to the 'community forest management' since this study clearly throws up the fact that engagement with and dependence on forest resources is socially differentiated. Thus, tying the degree of dependence and forest conservation becomes extremely important from the view of 'sustainable' forest resource management. The statization of forest resources also has to keep in view the intrinsic way in which the forest dependent population interacts with the forest.

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Could Natura 2000 management to change the perspectives of the periurban forests in Romania?

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Abstract:

Urban areas generate a huge land use and land cover changes. The decreasing forest areas are one of the most common trends in periurban areas, affecting the capacity to provide the ecosystem services. Over the last years, several eco-development strategies have been created, including Natura 2000 ecological network, in order to reduce the different ways urban areas, affect the natural ecosystems. Our paper aims to assess the relationship between Romania cities and periurban forests included in Natura 2000 network. The relationship between cities and protected periurban forests has been assessed based on: (a) cities' characteristics (e.g. number of inhabitants, population dynamics, the employment rate, the education level and cities' functions), (b) cities' impacts on the urban forest during the time (e.g. the dynamics of the built-up and forest areas within the Natura 2000 sites) and (c) the opportunities offered by the periurban forests to the cities (e.g. the intensity and characteristics of cultural ecosystem services valuation by the urban users). Preliminary findings show the city as an important aggressor for the periurban forests. Cities' integration within the management strategies of the Natura 2000 sites is lacking and therefore the potential for sustainable relationships between them is hindered. This situation is diminishing the chances of the Natura 2000 network to achieve its targets, specifically the connection between people and nature. Therefore, there is a need to integrate the neighboring protected areas into the eco-cities' development plans for a synergistic relationship.

Conservation status of the plant species and habitats of community importance in the protected areas of Carpathian range

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Abstract:

The aim of this paper is to achieve the conservative status of the plant species and habitat types of community interest that occur in the area of the Alpine biogeographic region that overlap on the Carpathians range and elaborate the effective conservation measures for maintaining their status. This study was based on available data that were resulted from the monitoring and assessments of conservative status of the species and habitats of Community interest from Romania (Mihailescu et al., 2015), Czech Republic, Slovakia, Poland, and Hungary. According to the European methodology this has been achieved during the 2007-2012 monitoring period as an obligation arising from Articles 11 and 17 of *Habitats Directive* 92/43/EEC in order to report in 2013 that requires Member States to report every six years the progress made with the implementation of *Habitats Directive*. The assessment of conservative status of all plant species and habitat types was carried out following the methodology agreed by the European Commission (Evans et Arvela, 2011) and the Member States that is based on separate evaluation of four parameters which define the" Favourable Conservation Status" given in the *Habitats Directive*.

According to the latest reference lists of plant species and habitats from each country where lies the Alpine biogeographic region, we were considered results for the conservative status assessment of 21 plant species and 42 habitat types.

After evaluation, for studied species and habitats we mentioned five very important conservative measures that are useful for management both local authorities and administrative bodies.

Due to the biogeographical junction, the great heterogenity of the landscape within their territory, and relatively low anthropogenic impacts, the Carpathians host a great diversity of plant species and natural habitats. They are protected and preserved 92% within the protected areas of the Natura 2000 European ecological network.

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Forest regeneration by local communities for sustainable livelihoods: a case study of Dimapur district in Nagaland, India

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Abstract:

Restoration and regeneration strategies have received worldwide attention due to their vital role in mitigation of climate change, the performance-based instruments like Reducing Emissions from Deforestation and Forest Degradation (REDD+) of the United Nations Framework Convention on Climate Change (UNFCC) further invoked the academia to explore the dimensions of regeneration. When forest and its resources form an essential part of the lives of the tribal people, the importance of forests increases manifold. This had given rise to the community-based forest management which is one of the most commonly found mechanism to earn livelihood in Nagaland, in North East India. Along with the academia the Non-Governmental organizations, Planners, leaders are arriving at a consensus in terms of the role of Community Participation. The need for collaborative effort is widely recognized however there is a research gap in terms of the results produced by the community efforts. Most forest products, including timber, fuelwood and a wide range of NTFPs, are either traded or are tradable in markets and are also used for subsistence. With this backdrop the present study tries to explore the role of community in forest regeneration by utilizing the existing secondary data and collected primary data through Interviews, Focused Group Discussion. The study analyzed the change over a period of 2003 and 2015 using Landsat 7 & and Landsat 8 Images from USGS of 30-meter resolution. The results indicate a transformative change in the forest cover and built up area both therefore the study took this as a major vantage point for the discussion.

Keywords:

Forest Regeneration, Livelihoods, Community based forest management, Community participation Tribals

Description, mapping, threats and management of the habitats from ROSCI0359 Prigoria-Bengeşti protected area (Romania)

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Abstract:

ROSCI0359 Prigoria-Bengești natural area of community interest is situated in Gorj County (south-west Romania) on 2490 ha surface. The forests of the protected areas present conservation interest being formed by priority (91E0*) or community interest (9110, 9130, 9170, 91M0, 91Y0) habitats. The analysis of the altitudinal classes highlights that the altitudes have limits between 200 and 510 m a.s.l. with slopes between 0 and 14 degrees. All the forest habitats are listed in Annex 2 of Council Directive 92/43/EEC and Annex 2 of OUG. The habitats dominated by durmast (*Quercus petraea*), beech (*Fagus sylvatica*) and hornbeam (*Carpinus betulus*) are described following bench and in situ studies: corresponding Romanian habitats, general characterization, dominant and characteristic species, favorable conditions, plant species inventory lists, threats and their intensity and conservation measures.

GIS mapping analysis distinguished the surface of the habitats, areas affected by different type of threats (after Combroux & Schwoerer, 2007), the evaluation of conservation status.

The assessment of the conservation status took into account the ranges and areas of the habitats, specific structure and functionality, and future prospects. The same analysis were applied to the priority habitat 91E0* Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) presents in Prigoria-Bengești protected area on small range.

The described conservation measures are based on knowledge about the acceptable limits of habitats attributes. The selection of the most appropriate conservation measures take into account the types of habitats, history and current status.

The conservation status of the habitats from Prigoria-Bengești protected area is still favorable and the main objective of the administration is to not increase the number of threats that might affect the habitats in the future, and also diminish the intensity of the current threats.

The adaptive management is necessary to be applied by the managers, taking into account the structure and functions of the habitats based on the reality in the field.

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The dynamics of the forest cover in Apuseni Mountains Natural Park. Spatial and statistical analysis

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Abstract:

Forest cover changes are key components of global environmental change through the fundamental impacts on biodiversity, ecosystems and the services they provide, and ultimately livelihoods. Apuseni Mountains Natural Park (75,784 ha) is located in the north-west of Romania, covering a large part of the Western Carpathians. It includes extended forest ecosystems (72%), pastures and grasslands, karst forms and phenomena, and a large variety of flora and fauna. Following the social and economic transformations of the past decades, forest cover in Romania was seriously impacted, particularly in mountain areas. The study is seeking to analyse the spatiotemporal forest cover changes in Apuseni Mountains Natural Park in relation to the key underlying factors: land reforms, deforestation, tourism, grazing, but also afforestation or management (e.g. IUCN, Natura 2000). The spatial and statistical analyses relay on LANDSAT satellite images (1990, 2000, 2015) aimed at assessing forest flows, conversion, and dynamics using some relevant landscape metrics (binary change index and trend index). Despite the protected area status, over the analysed interval, forests recorded a slight decrease (4.3%); pastures and grasslands being the main categories forests were converted to, but also the main categories converted into forests, followed by scrub and/or herbaceous vegetation. Forest cover evaluations in protected areas are critical in understanding the spatial dimension of landscape dynamics, and the resulted environmental disturbances (e.g. habitat fragmentation, watershed protection, land degradation) in order to perform further evaluations on ecosystem services (e.g. carbon storage, climate regulation), risk assessment etc.

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Adaptation of silver fir seedlings (*Abies alba* Mill.) to light conditions and climatic factors in the Beskidy Mountains (Poland)

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Abstract:

Beech and fir forests with addition of spruce, which participation usually increased together with the altitude above the sea level, were originally dominant in the Carpathian Primeval Forests overgrowing the Beskidy Mountains. In the 19th century even aged spruce monocultures, not genetically adjusted to climate in the Beskidy Mountains, were planted in the place of the originally existing forest. At the moment there is the major extinction of the spruce forest in Beskidy region. For the last 20 years, within the "Project for Beskidy", forest management focusing especially on the adjustment of species seedlings composition to the habitat has been conducted. Fir (*Abies alba* Mill.) seedlings, which in the past was one of the dominant species in the lower parts of Beskidy forests, has an important role here.

The Project, carried out together with Katowice Regional Forest District, was realized which aim was to select optimal places for silver fir seedlings in the Beskid Śląski and Żywiecki region with consideration of the specific conditions in the mountain forests. Silver fir is known to be one of the most shade-tolerant European tree species, able to survive under deep shade for several years and to rapidly respond to a clearing in the canopy above (Brzeziecki & Kienast 1994). Aim of this paper was to estimate the influence of light conditions on the growth of silver fir seedlings in the diversified climate conditions in the Beskidy region. Three-year-old fir seedlings were planted in ten different fenced sites (to eliminate ungulate browsing) located on the different altitudes above the sea level. The amount of rain and temperature was measured on each site. The amount of light reaching the silver fir seedlings was estimated on the basis of the digital hemispheric photos. The area and growth of photosynthetic apparatus in the first whorl were estimated through the digital processing of the photos. Moreover, the growth of seedlings, apical dominance ratio (ADR), gas exchange, photosynthetic pigments and nitrogen contents in needles were measured. It may be said on the basis of the conducted observations that the amount of light influences significantly the growth of the seedlings, however the microclimate factors, which are connected with the altitude above the sea level and exposure of the seedlings, have equally important role.

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Variable retention as land sharing strategy to conserve arthropod diversity in forests and non-forest ecosystems of southern Patagonia, Argentina

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Abstract:

Variable retention is a silvicultural proposal to mitigate harmful effects of traditional harvesting practices on biodiversity of forests (Kohm and Franklin, 1997), and their benefits for several organisms have been reported worldwide (Lindenmayer et al., 2012). However, we suggest this approach could be useful not only for forests, but also for other ecosystem types. Here we presented some results that could justify their implementation as land sharing strategy in both forest and non-forest ecosystems of southern Patagonia (Argentina) to improve arthropod diversity conservation.

We studied above-ground arthropod communities (mainly Coleoptera, Formicida, Solifuga) using pitfall traps in *Nothofagus pumilio* forests, *Mulguraea tridens* scrublands, and magellanic steppes. The studied forests were located in Tierra del Fuego Province, while the scrublands and the steppes were in Santa Cruz Province. In these forests and scrublands, retention approach had been implemented, therefore we studied aggregated and dispersed retention harvesting in forests (Martínez Pastur et al., 2009), and managed cut and retention strips in scrublands (Sola et al., 2016). On the other hand, we selected dry and humid steppe habitats; both impacted by livestock grazing. For all ecosystem types, control situations without harvesting neither grazing impacts were sampled as reference. Richness, abundance, occurrence frequency, Shannon-Wiener diversity and Pielou evenness indices, and similarity among assemblages were evaluated using univariate and multivariate statistical tests.

In forests and scrublands, we found that retention approach (aggregates or strips) allowed the partial maintenance of arthropod community structure, preserving some of their characteristics more similar to natural and non-impacted ecosystems. On the other hand, dry and humid steppes presented significantly different arthropod assemblages, but grazing homogenized and resembles communities by loss of species, showing the need to implement strategies that mitigate impact, or exclude areas from livestock use.

We conclude that land sharing could be implemented in forest and non-forest ecosystems to preserve arthropod communities, being the variable retention approach a good alternative for private or public lands. Likewise, legislation to promote conservation (like National Law 26331) could be not only generated for and implemented in forests, but also in non-forest ecosystems.

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Ecological Diagnosis of Beaver (Castor fiber) Habitats Using Satellite Maps and Geographic Information System (GIS)

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Abstract:

The development of a methodology for the diagnosis of favorable habitats for beaver is a necessity given that the species area in Romania has expanded greatly after reintroduction and the classical methodology of habitat assessment on is impossible to apply at the scale of the whole hydrographic network that amounts a length of over 222,000 km.

In this context, models can offer a cheaper alternative (both in terms of budget and time required) with reasonable accuracy limits.

The first models used to identify the favorable habitats to the beavers (Webb et al., 1997) have considered as criteria the land with an altitude below 400 m, with slope below 2%, the wooded vegetation (hardwoods), the low- flow water courses and exclusion of urbanized areas.

For Romanian conditions, the criteria considered for determining the favorable habitats for beaver were: altitude (under 1000m), riparian vegetation (100m vegetation strip on both banks) and land gradient (water courses below 5%);

The study used the Copernicus Land Monitoring Service and satellite images for the riparian vegetation analysis. The area of potentially useful habitats resulted was 190,028 ha.

At present the area of the habitats occupied by the species is 5,638 ha, representing 2,97% of the potentially favorable habitats. Under these conditions, the repopulation of other river basins in Romania that once belonged to the area of the species is possible;

Statistical analysis revealed that the GIS processing based on the digital terrain model presents errors, generated on the one hand by its resolution, and on the other hand the precision of registering the GPS coordinates for the presence of the species. In the future, with the increasing accuracy of GPS devices and land model, the method will be indispensable for determining the favorable habitats to different semi-aquatic species.

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Return of Grey Wolf (*Canis lupus*) to Central Europe: Challenges and Recommendations for Wolf Management

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Abstract:

The present paper deals with the question as to how the re-colonization of Central Europe by Grey wolf (*Canis lupus*) has to be supported by active management efforts. It defines some important future needs of active management based on an analysis of the last decade of re-migration in Germany. The actual situation of Grey wolf in Central Europe is characterized by a high rate of re-colonization, establishing local packs and reproducing successfully. In Germany, an exponential population increase is to be actually observed (Herzog 2014). Switzerland and Austria show a similar situation. Over the last decade the core business area of large predator management was to avoid or to reduce conflicts, but conflicts between man and wolf as well as between different stakeholders are increasing, and management has failed to a large extent (Herzog 2016). It is shown that existing legal basis or management plans of the states are not sufficient to guarantee an adequate management of the species. The existing management plans and protective legislation are to be exempted from bureaucratic restrictions and improved on a scientific basis. It is further shown that participatory processes involving all relevant stakeholders are required in development of management plan as well as in conservation legislation.

According to the European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, the status of the species will be taken as "favourable" when population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats, when the natural range of the species is neither being reduced nor it is likely to be reduced for the forseeable future and when there is a sufficiently large habitat to maintain its populations on a long-term basis. Recently, according to these conditions, Grey wolf in Central Europe is in a favourable state of preservation.

If this would be also officially acknowledged, it would allow a more active way of management as it has been performed in the past. Actually, we have to learn from Eastern European regions about management. What actually is called "wolf management" in Germany and Austria is a kind of passive observation of the ongoing situation. This might be a proper approach in an early state of a re-colonization process. To avoid major risks for the future, this concept has to be replaced by a more sophisticated approach, defining clear goals and taking different measures of management into consideration, including the whole spectrum from scaring off wolves from herds and settlements to regular, sustainable utilization.

A local differentiation and a combination of different management measures, as e.g. total protection, sustainable utilization, prevention of diseases, herd protection measures and a management concept, developed from a participatory process should be a solution.

A passive "wait and see" strategy is bound to fail, and failure of wolf management would mean huge problems for the wolf as well as for man in the future. In addition, there is a lack of fundamental knowledge concerning the development of wolf-man interactions in densely settled and urban environments. So, the actual situation requires also intensive research on questions as predator-prey-relationships, dynamics of re-colonization

by the wolf, disease management, hybridization, development of repellent techniques and, last but not the least, research on the question as to how we can maintain timidity against man.

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Identification and management of torrential risk areas in Natura 2000 sites ROSCI0207 Postăvaru, ROSCI0195 Piatra Mare and ROSCI0038 Ciucaş

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Abstract:

The management of the torrential risk areas located in natural protected sites implies special approaches. Torrential processes are natural phenomena crucial for terrain modelling. Also, those processes damage intercepted social-economic objectives (roads, railways, etc.) and the protected landscape, sometimes endangering protected species and habitats. The restoration of the hydrological balance must be achieved using ecological methods, technologies and materials.

This research has been conducted in three Natura 2000 sites (ROSCI0207 Postăvaru, ROSCI0195 Piatra Mare and ROSCI 0038 Ciucaş) placed in central Romania. The paper presents a methodology to identify areas vulnerable to flash floods using MikeShe hydrological model.

To achieve this goal, watersheds with high torrential risk, capable to generate flash floods have been identified using the torrential coefficient (Clinciu 2013; Gaspar 1967; Tudose 2012). For each identified watershed, measurements on the riverbed topography and the geometric characteristics of the endangered objectives were made.

Based on hydrological simulation, flood maps were generated for floods with 100 years return period. Using resulted flood maps the maximum water level was determined highlighting flood risk areas for each objective (road, railway, household, etc.)

In areas identified as floodplain, special structural and non-structural solutions were proposed in order to guide water on convenient trails in relation to endangered objectives.

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Physical status of torrent control structures in Romania

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Abstract:

Torrential watershed management actions should be integrated and should last for a long time. In Romania these actions cover the entire area of the watershed (slopes, banks as well as riverbeds). They consist in complex sets of structural and non-structural measures and works in order to control runoffs and erosion, to protect social economic objective as well as, to improve degraded lands.

The most vulnerable are the hydrotechnical structures, placed on riverbeds in direct contact with torrential flows. Being at the mercy of environmental factors (like violent flash floods loaded with sediments and floaters) and in isolated condition, those works should be continuous and systematic monitored. Different research, focusing on deficiencies occurred during torrent control structures service (Gașpar et al., 1994; Clinciu, 2006; Lupașcu & Clinciu 2009; Davidescu et al., 2012, Tudose et al., 2016), lead to a substantiated monitoring system based on a repeated inventory (once at 5-10 years). Resulted database permit to emphasize the evolution of all occurred behavioural events (damages and dysfunctionalities).

This paper presents the evolution of the physical state for 192 transverse structures between two successive inventories. Also, it analyses the influence of some features (structure's age, initial condition rate, height, building materials, etc.) on the structures condition rate variation between inventories. Results are showing a high influence of structures height over the annual decay of the structure. Due to the poor quality of building materials and improper technologies used in the last period of time structures built sooner than 2000 have been more damaged between the inventories. As a fact the influence of structures age, for our sample, is not relevant.

The functionality of torrent control structures is affected by various factors that cause unembedding, undermining, cracks, breaks and abrasions. In order to improve the maintenance of these structures, a substantiated monitoring system is required, as well as a well-trained staff (designers and builders) to ensure a better flood and erosion control, the protection of endangered social economic objectives and a better use for degraded lands.

Keywords:

torrent control structures, condition rate, damages, dysfunctionalities, monitoring system, maintenance.

Molecular signatures of climate adaptation and range expansions in Mediterranean conifers

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Abstract:

Understanding the interaction among environments, demography and evolution is essential in the face of impending climate change. Species from the Mediterranean Basin, inhabiting highly heterogeneous environments, are particularly at risk because of the predicted increase in aridity and recent land-use change. In this talk, we review our studies on population genomics and association genetics in maritime and Aleppo pines, two relevant components of Mediterranean landscapes. In maritime pine (*Pinus pinaster* Aiton), 17 SNPs (Single Nucleotide Polymorphisms) were found to be strongly correlated with climate, once population genetic structure was removed from environmental association models. The utility of these SNPs to predict climate maladaptation of forest stands was further tested in a common garden. Furthermore, some of these loci were correlated with both fire-related and drought traits using association genetic approaches. In Aleppo pine (*Pinus halepensis* Miller), we are studying population genetic signatures of range expansions, from refugia in Turkey and Greece towards the large western Mediterranean part of the distribution. This species showed signatures of selection in expanding populations based on drought-response candidate genes. However, new microsatellite and SNP data showed signals of recurrent bottlenecks in the colonized range and 'gene surfing' in the expanding wage of colonization appears now as a reasonable alternative explanation. These studies at large spatial scales are accompanied by research at local scales aiming at detecting the role of micro-environmental variation in creating and maintaining genetic diversity within populations. The combination of approaches and spatial scales provides an integrated view to understand the quantitative genetic and molecular mechanisms responsible for adaptation as well as the drivers of selection (both climatic and ecological) in Mediterranean conifers. Some preliminary results about the demographic history of *Pinus leucodermis* will be also presented.

Microsatellite genetic structure in *Quercus robur* complex in south-eastern Romania

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Oliver Gailing	Georg August University Goettingen	Germany

Abstract:

European oaks are well-known for their large morphological variability. Here we tested a suite of genomic and EST-SSR markers to look for genetic divergence between two morphological varieties of *Q. robur* which occur in south-eastern Romania. The typical form has glabrous leaves while the other, also known as *Q. pedunculiflora*, is characterized by pubescent leaves. Our data suggest the existence of two distinct genetic groups corresponding to the two morphological forms although there are many admixed oak individuals.

What do we learn from pot experiments in the greenhouse?

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Abstract:

Experiments with potted plants in the greenhouse are an excellent opportunity to test morphological and physiological reactions of plants under controlled environmental conditions. Especially the repeatability of these experiments and the possibility to observe specific traits under defined conditions make such experimental design attractive for breeding purposes. Nevertheless, those experiments do not play a significant role in forest tree breeding projects. Among others, reasons are the relatively long developmental time of the plants and in conjunction with this, the development of important traits after several years or decades. In addition, the above and belowground size of older plants often poses a problem.

Based on pot experiments which were carried out in 2012 and 2016 with hardwood cuttings of the same set of plant material (Max3, Hybride 275 and AF2) under comparable environmental conditions in the greenhouse the challenges and opportunities of the experimental design will be discussed. Our traits of interest are the development of the longest shoot and longest root, the root-shoot-ratio, leave dry mass and root dry mass under optimal watered conditions and under dry conditions.

The results of our experiments showed that the abiotic environmental factor water availability as well as the genetic factor variety has an impact on the early shoot and root development of poplar hardwood cuttings. This impact is already obvious after an experimental time of less than 65 days. It can be concluded that for the extraction of specific growth parameters, the arrangement of pot experiments in the greenhouse can be a valuable addition to field experiments.

The analysis of the phenotypic evaluation showed that specific environmental effects have an impact on root and shoot growth. The example of Hybride 275 clearly indicates that some genotypes are phenotypically more stable than for example AF2 and Max3, which show an immediate reaction on small environmental differences (in the present case: air humidity and temperature which differed between the experimental time of 2012 and 2016).

Genetic structure of scattered natural populations of Scots pine (*Pinus sylvestris* L.) in the Romanian Carpathians

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Abstract:

The *Pinus sylvestris* L. (Scots pine) is one of the oldest tree species, originating in the Tertiary era (Pyhäjärvi et al., 2007). Although *P. sylvestris* was very widespread in the Carpathian area during the last glaciation, at present, it has a scattered distribution across Eastern and Southern Carpatian Mountains. The total area occupied by natural populations of *P. sylvestris* is estimated at 9,000 ha (Şofletea and Curtu, 2007).

The aim was to evaluate the genetic diversity and differentiation in natural, relict populations of Scots pine located in the Romanian Carpathians using a set of 10 nuclear microsatellite markers. The largest proportion of genetic diversity was found within populations.

The level of genetic diversity within populations was relatively high (He=0.64). Our data suggest the existence of a genetic structure consisting of three groups. One group was mainly formed by individuals located in peat bogs, one compriese the population from Retezat Mountains (Southern Carpathians) and one the remaing populations from both Eastern and Southern Carpathians.

Our results are impornatant for the strategy of conservation of natural populations of *Pinus sylvestris*.

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Testing of the narrow-crowned Norway spruce ideotype (*Picea abies* f. *pendula*) in multisite comparative trials

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Abstract:

The study aims were to analyze the stability of the narrow-crowned Norway spruce (*pendula* form) instead of normal spruce form (*pyramidalis*), in 5 *full sib* field trials (Comandău, Lepşa 1&2, Ilva Mică and Voineasa) located in Romanian Carpathians. Three *pendula* and three *pyramidalis* trees have been selected in the Stâna de Vale population (Western Romanian Carpathians, Apuseni Mountains, at 1150 m a.s.l.) and used in a full-diallel mating design in 5 *full sib* trials. At age 20, measurements were performed for the following traits: trees height (Th), breast height diameter (Dbh), height growth of the last year, number of branches per whorl (Nbw) and dominant branch diameter. Some important traits were calculated: branches finesse, average volume per tree and trees slenderness. Pearson simple correlations between all traits were calculated. Also, the cores were collected from two trials, to compare the wood density of the two forms of spruce.

In all trials ANOVA revealed significant ($p<0.05$) differences between the two forms of spruce, especially for the stability and quality traits (while differences between the growth traits are significant only in three of the five trials). Factorial ANOVA revealed a very significant influence ($p<0.001$) of the locality and also a significant influence ($p<0.05$) of the locality x spruce form interaction, suggesting that the both form of spruce react different to the changing of the environmental conditions. Norway spruce narrow crowned present a high adaptability, survival rate (80.2%) being superior with 6.7% then *pyramidalis* spruce form for the total of all 5 *full sib* trials. In relation to the quantitative traits, the *pendula* form was superior in three of the five *full sib* trials (significant only in Ilva Mică trial), and the average of Dbh and Th for the ensemble of all 5 *full sib* trials were almost equal. On average, Dbh is 16 cm and Th are 12.7 m. The Th values are situated over the Romanian trees production table (Th= 12.5 m, is the maximum value for the superior production class of spruce trees at age 20), wich confirms the vigor of their parents. Tree slenderness coefficient (Dbh/Th) was more valuable for *pendula* (80, compared with 83), both values sugesting a very good stability of trees. In all trials, a very good result in term of stability was obtained also by *pendula* form for number of branches per whorl (Nbw= 6, with one less then *pypamidalis*), differences being significant in each trial, and also for the cumulated data of all trials, where the factor forms had a very significant ($p<0.001$) influence. Also, the branches finesse is more favourable for *pendula* form in all trials (significant in three trials). The conventional wood density, which influence the trees stability and the quality of the wood, is higher only with 1.8% for the *pendula* form (insignificant differences) in Lepşa trial, while in Comandău trial the *pyramidalis* registered a higher value (superior with 7.3%), the mean value of all trees was 0.337 g/cm^3 and 0.371 g/cm^3 at Lepşa and Comandău trials.

In conclusion, the trees of *pendula* spruce form present higher value for survival rate and lower values for trees slenderness, number of branches per whorl and branches finesse, compared to *pyramidalis* spruce form, which indicates a higher stability of narrow crowned form to disruptive action of the abiotic factors such as wind and snow. Pearson correlations show that with increasing of the Dbh and Th also the Nbw (r=0.38*** and 0.31***) and branches diameter (r=0.71*** and 0.53***) increased. In the next generations of the breeding programme, simultaneous selection of Norway spruce populations for quantitative and qualitative traits is contraindicated. The two-stage selection strategy is appropriate in this circumstance, starting by selection of the trees after qualitative traits, because the adaptability is suitable.

Carbon dynamics modelization in forest soils under two clonal varieties of *Eucalyptus globulus* as an environmental tool for CO_2 offset management

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Abstract:

After Eucalyptus globulus Labill. was introduced in the south-western Europe and northern Africa in the mid XIX century, this species was widely spread for mercantile purposes throughout the whole Iberian Peninsula (especially in its western part, where it became a valuable resource for manufacturing wood and paper products), being nowadays a vastly cultivated tree species mainly due to its rapid growth and wood structural peculiarities with high-quality long natural cellulose fibers that are optimal for these type of industrial uses. With the development of recent silvicultural innovations that involve the application of genetic bioengineering to obtain new clones of E. globulus aimed at a better suitability for planting in the particular climatic conditions of each geographical region, the study of the main environmental impacts of the diverse clonal varieties, as a support to develop adaptive forest management strategies under the current challenge posed by global change, becomes progressively more necessary. Hence, the main objective of this research is to understand the edaphic C cycle in this type of forest ecosystems by quantifying the biodegradative processes of the soil organic matter and the soil-atmosphere CO2 exchanges as well as by tracing the isotopic 13C changes that take place during the decomposition of soil organic inputs. For this purpose, a representative number of edaphic samples from 9 different E. globulus plantations developed over granitic or schistic bedrocks with one of the two clonal types studied (a 1st clonal generation attained by morphological or phenotypic selection: Clone □, and a 2nd clonal generation genetically obtained: Clone □) were collected. The whole set of soil and litter samples was analyzed using stable C isotope ratio mass spectrometry and applying different respirometric methodologies, both in laboratory and field conditions, in order to clarify the ecological behavior of each eucalyptus variety relative to the soil isotopic composition and organic matter turnover. In general terms, in-situ measurements of soil C fluxes monitored over a two-year period, together with biochemical results and isotopic dynamics during the decomposition process showed some differences according to the type of eucalyptus clonal variety and/or the bedrock type underneath. Multilinear regression modelling not only revealed a significant relationship between soil bases content and potential C mineralization (determined under controlled optimal conditions for microbial growth), since the nutrient content explained by itself ≈75% of mineralization activity variance, but also highlighted some other key results: i.e. >50 or >60% of total variance of soil CO2 effluxes in the field can be predicted by the potential C mineralization coefficient alone or in conjunction with the soil labile C content, respectively. Therefore, besides confirming the importance of the soil nutrient supply as a driving factor in the soil C cycle for these short-rotation silvicultural practices associated with fast-growing tree species, this research showed some differences between both eucalyptus clonal types on edaphic CO2 emissions and isotopic 13C/12C dynamics during litter decay. Thus, the outcomes of this experimental work could be useful to evaluate the net quantity of greenhouse gases released to the Earth's atmosphere from these types of tree plantations, being also a worthy contribution to implement low carbon forestry policies and to develop better accuracy model predictions of the terrestrial C balance that are essential for an adequate environmental management in a global warming scenario.

Adaptive genetic potential and the impact of the climate changes on forest tree species: a case study on Norway spruce in Romania

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Abstract:

Researchers in the last decades have revealed a clear change in global climate, which cannot remain without effects on forest ecosystems. The most pessimistic climate change scenarios indicate increase of 4°C and higher in average annual air temperature until the end of the century, as well as changes in the rainfall regime and in the frequency of some extreme events (Salinger 2005). In Romania, the annual air temperature is projected to increase by 1.2°C during 2021–2050 compared to 1991–2020 (Cheval et al. 2017), and by over 2°C in 100 years, i.e., 1961–1990 vs 2061–2090 (Bojariu et al. 2015).

The ability of tree species to survive under changing climate depends on their intraspecific variation in climate response. Therefore, assessment of adaptive genetic potential of local species is essential for increasing forest productivity and stability in the context of climate changes. Proper choice of provenances with high plasticity are decisive for increasing the adaptability of tree populations to rapid environmental changes.

The aim of this study is to evaluate the genetic diversity and adaptive genetic potential of Norway spruce in the context of regional climate change. Based on data from a long-term provenance experiments network and climate variables over last 50 years, we have investigated the impact of climatic factors on growth performance and adaptation of Norway spruce populations. Combining the adaptive genetic variation with analysis of nuclear markers we obtained different images of the genetic structure of Norway spruce populations. Spatial genetic analyses have allowed identifying the genetic centers holding high genetic diversity which will be valuable sources of genes able to buffer the negative effects of future climate change.

Results show that the growth was very significantly influenced by the annual mean temperature and total mean precipitations of the trial sites. Based on growth response functions and RCP4.5 scenario we could project the shifts in species distribution for 2050s and 2100s and identify vulnerable populations. Strong correlations were found between the level of nuclear diversity and population suitability for future climate. They will allow the assessment of future risks arising from the current genetic structure.

Therefore, the strategies for conservation and management of forest genetic resources have to rely on the intraspecific genetic variation of the valuable genetic resources.

This work was realized within the framework of the GENCLIM project (Evaluating the adaptive genetic potential of the main coniferous species for a sustainable forest management in the context of climate change) financed by the Executive Agency for Higher Education, Research, Development and Innovation Funding, grant number PN-II-PC-PCCA-2013-4-0695.

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Combined syntaxonomic, dendroecological and genetic analysis of two close but distinct silver fir forest stands in Banat Mountains (Western Romanian Carpathians)

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Abstract:

One of the most fragmented silver firs (*Abies alba* Mill.) populations are located in Banat Mountains, which also represent the marginal range of species distribution in the Western Romanian Carpathians.

Two geographically close but distinct silver fir populations (decline and non-declined), located close to Anina and Văliug localities, were compared through a detailed syntaxonomic analysis of forest phytocoenoses and genetic survey with transcriptome derive EST-SSRs markers (Postolache *et al*., 2014).

Both silver fir populations are characterised by a narrow genetic diversity, most probably due to fragmentation, isolation and past anthropogenic activities (e.g. silver fir planting, mining activities, air pollution).

The syntaxonomic analysis revealed that both forests stand with silver fir belong to the zonal European beech forest communities. The phytosociological assessment revealed two distinct plant associations: *Phyllitidi-Fagetum* Vida (1959) 1963 on calcareous bedrock near Anina locality and *Festuco drymejae-Fagetum* Morariu ex Resmeriță 1977 on siliceous bedrock near Văliug.

Although the proportion of silver fir reaches up to 40% in the floristic structure of both phytocoenoses, neither of analysed forest stands could be considered as a mixed silver fir - beech forest in phytosociological terms, because of the lack of differential plant species within the herb synusia.

The dendrochronological analysis of silver fir in Anina site distinguished three types of trees based on tree-ring growth response to climate (temperature and precipitation).

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Genetic diversity in Norway spruce (*Picea abies*) seed orchards in Romania

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Abstract:

Norway spruce is the most important coniferous species in Romania. It is also the most planted tree species in the Carpathian region. Here, we characterized for the first time the genetic diversity in four clonal seed orchards of Norway spruce located in the Eastern Carpathians. By using a set of highly polymorphic microsatellite markers we determined the genotype of the existing Norway spruce clones. The vast majority of the sampled ramets of the same clone according to the planting scheme were genetically identical. The genetic differentiation between the four seed orchards was 4%. The Bayesian analysis indicated a genetic structure with two clusters, one corresponding to the seed orchard with the highest number of clones (Aluniș) and the second one consisting of the three remaining seed orchards. This molecular data is of great practical significance for the forest management.

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Preservation of genetic resources of *Quercus robur* l. And *Quercus petraea* (matt.) Liebl. through *in vitro* culture

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Abstract:

The posibility of plant regeneration from somatic and genetic cells open the way of *in vitro* storage of genotypes (Ioniță 2009). The utilisation of such a method has a lot of advanteges as: relatively reduced space for preservation of a large number of multiplicated clonal plants, the plants are preserved free of pathogens and viruses in special storage conditions, the plants do not need special tretments during preservation, the material has an adequate form for establishing nuclear stocks which make possible rapid propagation of a very large number of plants.

The *in vitro* cultures of the two oak species were initiated from nodal segments from *in vivo* germinated acorns and immature and mature acorns germinated *in vitro* which were harvested from selected genetic resources. We tested the influence of different factors on the initiation *in vitro* cultures: the type of initial explants, the sterilisation method and the culture medium. The culture media we utilised was GD medium (Gresshoff & Doy 1972), MS_1 medium which is Murashige-Skoog medium (1962) modificated by Chalupa (1983) and WPM medium (Lloyd & McCown 1980) supplimented with different hormonal balances, for establishing the optimum composition for initiation of *in vitro* cultures for these forest species. The percentage of survival was sometimes up to 100%. These cultures were transferred on multiplication medium, the multiplication coefficients being relatively high and varying with the oak species, the clone and the culture medium used.

The multiplicated plants were rooted, this step being essential for the succes of the conservation of genetic resources through *in vitro* cultures. We studied, also, the influence of the culture medium on rooting of the *in vitro* plants and we established the optimal condition for plant regeneration from *in vitro* cultures. The regenerated plants were transfered *in vivo*, but only the sessile oak plants were able to resist the transfer and developed well in *in vivo* conditions.

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Chloroplast DNA polymorphism of oriental hornbeam (*Carpinus orientalis* Mill.) in the Balkan Peninsula and the Black Sea region

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Abstract:

Carpinus orientalis Mill. is a native tree species, distributed in the sub-mediterranean area of Europe and Eastern-Asia, usually occurring in hot and dry sites. It is a thermophilous and xerophyte species, thriving even on dry and calcareous rocky soils, on sunny slopes, covering different ecological habitats in the silvo-steppe zone.

Even though oriental hornbeam has a low economically value, it is still considered a valuable tree species for afforestation and ecological restoration of degraded lands, due to its high drought resistance and remarkable capacity to regenerate from root suckers.

Oriental hornbeam populations were sampled both across the Balkan Peninsula (Bulgaria, Serbia, Bosnia and Herzegovina, Albania, Montenegro, Greece and Romania) and Black Sea region (Turkey and Georgia).

Chloroplast DNA (cpDNA) polymorphism was assessed using PCR-RFLP and microsatellites markers (cpSSRs). We estimated haplotype diversity within populations and geographic regions. Post-glacial re-colonization routes of *Carpinus orientalis* Mill. have been delineated based on geographic distribution of cpDNA haplotypes. Spatially explicit genetic data will help to maintain evolutionary potential and to identify conservation units of *Carpinus orientalis* Mill.

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Tracking the associations of tree-pathogenic fungi and insect vectors in space and through time

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Abstract:

Scolytine beetles associate with pathogenic fungi, leading to the devastation of huge forests. This has important ecological and economic effects worldwide. Fungal diseases caused by pathogenic fungi are often vectorised by these beetles. Scolytine beetles are classified into two main categories depending on their feeding style. While bark beetles only use fungi to get extra nutrients, ambrosia nutrition rely on fungi. Beetles create egg galleries into trees, by which pathogenic fungi get expanded to the whole tree. From a single beetle, a whole new generation emerges, spreading the fungus to other trees. Some beetles vectorise pathogenic fungi across trees, resulting in large scales pest and diseases outbreaks. This problem is likely to increase due to globalization, which may facilitate the movement of invasive beetle and fungal species. Therefore, it is crucial to address new management strategies to prevent or mitigate the economic and ecological impacts of these outbreaks.

My Ph.D. aims to clarify the role of bark and ambrosia beetles in the dispersal of tree-pathogenic fungi in the UK. Ecology and taxonomy are combined with new genomic methods of identification of fungi such as Metabarcoding. This technique identifies potential pathogens through its DNA barcodes. DNA barcodes are standardised short sequences of DNA that works as unique identification markers for all species. High-throughput sequencing of fungal communities carried by these beetles can be performed directly on the DNA extracted from individual beetles(Miller et al., 2016), giving an unprecedented resolution of their species composition and association with particular beetle species, host trees, climatic conditions or biogeography.

My research project consists of three main phases:

The first phase comprises a biodiversity survey of fungi across the three major forest types across the UK, which are pine, spruce and oak forests. This survey has been be carried out by trapping beetles in forests which do not show clear symptoms of important pests or diseases outbreaks and analysing its fungal communities through Metabarcoding.

The second phase involves identifying potentially dangerous invasive fungi that could arrive to the UK in the near future. This will be achieved by 'horizon-scanning', a technique that uses systematic examination of information to identify potential threats to British forests of key pathogen beetle and fungi species(Roy et al., 2014). Finally, the most likely paths of these invasive species for introduction in the UK, and consequently areas with highest risk of invasive fungi will be identified.

The third phase comprises an evaluation of the accuracy of beetles as sentinels to prevent outbreaks through developing and testing a protocol to evaluate the risk of alien fungal vectors to spread across the country. To test this protocol, areas with low and high probabilities of invasive beetle and fungi will be compared.

A major outcome of this project will be a methodology to detect fungal pathogens using this DNA technique to identify them directly from trapped beetles. This will facilitate management decisions at the earliest stages of disease outbreaks.

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Acute Oak Decline in Britain, and the role of *Agrilus biguttatus*

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Abstract:

Acute Oak Decline (AOD) is a rapidly acting disease syndrome which presents a serious threat to native oak trees in Britain. It is characterized by 'bleeding' from cracks on the stem, and necrotic lesions containing a distinct community of pathogenic bacteria. AOD is typically linked to environmental stressors, and may lead to mortality of the tree within a few years. Additionally, the larval galleries and distinctive adult exit holes of Agrilus biguttatus, a native buprestid beetle whose larvae feed in the vascular tissue of weakened oak trees, are typically found. Further, the restricted geographical distributions of the beetle and AOD in Britain are markedly similar, raising concerns that A. biguttatus may be contributing to the syndrome or hastening the mortality of affected trees. An overview will be presented of our research into the cause of the tissue necrosis, and the role of A. biguttatus in the disease. This includes novel findings on the life cycle and development of the beetle, inoculation experiments of oak with bacteria and larvae, the molecular detection of AOD bacteria in the environment, and the construction of a dendrochronological timeline of tree health.

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Geographical distribution of three forest invasive beetle species in Romania

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Abstract:

Ips duplicatus (Sahlberg, 1836), *Xylosandrus germanus* (Blandford, 1894) and *Neoclytus acuminatus* (Fabricius, 1775) are invasive species reported from different places in Romania during the last decades. However, their current distribution is poorly known. Consequently, the goal of the research was to bring new information on this issue.

To detect their presence, flight interception traps (FIT) and bottle traps (BT) were used. In 2015, 3 ethanol-baited FIT were set up for 3-5 weeks, in June-July, in each of the 13 places selected to search for *X. germanus*. In 2016, 3-4 FIT baited with one pheromone lure (specific for *I. typographus*, *I. duplicatus* or *T. lineatum*) or with ethanol and alpha-pinene, and one ethanol-baited BT were set up in each of the 54 studied places. During 2017, additional 17 places were investigated, using only FIT baited with the same attractants like in 2016. Both in 2016 and 2017, the traps functioned between May and September. The biological material was collected and the volatile substances (especially ethanol and alpha-pinene) were refreshed every 2-3 weeks.

The presence of the first two species was also detected elsewhere in the country on other occasions, by trapping insects when conducting other studies or observing them in the outbreak areas (e.g. *I. duplicatus*).

In 2016-2017, *I. duplicatus* was trapped at 30 locations, including some in the western part of the country and at Bucharest and Constanța (sea port), where previously were no records. A total of 36,336 beetles were collected, the highest captures being in the log yards of the big factories processing spruce wood. Considering all known records so far, most of them are in the eastern part of the country, where an outbreak took place during the years 2005-2014.

X. germanus was collected in the years 2015-2017, at 34 out of the 84 monitored places. Less than 10 specimens were captured at the most places, but more than 100 insects/site at 8 places. The presence of species was confirmed in other 6 places through observations conducted during

other studies. Overall, the species was collected from 18 m up to over 1200 m above sea level, within tree stands with varied compositions and ages. The largest catches come from altitudes of 400-1000 m, from old tree stands with beech in their composition.

N. acuminatus was found in only 6 places, in the western and southern parts of the country. The most captures (10 insects/site) were in a log yard. It seems that the species is spreading slowly in broadleaved tree stands at low altitudes.

The available data indicate that *I. duplicatus* is already established in the most parts of the Norway spruce' range, *X. germanus* is still spreading in the country and in some areas has already quite numerous populations, while *N. acuminatus* is present only alt low altitudes, in the warmest regions of the country and the population level is very low.

On the biological control of forest pests by using predator and parasitoid insects in Turkey

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Abstract:

Turkey has totally about 20.199.296 ha forest area. Several biotic and abiotic factors threat to forest health in Turkey. Insect pests are the main destructive biological threat to Turkish forests. IPM strategies with the ecological aspects are the main perspective to improve pest control strategies against forest pests. Predators and parasitoids are the most preferable organisms to control insect pest populations. For this, 500-600 thousand of predators are reared and released to forests in Turkey per year. Pine bag insect and bark beetles are in the most destructive insect groups in Turkish forests. Two predators and one parasitoid have been used actively for recent two decades. Rhizophagus grandis, R. depresus and Thanasimus formicarius have been reared in huge amount and released in Turkish forests against bark beetles, and Calosoma sycophanta against pine bag insect. In 2016, 89.570 hectare of forest were targeted for biological control and 689.146 predators were released for 41.232 hectare of forest. In last four years, more than 2 million predators were reared and used against important forest pest. However, only one parasitoid species, Torymus sinensis has been actively reared and used against important chestnut pest, chestnut gall vasp, Dryocosmus kuriphilus. In this presentation, biological control of some important forest pests by using predators and parasitoids in Turkey are reviewed and discussed with literature.

Key words:

Biological control, predator, parasitoid, rearing laboratory, Turkish forest, forest pests.

Differences and similarities among forest invasive fungi impact and control

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Gheorghe Achim	University of Craiova	Romania
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Abstract:

Introduction. Several Asiatic invasive fungi produced mass dieback of forest ecosystems in Europe: Dutch elm disease (produced by *Ophiostoma ulmi* and *O. novo-ulmi*) (Brasier, 1991), sweet chestnut blight (caused by *Cryphonectria parasitica*) (Heiniger and Rigling, 2001) and ash dieback (due to *Hymenoscyphus fraxineus*) (Kowalski, 2006).

Natural and artificial hybridisation to transfere resistance to local populations of elm (Cogolludo-Agustín et al., 2000) and chestnut (Steiner et al., 2016) are still contradictory in European silviculture.

Method. Actual health status of elm, chestnut and ash was evaluated in experimental plots (comparative resistance to artificial or natural inoculations, biological control) and regular forests.

Results. Seven decades after the first waves of DED were recorded (Petrescu, 1967), no important old healthy elm population can be found all over Romania, periodic mass infections covering the relatively young elm regenerations, but isolate or small groups of healthy old individuals still occurr in nature or cities. Reevaluation of elm resistance in former experimental plots shows different resistance among the tested genotypes.

Three decades after chestnut blight occurence (Popa and Ispas, 1989), all the old trees have been killed in unprotected forests or orchards. Biological control of pathogen (Milgrom and Cortesi, 2004) in the forest and use of chestnut hybrids in orchards (Barakat et al., 2012) gave positive results in Romanian tests, too.

Ash dieback spreads in the last decade in northern half of Romania till now, but only humid habitats seem to be very vulnerable. Native and cultivated ashes have different reactions to the new disease.

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Isolation of pathogenic bacteria of the predator beetle *Calosoma sycophanta* (Coleoptera: Carabidae)

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Abstract:

Calosoma sycophanta L. (Coleoptera, Carabidae) is reared in insect rearing laboratories and released to forest infested by *Thaumetopoea pityocampa* (Den. & Schiff.). However, this predator is infected by microorganisms. This is the main factor effecting mast production of *C. sycophanta.* In this study, the bacterial pathogens of *Calosoma sycophanta* in the rearing laboratories in the years 2015-2017 were studied. During three years 302 bacterial isolates were isolated and identified using VITEK *bacterial identification systems.* The majority of identified species were entomopathogenic species. Six most isolated bacteria were further identified using 16SrDNA analysis and tested for insecticidal potential on the larvae and adults of *C. sycophanta.* All of them were found to be pathogenic on the adults or larvae.

Keywords:

Calosoma sycophanta, pathogenic bacteria, rearing laboratory, insecticidal effect

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Phoretic mites associated with *Ips typographus* from Central Romania

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Abstract:

Ips typographus is the the most widespread pest of spruce in Romania. The effects of its associations with species of fungi that lead to the die-back of trees have been highly studied. On the other hand, the associations of this beetle species with mites species were not studied in our country. Literature confirms the presence of approximately 20 mites species associated with beetles from Ips genus. Having reduced mobility, they use bark beetles for dispersion, a phenomenon known as phoresy. The interaction between mites and bark beetles can be a mutualistic one but in case of some mites can become antagonistic. In order to highlight the type of interaction, mites species and related parameters must be identified/established first. Consequently, for this purpose, the aims of this study were to find i) the mites diversity and related parameters, ii) mites locations on the body of the beetle of different sexes as well as mites assemblages and iii) the seasonal dynamic association between mites species and beetle.

To reach these objectives, in 2011, 15 commercially-intercept traps baited with commercial aggregation pheromone of *I. typographus* (a blend of cis-verbenol (cV) and 2-methyl-3-buten-2-ol (MB) and Ipsdienol) were placed in an area heavily affected by bark beetles located at 975 m.a.s.l. and surrounded by a spruce tree stand with an age of 120 years.

Captured material was collected in 15 separate sessions, performed periodically at intervals of 10-14 days, between beginning of insect's flight (early April) until the end of the flight (early September). The material was analyzed to identify the sex of the insect, to see if there are mites attached to the insect's body. In the case of mites presence, the species and the position on the body were recorded.

A total of 7896 adults of *I. typographus* were analyzed, on the body of which six species of mites were identified: *Dendrolaelaps quadrisetus*, *Protolaelaps fiseri*, *Trichouropoda polytricha*, *Histiostoma piceae*, *Uroobovella ipidis*, *Uroobovella vinicolora* belonging to five families from *Mesostigmata* and *Sarcoptiformes*. Almost a fifth (19.45%) of the adult insects had mites on their body. The most abundant species were *T. polytricha* and *D. quadrisetus*, which represented 84.9% of the total mites. The second species showed a preference for positioning under elytrae of the adults, while the first species preferred the elytral declivity and thorax. Most mites were identified under the beetle elytrae (46.8%), while thorax (ventral) and eytral declivity were occupied by mites in approximately equal proportions, 26.7% respectively 25.8%.

In most cases (85.5%), beetles have been vectors for only one species of mite, while 13.5% of them transport two species of mites, and about 1% of the insects have three different mite species.

Most of the time, 1-3 individuals of *D. quadrisetus* were found on the body of *I. typographus.* In fewer cases the numbers were 5-6 and in one case, on a male 26 mites were identified. Due to this particular case, when only this species was identified on beetles, the average was 2.23 mites / beetle.

Also, for this species of bark beetle, the dynamics of the association with their phoretic mites in a flight season were recorded, with two maximums, the first one, in the spring, corresponding to the *I. typographus* dispersion flight and the second one, lower as intensity, made by the insects from the second generation. Each mite species had a different dynamics pattern, depending on its biology, the most constant species during season being *D. quadrisetus*.

Bark and ambrosia beetle species on pubescent oak (*Quercus pubescens* Willd.) in forests of Afyonkarahisar region, Turkey

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Abstract:

A total of 18 oak species grow naturally in Turkey. Pubescent oak (*Quercus pubescens*) is a round-topped tree which is usually about 15 meters tall and rarely reaches 20 meters. It is native to Central Anatolia and is growing under semi-arid conditions. It has fine growth in thick ground and north-facing areas. The species is distributed especially in the inner parts of Black Sea and Mediterranean regions and also in the Marmara and Aegean regions of Turkey.

The aim of this study was to identify the bark and ambrosia beetle species (Col.: Curculionidae, Scolytinae) distributed in *Quercus pubescens* stands of Afyonkarahisar region. Three stands of *Q. pubescens*, which are situated in Sandıklı, Sinanpaşa and Şuhut provinces, were investigated. Field studies were conducted from March to October 2017. Red wing sticky traps (baited with ethyl alcohol 96% and toluene 1%) were set up in these stands and checked periodically. Specimens were also collected from weak, broken or fallen trees. As a result, 10 Scolytinae species were identified, namely: *Hylesinus fraxini* (Panzer, 1779), *Dryocoetes villosus* (Fabricius, 1792), *Taphrorychus ramicola* (Reitter, 1894), *T. villifrons* (Dufour, 1843), *Scolytus intricatus* (Ratzeburg, 1837), *S. mali* (Bechstein 1805), *Anisandrus dispar* (Fabricius, 1792), *Trypodendron signatum* (Fabricius 1787), *Xyleborus monographus* (Fabricius, 1792) and *Xyleborinus saxesenii* (Ratzeburg, 1837). Of these, *A. dispar* and *X. saxesenii* were found in all three stands. *T. villifrons* was determined in both Sinanpaşa and Sandıklı stands. Among other species, *H. varius* and *D. villosus* were found only in Sandıklı, *T. ramicola* and *T. signatum* were only in Sinanpaşa, while the remaining species *S. intricatus*, *S. mali* and *X. monographus* were found only in Şuhut stand. *X. saxesenii* was the most abundant species in all studied stands.

Entomophaga maimaiga and *Entomophaga aulicae* - powerful protectors of vitality and health of deciduous forests in Republic of Serbia

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Abstract:

In Serbia, where the deciduous forests cover an area of 1.8 million hectares, *Lymantria dispar* and *Euproctis chrysorrhoea* (Lepidotera: Erebidae), are the main economically harmful outbreaking insects species. During the outbreak, *L. dispar* frequently spreads in the forests which cover an area of several hundred thousand hectares. *E. chrysorrhoea* occurs periodically in high numbers also, but on a relatively small area of a few hundred hectares.

The fungal order Entomophthorales is mainly composed of obligate pathogens that infect arthropods. More than 300 species within fam. Entomophthoraceae are well-known for their ability to cause dramatic epizootics in host populations (Georgiev *et al*, 2010; Hajek 1999; Keller 1987; Tabaković-Tošić 2014). *Entomophaga maimaiga* Hamber, Shimauzu & Soper was isolated and described as the natural enemy of the gypsy moth in Japan, some parts of China and the Russian Far East. Bulgaria has been the first one in Europe in which *E. maimaiga* was introduced successfully. This entomopathogenic fungus slowly spreads over the Balkan Peninsula, and so far, its presence has been noted in Georgia, Serbia, Macedonia, Bosnia and Herzegovina, Croatia, Turkey, Hungary, and Slovakia (Pilarska *et al*, 2016). *Entomophaga aulicae* (Reichardt in Bail) Humber is a widespread Holarctic species, with many host insects from the order Lepidoptera, including some of the most economically harmful, outbreaking species of forest defoliators.

During the latest outbreaks of *L. dispar* (2011-2014) and *E. chrysorrhoea* (2014-2016) in Serbia, natural and assisted widespread *E. maimaiga* and *E. aulicae* caused the crash of the outbreaks of this most harmful species of the defoliating insects of the forests and orchards. The results of research show that entomopathogenic fungi emerged as a very promising biological agent, capable to cease *L. dispar* and E. *chrysorrhoea* calamities and maintain its population density at low levels under favorable conditions.

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Forest pest, *Colestra cuperata* (poplar defoliator): Diseases and its management

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Abstract:

Poplar is widespread and high economic agro forestry species in India. It constitutes an excellent raw material for paper, pulp, plywood and ply board industries as about 70% of the wood grown used in plywood and ply board manufacturing. It is the main source of economy of rural livelihood for farmers. Poplar is highly prone to insect attack, approximately, 108 insect species are causing damage. Out of these, Poplar defoliator-*Clostera cupreata* (Lepidoptera: Notodontidae) is one of the most damaging pests of poplar which defoliate poplar plantation and often appears in outbreaks even causes death of tree. Repeated defoliation cause loss of MAI and CAI which adversely affects growth increment and quality of the timber.

In India, poplar defoliator is being controlled by unlimited use of insecticides leading to several health and environmental hazards. Moreover, insecticides used are not target specific, broad spectrum and develop resistance to insect. With a greater awareness of hazards associated with the use of insecticides, there has been an urgent need to explore suitable alternative for pest control. Screening of plant extracts is one of the approaches for control of insect-pests. Little information is available on the control measures on poplar defoliator by using plant extracts. Therefore, the present study was undertaken to observe the effectiveness of *Calotropis procera* (family: Asclepiadaceae) leaves agains *C. cupreata*.

The 3rd instar larvae of *C. cupreata* were collected from the field, reared in glass chimney and wooden cages in the laboratory for stock culture. *C. procera* leaves extractives were prepared with different solvents of elutropic series. The larvae of *C. cupreata* were exposed to a wide range of concentrations (0.0625 to 2.00%) and a control. After repeated experiments, a herbal Bio-*Pesticide* was developed. Almost, 70% larval mortality was observed under lab as well as in outdoor cages. *Bio-Pesticide* is safe and economic alternatives to the synthetic insecticides and it will improve farmer's livelihood through increased productivity of poplar.

Acknowledgement:

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Neurostresspep: novel control agents for an old problem.

Name	Institute	Country
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Abstract:

In a changing environment where insecticide resistance is becoming a widespread problem, and legislation increasingly limits their use, there is an acute need for 'greener' control agents of damaging pests. A novel research area is exploring the selective nature of neuropeptide signalling hormones for controlling pest insects of agriculture, horticulture and forestry, whilst remaining harmless to non-target insects. Adults of the large pine weevil Hylobius abietis (L.) (Coleoptera: Curculionidae) attack newly planted seedlings, and remain the most important pests of coniferous plantations across Europe. Despite extensive research and trials into environmentally sensitive management techniques, such as entomopathogenic nematodes and fungi, soil preparation and feeding barriers; chemical means of seedling protection are still widely used. Using H. abietis as a model, Forest Research is working within an EU-funded consortium to explore the potential of neuropeptides as part of an integrated management system, and reduce the use of harmful chemicals. To date, trials of synthetic peptides have explored their impact upon diuresis, feeding, and overwintering in H. abietis. The technology and principles of the project will be outlined, and our experimental approach discussed.

New Solutions for Integrated Pathogen Control in Forest Cultures in the Current Climatic Context

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Abstract:

Climate changes that occur at the present time and, implicitly, the impact that these changes have on the health and vegetation state of forests are a complex and actual issue. It requires an increased attention from foresters during the management of forests that are permanently under the influence of disturbing factors, that act simultaneously or one at a time.

A first consequence is the onset of non-parasitic diseases concurrently with the increase of virulence and pathogenicity of some phytopathogenic agents, that could lead to some forest crops or even stands be compromised.

In the current paper, analyzes were made on the nutritive base, seeds, plantules, affected plants. The main mycotic agents were identified and the links between the evolution of infections and the local topo-pedo-climatic factors or the links between diseases and stand/biocenosis factors were analyzed. For their control, new products and methods (treatment techniques) that offered adequate solutions for the achievement of healthy cultures, while the recorded losses did not exceed the damage threshold, were tested.

The analyzes performed on coniferous planules shown that the most dangerous pathogens belong to *Fusarium, Pythium, Rhizoctonia, Botrytis* genera, and under strong infestation conditions, the *Alternaria* genus, although a saprophyte, contributes to culture debilitation.

In field coniferous cultures, foliar parasites from the following genera predominate: *Phoma piceae, Lophodermium macrosporium, Mycosphaerella tulasnei, Diplodia pinea*.

In broadleaf cultures, the following pathogens were identified: Coccomyces hyemalis at European sweet cherry, *Microsphaera sp., Roselinia quercina, Taphrina coerulescens* at oaks, *Dotichiza populea* and *Cytospora sp*. At black and hybrid poplar.

The experimental procedure for their control imposed the usage of broad action spectrum fungicides that, through their combined usage, acted on the whole range of presented pathogens.

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Derivation of flux-based critical levels for European forest protection against ozone and the National Emission Ceilings Directive implementation

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Abstract:

Unique in the world, the project MOTTLES* takes place in the main European areas at highest and medium risk of O_3 injury, relative to human well-being and vegetation impacts, i.e. Southern and central Europe and combines field epidemiology with plant-responses to O_3. A standard for forest protection is considered biologically relevant when it translates into real-world forest impacts. For this reason, epidemiological investigations where large-scale biological responses (e.g radial growth, crown defoliation and visible foliar O_3 injury) are compared with ambient data in the field provide useful information for establishing the best standards and thresholds for forest protection from O_3.

Ozone effects on vegetation depend on the air concentrations but also on the O_3 uptake through the stomata, i.e. Phytotoxic Ozone Dose above a threshold Y of uptake (PODY). With the effort of implementing permanent new-generation monitoring stations across Europe, capable to return continuous hourly O_3 concentrations with meteorological and environmental parameters in real-time, PODY is estimated and correlated to measured forest-response indicators to develop flux-based critical levels (CLef) for forest protection against O_3. Based on real-world flux-effect relationships, derivation of suitable species-specific epidemiologically-based O_3 critical levels for European tree species represents a considerable progress in the development of methods for quantifying O_3 effects on vegetation at the regional scale.

Under the National Emission Ceilings Directive (NECD), Article 9 "*Monitoring air pollution impacts*", Member States shall ensure the monitoring of negative impacts of common air pollutants and ground-level O_3 upon ecosystems based on a network of monitoring sites to allow the effectiveness assessment of the Directive in Environmental protection. Member States may use optional monitoring indicators, e.g. leaf injury and exceedance of CLef for O_3 damage to vegetation. A great opportunity is offered by MOTTLES sites, where hourly O_3 concentrations and meteorology data are continuously available for calculating PODY during the growing season of plant species, to be included in the NECD as monitoring network. By July 2019, Member States will need to report the first actual data.

Aknowledgement:

This work was carried out with the contribution of the LIFE financial instrument of the European Union (LIFE15 ENV/IT/183) in the framework of the MOTTLES project "*Monitoring ozone injury for setting new critical levels*".

Forest ozone risk assessment over Europe by regional modeling approach: new updates

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Abstract:

Tropospheric ozone (O3) produces harmful effects to forests and crops, leading to a reduction of carbon assimilation that, consequently, influences land sink and crop yield production. To assess the potential negative O3 impacts to vegetation, the European Union uses the Accumulated Ozone over Threshold of 40 ppb (AOT40). This index has been chosen for its simplicity and flexibility in handling different ecosystems as well as for its linear relationships with yield or biomass loss. However, AOT40 does not give any information on the physiological O3 uptake into the leaves since it does not include any environmental constraints to O3 uptake through stomata. Therefore, an index based on stomatal O3 uptake, which describes the amount of O3 entering into the leaves, would be more appropriate. Altought recent climate change significantly modified terrestial ecosystems and vegetation activity, little is known about how climate change and air pollution interact to affect forest health. Using a chemistry transport model, driven by anthropogenic emissions inventories, we find that European-averaged ground-level ozone concentrations significantly declined (-1.56%) over the time period 2000-2014, following successful control strategies to reduce the ozone precursors emission; as a consequence, the AOT40 metric declined (-22%). However, we show that climate change increased both growing season length (~7 days/decade) and stomatal conductance and thus enhanced the stomatal ozone uptake by forests (5.9%), leading to an overall increase of potential ozone damage on plants, despite the reduction in ozone concentrations. Forest protection against the negative impacts of ozone thus requires new strategies that integrate both climate and air quality policies..

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This work was carried out with the contribution of the LIFE financial instrument of the European Union (LIFE15 ENV/IT/183) in the framework of the MOTTLES project "*Monitoring ozone injury for setting new critical levels*".

3D ozone FACE as a basic device for the parameterization of tree forest species and the validation of visible foliar ozone injury

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Abstract:

Tropospheric ozone (O_3) is recognized as a widespread phytotoxic air pollutant. Visible foliar injury by O_3 (O_3 visible injury) is known as a bio-indicator to assess potential phytotoxicity of O_3. Ozone injury may closely relate to O_3 uptake into a leaf through stomata, i.e. Phytotoxic Ozone Dose above a threshold Y of uptake (POD_Y). To estimate POD_Y, accurate parameterization of the stomatal conductance (g_s) model is essential. Model parameters and O3 visible injury descriptions are available for several tree species of Europe (e.g., *Fagus sylvatica, Betula pendula, Quercus ilex*) . However, more information is needed for various plant species in the region where high species diversity can be found, e.g. in Mediterranean Europe. In this presentation, we present current developments for the parameterization of forest tree species and the validation of visible foliar O_3 injury by using a last-generation 3D Free-Air Controlled Exposure (O_3 FACE) facility, which is the first O_3 FACE facility in the Mediterranean region and the only one in Europe at present. In 2018, we work with four species that occur at the forest sites of the MOTTLES project* (*Alnus glutinosa, Phyllirea angustifolia, Sorbus aucuparia, Vaccinium myrtillus*). For *A. glutinosa* and *P. angustifolia*, the g_s model parameters were not available in previous literature. For *S. aucuparia* and *V. myrtillus*, an experimental validation of O_3 visible injury was needed. The exposure system is located at Sesto Fiorentino, nearby Florence. Ozone treatments are applied at three levels: ambient air concentration (AA), 1.5×AA and 2.0×AA. Three replicated blocks (5 m × 5 m × 2 m) are assigned to each O_3 concentration. Ozone is generated from pure oxygen, then diluted with ambient air, and fumigated at canopy height by 25 teflon tubes hanging down from the fixed grid above the trees. In 2017, 24h averaged O_3 concentrations during the experimental period (June to October) were 41.2, 53.0, 66.3 ppb at AA, 1.5×AA and 2.0×AA, respectively. Ozone visible injury of target trees will be periodically surveyed by two observers over the experimental period. In addition, diurnal courses of g_s will be measured on fully expanded sun leaves of target plants using a portable infra-red gas analyzer (CIRAS-2 PP Systems, Herts, UK). In this presentation, current experimental results of O_3 visible injury and g_s model parameters for the target species will be discussed.

Aknowledgement:

This work was carried out with the contribution of the LIFE financial instrument of the European Union (LIFE15 ENV/IT/183) in the framework of the MOTTLES project "*Monitoring ozone injury for setting new critical levels*".bbb

Carbon, nitrogen and phosphorus stoichiometry of Quercus species under ozone and water stress

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Abstract:

Tropospheric ozone is recognized as one of the most damaging greenhouse gases for plants. O_3 effect is particularly severe in the Mediterranean area as it is combined with other oxidizing factors such as drought. According to the climate change scenarios, such multiple threat will affect a growing number of forest species. Stress factors are known to act on foliar economics and allocation of nutrients in trees. Hence, in order to evaluate its influence on biogeochemical cycles at forest level, it is of utmost importance understanding how ozone exposure is able to alter nutrient contents and allocation to tree organs in combination with drought. The present study evaluated the interactive effect of ozone and water stress on C, N and P concentrations, their stoichiometry and processes of nutrient resorption of three main *Quercus* species (*Quercus ilex*, *Q. pubescens* and *Q. robur*). The experiment was performed with 2-year-old potted seedlings exposed to three levels of water availability and three levels of O_3 pollution during one growing season in an ozone FACE (Free-Air Controlled Exposure) facility. Ozone and water stress were found to significantly interact in affecting the foliar C and N contents in *Q. robur*. At stem and root level in the 3 species, both stressors affected negatively C without interaction and O_3 was the main driver for N decrease. Higher O_3 levels increased the C/N ratio in *Q. ilex* roots, with a general positive effect for all three species. On the contrary, the contents of P were not affected by ozone but were clearly negatively influenced by the reduced water availability in roots and stem. Similarly, N/P of each individual organ was affected by water limitation. The three species behave differently in terms of nitrogen resorption efficiency, as at high water availability levels, the nutrient resorption efficiency (NuRE) of *Q. robur* was significantly reduced by higher O_3, while the other species did not show significant results. Overall, despite a different O3 and drought-sensitivity of the three species, we found that ozone affected the stoichiometry of C and N in all species and interacted with water stress on both foliar nutrient dynamics and N resorption of *Q. robur* suggesting potential alterations of nutrient cycles in Mediterranean forests.

Assessment on ozone foliar injury on French MOTTLES plots: correlation with ozone levels and sensitivity of species - Comparison with results on national plots

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Abstract:

In this project, on the French side, visible foliar injury of ozone is monitored on four forest plots distributed in different areas chosen for their varying weather conditions. The species selected are larch *Larix decidua*, Scots pine *Pinus sylvestris,* spruce *Picea abies* and alder *Alnus glutinosa*. In 2017, all species studied had foliar symptoms specific to ozone pollutant. Of these four species, the Scots pine showed the most foliar damage, confirming its sensitivity to ozone. In addition, its defoliation is highest. The vegetation of clearing sites (LESS) near the study forest plots has reacted well, often showing characteristic "bronzing" on the observed foliage. It is on the Casset clearing site that the greatest number of symptomatic species was observed. It is the only site of altitude benefiting from a strong summer solar radiation. These observations seem to confirm the importance of altitude and sunshine in the occurrence of ozone foliar damage (Sicard and Dalstein, 2015; Dalstein and Vas, 2005). In the clearing sites, among the most symptomatic species *are Fagus sylvatica, Coryllus avellana* and *Acer sp*. This first year of monitoring confirms the results obtained by the GIEFS on the forest plots of the national network RENECOFOR (National Long-Term Monitoring Network of Forest Ecosystems) of the National Forestry Office (ONF), since almost 20 years.

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Tree growth monitoring under changing environment: effect of ozone pollution on intrannual stem growth dynamic of O3 sensitive species

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Abstract:

Aboveground tree growth is driven by the activity of primary meristems assuring the increase of stem height and secondary meristem activity (i.e., cambium) controlling the stem girth increment. The growth of stem height and girth is responsible for the above ground carbon accumulation in forest ecosystems. The ecological importance of the secondary meristems (cambium and phellogen) as important carbon sinks was discussed in the last years by several authors (Zweifel et al., 2013) above all for their pivotal role in the carbon flux in forest ecosystems. Like tree height increment, stem radial growth is highly sensitive to microclimatic conditions and recent evidences highlighted the higher sensitivity of cambium to water stress, warming and cooling is higher for cambium than for primary meristems (Balducci et al., 2016). These results showed the importance to deepen the studies on the stem radial growth in response to environmental stressors with the aim to provide new insights to forecasts putative scenarios of forest productivity in a context of global changes.

Ozone (O_3) pollution has been recorded in European forests and O_3 effects were reported on leaves and crown level while the effect on the stem growth have been underinvestigated (Carriero et al., 2015).

Dendrometers are automatic instruments to measure short-term changes in stem radius (point-dendrometer) or circumference (band-dendrometer) in temporal detail at resolution of micrometers. Dendrometer measurements provide time series documentation of the water storage fluctuations over the year and seasonal tree growth. The combination of synergistic measurements of plant processes provides the quantification of growing rate and the synchronization of environmental drivers with plant physiology. The radial stem variations are detectable during the whole year, both during the growing season and in winter, when large stem variation is caused by alternating frost shrinkage and thaw expansion due to temperature changes. Although dendrometers represent important tools to describe at fine time scale the intra-annual growth pattern and tree water relations, the physiological interpretation of growth signals remains difficult because it is the result of a complex interaction between plant phenology, genotype and the environment.

In this context we present the preliminar results of the tree stem monitoring activity developed within the LIFE-MOTTLES project and on poplar exposed to ambiento zone and protected by ethylenediurea (EDU) highlighing the possible ecological, technolgical and physiological implications of dendrometer analyses with environmental stresses.

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Data management, validation and ozone flux calculation in Mottles network

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Abstract:

Processing large datasets require dedicate and flexibile computer programms or rutine. For ozone fluxes calculation dedicated software are available (e.g. DO3SE) but with relative low flexibility and adaptability to specific datasets format. The R enviroment have increasing popularity in scientific commnunity as a powerfull and free tool for data processing and statistical analysis. For an efficient and integrate data collection, validation and analysis in the frame of Motlles project, specific database format, communication and proccesing was required. The proposed script contains customizable function to read, process and plot the ozone fluxes based on stomatal conductance. Datasets structure, stomatal ozone fluxes calculation and functionallty of the R script is presented. Also, we highlight its the flexible structure and future posibility to development.

Towards an integrated monitoring system from Earth-Observation data for the Romanian forests

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Abstract:

Forests are among the most biodiverse terrestrial ecosystems, provide habitat for a wide range of species, are a key element for carbon sequestration, and a major component of rural development, providing protective functions for soil, water and infrastructure and contributing goods and services (Ojea et al. 2010). In the last decades, environmental (climate, insect outbreaks, wind throws) and anthropogenic (logging) factors have caused serious threats to ecosystem integrity, functions and processes, leading to habitat degradation, and increased risk of collapse. Natural disturbances affect Romanian forests, but large-scale disasters are rare with extreme events occur every 10–15 years (Anfodillo et al. 2008; Popa 2008). To prevent effects of these various disturbances and to maintain and develop the Romanian sustainable forest management system it is more

than ever necessary to *continue applying of an adaptive forest management in relation to their vulnerability to climate change and their role in performing functions and delivering goods and services*.

The EO-ROFORMON project aims at prototyping a forest monitoring system based on the integration of active and passive Earth-Observation (EO) sensors calibrated with in situ data. Sentinel 1 and 2 missions provide the main source of EO data with Landsat 5/7/8 and ALOS PALSAR 1/2 satellites being used as ancillary data sources for model development, calibration and validation. The specific objectives are the i) retrieval of forest variables related to forest condition and anthropogenic and natural disturbances (forest type, forest canopy cover, forest defoliation, above ground biomass), and ii) detection of disturbances including differentiation among sources by taking advantage of the temporal dimension of the remote sensing signal. To achieve these objectives a combination of *in situ* campaigns, theoretical simulations, and active and passive EO datasets are used for the development of parametric and non-parametric models adapted to the specific conditions of the Romanian forests.

This paper presents an overarching view of project activities, including the experimental setup, preliminary results from the first year, and future activities.

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Forest cover extraction using remote sensing in the Southern Carpathians

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Abstract:

Forests enable numerous ecosystem services, but their value might be negatively altered by disturbances. The main environmental related disturbances affecting Romanian forests are wind throws and insect outbreaks (Anfodillo et al. 2008, Popa 2008). The frequency of these disturbances may be modified by the climate change, which is expected to alter the natural cycles (UN 1992). On the other hand, logging has been the main anthropogenic disturbance during the last decades, linked to socioeconomic changes in Romania (Knorn et al. 2012).

To monitor forest disturbance, continuously updated information over large areas is needed. Earth observation platforms can provide such information with both wall to wall coverage and high acquisition frequency. The objective of this study is to explore how the dense time series acquired by the Sentinel-1 and 2 constellations can be employed to map forest cover loses under the specific conditions encountered in Romania. The classification is performed in two steps. The first step uses automated tools to select the most informative variables. This information is employed in the second step to construct a decision tree separating forest from the other classes.

The samples employed for training and validation are created by intersecting preexisting land cover layers (i.e. CLC2012, DLR-GUF, etc.) and keeping polygons where there is agreement about class. The selected sample are randomly separated in training (70%) and validation (30%) sets.

The classification process results in a forest cover map update on bi-monthly basis. In addition, improved knowledge of the features separating forest from other land cover classes using near concurrent (one day apart) SAR and optical datasets was obtained.

This research has been possible thanks to the financing of the project EO-ROFORMON and the support of the INCDS.

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Assessing the performance of various machine learning algorithms for forest disturbance mapping

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Abstract:

One of the key elements in monitoring forest changes is Remote Sensing. With the increase of public available satellite images, like Landsat and Sentinel 1 and 2 (DeVries et al. 2015), the accuracy of forest disturbance mapping in space and time has also increased significantly. Even though the number of available satellite images has increased, tracking changes in space and time still has to deal with cloud cover. Obtaining images for at least two distinct points in time, with very similar environmental conditions is not always easy to achieve (Rodriguez-Galiano and Chica-Olmo 2012). In this paper we assessed the accuracy of different machine learning algorithms for mapping forest disturbance for small time intervals and not very similar environmental conditions (Pelletier et al. 2016). We considered the forest disturbance as full canopy removal without a special emphasize on the natural or anthropogenic processes (Griffiths et al. 2014). Hence, any significant change in canopy recorded between two or more-time intervals was considered disturbance. Our test site is Făgăraș Mountains, located in the central part of Romania. For this site we used the entire archive for Landsat and Sentinel-2 imagery. Because of the lack of available images for each year, the time intervals are not equal throughout the entire time period. To compensate for the uneven time intervals and better understand the space-time patterns in forest disturbance, we gradually increased the time interval by 1, assessed the forest disturbance pattern for the new time interval and continue until we reached one big time interval, delimited by the first and the last available images.

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Exploring spectral, angular and height information from Ziyuan 3 satellite data to steer forest inventories

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Abstract:

Data sets of the Chinese Ziyuan 3 satellite (ZY-3) are investigated to derive forest structural information. The information should support decisions on the strategical/tactical level of a forest enterprise at an envisaged scale of 1:10.000. ZY-3 is combining four bands VIS/NIR imaging at 5.8 m spatial resolution with three-line panchromatic imaging at 2.5m nadir and 3.5 m off nadir stereo imaging capability. The analysis focused on complementarities and synergies by combining height and angular information from stereo bands and spectral information from the multispectral bands of ZY-3. The stereo bands derived digital surface model provide canopy heights with an accuracy of appr. +/- 3 m. Angular signatures, giving answer on the anisotropy behavior of the surfaces, were derived via the difference in intensity of the forward and backward stereo band reflectance (anisotropy ratio). Forest type classifications were performed separately based on angular and multispectral signature and compared with the approach combining these signatures. Main forest types “coniferous”, “broadleaved” and “mixed” were classified with all approaches. By introducing the height information, the three forest type classes could be expanded to nine overall classes by distinguishing the forest management relevant height classes <12 m (establishment), 12-24 m (stabilization, qualification) and >m (dimensioning). Verification of the classifications was performed on behalf of digital CIR photographs and LIDAR height products. The best classification result into forest types was received by the combinded method with the highest overall accuracy of 81 % and with the KHAT statistic of 63.8 %. In the next step the classification output is used to place inventory points into area objects of the respective strata. If the object is large enough to completely cover the 500 m² circle of an inventory point then the condition for becoming a candidate for an inventory point assumed fulfilled. A statistically calculated number of 76 inventory points are randomly selected from the set of objects fulfilling the above condition. The volume estimation based on the inventory of the stratified remote sensing data is compared with the result of the traditional regular grid inventory (349 inventory points) of the forest enterprise. The stratified remote sensing-based inventory shows a relative standard error of 4.2 %, with a mean volume per hectar of 399.7 (m³/ha). Whereas the relative standard error of the regular grid inventory was 2.8 %, with a mean volume per hectar of 336.2 (m³/ha). As a result, it can be stated that the stratified remote sensing-based approach leads to cost savings. On the one hand, due to the smaller sample size and, on the other hand, due to the shorter time required to search for the sampling point in the terrain. The method seems appropriated for inventories without established regular sample grid like it is common in provate owned forests. The overestimantion of the standing stock is still under investigation.

Field Map System and Terrestrial Laser Scanning – data collections methods comparison for forest inventory

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Abstract:

This study aims to present a comparison analysis of two data collection methods that can be used in order to obtain reference ground truth data for forestry – a classical method that use specific equipment as Field Map system, calliper and vertex inclinometer and a modern method based on terrestrial laser scanning (TLS) technology.

In order to compare the two acquisitions methods, we applied a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis on the basis of which we could establish the pros and cons of using the two methods. Therefore, one can choose the most advantageous method for obtaining the reference data for forestry, in terms of equipment acquisition cost, personnel skills and qualifications, data collection working time, accuracy of the data recorded, post processing time, labour costs.

The research was conducted in six circular Permanent Subsample Plots (PSPs) with an area of 500 square meters each, within thinning and selected cuttings stands of oak (Quercus petraea), beech (Fagus sylvatica) and Norway spruce (Picea abies), all situated in the Southern Carpathians (Mihăești and Mușetești Forest Districts).

As a classical method for data forest inventory, a combination of Filed Map system, calliper and vertex inclinometer was used for each PSP. Thus, in the field were directly measured the dendrometrics tree characteristics as height, diameter at breast height (DBH) and the tree position.

As a modern method for data collection, a Faro Focus3D X 130 HDR terrestrial laser scanning device was used to scan each PSP. Two scanning approaches were used - single scan (SS) and multi scan (MS).

The point clouds are segmented referenced to the Permanent Subsample Plots’ (PSP) centre defined by the position of the scanner. An initial classification ensures the differentiation of the vegetation from the ground points further used as a reference for computing DBH and height. It was opted for a Randomized Hough Transform (RHT) algorithm with 300 iterations for height and DBH estimation. The positions were extracted as the

contact values of an axis defined by the centres of two different cylinders fitted on the segmented individual tree (0.65m and 1.3m) and the ground. Based on the TLS methods the main dendrometrics tree characteristics are calculated indirectly, being estimated.

In one of the PSP (oak thinning forest stand) the preliminary results show a root mean square error (RMSE) of 1.6 meters calculated between directly measured tree heights and their corresponding heights estimated based on the TLS technology and multi scan approach. In the case of DBH as well as for the MS approach an RMSE of 2.1cm was obtained.

Although, using both data collection methods, comparable results were obtained. For accurate reference ground truth data for forest inventory, it is recommended to use the classical integrated equipment (Field Map system, calliper and vertex inclinometer).

Retrieval of forest structural parameters from single terrestrial laser scans

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Abstract:

Forest inventories are the mean of deriving information on forest stand characteristics for a range of fields including, dendrometry, condition monitoring, physiology as well as for appraising forest biodiversity or the success of forest management practices. Inventory methods are defined as a function of objectives, precision, and costs (Liang, et al., 2016). Over the last decade, technological advances in the field of terrestrial laser scanning (TLS) have allowed for the development of highly portable, accurate and increasingly cost-effective sensors as well as for data processing solutions capable of segmenting and reconstructing accurate tree models. However, tree reconstruction at stand level from TLS data requires several scans from different directions to mitigate occlusion effects. Multiple scans significantly increase field work duration, the complexity of TLS data processing (scan co-registration is needed), as well as computational costs.

This study evaluates the utility of single scans for the retrieval of forest structural information at stand level as opposed to multiple TLS scans. As reference, field measurements from classical and computer assisted forest inventories were used. TLS scans were analyzed by species (coniferous, deciduous) and age classes. Tree reconstruction techniques were applied on pre-classified point clouds (trunk, branch and foliage returns) with ground returns being filtered out (Trochta, Krůček, Vrška, & Král, 2017; Hackenberg, Spiecker, Calders, Disney, & Raumonen, 2015). For completeness the analysis was also carried out without using pre-classified point clouds. The point clouds were analyzed as a function of the horizontal distance to the scanner, placed at the center of the permanent field plot (PSP).

Preliminary results demonstrate significant correlations between field and single-scan TLS-derived stand measurements when the point cloud is stratified by distance. An increase in correlation strength was observed when subsampling the cloud based on the proximity to the scanner position. This leads to increased correlations for height measurements as the distance to scanner diminished (r=0.91 close range vs. r=0.59 far range), whilst DBH values tend to illustrate a reversed effect (r=0.52 far range vs. r=0.35 close range). Composition, diameter and species variations influenced these trends.

Single swipe TLS scans seem to provide accurate estimates of average stand parameters (i.e. height, DBH) while significantly reducing the time spent in the field as well as the computational costs.

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Keywords:
Tree reconstruction, Forest inventory, Terrestrial Laser Scanner.

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Understanding forest structural diversity through terrestrial laser scanning

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Abstract:

Information on forest structure is important for understanding forest ecosystems functioning with foliage distribution driving the exchange of energy between vegetation and the atmosphere (Jonckheere, et al., 2004). Canopy structure is often parameterized by vegetation indices such as the Leaf Area Index (LAI), defined as half the total leaf area per unit ground area (Lang, McMurtrie, & Benson, 1991). However, apart from the LAI, other indices (i.e. stand denseness, espacement, canopy density, canopy cover, stand basal area) are commonly used to characterize forest structure in Romania (Giurgiu, 1979; Carcea & Dissescu, 2014). Terrestrial and airborne LiDAR data have been used to describe canopy structural diversity and provide accurate estimates of LAI. This study uses Terrestrial Laser Scanner (TLS) datasets to characterize forest structure through the above-mentioned indices in different forest types. In addition, the relationship between LAI and the remaining indices was also studied to assess the extent to which LAI corelates to other forest structural indices commonly used in Romania.

Different techniques were used to retrieve forest structural indices from TLS datasets. The results were subsequently compared to precise field measurement carried out with a computer assisted system (FieldMap) which provides accurate information on tree position (XYZ coordinates), as well as tree height and crown projection measurements. The diameter at breast height (DBH) was also measured for each tree through in situ forest inventory. Nine 500 square meters study areas have been delineated in the field (PSP), in *Picea abies*, *Quercus petraea*, and *Fagus sylvatica* mature forest stands. Each PSP was defined as a circular area (15 meters radius) where TLS measurements (point clouds) were recorded. In addition, high resolution digital images were acquired with a camera integrated with the TLS sensor.

The LAI was retrieved using the gap probability, a common method based on the ratio between emitted and retrieved laser pulses. The remaining forest indices were computed based on biometric data extracted from segmentation and 3D reconstruction of the point cloud. Some parameters (eg. crown area) required the use of voxels in order to determine the presence or absence of vegetation (if a voxel contains a laser return

it is considered as vegetated). By projecting the voxels to a plane and thus generating a raster image, it was possible to compute the canopy area. Within an iterative process, voxels of different sizes (5 to 25 cm) were tested to determine the optimum size (Henning & Radtke, 2006).

TLS based extraction of forest structural characteristics will help understanding forest ecosystems complexity by simultaneously retrieving structural properties which are difficult to estimate trough classical forest inventories.

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Keywords:
Stand denseness index, Espacement index, Canopy density index, Stand density index, Leaf Area Index, Terrestrial Laser Scanner.

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Monitoring and Modeling of urban forests cover and its effect on air quality and human health in National Capital Territory of Delhi (India)

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Abstract:

Urban forestry is the care and management of trees and tree populations in urban settings for the purpose of improving the urban environment. Urban forestry advocates the role of trees as a critical part of the urban infrastructure. Urban trees perform a number of ecosystem services including decreasing air pollution, carbon sequestration, cooling air temperatures and providing aesthetic beauty to the urban landscape. Trees remove air pollution by intercepting particulate matter on plant surfaces and absorbing gaseous pollutants through the leaf stomata. In this research, information related to forest cover and their spatial and temporal variability has been studied for the National Capital Territory of Delhi (NCT) (India) over a period of 27 years i.e., 1990 to 2017. NCT of Delhi is second most populous city in India. This research provides an opportunity to understand the spatial pattern and dynamics of forest landscape that would not only help in better regional planning and governance but would also maintain and uphold the sustainable growth of a region. The present study demonstrates the use of remote sensing and GIS techniques to highlight the extent of forest cover and its effect on air quality and human health in NCT of Delhi at a detailed level. Multi-temporal satellite images of Landsat Thematic Mapper (TM) 4 & 5 and Landsat 8 Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS) have been used over a period of nearly three decades (i.e., 1990 to 2017). A spatial modeling approach using vegetation indices, Leaf Area Index, local pollution concentration data and health data were applied. To establish the relationship between urban forest cover and its effect on air quality and human health, multivariate statistical technique has been used. In this study the relationship between urban forest and various pollutants such as Sulphur Dioxide, Oxides of Nitrogen (NO2), Suspended Particulate matter (SPM), Respirable particulate matter, Lead, Carbon Monoxide has been established for 1990, 2000, 2010 and 2017. Furthermore, this relationship has been extended for studing the effects of various pollutants on human health. For this purpose, various health parameters such as Crude death rate, Life expectancy etc. has been taken for the study. Air quality improvement in NCT of Delhi over a period of nearly three decades (i.e., 1990 to 2017) due to pollution removal by small patches of trees averaged 2% for particulate matter, 1.2% for Respirable particulate matter, 0.82% for sulfur dioxide, 0.30% for nitrogen dioxide, 0.34% for lead and 0.05% for carbon monoxide. In urban areas with 100% tree cover (i.e., contiguous forest stands), short-term improvements in air quality from pollution removal by trees were as high as, 14% for sulfur dioxide, 13% for particulate matter, 8% for nitrogen dioxide, 3% for lead and 0.05% for carbon monoxide. The results highlighed the role and potential of green infrastructures and urban forests in improving air quality in National Capital Territory of Delhi (NCT). In addition to this potential effectiveness of urban forests in air quality improvement depends on multiple factors and uncertainties.

Temporal variability of soil moisture at different level soil depths from six years of records in three different stand types

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Abstract:

Understanding soil moisture and its relationship with different climatic and soil characteristics are essential to better analyzing the interaction between forests and the soil dynamic of water (Broca et al., 2010, Sun et al., 2015) and monitoring these parameters will improve the predictability of climate changes (May et al., 2015; Seneviratne et al., 2010).

In this paper we have investigated the temporal variability of soil moisture in three different types of forests, but which present the same type of soil (eutric cambisol): Fundata, Predeal and Stalpeni. Soil moisture was measured daily from 2011 to 2016, by using three sensors at three different depths (20, 40, 70 cm), through the TDR technique. Statistical analysis was applied to search the interaction between soil properties, vegetation type, local climatic conditions and soil moisture for each site and soil depth. In order to determine the temporal variability of soil moisture content, two well known methods were used, namely Fourier series and the neuronal network fitting procedures.

A high variability in time and depth for soil volumetric water content was identified. The highest humidity levels are recorded at higher depths (70 cm) for almost all surfaces, with the exception of Fundata surface, where the limestone prevents this phenomenon. In the condition of higher precipitation quantities in the mountain area, specific to Fundata and Predeal areas, the level of the volumetric water content from the soil is mainly influenced by the soil's physical characteristics. The only area in which humidity levels were recorded under the drought level was Stalpeni (which presents the lowest altitude), during September-October 2012 (when lover precipitations were recorded).

The existence of a delay (time shift) between the precipitation moment and the soil humidification one was emphasized on certain depths of 0.4-0.8-time units (days). Furthermore, a high correlation between soil moisture and soil texture was also demonstrated, followed by a weak correlation with the vegetation type, caused by the lack of contributing replicates plots. Temperature is the factor that influences the soil's humidity levels at almost all its depths, while precipitations have the same effect only in the presence of a delay of one or two days.

These results can be useful in future studies, especially in monitoring and the implication of soil moisture in the context of climate change and plants adaptability.

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Poster Presentations

A transdiciplinary approach for the Romanian Long-Term Socio-Ecological Research Network (LTSER)

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Abstract:

New research and monitoring methods as well as new ways of integrating environmental and social research at different spatial and temporal scales are needed in order to better understand the environment and the interaction with social capital. The development of the Romanian National Network for Long Term Socio-Ecological studies (LTSER) is proposed as a viable solution. Such a platform will address also the inclusion of different disciplines but also the stakeholders for the co-production of knowledge; it will maintain disciplinary understandings but also will integrate and move beyond disciplinary and interdisciplinary research; it will include relevant information about policies, socio-economic data and trend, ecosystems and biodiversity related research. The network will encurage the use of the ecosystem services as a mean of communication with stakeholders and decision makers. In the same time the development of such a network will allow the integration of the existing research infrastructures in the biodiversity research field at national scale and the linkages needed to be established at European level. The paper is dealing with the description of the network, starting from the conceptual framework for site selection, definition of Long-Term Socio-Ecological Research areas, international and national tendencies for research and monitoring facilities, tools for network integration, institutional framework, aims and objectives of the RoLTSER as well as the development of the research agenda, partnership agreements, stakeholders involvement, organizational structure and future research prospects.

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The foliar chemical composition of *Betula pendula*: a comparative study of Lithuania and Romania (Transylvania region)

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Abstract:

The impact of different climatic conditions on growth and chemical composition of *Betula pendula* foliage in Lithuania and Romania were studied in growing season of 2017. Both studied European countries represent continental temperate region but differ by local meteorological conditions (temperature, precipitation), duration of vegetation season, solar radiation and other factors. Birch species have a wide natural distribution area on the Eurasian continent, ranging from the Atlantic to eastern Siberia. In Lithuania, representing more northern climate, birch is commercially the most important broadleaved tree species. Meanwhile, in Romania birch is not as much valuable or prioritized and considered as forest weed.

In both countries, 62 model trees were selected for the measurements in birch stands. The samples of birch foliage for the chemical analyses and increment cores for the growth analyses were collected in July-August, 2017 both in Central Lithuania and in Transylvania region, Romania. The carbon (C) and elements N, P, K, Ca, Mg, Mn and Fe were analysed.

This study has shown that there were no clear differences of the measured foliar elements in Lithuania and Romania. While, the birch foliage in Romania had higher concentrations of N, Mn and Fe but lower concentrations of K, Ca and Mg. Almost no changes were found in the concentrations of C, P and Zn. In young birch stands, mean diameter at breast height (DBH) tend to be by 12% higher in Romania than in Lithuania. Meanwhile, mean DBH was even by 36% higher in older stands in Romania. Assuming that the site effect was generally low, we could hypothesize that the main differences could occur due to the climatic conditions of the studied countries.

Impact of Climate Change on Mortality of *Dalbergia sisso* Roxb. and production of adaptive clones through genetic manipulation

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Abstract:

Shisham (*Dalbergia sissoo* Roxb.) is one of the important timber species of India commonly named as Shisham. It is the most preferred species of Farmers because of its wide adaptability to varied edaphic and climatic conditions. Farmers of North India also plant this species in Agro-forestry for profitable economic returns and is well accepted for social forestry programmes.

During last few decades, the species has registered heavy mortality assigned to climate change and land use pattern. The occurrence of Shisham Mortality was for the first time noticed by Bagchi (1945) as die back disease in Tarai region of Uttar Pradesh. Mortality in patches along roadsides and railway tracks showing wilting symptoms have been reported in Bangladesh (Basak 1999) and Pakistan (Khan *et al*. 2001). Mortality of Shisham in India varied from 10-90%.

The effect of climate change on Mortality of Shisham was studied for 4 consecutive years in a Clonal Seed Orchard of *D. Sissoo*, established under World Bank project comprising of 30 varied clones collected from diverse geographical areas of India and Nepal. At the time of study, they were 14 years of age. Wide variations were depicted in different genetic resources in symptoms and range of mortality which are discussed in detail in this paper. The mortality percentage enhanced each year from 4% to 22% after 4 years. Some of the clones were not affected with change in weather conditions while others showed 100% mortality. In general, the possible causes of mortality of Shisham has been assigned to weather changes (erratic rainfall, long duration of fog, extreme cold, long dry spells, more cloudy days, wide gap between maximum and minimum temperature) Kaushik and Bangarwa (2006) apart from other factors. Due to multiple factors, the plant becomes weak physiologically and is then predisposed to pathogen attack (*Ganoderma lucideum).* The production of resistant genotypes for adaptive forest management is the need of the hour. Identification of resistant clones and their mass multiplication for large afforestation programmes leads to a viable solution in this present scenario. Many clones growing in CSO at Lacchiwala, Dehradun were screened for their resistant ability in Pathology Division of FRI. After testing in the Field, Clone D-14 belonging to Haridwar was released as resistant variety. A complete protocol for multiplication of this adaptive clone *en masse* was developed which is discussed in detail. Selection, collection, rejuvenation and multiplication, establishment of clonal orchards, exploring of resistant clones, their laboratory and field testing and release of resistant clone in this changing scenario are highlighted in this paper.

Keywords:

Dalbergia sissoo, resistant clone, genetic resources, climate change

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Implementation of drone technology – opportunity and new challenges in the context of Romanian forest management practice (preliminary results)

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Abstract:

Forest management is subject to improvement from the field of small unmanned aircraft technology (Toth, C., Jóźków, G., 2016), (Zhang, J., et. al., 2016). Thus, the aim of this paper is to show preliminary work of UAV's equipped with different sensors within the context of Romanian forest management practice.

To evaluate the suitability for the diverse field conditions across Romania, plots from three distinct regions were evaluated (plane, hill and mountainous areas) in order to identify forest characteristics as from the management view point. Main findings were shown and evaluated according to current regulations. Aerial photographs provided by the RGB camera proved to be a reliable product for mapping procedures. Also, full inventory in pure stands of hybrid poplar was possible. Setbacks were discussed against relevant literature.

Conclusions drawn considered further investigations in order to set new approaches of suitability of drones in current forest management practice.

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Dynamic of the Mountain Forests in the Northern Carpathian Region in the Last 200 Years under Forest Management Methods

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Abstract:

The province of Bucovina is located in the northern part of Romania, mainly in the north eastern Carpathians and can be mapped to the actual Suceava County. Between 1775 and 1918, the region was part of the Habsburg Empire and a lot of changes occurred with regards to organization and management of the area. These changes continue to be visible even today, in comparison with other areas of the Carpathians. One of the most obvious differences is the structure of forests ownership and management. Because of the low density of population in the region (5.25 inhabitants/km2 in 1775) and reduced accessibility, until the 19th century more than 90% of the forested area preserved the structure and aspect of primeval forests. Based on old maps, descriptions, and inventories conducted in the forest management plans (1870-2010), and field studies conducted in forest reserves, we have established and mapped the “structure types” related to the intensity of human activity. Three types of forest structures were analyzed for the last century:

1. Primeval forests - with old ages and big dimensions of trees, without human intervention by cuts
2. Secondary forest - naturally regenerated forests that replaced the ancient primeval forests
3. Artificial stands - artificially and naturally regenerated after the cut of secondary forests. The most planted species were Norway spruce and fir.

At the end of the 19th century more than 90% of forests were virgin forests. The construction of railroads and forest roads made the wood from the Carpathians accessible to the markets of Europe. Before that only the few forests located in basins where wood rafting permitted the wood transport, were used (Bistriţa). Our studies show that the amount of spruce in the composition of stands increased, whilst fir and broadleaves proportion decreased. For example, in the Obcina Mare Mountains area, the proportion of spruce increased form 27-30% to 40-60%, the proportion of fir decreased form 30-40% to 20-35%, and the proportion of beech in mixed forests also decreased because of cuts in the early 1900.

The dynamics of the mountainous forests in the Carpathians are driven by infrequent but significant disturbance events such as snow, wind, drought, insects, and game. These disturbing factors interact with the continuous disturbances of browsing and grazing animals (for silver fir with significant decrease in stands’ composition) and localized processes of single tree growth and competition, decaling to specific dynamic of the stands. Both abiotic and biotic disturbances operate at regional scale (such as tempests in the Carpathians in 1948, 1962, 1966, 1972, 1982, 1996, 2002 or gypsy moth - Lymantria monacha - in 1956 – 1959 in the Eastern Carpathians) and at fine scale (such as local damages caused by snow or excessive herbivores).

Natural Regeneration in stands affected by silver fir decline in Northern Romania

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Abstract:

The research was conducted in the northern part of the Eastern Carpathians in Suceava County, mainly in silver fir stands located at 450-700 m were in the period 1983-1993 heavy salvage cuts caused by silver fir decline occurred every year. The original stands at the end of 19th Century were mixed stands of silver fir beech and other broadleaves mainly hornbeam. After the clear cut of the natural stands, regeneration were dominated by silver fir which was abundant in the structure of the old stand. Silviculturists have eliminated the broadleaves (beech, hornbeam, Adler, etc.) and conduct this stands to pure silver fir stands or mixture of fir, beech and spruce.

At the beginning of the 80’s large areas were affected by forest decline and in 10 years more than 60-200 m^3/ha were extracted. Following the forest decline, defoliation and the death of frees occurred not only to silver fir but also other species (beech, hornbeam, sycamore, spruce) were damaged. The area were described as one of the richest in forests of high productivity but also frequent damaged by natural damaging factors (snow, wind) and in the last 50 years by the game (*Cervus elaphus, Capreolus sp.*).

Forest ecosystems are dominated by Silver fir ecosystems high-medium productive with mull (mull-moder) on brown and luvic-brown soils. In the areas clear cutted after the repeated salvage cutting the vegetation cover the soil (*Molinia coerulea, Deschampsia caespinosa, Juncus sp*.) and create a continuous impenetrable cover disabling the installation and the growth of the seedlings. Frequent passage of the tractors conduct to high compaction of the soil and even erosion and water logging in large areas.

For the study of the dynamic of natural regeneration in the areas damaged by forest decline 6 stands located in the Forest District Gura Humorului were investigated.

In every stand a raster of 100 x 100 m were installed and in every point a plot area of 500 m^2 for the characteristics of the old stand and micro site description were investigated. Natural regeneration were investigated in 4 subplots of (1x100 m^2) 10 m^2 placed on the direction N, E, S, W at 10 m of the permanent plot center. In total were investigated 39 plots with 4 subplots for natural regeneration. In each plot were made 4 Bitterlich sample located at 10 m in the direction N, E, S, W for the estimation of the ground area of the old stand. The inventory were made in 1983, 1994, 2003 and 2010 using the same protocol. For the old stand all tree, were measured and estimated: species, Kraft position, diameter were measured et ($d_{1,3}$), height, height to crown insertion (h_c) and the class of defoliation according with the European criteria (4 health classes). For the natural regeneration were collected following characteristics: sp., $d_{0,3}$ (mm), h (cm), damages, annual increment (cm).

Statistical analysis of the data permit to formulate the following conclusions:

the maximal proportion of silver fir in the natural regeneration were registered at 10-15 years after the first cuttings, only in the areas were the density index drop progressively with 40-50% in 10 years

the maximal proportion (60-70%) of silver fir in the natural regeneration were registered under the stands with 30-50% silver fir in the old stand before the first salvage cuttings

in the old stands with more than 70% silver fir (before the salvage cuttings) and less than 25% the participation of silver fir in the natural regeneration represent less than 40%.

After 10-15 years of the first salvage cuttings the maximum density of natural regeneration were registered in the stands with 300-400 N/ha

In the areas heavily damaged (with 30-150 trees/ha) after 10-15 years of salvage cuttings and in the unaffected stand (N>5000/ha) the proportion of the silver fir in natural regeneration represent less the 30% of the total number of seedlings

For the stand density of 250-500 tress/ha the proportion of silver fir in the natural regeneration represent over 60% of total seedlings.

Maximum regeneration of silver fir were registered for the stands with 20-35m ground area/ha. For the values higher than 35 m^2*ha^{-1} and lower than 20 m^2*ha^{-1} the participation of silver fir in natural regeneration stand drop under 40%

In the stands with high reduction of ground area in the first 10-15 (after the decline) years to 5-15 m^2*ha^{-1} and improper site conditions (water in excess, invasion of *Molinia* and *Juncus*) the density of natural regeneration is 7000$\pm$4000 N/ha with maximum density estimated at 17000 N/ha

In the areas moderately affected by salvage cuts with G = 10-35 m2/ha dominated by broadleaves (beech, hornbeam, sycamore and with 10-20% silver fir and favorable site conditions for natural regeneration, the density of seedlings natural installed represent 20000-45000 N/ha. The composition of the natural regeneration is also dominated by broadleaves (60% hornbeam, 30% beech and 10% silver fir)

In the stands with high density before the salvage cuttings and strong affected by the dying away in the period 1983-1993 the natural regeneration is more difficult and is dominated by hornbeam and pioneer species (*rovan, birch, aspen)*.

On the ground of the results obtained in the permanent plots we have analyzed the multiple and simple regressions, with the objective to obtain a model for the distribution of the natural regeneration in the damaged areas of the region and the rationalization of the costs for the artificial regenerations.

Dynamic of landscapes in Bucovina during the 1775-2010 period

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Abstract:

Sustainable management of landscapes and environment protection represent the main goals of the socio-economic system in Romania, especially with the increasing pressure due to the changes that occurred after 1990.

Bucovina is a well-known region in the Carpathians with well-preserved landscapes and historic monuments. Changes in the area, structure, and functioning of the landscapes under human pressure in the last 235 years have been analyzed using the old Josephine maps made during the 1773-1775 period versus the actual orthophoto plans.

The actual picture of the landscapes and socio-economic system is very complex and pays tribute to the changes registered in the last 3 centuries:

Organization during the Habsburg Empire - confiscation of mountainous area after 1775

Post WWI WWII – deforestations in order to pay war reparations

Socialist period - with confiscation of all the forests and implementation of Stalinist methods of land use.

During these periods unsuitable methods of land use management (deforestation, clear cuttings) and wood logging (replacement of natural tree species with introduction of Norway spruce in the forest dominated by beech and silver fir) have been applied and left visible traces in the actual forested landscapes and forest stability.

Traditional land use practices in all these periods played an important role in the conservation of cultural heritage and biodiversity. The aim of this study is to evaluate traditional villages as way of integration of best practices of traditional land use into sustainable development, while conserving the socio-economic system and protecting biodiversity and cultural heritage. Based on case studies in different natural and economic conditions we tried to put highlight good practices as examples for sustainable development of mountainous villages.

Rural population plays an important role in the mountainous landscapes at multiple levels. Recent political changes in Romania have had a big impact on the socio-economic system with large implications in sustainable land use and conservation of the cultural heritage and traditional knowledge. Bucovina’s mountainous area represents more than 50% of the whole Bucovina and more than 75% in the southern part (in Romania). Forest resources with high quality and high economic value play an important role in the actual socio-economic system dominated by market economy. On the other hand numerous international agreements and resolutions insist on promoting sustainability at environmental, regional, and local levels, and on conserving habitats with high value and biodiversity. Between these two tendencies, today the population in forested areas experience decreasing standards of living due to the disintegration of the socialist economy based on plans to intensively use the resources for the benefit of the whole country.

In the sub mountainous and hilly area, the non-forested areas continuously increases due to the expansion of urbanism and agriculture. The socio-economic system, technological changes, and the political changes of the last decades (privatization of land and forest, market economy, high levels of poverty for the most part of population, corruption, and mafia groups) are the main drivers of change in the forest landscape pattern across Romania and especially in Bucovina.

In the high mountainous area, forested areas appear to be the dominant land cover type, with non-forested patches used for grazing, agriculture, mining etc.

Keywords:
landscape change, landscape patterns, Bucovina, land use, mountains, Carpathians

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Trends Observed in the Distribution of Tree Species Under Climate Change in the Carpathians

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Abstract:

For 10 representative zones located in the Carpathians the authors made a special evaluation of the forest state through biometrical parameters of the trees. For this purpose the authors developed and used a special index - VID (index of dendrological value) - based on inventories made in the statistical plots. The transects method has been used in old stands as well as in the young regenerated stands of the last 2-5 decades, under the impact of actual climate changes. Based on these indices the book (Ch. 7.9.1 – 7.9.11) presents the results of the assessment process.

Examples and case-studies are mainly based on data from Eastern Carpathians, more familiar to the authors. Data and maps derived from mathematical modeling of real data, from accurate inventories, represent only the first step in the development of tools for the visualization of trends observed in the last decades (Ch. 7.10-7.12).

Based on mathematical models for each study-zone graphs and maps showing the trends in tree species succession under presumed climate change in the future have been presented. The zones delineated by altitude, mean temperature, and mean precipitation where some tree species will be stressed, and in time will tend to disappear under the pressure of concurrent species, are presented in synthetis, as well as the zones in which tree species will migrate for a better ecological niche.

These maps generated based off on real data represent the most attractive part of the research. It is regrettable that most of the maps are in grayscale, but in the electronic form of the book all figures and maps are in color. The most important maps represent the trend observed in the proportion of tree species in the actual stands. Based on the difference of participation of the same species in the old stand and in the young regenerated cohorts, the map shows areas in which an increase in participation of a tree species in the composition is expected, as well as areas (zones) in which the tree species will diminish in composition during the 21st century. All the parameters are quantitatively expressed and can contribute to a better adaptation of the methods of regeneration in the future.

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The contributions to knowledge of *Pygaera anastomosis* L. insect (Lepidoptera, Notodontidae)

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Abstract:

Pygaera (Clostera) anastomosis is an important poplar and willow defoliator which, especially since 1950, caused important damages to intensive hybrid poplar crops in Europe and Asia. The need to reduce the loss caused by this insect, often led to radical control tactics, consisting in spraying chemical insecticides with low specificity and high impact on biodiversity.Other control methods (biological control) had not the expected effect. Considering the above mentioned aspects and the fact that *Pygaera anastomosis* overwinters as larvae, mainly in bark crevices of the stems of infested trees, it was tested the possibility of controlling this pest, by chemical control of the larvae, early in spring.

The purpose of the research was to limit infestations and injuries through prevention and combat measurements of *Pyagera anastomosis* L. populations and achievement and maintain a proper phytosanitary status of poplar forests in Romania (Blaga, T.,2014,2015).

There pests are considered as very dangerous defoliators for poplar stands and especially for Euramerica poplar trees, being able to cause economic losses, debilitation and drying poplar trees.

The strongest attacks were reported in the arboretum from the dugged outcrops , but also in area with dams especially in areas that suffered a physiological stress due to a dry extended period or due to a flood water.

The paper present a synthesis of literature data and the results of three years investigations concerning morphology, biology and injuries.

Keywords:

Pygaera (Clostera) anastomosis, control, poplar.

References:

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The influence of defoliation caused by the Stereonychus fraxini L. beetles on the radial growths in the Siret basin stands

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Abstract:

The appearance of mass multiplication of a primary defoliator - *Stereonychus fraxini* L.- in the past years, which caused injuries of economic importance, imposed measures of knowledge of pest biology in order to supervise and even combat it (Simionescu, A. și al.,2012).

The research aimed at understanding the influence of defoliation caused by the *Stereonychus fraxini* L. beetles on the growth and vitality of forest stands with ash trees in their composition or ash forest stands.

In the field, the network with permanent control surfaces has materialized, and also had done observation and measurements, and from there, were periodically harvested through the vegetation season for all various stages of insect development, biological material for laboratory analysis.

In order to determine the effect of defoliation on forest stand vitality, the same stands –defoliated and witness- were used and annual observations on the occurrence of dry trees were carried out. The measurements were limited to certain permanent sample surfaces (sample lots), and the observations and experiments were performed in several stands of different diameter classes.

Defoliation causes a sensible reduction in growth of trees in forest stands. Complete, unrepeatable defoliation has important consequences on tree vitality, especially in the case of early defoliation, causing a 50-70% reduction in the vegetative mass compared to the witness trees unaffected by defoliation; the effect of defoliation manifests differently, depending on the age of the stands, being more pronounced in young stands than in older ones; repeated defoliation within the same year causes partial or total drying of the trees towards the end of the vegetation season (Blaga, 2010).

The defoliation caused by *Stereonychus fraxini* L. in ash stands or broad-leaved stands with ash trees in their composition generates the reduction in growth of wood mass (when the defoliation exceeds 25% of the foliage surface); the age of the stands influences the reduction in growth due to defoliation, in the sense that young stands are more sensitive than old (mature) stands; in severely and very severely defoliated stands, a small percentage of dry trees is observed. Drying occurs especially among the trees belonging to the last classes in Kraft's classification and in the case of young stands not subjected to specialized treatments/care; it would be equivalent to an accentuation of the self-elimination phenomenon (Blaga, 2010).

Prevention of defoliation is possible through pest control methods. Pest control treatments manage to prevent defoliation and to put an end to mass multiplication of insects.

Keywords:

defoliation insects, ash plantations, radial growth.

References:

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Soil respiration in a virgin and former virgin beech-silver fir forest of Southern Carpathians

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Abstract:

Soil carbon dioxide efflux, the major part of ecosystem respiration, is useful to estimate net ecosystem production (NEP) of old growth forest. However, investigations of soil respiration in virgin forests are very rare due their scarcity. In this study we investigated the variability of soil respiration in a beech-silver fir virgin forest (Southern Carpathians) (VF) and in a former virgin forest (FVF) with similar tree composition located in its proximity, in which the first silvicultural interventions were carried out ten years ago. In each forest type, six plots of 50 x 50m was randomly chosen and divided in 16 subplots (12.5 x 12.5 m). Using IRGA technique the soil respiration was measured in Spring, Summer and Autumn 2017 in centre of each subplot and the main factors that can modulate it (soil temperature, soil moisture, soil carbon and nitrogen content, pH and structural stand characteristics) was determined.

The mean value of soil respiration was 2,72 μ m^{-2} s^{-1} in VF compared to 3,68 μ m^{-2} s^{-1} in FVF. The rates of soil carbon dioxide ranged from 1,99 μ m^{-2} s^{-1} in November in VF to 5,43 μ m^{-2} s^{-1} in August in FVF. Highest within site variability of soil respiration was found in FVF during the summer season FVF (CV=47%) and during fall season for VF (CV=56%).

The high spatiotemporal variability of soil respiration rates was influenced by environmental factors, especially by soil temperature. Reducing the stand density by silvicultural intervention influences significant the soil respiration rates, especially in summer when the soil perturbation and the high intensity of light were the most affecting indirect factors which explained variability in biological and environmental soil ecosystem.

Acknowledgement:

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Applications of artificial Neural Networks and forestry

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Abstract:

Planning of wood raw material production jobs, production of wood raw material, splitting the work covers the extraction, planning of forest roads and forestry, such as the main transport This situation has a complex structure that requires effective and harmonious design and application within itself and between each other.

Artificial neural networks (ANN) is a methodology developed from the biological working system of the human brain. Very complex problems are applied. Different modeling methods based on Artificial Neural Networks (ANN) are used by many researchers as a popular method in different engineering applications.

The aim of this study is to attract the attention of the researchers in forestry area to this method, and to introduce the method as an alternative for the solution of forestry problems.

In this study, ANN method is explained and its method is applied in various forestry areas. The aim is to draw the interest of researchers working in the field of forestry and to make them considered as an alternative method of solving forestry problems. At the same time, it was tried to focus on why forestry should be used in this study and what kind of benefits it could provide.

Keywords:

Forestry studies, Artificial neural networks, modelling

Sustainability of MOTTLES monitoring system: a comparison with traditional methods in terms of economic and environmental costs (Life Cycle Assessment analysis)

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Abstract:

Forest monitoring is a crucial point for the protection of forests from different stressors. Ground-level ozone is one of those stressors. Our knowledge on ozone impacts on real-world forests is at present imperfect. Most European countries carry out forest monitoring, but different country-specific approaches make comparisons at the European level problematic. The LIFE project MOTTLES aims to harmonize ozone monitoring approaches at forest sites by establishing a permanent new-generation monitoring system, in order to define new standards based on stomatal flux, i.e. PODY (Phytotoxic Ozone Dose above a threshold Y of stomatal uptake). Currently, PODY is under discussion as new European legislative standard and is included among the parameters to be monitored within the revised National Emission Ceiling (NEC) Directive. Fluxes are modelled thanks to continuous measurements of meteorological parameters and ozone concentrations with hourly temporal resolution, requiring continuous active monitoring by meteorological and ozone sensors instead of biweekly passive monitoring by ozone diffusive sampling which gives a concentration value integrated over time. Thanks to the technological development of solar panels, it is now possible to install continuous monitors at remote sites even when electrical power supply is not available. The aim of the present study is to assess the sustainability of this active monitoring system from an economical and environmental point of view. The economical evaluation is carried out through the comparison of costs for the installation of the two systems (active vs. passive), while the environmental costs are analysed through Life Cycle Assessment (LCA) in terms of savings in CO_2 equivalents and photochemical oxidant formation equivalents LCA is an internationally recognized methodology that evaluates the entire life cycle of a product, process or service to identify, quantify and to environmentally analyse all of the inputs and outputs involved in the production, use and disposal of that product, process or service. Starting from the installation of monitoring stations, different data, such as number of trips, working hours, distances etc., are collected to implement the LCA assessment at the end of the first year of monitoring. The environmental assessment is conducted using suitable characterization factors for the computational implementation.

Biodiversity survey of fungal communities associated with Scolytine beetles

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	Imperial College	
Alfried Vogler	Natural History Museum	United Kingdom
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Abstract:

Scolytine beetles associate with pathogenic fungi leading to the devastation of huge forests, which has important ecological and economic effects. Fungal diseases caused by pathogenic fungi are often vectorised by these beetles. Beetles create egg galleries into trees, by which pathogenic fungi get expanded to the whole tree. From a single beetle, a whole new generation emerges, spreading the fungus to other trees. These beetles are classified into two main categories depending on their feeding style. While bark beetles only use fungi to get extra nutrients, ambrosia nutrition rely on fungi.

My Ph.D. aims to clarify the role of bark and ambrosia beetles in the dispersal of tree-pathogenic fungi in the UK. Ecology and taxonomy are combined with new genomic methods of identification of fungi such as Metabarcoding. This technique identifies potential pathogens through its DNA barcodes. DNA barcodes are standardised short sequences of DNA that works as unique identification markers for all species. High-throughput sequencing of fungal communities carried by these beetles can be performed directly on the DNA extracted from individual beetles(Miller et al., 2016), giving an unprecedented resolution of their species composition and association with particular beetle species, host trees, climatic conditions or biogeography.

A biodiversity survey of fungal communities from Scolytine beetles trapped in different forests across the United Kingdom will help to understand how beetle and fungi interact, revealing potential pathogenic fungi before any sign of pest or disease outbreak.

Reference:

Miller, K.E., Hopkins, K., Inward, D.J.G., and Vogler, A.P. (2016). Metabarcoding of fungal communities associated with bark beetles. Ecol. Evol. *6*, 1590–1600.

Volumetric growth of a new thinning methodology in *Nothofagus* forests under forest management in Southern Patagonia.

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Abstract:

The forests of Nothofagus form the entire timber resource for the sawmills in Tierra del Fuego, Argentina. Most of the studies on growth in forests of *Nothofagus pumilio* (lenga) in the region have focused on mature forests, being scarce in harvest forests and even less after the application of intermediate treatments. The establishment of permanent plots allows to know the evolution and response of trees to silvicultural interventions (e.g., growth and mortality) that affect their forest structure. The objectives of this work were to determine the differences in forest structure and growth of a young stand of *N. pumilio* in the Aguas Blancas experimental plot. The study forest was installed in 1967 and a thinning was carried out in 1985 using 2m width strips alternating crossed transversely (checkerboard), and later in 1999 a selective thinning was performed. In this work three situations were compared: control thinning (CT, only thinning in 1985 n = 15432 ind / ha DBH = 4.2 cm), strong thinning (STT, thinned in 1985 and 1999 n = 2933 ind / ha DBH = 6.8 cm) and soft thinning (ST, in 1985 and 1999 n = 6141 ind / has DBH = 6.9 cm) during the period 1999 - 2010. Simple and multiple ANOVAS were performed, and the means were separated by the Tukey test ($p < 0.05$). This forest responded favorably to the application of different levels of thinning. The growth in individual volume for the year 1999 did not present differences for all treatments (0.0014 m3.yr-1.), While in 2008 the differences were the most marked (CT 0.0017 m3.yr-1, ST 0.0039 m3 .year-1 and STT 0.0046 m3.year-1). An increase in the annual individual growth in the treatments was observed until reaching a maximum of 6 years after the thinning, gradually decreasing until reaching the initial values in the year 2010. In contrast, ST presented the greatest volumetric increases (13, 6m³ / ha.year) compared to the highest intensity (9.5m³ / ha.year). Silvicultural interventions improve individual growth levels, meeting the objectives of forest management.

Management proposals in Nothofagus forests in Tierra del Fuego: What did we learn from long-term study permanent plots?

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Abstract:

Nothofagus forests provide numerous ecosystem services in Tierra del Fuego, and have been used by mankind throughout its history. The impacts received by the forests generate changes in their structure and function, and it is necessary to know: (i) if the resilience of these is able to absorb the impacts and return the ecosystems to their original condition, or (ii) if the impacts generate Novel ecosystems with different characteristics. Silvicultural management modifies the original forest to achieve production objectives (e.g., quality timber or livestock breeding). The management cycles include many years (e.g. > 100 years) being necessary to have long-term information for the development of new proposals that keep the provision of ecosystem services and ensure sustained economic production in the time. The PEBANPA network (Plots of Ecology and Biodiversity of Natural Environments in Southern Patagonia) established by INTA CADIC seeks to give answer to these questions, and has permanent plots of regeneration, silvopastoral system and intermediate treatments. This work presents some results in reference to questions about forest management and forest conservation, including: (i) litter production, (ii) seed production, (iii) regeneration dynamics, (iv) herbivory damage, (v) canopy stability, (vi) growth, (vii) impact of pests, (viii) biodiversity, (ix) invasion of species, and (x) climate change. The results obtained from these monitoring have allowed determining which are the most important variables for each management or conservation objective, identifying the most influential indicators and the lowest implementation cost, maximizing the results and minimizing the costs of field measurements.

Ecosystem services provided through afforestation of degraded lands in south-eastern Romania (Case study)

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Abstract:

After Romania was the first nation of Annex I to the Kyoto Protocol, which ratified this international agreement, our country has started in the year 2002 the first project of afforestation of degraded agricultural land through a Joint Implementation mechanism (specific to KP) for the purpose of trading CO2 emissions reductions resulting from 15-year storage of atmospheric carbon in forest ecosystem pools (biomass, necromass and soil). Partners within the Afforestation of Degraded Agricultural Lands Project in Romania were the World Bank and the National Forest Administration - Romsilva (as project entity), the annual monitoring of the project being provided by the National Institute for Research and Development in Forestry "Marin Drăcea".

Within the project an area of approx. 6,000 ha of degraded lands were afforested spanning across 7 counties in southern and eastern Romania where the areas occupied by forests was very low and the effects of the desertification phenomena were obvious (e.g. prolonged drought, high average temperatures, "flying sands"). The main species used for afforestation were indigenous oak, poplars and willow species, a number of auxiliary species as well as black locust, but only in situations where the stand conditions did not allow the use of indigenous species.

The aim of the paper is to present the main ecosystem services generated by the plantations over the 15 years of continuous implementation of the project. Based on the latest project monitoring results the identified services include air quality improvement by storing 319673 tCO2 in the trees biomass, remediation of land degradation by stopping sand deflation on 1890 ha and biodiversity improvement by offering shelter to a number of 31 bird species and 7 mammal species that have been identified within the project bounderies. Local communities lives was improved one hand by the access to a renewable source of energy (1650 m3 of wood harvested from tending operations) and on the other by benefitting new revenues from working in the afforestation activities or by being paid for the value of the emission reductions in the case of private owners of plantations included in the project.

The specific activities of the project were pioneering at the start of the project (e.g. the elaboration of the carbon stocks monitoring methodology) and remain current in the context of Agenda 2030, and in particular with the Sustainable Development Goal 15.3. - "By 2030, combating desertification, rehabilitating degraded land and soil, including land affected by desertification, drought and floods and achieving neutrality of land degradation."

These young plantations shall ensure that future generations from the rural communities directly affected by the afforestations, will benefit from forest specific ecosystem services.

Keywords:
desertification, biomass, carbon storage, services, ecosystem

Afforestation technologies for afforestation of degraded land from the Vidra Experimental Base

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Abstract:

The technologies of afforestation on degraded lands have been concerned the specialists from our institute since establishment, year 1933. Among the first experimental plot in areas for afforestation of degraded lands are the ones installed between 1953-1957, in the Ruget-Colacu and Scaune perimeters in the current territory of the Vidra Experimental Base. Later, in the year 1981, a network of long-term research plots was located in representative degraded lands of Romania (Traci, Untaru, 1986). Among them, 34 were located in the current territory of the Vidra Experimental Base.

The paper presents the results obtained from the experiments performed, regarding the techniques of lands preparation and consolidation for afforestation, the planting technologies, as well as the subsequent evolution of the forest plantations in relation to the environmental conditions.

The results of the experiments represent the scientific basis for the technologies of afforestation on degraded lands and some of them were appreciated as innovations and were later patented (Constandache et al., 2010).

Key words:

degraded lands, afforestation technologies, experimental plots

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Traci C., Untaru E., 1986, Comportarea si efectul ameliorativ şi de consolidare a culturilor forestiere de pe terenurile degradate din perimetre experimentale, ICAS Seria II-a, 70 p.

Ozone deposition in a Mediterranean forest

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Abstract:

Tropospheric ozone is a powerful oxidant of particular concern for plants. Ozone penetrates stomata and leads to oxidative stress and damage to plant cells. This stress impairs many physiological processes reducing carbon assimilation, inducing early senescence and affecting stomatal functioning. However, the net effect of these various impacts on plant health and growth is not well understood. Studying these dynamics in Mediterranean region is particularly relevant because of its climate characterised by high summer temperature and strong insolation that favour tropospheric ozone formation. Vegetation in this region has developed adaptations to the dry-hot summer conditions that could make them avoid or reduce the ozone stress. With the aim to verify if and how much ozone could affect the ecophysiological processes of the Mediterranean vegetation, we applied a multi-layer canopy model to a holm-hoak forest at Castelporziano, a natural reserve near the city of Rome (Italy). We tested different models of stomatal conductance and different methods to assess ozone impact on plant biochemical processes. We used continuous Eddy Covariance (EC) data to validate the model with the aim to identify which method could best work in a particular ecosystem such as the evergreen mediterranean forest. With this work we want to highlight the importance of integrating environmental monitoring and modelling for a deeper understanding of the complex mechanisms that affect forest ecosystems.

Realizing an adequate structure for wathershed protection thru continous forest cover transformation cuttings in Vaida forest (Săcele)

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Abstract:

Vaida forest, covering 23,5 ha, is located in the watershed of the creek with the same name, a tributary of the Târlung river, which is tributary to the Târlung reservoir.

Being located altitudinally between 950 m and 1250 m, in mountain mixed-forests vegetation belt, and having the age of 150 years and a relative multiage structure, the studied forest is managed to fulfill the aim of protection of the slopes of the creeks which are filling Târlung reservoir (TIV).

In order to fulfill in good condition the given function of watershed protection, in the studied stand was decided to obtain an adequate structure thru continuous forest cover transformation cuttings. Thus, starting from a relative multiage structure, which existed in the stand, in the studied forest two cuttings were done, and in this year the third cutting will take place.

At the first cutting, which took place in 1997, the aim was to obtain a stand structure close to the continuous cover one, but especially, to cut the trees from middle diameter categories, especially the dead ones and the ill shaped.

At an initial stand volume of 705 m^3 and a proportion of species on volume of 73BR23FA*, the harvested volume represented 102 m^3/ha, which correspond to an intensity of 14%.

As result of the first cutting the structure of the stand did not changed very much, but what was obtained was that the seedlings were not shaded anymore.

The second cutting with transformation cuttings, done in the year 2008, was done starting from a volume of 727 m^3/ha and a stand composition on volume of 70BR30FA, having as a result a harvested volume of 141m^3/ha and an extraction percent of 19%. With this intervention was done also, beside promoting the existing seedlings, new regeneration points in the existing stand.

For a third cutting, which will take place this year (2018), the existing standing volume was computed (678 m^3/ha), at a composition of 62BR38FA, and based on the values from the Technical norms forest management planning, according to the forest type and aim composition of the stand, an optimal standing stock was computed (556 m^3/ha). This was compared with the standing stock; thus, a volume of 122 m^3/ha will be extracted, representing an percent of 18%.

Thru the works that will be done, the structure of the stand will be guided towards a continuous cover structure, by extracting trees from the middle classes diameters and even large trees and by promoting and creating favorable conditions for the natural regeneration of the stand.

Assessment of logging trails erosion coupled with timber harvesting

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Abstract:

Soil presents an important role in the development of ecosystems, it controls the water flow and also stabilizes the Earth temperature. Due to the use of mechanized wood harvesting and of the climate changes, the forest soil has suffered seriously degradation processes and the most important is erosion. This study shows the degree of forest soil erosion due to logging trails execution in the Sacele Experimental Base (B.E. Sacele).

Taking into account that the forests managed by B.E. Sacele are located upstream of the Tarlung reservoir, the soil erosion study due to timber harvesting is of high interest, given the accelerated lake rate of clogging. In this regard, the existing and new logging trails have been measured before and after wood cutting operations in the winter of 2016/2017. Cross-sections were placed in characteristic points, defined by landmarks at the tree bases. All the dates recorded were analyzed using AutoCAD, GIS and MSExcel.

Wood collecting routes have the total length of 5584 m, a surface of 27195 m^2 and the average width 4.87 m, ranging from 2.30 m to 12.00 m. The average volume of eroded soil in the profile was relatively low, of 0.54 m^3/m, spread between 0.02 – 3.51 m^3/m, and the average volume of deposits was 0.14 m^3/meter of road, ranging from 0.00 – 1.18 m^3/m. The overall soil loss volumes recorded during the period 2016-2017 for the logging trails are 2.5 times higher than on the roads from which no biomass or very low volumes have been removed. It was noticed that the land deformation was preserved even if the roads were not used in the recent years.

We suggest that this results to be integrated in a data base that can be further used for developing risk maps regarding soil degradation due to the use of forestry machinery, thus contributing to the implementation of adequate management solutions for sustainable forest management.

Keywords:

soil erosion, mechanized harvesting, logging trails

Carpatii de Curbura - a bridge between Carpatii Meridionali and Carpatii Orientali, in terms of capercaillie connectivity

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Abstract:

Habitat fragmentation affects the genetic structure of populations (Giles & Goudet 1997). If the populations remains connected through the dispersal of some individuals the genetic diversity can be maintained (Segelbacher & Storch 2002). In this study, DNA from 137 samples collected across Romanian Carpathians was amplified using 9 microsatellites (designed for this species). The genetic research conducted on capercaillie, using non-invasive techniques, indicated that Carpatii de Curbura, act as a connectivity bridge for Carpatii Meridionali and Carpatii Orientali. The population from Carpatii de Curbura has been differentiated in the philogenetic analyses, as a single cluster and registered the highest genetic diversity. Ensuring the protection of the habitats from this mountain range, can contribute in maintaining a healthy and vigorous population thus ensuring species conservation across Carpathians.

Growth's aspects of virgin and quasi - virgin forests from Eastern Carpathians

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Abstract:

Virgin forests in Romania has a significant role for entire world, because these forests keep natural values who have been lost from other country patrimony. These types of forests, so called "virgin forests" or "quasi – virgin forests", are also identified in Buzau Mountains which are a part of Eastern Carpathians from Romania. Research are situated in Penteleu Mountains, a part of Buzau Mountains. For understanding and develop principles of virgin forests growth, from three permanent research plots of one-hectare area, useful field data were collected. A representative number of standing trees (70 – 80 trees in each research plot) were cored at breast height, by following the cardinal points (N, E, S, V), in order to reduce the influence of the transversal form section, using an increment borer for annual radial growth analysis over the last 10 years. Cores were mounted, sanded and polished. Ring width was measured using Coorecorder and CDendro computer programs. Then, were analyzed relationship between average radial growth over the last 10 years and DBH, the structure of studied stands in relation to diameter increment (the experimental diameter increment distributions were adjusted using the theoretical frequency functions Gamma, Gamma 3p, Gamma mixture, Gen.Gamma, Weibull and Weibull 3p). In the end, volume increment was determined and its distribution in relation to DBH was analyzed. Logarithmic equation used in graphical representation of volume increment in relation to DBH is applicable to virgin and quasi-virgin stands studied in this case (Giurgiu,1979). In comparison with the managed stands from the selection forests, where the volume growth is to 6,7 m3· year-1 · ha-1 (Duduman,2008), the Penteleu virgin and quasi-virgin stands have the characteristics of a stand with high volume growth. The virgin and quasi-virgin forests have an optimal diversity that gives them greater stability and polyfunctionality and they can be models for managed forests.

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The success story of the European beaver (*Castor fiber* L. 1758) reintroduction in Romania

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Abstract:

It is being recognized the multidimensional character of the niches of the different species, manifested by the modification of the physical characteristics of their environment. Typically, these species are known as key species having a particular influence on ecosystems and causing changes in biochemical composition. Eurasian beaver (*Castor fiber*) has disappeared from Romania in the beginning of the 18th century, however in the recent history (1998-2003), 190 individuals captured from Bavaria were reintroduced in 3 main river basins (Olt, Mures, Ialomita). Nowadays, more than 2500 individuals are occupying habitats across the country also on tributaries, beaver dispersal being realized first on short distances. The research was carried out in Romania along the main river network. A total of 98 tissue samples (tail) were collected during two years, under the annual derogations by capturing the individuals and DNA fragments were amplified using a set of nine fluoro-labelled microsatellite markers. The mean of genetic diversity in the Romanian beaver population is higher that the one reported in previous studies at European level, moreover, this suggest the existence of an evolutionary process and natural selection in the beaver population after reintroduction. We found low levels of genetic differentiation between the nuclei, however the highest degree of differentiation was registered between Covasna - Harghita and Ialomita, followed by Brasov - Sibiu and Ialomita. These results offers a good resolution in determining species evolution, offering an excelent tool for permanent monitoring and for determining if the population requires new genetic material from different areas over time.

The evolution and importance of torrent control structures on Bogdan's Valley

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Abstract:

Bogdan's Valley watershed is the first torrent control objective built by Romanian government. The first torrent control structures were aimed to defend two important transport infrastructure connecting the cities of Brasov and Bucarest.

A first stage of the watershed management was accomplished in the 1890s. In these years, wooden bows were built. But, due to massive flash floods from 1900-1905s, they were destroyed. Thus, in 1905 constructed 12 torrent control structures of stone masonry with cement mortar were built.

In the interwar period, a study was carried out assessing the behavior of structure built before the First World War (Drâmbă, 1937). Concluding , the fact that 12 torrent control structures were placed at a far distance from each other (approximately 300-400 m). In this situation, in order to reduce the torrentiality degree of the Bogdan's Valley, the author proposed the construction of other same structures, intercalated among the existing ones.In the same time, he proposed to afforestate the slopes of the watershed to reduce the runoff.

Between 1992-1994, the Forest Research and Management Institute (ICAS) was conducting a national inventory of torrent control structures. This inventory shows that in the Bogdan's Valley, 59 structures were built.

Between 2009-2011 a monitoring systems for torrent control structures was carried out (Davidescu et al, 2012; Gancz et al., 2015; Tudose et al., 2017), the physical status of Bogdan's Valley structures being evaluated using the condition rate equation (Tudose et al., 2017).

In this paper, based on the comparative analysis of historical data (Drâmbă 1937; ICAS 1994) and using the data available on abht.ro site, an assessment of the evolution of the physical status of the torrent control structures built on the Bogdan's Valley river watershed and the way in how these works have achieved their goals was made.

Keywords:

torrent control structures, monitoring systems, condition rate.

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Floristic composition and similarity analysis of forest ecosystems in Bucegi Mountain LTER-sites

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Abstract:

In the Long–Term Ecological Research (LTER) site located in Bucegi Mountains (Southern Carpathians, Romania), the vegetation survey was carried out on a network of 9 permanent plots. Each LTER plot represents an area of 0.7 ha and consists of 5 circular sub-plots of 500 m^2. The survey is part of a transdisciplinary study on the monitoring of air pollution, bulk precipitation, throughfall, soil conditions, nutritional status, health and growth of key tree species. Vegetation investigations were based on the Braun-Blanquet method, combined with numerical syntaxonomic analyses (hierarchical cluster analysis and Detrended Correspondence Analysis - DCA).

Four forest plant communities (associations) were identified: two European beech communities (*Symphyto cordati-Fagetum* Vida 1959 and *Hieracio transsilvanici-Fagetum* (Vida 1963) Täuber 1987) and two associations with Norway spruce (*Hieracio transsilvanici-Piceetum* Pawl. *et* Br.-Bl. 1939 and *Chrysanthemo rotundifolii-Piceetum* Krajina 1933). Also, two coniferous plantations were identified.

The cluster analysis reveals the separation of beech forest communities from the spruce ones and from the coniferous plantations. The DCA analysis shows a similar result to that of the cluster analysis, 4 main groups of phytocoenoses having been obtained. The two axes of the ordination diagram can be associated with ecological variables. Thus, over the first DCA axis overlaps an obvious altitudinal gradient: in its right extreme are grouped the phytocoenoses with spruce from higher altitudes (over 1600 m a.s.l.), due to the presence in the herb synusia of the flora elements characteristic of this higher vegetation range. At the opposite pole, at the origin of the axis, the lower altitude beech communities are grouped together. The second DCA axis should be associated with a soil moisture gradient: at the farthest edge of the axis, the wet-mesic, springwater-dominated spruce phytocoenoses are located.

The results obtained by the hierarchical cluster analysis show that the *a priori* classification of forest phytocoenoses in the above mentioned plant associations is a correct, objective one, based on the floristic structure of the communities and on the differential species of the herb layer. The use of DCA has revealed the spatial distribution of phytocoenoses at the ecosystem level according to the existing ecological gradients.

Forest condition monitoring in the Republic of Moldova for the period 1993-2017

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Abstract:

Assessment of the health of forests in Moldova is produced annually on two sample plots surveys networks. European Network – with the density of one sample plot to 25 600 ha (16X16 km) - 10 sample plots. This network gives annual information on physiological injuries (defoliation, discoloration) and biomass data increment, volumes - recorded every five years. National network of permanent sample plots with the density of one plot to 400 ha (2X2 km) - 618 permanent plots, is intended for health surveillance of trees and forest inventory. This network gives us information on the physiological injuries (defoliation and discoloration of trees crowns).

The most affected species are oaks and black locust, which occupy 40% and 36% of Moldova's forest. The average percentage of defoliation of oaks is 67,5%. For black locust the average percentage of defoliation is 72%, higher than average percentage of defoliation of all species.

It is alarming that the percentage of trees in defoliation classes 1-4 for main forest species is over 60%, or more than half of the assessed trees are affected by the phenomenon of defoliation and discoloration.

In the reference period 1993-2017 the crown condition of forests in Moldova presents cyclical variations as follows: during 1993 - 1998 predominate trees from class 0 (less then 10% defoliation); in 2000 - 2004 period predominate trees from classes 1-2 (up to 60% defoliation) ; during 2004 - 2011 predominate trees from defoliation class 0 and during 2011 - 2017 predominate trees from defoliation classes 1-2. The same cycle is observed for discoloration: 1995- 1999; 2002-2004; 2004-2011; 2012-2017.

The main causes of defoliation and discoloration are abiotic factors such as: severe droughts associated with high temperatures.

Distribution, structural and functional characteristics of beaver dams (Castor fiber): Case study Black River Basin

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Abstract:

By his ethology, beaver is known to be the species that create and modify wetland habitats.

One of the important aspects that need to be monitored are the placement of dams because they affect runoff the streams and also the development and formation of wetlands. Considering the category of land use adjacent to beaver colonized rivers, they can produce several damage and conflicts.The study area, Black River Basin, has a high density of beavers, so monitoring their activity is necessary to benefit from their presence and to manage conflicts as effectively as possible.

There were identified 148 active beaver dams with an average length of 6.2 meters, average height of 1 meter and average width of 1 meter.

Keywords:

castor fiber, beaver dam, monitoring, management

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Variable retention as land sharing strategy to conserve arthropod diversity in forests and non-forest ecosystems of southern Patagonia, Argentina

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Abstract:

Variable retention is a silvicultural proposal to mitigate harmful effects of traditional harvesting practices on biodiversity of forests (Kohm and Franklin, 1997), and their benefits for several organisms have been reported worldwide (Lindenmayer et al., 2012). However, we suggest this approach could be useful not only for forests, but also for other ecosystem types. Here we presented some results that could justify their implementation as land sharing strategy in both forest and non-forest ecosystems of southern Patagonia (Argentina) to improve arthropod diversity conservation.

We studied above-ground arthropod communities (mainly Coleoptera, Formicida, Solifuga) using pitfall traps in *Nothofagus pumilio* forests, *Mulguraea tridens* scrublands, and magellanic steppes. The studied forests were located in Tierra del Fuego Province, while the scrublands and the steppes were in Santa Cruz Province. In these forests and scrublands, retention approach had been implemented, therefore we studied aggregated and dispersed retention harvesting in forests (Martínez Pastur et al., 2009), and managed cut and retention strips in scrublands (Sola et al., 2016). On the other hand, we selected dry and humid steppe habitats; both impacted by livestock grazing. For all ecosystem types, control situations without harvesting neither grazing impacts were sampled as reference. Richness, abundance, occurrence frequency, Shannon-Wiener diversity and Pielou evenness indices, and similarity among assemblages were evaluated using univariate and multivariate statistical tests.

In forests and scrublands, we found that retention approach (aggregates or strips) allowed the partial maintenance of arthropod community structure, preserving some of their characteristics more similar to natural and non-impacted ecosystems. On the other hand, dry and humid steppes presented significantly different arthropod assemblages, but grazing homogenized and resembles communities by loss of species, showing the need to implement strategies that mitigate impact, or exclude areas from livestock use.

We conclude that land sharing could be implemented in forest and non-forest ecosystems to preserve arthropod communities, being the variable retention approach a good alternative for private or public lands. Likewise, legislation to promote conservation (like National Law 26331) could be not only generated for and implemented in forests, but also in non-forest ecosystems.

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Creating a map of reforestation on abandoned agricultural lands in Republic Mari El using satellite images

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Abstract:

The aim of the study was to find the optimal combination of the Landsat 8 satellite imagery channels for revealing the young trees on the former agricultural lands of the Republic of Mari El, and also to create a map of agricultural lands that are overgrown with tree species.

To achieve this goal, the following tasks were accomplished:

• Cloudless images of the satellite Landsat 8 on the investigated territory were selected;

• Several spectral channels of Landsat 8 images were used to identify their optimal combination;

• Thematic mapping of selected three-channel images was carried out;

• The areas of agricultural lands of the Republic of Mari El, overgrown with tree species, were identified.

The object of the study was the abandoned agricultural lands of the Republic of Mari El.

Materials and methods. Evaluation of the accuracy of the developed thematic maps allowed to identify the optimal combination of spectral channels of satellite imagery and the time of survey.

For thematic mapping using the method of controlled classification (maximum likelihood) and evaluation of the maps obtained, the data collected for the 2007-2016 field season were used. In the process of thematic mapping, three classes were identified on each survey: agricultural land (including unused ones), young growths of coniferous species, young growths of deciduous species.

Results. The evaluation of the resulting thematic maps was carried out using control points obtained in the test areas, with the Kappa coefficient (k) being determined. The highest accuracy was shown by the thematic map, obtained from the spring image in combination of the 6-5-2 (SWIR2 - NIR - BLUE) spectral channels. The Kappa coefficient, which has a value of 0.66-0.67 for spring shots, indicates good consistency of thematic maps and field data.

Conclusions

• The developed thematic maps testify to a stable process of mass overgrowing of young tree vegetation in the territory of the Republic of Mari El.

• The most accurate was the thematic map obtained by the spring snapshot in combination 6-5-2 (SWIR2 - NIR - BLUE) spectral channels.

• Thematic mapping of young forests on deposits allowed to determine the area ofovergrowth for 2017. The total area of agricultural land according to the obtained thematic map reaches 763694.46 hectares, while overgrowing of young growths of deciduous species up to 123776.19 hectares (1.6%), respectively, and overgrowth by young conifers species reaches 52557.12 ha (7%), respectively.

Pollution evolution in Copșa Mică forest area

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Abstract:

In Romania there are areas where, historical pollution produced a significant influence on the environment. An intensely polluted area that has been in our attention is Copşa Mică, which is considered one of the most polluted cities in Romania and Europe. Thecity was developed around two industrial areas (first for non-ferrous ores extractive metallurgy and the second for carbon black production). The pollution remains in the surrounding environment long time after even the factories have been closed.

Soil contamination evolution with cadmium, copper, lead, and zinc was analyzed during the four campaigns of the forest management planning (1977, 1999, 2008, and 2017).

The monitoring of pollution evolution aims at assessing the pollution of the forest environment and finding low-cost and efficient soil remediation solutions.

Identification, mapping and conservation of four protected saproxylic beetles from the Prigoria-Bengeşti protected area (ROSCI0359)-Romania

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Denisa Lavinia Badiu	University of Bucharest, Centre for Environmental Research and Impact Studies	Romania
Marilena Onete	Romanian Academy, Institute of Biology Bucharest, Department of Ecology, Taxonomy and Nature Conservation	Romania

Abstract:

Romania's protected area network currently covers 16.76 % of the national territory, and comprises 383 protected areas (Brânzan & Mănoiu, 2013). One of these protected areas is ROSCI0359 Prigoria-Bengeşti – a Site of Community Interest (SCI). It is situated in the northeast part of Gorj County, within the Getic Subcarpathians and covers 2490 hectares. In this protected area, four protected saproxylic species were identified: *Osmoderma eremita* (Scopoli, 1763), *Lucanus cervus* (Linnaeus, 1758), *Morimus funereus* Mulsant, 1862 and *Cerambyx cerdo* Linnaeus, 1758. The beetle fauna was sampled within the period March-September 2014. Ten dry tree pitfall traps were used and 98 transects were investigated. *Lucanus cervus* was identified in 59 transects, with a total abundance of 228 individuals; *Morimus funereus* was observed in 16 transects, with 47 individuals; *Cerambyx cerdo* recorded 22 individuals, in 9 transects. Direct observations identified one female of *Osmoderma eremita*, larval faecal pellets and seven pupation chambers. Using GIS mapping analysis, the distribution of these species was established in terms of the habitats described in the Natura 2000 framework.

The Natura 2000 habitat 9170 *Galio-Carpinetum* oak-hornbeam forests was the most favourable type of ecosystem for the investigated beetle species.

The local investigations revealed two major threats to the beetles e.g. forest thinning associated with timber cutting and extraction; and the high number of paths and trails.

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Structure and functioning of some forest ecosystems located in Curvature Carpathians of Romania

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Abstract:

The research was carried out in the ecosystems of sessile oak and beech with in Vizantea forests of Experimental Forestry Base Vidra. There were located three plots of 1 ha each, where information on the biometric features of component trees was collected.

The purpose of the research was to know the structure and functioning of the sessile oak and beech crops stands in the Curvature Carpathians, as a result of their current status, in the context of sustainable forest management and climate change over the last decades.

It has been shown that in the sessile oak and beech mixtures, the sessile oak retains its dominance only in the upper crown, in the middle and lower the beech has become dominant. The dominance of the beech (shade tolerant species) and the sessile oak tree (light tolerant species) in the composition of the stands influences the structure and diversity of the mixtures. From the analysis of the results so far, it can be concluded that without tending operations (helping natural regeneration, care cuts) or if there will be no major disturbance processes in the canopy, the beech will be the species that will dominate Vizantea forests in the future.

Keywords:

sessile oak, beech, stand structure, tending operations, natural regeneration

The photo trap method, a tool in estimating the density of large mammalian populations

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Abstract:

The density and distribution of species and also population attributes are critical data for biodiversity conservation. As an important tool for obtaining such data, photo trap camera have become increasingly common into wildlife research. It is known that the photo trap camera method has some limitations due to imperfect species detectability and the use of capture rates as surrogates for abundance. In order to reduce these limitations and increase the accuracy of density estimation we used the snow-track counting for calibration. The density of the large mammalian populations was assessed on an area of 2767.75 ha, covered by forest habitats, pastures, meadows, agricultural lands and orchards located in the Zarand mountains.

Field data collection was based on a grid of 0.5 x 0.5 km, which generated a total number of 19 transects, of which only 16 transects were used in the research, the other three overlapping the villages. On each transects two phototrap cameras were installed in the areas with the highest density of large mammalian species.

Recordings of photo trap cameras revealed the presence of the following species: wild cat (*Felis silvestris*), wild boar (*Sus scrofa*), roe deer (*Capreolus capreolus*), fox (*Vulpes vulpes*), badger (*Meles meles*) and pine marten (*Martes martes*).

Our results, have showed variations in the distribution of records at each sampling point and location, highlighting probability associated with trap location and orientation. The results, also have shown that the presence or absence varies between transects and over time. These differences resulted mostly from the habitat use and behavioral attributes of species. This method greatly reduces the amount of data needed for analysis, making it a practical management tool that provides additional information on the structure of the population and requires less experience.

Key words: photo trap, snow-track, estimating, mammalian population, density

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Study of K means clustering method approach in forest composition identification. Case study – Hanu Conachi Forest areas

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Abstract:

In this paper, we present the comparison between two implementations of the same recurrent algorithm for statistical analysis of spectral imagery. As a source of spectral images, the Copernicus ESA and LANSDAT services were used respectively. Using the data sets of the last 6 years, and considering a k-mean clustering statistical analysis method with the progressive inclusion of the captured imagery, we were able to obtain a forest composition identification. As a case study, were considered the Hanu Conachi - Independenta forest of Galati County. Although the entire study covers the period 1990-2018 and accumulates a 570 Gb basis, in this paper will be presented for comparison only the results from the last 6 years for which we have databases with ground records. A quality criterion was used to evaluate the performance of the two result groups. In this way, the obtained models could be compared with the data taken from the ground. The results obtained by the algorithm described in the paper highlight the innovative character of the method. In the final part, is presented the evaluating method results for the accuracy of this procedure.

References:

Yi Yi Aung, Myat Myat Min, An Analysis of K-means Algorithm Based Network Intrusion Detection System, Advances in Science, Technology and Engineering Systems Journal Vol. 3, No. 1, 496-501(2018).

Felix Morsdorf, Erich Meier, Benjamin Kötz, Klaus I.Itten, Matthias Dobbertin, Britta Allgöwer,
LIDAR-based geometric reconstruction of boreal type forest stands at single tree level for forest and wildland fire management, Remote Sensing of Environment, Volume 92, Issue 3, 30 August 2004, Pages 353-362, https://doi.org/10.1016/j.rse.2004.05.013

Mikko Malinen, New Alternatives for k-Means Clustering, Publications of the University of Eastern Finland, Dissertations in Forestry and Natural Sciences No 178, Metria M100 Auditorium at the University of Eastern Finland,Joensuu, on June, 25, 2015

Identification of Individual Tree Crowns From Aerial Imagery Using ANN Structures. Case Study Hanu Conachi - Independenta Forests

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Abstract:

In this paper, we present the comparison between two implementations of the same recurren. In this paper we present a first step towards identifying tree species online during an overflight flight. For this purpose, we have used multispectral cameras of several types. By using the database of the set of images taken and knowing the composition of the forest in a set of landmarks, we could reconstruct the distribution of species throughout the area. Hanu Conachi - Independence forest was used as a case study. The results obtained being promising, the research will continue.

References:

Yi Yi Aung, Myat Myat Min, An Analysis of K-means Algorithm Based Network Intrusion Detection System, Advances in Science, Technology and Engineering Systems Journal Vol. 3, No. 1, 496-501(2018).

Felix Morsdorf, Erich Meier, Benjamin Kötz, Klaus I.Itten, Matthias Dobbertin, Britta Allgöwer,
LIDAR-based geometric reconstruction of boreal type forest stands at single tree level for forest and wildland fire management, Remote Sensing of Environment, Volume 92, Issue 3, 30 August 2004, Pages 353-362, https://doi.org/10.1016/j.rse.2004.05.013

Mikko Malinen, New Alternatives for k-Means Clustering, Publications of the University of Eastern Finland, Dissertations in Forestry and Natural Sciences No 178, Metria M100 Auditorium at the University of Eastern Finland, Joensuu, on June, 25, 2015

Study of soil moisture dynamics in forests, depending on surface parameters and a reference in the Southern Carpathians areas

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Abstract:

The process of water transport in the soil is a subject studied in the literature. The way in which it can be assessed and especially predicts the level of soil moisture at different depths has been analysed many times. To process the statistical analysis, the Statistica 10 software was applied.

In the present paper, we present a set of mathematical models that correlate the moisture content of the soil at a certain depth, the surface and surface precipitation level to assess the humidity level at other depths. The obtained models by using mathematical interpolation structures, show good quality and performance. The results are compared to the neural network models outcomes which provide an accuracy of about 5 percent. As a case study, three areas of the Carpathians are analyzed: Predeal - Brasov county, Stalpeni-Mihaesti - Arges county and Fundata area - Brasov county. The results are based on databases containing over 15,000 records for each area, and are innovative and encouraging.

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Surveying pan-European Indicators for Sustainable Forest Management with NFI and Ancillary Data

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Abstract:

One of the goals of the National Forest Inventory (NFI) is to record the nowadays state and recent development of the Romanian forests in a representative and reproducible way, using various data sources and combination of different methods in order to systematically observe the fulfilment of the sustainable forest management (SFM).

Linking SFM knowledge needs with data needs it is a paramount process since most of the data are stored in relational databases belonging to various stakeholders (environment and socio-economic data) and evaluated using statistical software developed specifically for this purpose.

Furthermore, it is necessary to define and use new or existing models and tools based on information needs for analysis and predictions and to generate a powerful and relevant decision support system (DSS) for the benefit of forest policies and management, both at national and regional levels.

The methodology covers the analysis of information features and sources and information classification and characteristics. The methodology will explore the integration process of multiple data sources to generate accurate and consistent SFM indicators according to the international requirements (MCPFE, 2011; 2015).

The end results and conclusions will wrap up the available data features and suitability for generating SFM indicators relevant to decision makers.

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Long-term dynamics of growth in an oak periurban forests (Quercus robur L.) in the Bucharest metropolitan area

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Abstract:

Oak forests are particularly important environmentally, socially and economically for Romania, in addition to their contribution to the continuity of our people on this territory, we found self-identity and respect in the symbolic representation of the oak leaf and acorn, symbolising stability and a long history.

The main objective of the study is to gain knowledge on the influence exerted by the major disturbing factors on long term dynamics of growth in an oak periurban forests (Quercus robur L.) in northern Bucharest metropolitan area, near Snagov lake. This is supported mainly by the significant impact of different pressure factors (land use type, climate fluctuations, silvicultural interventions, invasive species etc.) on forests. Considering the variability of the climate regime, 15 negative pointer years and 16 positive pointer years were identified, from which 10 (1904, 1909, 1928, 1931, 1934, 1949, 1956, 1975, 1980 and 1984) were commonly identified in previous similar studies across Europe (Kelly et al., 2002), based on a simple method of time period window normalisation used to identify the pointer years (Schweingruber, Briffa, 1996). Their frequency had amplified slowly and steadily during 1840-2017 period, demonstrating the influence of increasing incidence of extreme climatic events. Temperature had a negative influence on growth, especially the maximum temperatures, which had a limiting factor influence. Factor analysis proved that precipitation amount and the temperatures explained 60% and 30% of the common variance of the tree-ring series, respectively. The assessment of radial increment across equivalent cambial age classes confirmed the negative trend for the oak trees in this region. Four age classes have been considered: 1-50, 51-100, 101-150 and 151-200 years, respectively. Confidence limits for each period were estimated (p=0.01), based on the number of sampled trees. The radial increment series were summarized to estimate long term changes. The statistical significance of the differences between the age classes was tested by comparing the confidence limits for estimated means, based on the number of measured tree rings.

The analysis of growth series confirmed the negative growth trend in the last 200 years, which was statistically validated by means of analysis of variance (p=0,01). The relative radial increment losses are between 9 and 18%, according to the considered tree age classes and compared to past data. The most plausible explanation of this trend is linked both to natural and anthropogenic stresses.

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The first outbreak of *Acrobasis tumidana* Denis & Schiffermuller, 1775 (Pyralidae, Lepidoptera) in Romania

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Abstract:

Acrobasis tumidana is a species of insect fauna in oak forests in Romania, which over time has not produced outbreaks. Symptoms specific to the damage caused by this species were reported each year, however, the freqvency and intensity of attacks were very weak.

This paper presents the distribution of infestations and quantitative and qualitative caracteristics of the outbreaks developed in southern Romania in the last two years, highlighting elements of species bioecology, closely related to the control of future populations. It is hoped this study will inform practitioners about identification and control of future populations.

Socioeconomic Impact of the Program of Payment for Environmental Services —Reforestation Modality— in Northwestern Costa Rica: Marketing aspects

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Abstract:

The purpose of this study was to assess the socioeconomic impact of the Program of Payments for Environmental Services (PPES) on beneficiaries who engaged in reforestation contracts between 1998 and 2013 through two forest grassroots organizations (FGO) in the northwest region of Costa Rica. Besides an extensive literature review, field visits and interviews with beneficiaries and program experts helped identified socio-economic characteristics; then a set of principles, criteria and indicators was developed and used to measure the social and economic impacts. The follow-up analyses considered three different approaches: the role of FGOs, the period (1998-2000, 2005-2007 and 2011-2013) and an overall analysis. General results indicate that beneficiaries are mostly impacted on the social dimension and those who process their contracts with the more consolidated organization derive more benefits. As main conclusion, the program has strengthened local capacities for forest development in the area, mainly through the active participation of FGOs and beneficiaries, although through time the perception of such benefits seems decreasing. Related to marketing aspects stands out the strong presence of intermediaries in these processes as well as the form of payment and the sale price of the wood.

Educational project on cognition and use of mushrooms at the Technical University in Zvolen (Slovak Republic)

Name	Institute	Country
Martin Pavlík	Technical University in Zvolen, Slovak Republic	Slovak Republic

Abstract:

The “wood-destroying fungi” is a special term for a big group of fungi connecting by the ability to damage and to decompose a wood mass. However, that primarily negative activity is a base for evolution and circulation of nutrients in nature. Abilities of some species of wood-destroying fungi and the quality of their fruiting bodies are intensively utilised already millennia all over the word, especially in Asia. Growing of interest in positive effects of fungi to health of people is evident especially during last decades. So-called “medicinal mushrooms” are the natural components of Slovak forest stands and are ranked mostly to so-called group of wood-destroying fungi. A lot of them are possible to cultivate by a relatively easy way. Some fungi species have the ability to decompose or bind toxic substances from the environment and can thus help in cleaning and revitalization of nature and landscape.

The realised project has been focused on students of Technical University in Zvolen, to introduce the possibilities of identification, recognition, processing of these rare fungi. Vast collections of fruiting bodies and cultures of wood destroying fungi have been made accessible to the students of Practical mycology course, as well as all the other students and research workers to help them with their research in properties and abilities of the fungi. By creating the Laboratory of Practical mycology, we allowed the students to practice the practical methods of growing, utilising, management and storage of wood-destroying fungi. The Borova hora Arboretum provides the means to present the methods of utilizing the wood destroying fungi as a part of the mycoremediation and subsequent decay of the waste dendromass and growing them under natural conditions of forest stands. The area allows us to test our abilities of growing fungi in terrain, substrate care and gathering of the fruiting bodies.

An important part of this project was a vast number of exhibitions, lectures and scientific seminars on mushrooms, which helped us in popularization of mycology as a nature-friendly way of utilizing mushrooms that is also beneficial to human health. Another important outcome of this project is an e-learning project focused on these topics, available to those who are interested, online. Naturally, a large number of publications has been published, both scientific and popularizing. Another basis of broadening the knowledge, practical skills and overall development of the Practical mycology course is a number of both pending and realised projects, based on collaboration between scientific organisations in Slovakia and other countries.

Structural and compositional diversity as a result of silvicultural pratices

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Abstract:

Forest stand structure and compositional diversity are two important elements of biodiversity. They can be therefore easily modified by silvicultural treatments. In this contex, forest management plans are an objective tool for collecting information about biodiversity and silvicultural practices. For the determination of stand structure and compositional diversity, methodology described by Skovsgaard (2000) was followed. The UMF (uneven-aged mixed forest) index was applied in a case study in the Buhoci area from Traian, Bacău county.

The stand parameters required by the index were extracted from existing data included in forest management plans and analysed for two periods (1952, 2008). The estimates of UMF index were calculated for each plot. On the base of multiple regression analysis, we also tested the potential influence factors for the two situations. The values of UMF index reported in the two cases vary as a result of different silvicultural operations applied along time.

More importantly, the obtained results can help to better address silvicultural practices and forest management strategies in the long-term development period.

Keywords:

diversity, forest management, stand structure, UMF index

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Skovsgaard J.P., 2000. The UMF-index: an indicator to compare silvicultural practices at the forest or estate level. *Forestry (Oxford)* 73(1): 81-85.

Nutritional status of most frequent Mediterranean forest trees in Croatia in relation to environmental pressures

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Mladen Ognjenović	Croatian Forest Research Institute	Croatia
Tamara Jakovljević	Croatian Forest Research Institute	Croatia
Melita Perčec Tadić	Meteorological and Hydrological Service	Croatia
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Abstract:

Mediterranean forests in Croatia account for 24% of total forest area. Although they are of small direct economic value, their social and ecological functions are very important (preservation of soil, air, water and biodiversity; carbon sequestration; impact on microclimate conditions; aesthetic and touristic function etc.). Several factors have been recognized to influence tree vitality, and the reasons for the deterioration of tree condition can be found in specific interactions of environmental pressures. Changing climate properties can be critical for the condition of trees, as they can bring about the disturbed water absorption and transport, and water deficits may cause inadequate nutrition of trees with a subsequent loss of tree vitality. Since the knowledge on the condition of Mediterranean forest ecosystems in Croatia is insufficient, the main goal of this research was to determine the spatio-temporal variability in condition of forest ecosystems through tree mineral nutrition (foliar composition) and crown defoliation, taking into account the elevation, inclination, exposition and climate influences. We used UNECE-ICP Forests large-scale (Level 1) plot network to utilize existing data (defoliation) and to obtain new data on tree nutrition. Foliar concentrations were compared to literature data on limit values. The field data was complemented by modelled climate data, with the overall objective of determining the adaptive capacity of Mediterranean forests in Croatia to environmental pressures. We expect the results of this research to provide basis for various decision-making processes related to forest management, forest ecosystem services, forest status reporting and climate change mitigation planning in the Mediterranean area.

Acknowledgement:

This research was financed by the Ministry of agriculture, Republic of Croatia as a part of the Green Tax Fund project „Adaptative capacity of Croatian Mediterranean forests to environmental pressures“.

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An Assessment of Conservation and Management of Forest Cover in India: Ancient and Present Perspectives

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Abstract:

India is a big country (3,287,263 km^2) with diverse climatic conditions supporting varied types of vegetative cover starting from equatorial rainforest along Western Ghats to alpine in the higher slope of the Himalayas. The dry deserts are in the western part to the wettest evergreen forests in the northeast. The country is known for supporting and maintaining the harmony between the human beings and its diverse forest ecosystems and mega biodiversity since time immemorial. During ancient time, human beingswere very much close to nature and natural resources. The harmonious relationship with nature is well documented in historical records and texts. In ancient time, India was rich in biodiversity and ecological wealth and it had continued till a few centuries before.

In spite of a big country and very extensive fertile soils of the plains of numerous rivers, India is a land of second largest population of the world. In terms of density (368 persons/km^2), it ranks 27^{th} but many of the countries having higher density are very tiny (16 countries with less than one thousand square km area). The most populous country of the world, China is 73^{rd} with a density of only 139 persons/ km^2. The needs of the people are met from the resources available and growing population has created tremendous stress on the resources. The demand of the time is to make a proper balance for the sustainability of the planet. Both humans as well as all biotic lives are part and parcel of the total and their significance cannot be undermined. A lot has changed from the ancient time to the present one not only in India but for whole of the planet. Numerous global problems are existed today because of the anthropogenic activities. In the long run, many of them could be corrected by bringing balance between man and nature. Many of the local and global problems are the manifestations of the reactions of nature in response to the anthropogenic actions. Therefore, once the anthropogenic actions are corrected, the natural reactions are bound to get corrected naturally.

This study aims at scanning various literatures from the past to assess the relationships of human beings with the nature and forest resources vis-à-vis its management. The same is supposed to be analyzed in current situation also. The different forest policies of the Government of India are supposed to be assessed. Numerous causes and their effects are subjected to study. Therefore, the data acquisition both from the offices, secondary records as well as the current satellite soft data would be analyzed to arrive at the conclusions. Based on the analysis of the data, remedial measures would be suggested to follow and save not only India but the whole of the planet from degrading situation.

Keywords:

Forest cover, forest conservation and management, harmonious relations, biodiversity, economic growth and development, global warming, greenhouse effect.

Potential biodiversity of understory plants in *Nothofagus* forests: Representativeness inside the protected areas

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Abstract:

Plant biodiversity of *Nothofagus* forests varied according environmental gradients and the different forest types. Maps of potential biodiversity (MPB) allowed to understand the potential distribution, representing a useful tool in the decision making. The objective was to elaborate a MPB based on understory plants using potential habitat suitability (PHS) of indicator species in Santa Cruz (Argentina), describing their marginality and specialization. Also: (i) characterize environmental gradients and forest types where species occurred, and (ii) analyse their representativeness inside the protected areas. We worked with 11 species with highest occurrence-frequency index, and obtained PHS maps using ENFA analysis with Biomapper 4.0. We used 42 grids of 90x90 m with climatic, topographic and landscape variables. Also, DCA analyses with a longitude gradient and forest types, and GIS analyses considering protected areas and MPB. ENFA used mean temperature and precipitation, elevation, NDVI and distance to rivers. Marginality and specialization indexes determine three plant groups, which were coincident with DCA analyses: (i) one related to evergreen forests in mountain areas (e.g. *Blechnum penna-marina*), (ii) one related to *N. pumilio* forests in central area (e.g. *Viola magellanica*), and (iii) one related to *N. antarctica* forests near steppe (e.g. *Festuca magellanica*). Representativeness analyses showed that first two groups were greatly protected inside the natural reserves, however, the better habitats for some of the studied plants occurred outside the reserves. New conservation strategies must include *N. antarctica* forests and new areas with higher MPB values, or developed off-reserve conservation proposals.

Damage and Expansion Potential of *Phloeosinus aubei* (Perris, 1855) on the Mediterranean cypress (*Cupressus sempervirens* L.) trees in southern Turkey

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Abstract:

Phloeosinus aubei (Perris, 1855) is an important bark beetle species (Col.: Curculionidae, Scolytinae) that attacks to the Cupressaceae family. This species has a range distribution in Mediterranean basin, southern part of central Europea, Armenia, Crimea, Caucaus, Iran, Syria, Turkmenistan and North African countries. The distribution of P. aubei has expanded to Centrel-Europe during the last decades. It was determined as an important pest of cypress in some European countries like Italy, France, Spain and also Israel and North African countries.

P. aubei feeds under bark and main galleries are mosty double arm-shaped, rather star-shaped longitudinal tunnel (between 2and 5 cm length). Also, pupation occur deep inside the spring wood. By feeding damage, crown decline or death of the trees is seen. Attacked twigs turn yellow and easily break off.

It is spreading on Cupressus sempervirens, Juniperus communis, J. excelsa and Thuja species in Turkey. Climate change is one of the most important global problems in present. Due to global warming, damages caused by pest insects and other forest pests will increase and unexpected problems can occur in their control. It is observed that the expantion and epidemy potential of P. aubei has been increasing especially through to the Mediterranean region of Turkey.

Non-Wood Forest Products Sold in Antalya Folk Bazaars

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Abstract:

This study was carried out between months September and December of 2017 in order to determine the non-wood forest products sold in the public bazaars of Antalya and for what purposes they were used and consumed. It was aimed to determine the non-wood forest products which were sold by making face-to-face interviews with sellers with snowball sampling method. Interviews were made in Yurtpınar and Çalkaya open field bazaars of Aksu county; Karaman open field bazaar and Yeşilbayır and Yeniköy covered bazaars of Döşemealtı county; Kütükçü and Zeytinlik open field bazaars and also Güneş covered bazaar of Kepez county; Öğretmenevi open field bazaar and Altınkum and Pınarbaşı covered bazaars of Konyaaltı county; Dedeman and Şirinyalı open field bazaars and Çağlayan covered bazaar of Muratpaşa county in Antalya city.

According to the results of this study; thyme, crayfish, mint, laurel and rosemary were determined as spice consumed products, while carob, myrtle, hawthorn, cranberry, olive, rosehip and deer apples were identified as consumed products for food purposes. The products used for tea are thyme, sage, mint, rosemary, rosehip, linden, echinacea, chamomile and lavender and the products that are used for the oil are centaury, olive, cavy and thyme. As a result, 18 different plant species grown naturally in Antalya province that were sold and used for food and health purposes, were determined.

Comparative analysis of length and diameter growth in *Vaccinium myrtillus* from treeline in the Eastern Carpathians

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Abstract:

Trees and shrubs from treeline ecotone are sensitive indicators of climate changes.

In this study we analyzed the growth dynamics in diameter and length for well spread shrubs *Vaccinium myrtillus* in treeline ecotone from two sites in Eastern Carpathians (Calimani and Rodna Mts.). In total 20 samples from each site were collected and used to measure annual length increase and tree ring width based on three cross-sections per stem. The maximum age of *Vaccinium myrtillus* is 25 yr in Rodna Mts. and only two years less in Calimani Mts. The dynamics of the shoots growth rate show a maximum in 2015 (Rodna), respectively 2014 (Calimani). The results show a similar trend in the length increment for period 2000-2009 in the both sites. Also intra-annual shoots growth dynamics for 2018 is presented.

Carbon stock estimation from Molova Noua Forest District using G.I.S data

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The researches were undertaken in South-West of Western Carpathians using data from two consecutive management plans of Moldova Noua Forest District. For determine above ground biomass and carbon stock it was used allometric equations. It was determined that the above ground biomass has fallen from 1.814.297 tonnes in 2006 to 1.706.545 tonnes in 2016. Also, carbon stock stored in Moldova Nouă Forest District decresed from 852.720 tonnes in 2006 to 802.076 tonnes in 2016. For describing experimental distribution of carbon stock it was used different theoretical distributions like Gamma 3P, Lognormal 3P and Weibull 3P. A GIS based method was used to assess the geographic distribution of quantity of carbon stock and was established the evolution of carbon stock between 2006 and 2016. The results are promising and were obtained with a minimum effort, encouraging further research.

Assessment of the Vegetation State and Health Conditions of Forest Species in the Improvement Perimeters Located in the Transylvanian Plain, 5 Years After Establishment

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Abstract:

The ecological reconstruction of some territories requires the exploitation of the degraded lands taken from the agricultural sector, by developing the forest vegetation. The previously mentioned lands have totally or partially lost their production capacity in terms of agricultural use and, therefore, in order to reintroduce them in the production circuit, extensive silvicultural works of improvement are needed; the purpose of these works is: -to stop the processes of land degradation and to progressively improve these territories, under the direct effect of forest cultures establishment, -to alleviate the climatic adversities, -to protect human settlements and agricultural crops, as well as other objectives located in the analyzed area. To the above mentioned, one can also add the beneficial effects generated by increasing amount of wood in a deficient area, improving the local meliferous base, the landscape effect etc.

The present paper analyzed 5 improvement perimeters located in the Transylvanian Plain, established in 2012-2013 and the following aspects were taken into consideration:

mapping of the non-regenerated portions,

determination of biometric features of the existing species,

inventory of the causative agents responsible for setting seedlings.

The following pathogens have been identified: *Lophodermium pinastri, Diplodia pinea, Microsphaera alphitoides* and the control of these diseases was made using experimental devices by applying generic fungicides administered in certain doses, concentrations and number of different treatments.

Significant differences were noticed between the treatment variants and the untreated control and the highest influence on health is the number of treatments applied during a vegetation season.

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Fuzzy cognitive mapping in small game management, Romania

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Abstract:

Although in Romania hunting management is practiced for a long time (Almăşan and Smith, 1962), a statistical analysis of the efficiency of different active management actions was not performed. Development and application of new and innovative methods and instruments were targeted, enabling hunting units managers to estimate, predict and manage these resources efficiently and correctly. With the help of Fuzzy cognitive mapping and through recognition of the annual fluctuations of populations in relation to certain abiotic and management factors influential to small game dynamics, a new method and interpretation of collected data was processed (Research activities were further carried out in two pilot areas, with hunting units characteristic for plain area, but with different features; Great Island of Braila and The Western Plain, with the possibility of transfer to other hunting units with economic, social and environmental significance). The results used for FCM come from a specific data form applied to 106 respondents, wich most of come either from forestry or hunting field. The point out reasons for annual fluctuations relate to small game management. Adopting appropriate measures to increase the efficiency of small game management has economic effects (increasing the number of game that can be harvested during a hunting season) and ecological effects (improving the health of populations) and also the classification in another category of creditworthiness, allowing bigger optimum effectives and hence greater benefits from all this (Negruţiu 1983 Negruţiu et al 2000).

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Tree breeding and genetic resources for an adaptive forest management to climate change

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Abstract:

In the forests administrated by the Mihăeşti Experimental Base, the sessile oak (*Quercus petraea L.*) occupies 2022 ha. This study investigated the level to which local conditions are favorable to the development of the sessile oak and analyzed the structure of two differently aged source units of sessile oak seeds.

For 30% of the sessile oak stands the local climatic and pedological conditions are favorable for species development, while for 69% of the stands the local conditions have an average level of favorability. The detailed analysis of two units of sessile oak seeds has shown that they do not yet have the proper structure for the seed source unit function.

The first case takes into consideration a 65 years old sessile oak stand: the first proposed activity consists of the selection of the best seed trees among the entire surface. The stand will be managed by guided thinnings, so that the seed trees will develop symmetrical crowns that can benefit from light from all directions. It is proposed to return with a new thinning work after a period of time shorter than the one highlighted in the technical norms, after the stand's canopyis almost reclosed.

The second case, consisting of 170 years old sessile oak and 80 years old beech, is included in the second class of production with 63% of the sessile oak trees within the first quality class. The stand has a non-uniform consistency, with frequent gaps, for which specific management measures have been proposed: selection and maintenance of seed trees; removal of the beech specimens shading the crowns.

This study highlights the necessity and opportunity of specific management of the source units of sessile oak seeds. These stands must be managed distinctly with specific works according to the structure of each stand, in order to stimulate flowering and maintain fructification.

Keywords:

seed source units, sessile oak, structure–function

Structure, Diversity, and Carbon Stock of Woody Plants during Succession Following Agriculture Abandonment in Wetland

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Abstract:

Bang Kachao Green Space (BKGS), the most important urban forest near Bangkok, the capital of Thailand, is the wetland on the alluvial plain of the Chao Phraya River. After the agriculture abandonment in BKGS, various plants are succeeding and growing. This research aimed to assess the structure, diversity, and carbon stock of woody plants in three sub-districts – Bang Yo (BY), Bang Ko Bua (BKB), and Bang Krasop (BKS) sub-district of BKGS. Four sample plots, 40 x 40 m-sizes, were established in each sub-district. The results found that vertical structure of woody plants had three layers in BY and BKB and two layers in BKS. The Shannon diversity index (H) of woody trees and saplings among BY, BKB, and BKS were non-significant different. The H and density of seedlings in BY and BKB were significantly ($p<0.05$) higher than in BKS. The density of saplings in BY and BKB was significantly ($p<0.05$) higher than in BKS, besides, height and diameter at 1.30 m above ground of saplings in BKS were significantly ($p<0.05$) higher than in BY and BKB. Moreover, the biomass and carbon stock of woody plants in BY and BKB were significantly ($p<0.05$) higher than in BKS. These may be caused by the different tidal current whereas the tidal current in BKS is following the tidal current of Chao Phraya River but the tidal current in BY and BKB are controlled by the floodgates. These can be the information of woody plant during succession following agriculture abandonment and can be used for further urban forest management in this wetland.

New Solutions for Integrated Pathogen Control in Forest Cultures in the Current Climatic Context

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Abstract:

Climate changes that occur at the present time and, implicitly, the impact that these changes have on the health and vegetation state of forests are a complex and actual issue. It requires an increased attention from foresters during the management of forests that are permanently under the influence of disturbing factors, that act simultaneously or one at a time.

A first consequence is the onset of non-parasitic diseases concurrently with the increase of virulence and pathogenicity of some phytopathogenic agents, that could lead to some forest crops or even stands be compromised.

In the current paper, analyzes were made on the nutritive base, seeds, plantules, affected plants. The main mycotic agents were identified and the links between the evolution of infections and the local topo-pedo-climatic factors or the links between diseases and stand/biocenosis factors were analyzed. For their control, new products and methods (treatment techniques) that offered adequate solutions for the achievement of healthy cultures, while the recorded losses did not exceed the damage threshold, were tested.

The analyzes performed on coniferous planules shown that the most dangerous pathogens belong to *Fusarium, Pythium, Rhizoctonia, Botrytis* genera, and under strong infestation conditions, the *Alternaria* genus, although a saprophyte, contributes to culture debilitation.

In field coniferous cultures, foliar parasites from the following genera predominate: *Phoma piceae, Lophodermium macrosporium, Mycosphaerella tulasnei, Diplodia pinea*.

In broadleaf cultures, the following pathogens were identified: Coccomyces hyemalis at European sweet cherry, *Microsphaera sp., Roselinia quercina, Taphrina coerulescens* at oaks, *Dotichiza populea* and *Cytospora sp*. At black and hybrid poplar.

The experimental procedure for their control imposed the usage of broad action spectrum fungicides that, through their combined usage, acted on the whole range of presented pathogens.

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Bioecology of *Corythucha arcuata* Say, 1832 (Hemiptera: Tingidae) in Romania

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Abstract:

Corythucha arcuata Say, 1832 (Hemiptera: Tingidae) is an invasive insect species of North America. The species was reported from the first time in Romania in 2015 in Arad. Distribution of *Corythucha arcuata* in Romania was been approached in other studies, but their bioecology in our country is unknown. Concidering that *Corythucha arcuata* is an significant pest species that causes severe damage to oak species and that had a extremely fast extension, it was considered necessary knowledge of species bioecology.

This paper presents the main bioecology elements of *Corythucha arcuata* in Romania, that is in closely relationship with possible methods of control.

Mapping of Forest Fire Risk Zone in Nainital district, Uttarakhand, India

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Abstract:

The environmental balance and natural ecosystem productivity fundamentally depend on the forest cover of the area. Its spatial cover and health is a true indicator of ecological conditions in any region. Forest fires, one of the major environmental concerns in the world, adversely affect the standing vegetations and their regeneration, wild animals and soil's organisms and cause damage to the natural ecosystem and environment at large (Dong, 2006; Ghobadi et al., 2012). In Himalayan region of India, forest fire is a major cause of forest and biodiversity loss. Controlling the natural hazards is almost impossible however; forest fire risk zone mapping may play important role in planning to minimize fire frequency in the forest. An availability of fire risk zone map of a region may contribute in precise assessment of forest fire problems and their remedial planning and proper management. Forest fire risk zones are locations where a fire is likely to start, and from where it can easily spread to other areas (Jaiswal et al., 2002).

In the present paper an attempt was made to map out forest fire risk zone in Nainital district (lies in the Kumaon Division of Uttarakhand State), situated in Himalayan region of India using modern geospatial tools of Remote Sensing (RS) and Geographic Information System (GIS). The Landsat 8 and Cartosat-1 satellite images acquired in year 2014 and Digital Terrain Model (DTM) acquired from Bhuvan site were analysed in Arc GIS 10.2.2 (ESRI) and ERDAS Imagine 2013 (Leica Geosystems , Atlana, U.S.A.) software. Survey of India Toposheet numbered 53 O/7 and 53 O/11 were used as collateral data, while Garmin GPSmap 76 Cx, (Garmin Taiwan) handset was used for field work and training/ ground data collection. Six criteria maps i.e., temperature map, slope map, slope aspect map, land use/ land cover map, multiple ring buffer of road map and multiple ring buffer of river were generated and integrated in GIS environment for forest fire risk zone mapping.

This study demonstrates the tremendous scope of GIS and RS techniques in forest fire studies and risk zone mapping. This study may prove a better input in managing forest fire hazard in the study area.

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High Conservation Value Forests from Experimental Bases of National Institute of Research and Development in Forestry" Marin Drăcea"

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Abstract:

High Conservation Value Forests (HCVFs) are natural habitats, which are of outstanding significance or critical importance, are such forests which are more valuable in terms of biodiversity values, ecological values and importance for local people than in terms of industrial timber. The HCV concept was originally developed by the Forest Stewardship Council (FSC) in 1999 to be used in forest management certification (Cashore et al 2004). HCV Framework is a practical conservation tool for ensuring that critical values in natural and production landscapes are identified, managed, and monitored.

The aim of the research was to identify the HCVF in the context of forest certification, on the surface of Experimental Bases (EB) of INCDS "Marin Drăcea", respectively the researches took place on the surface of the fourteen EB (Caransebeș, Lechința, Mihăești, Tomnatic, Vidra, Bărăgan, Cornetu, Craiova, Săcele, Simeria, Ștefănești, Hemeiuși, Timișoara, Tg. Mureș and Tucea).

The largest surface with HCVF were identified in EB Vidra (3147 ha) and at a great distance are EB Caransebes, Tulcea and Sacele with 432ha, 367ha and 356ha.

Of the total surface with HCVF of the EB, areas that provide basic ecosystem services in critical situations, respectively HCVF 4.2 - Forests critical to erosion control represent the highest percent - 73%.

FSC is the most rigorous and widely endorsed certification system in the world. The ecological benefits of FSC certification are numerous and significant.

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Preliminary forecasting models in Norway spruce, Silver fir and European beech mixed stands from northern Carpathians

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Abstract:

Models for estimating tree growth and yield, including the forestry work effects under the climate change, are important tools in stand management. The research material consisted of twelve mixing stands and the following research issues were approached: horizontal spatial pattern, trees number distribution modeling by diameter categories, tree auxological models and preliminary models in relation to tree growth and biomass.The horizontal spatial pattern shows that the spatial distribution of the trees is from random to uniform, with a slight increase to regularity, expressed by increasing the number of trees·ha^{-1}. As a result, group mixes lead to a more uniform growth of all tree species as intra-specific competition takes place in a limited space and tends to a mixture with beneficial consequences on forest development.

From the point of view of the number of trees distribution modeling by diameters categories, it follows that the sum of the species distributions can lead to a multi-modal distribution for the stand. Therefore, the use of uni-modal distributions when trying to apply distribution patterns can lead to a simplistic description, altering the stand structure characterization.

Auxological preliminary models show that the average increase in the period 2007-2016, depending on the diameter, is better adjusted using the logarithmic and power regression. As the number of trees·ha^{-1} increases, the average basal area over the period 2007-2016 (m^2·ha^{-1}) decreases, according to a logarithmic equation. The relation between the spruce proportion (% number of trees) and the average increase in the basal area over the period 2007-2016 (m^2·ha^{-1}) is expressed by a polynomial 2nd degree equation.

Preliminary model's relative to trees growth and biomass indicates that the larger trees representing proportionately less in terms of growth than the mass. Thus, the three and four stages of the stands development cycle, referring to the inverse growth dominance (in regression), obviously appear in mixing stands age over 80 years and are accentuated as the age of the stands grows.

The results obtained by research on preliminary forecasting models in Norway spruce, Silver fir and European beech mixed stands from the northern Carpathians indicate that these stands can develop in a fundamentally different way from pure stands.

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Effect of contaminated soil on multitrophic interactions in terrestrial system

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Abstract:

Potentially toxic elements (PTE) in the environment originate from both natural geological processes and human activities. The extent to which the PTE are mobilized and become available to exert negative effects depends largely on the soil properties. For belowground systems, multitrophic interactions involving plants, herbivores, and parasites have been documented. Plant roots emit different volatile organic compounds (VOCs) (Laznik and Trdan, 2016). Some VOCs emitted from the plant roots as a response to herbivory, e.g. β-caryophyllene, attract entomopathogenic nematodes (EPNs). However, knowledge about attraction behaviour of EPNs to volatiles emitted from tree roots as a response to root herbivory in different soil types is limited. In mesocosm experiment, beech seedlings (*Fagus sylvatica* L.) were grown in two types of soils: non-contaminated forest soils and contaminated garden soils. Seedlings were either grown in the absence or presence of summer chafer (*Amphimallon solstitiale* L.) larvae. Soil contamination significantly decreased ectomycorrhizal species richness, but regardless of treatment, the dominant taxon was *Tuber menseri* nom. prov. VOCs emitted from beech roots were tested for attraction behaviour of EPNs species. β-caryophyllene proved to be the most attractive compound for EPNs. This compound was detected in beech roots regardless of treatment, indicating that VOCs that affect movement of EPNs are emitted even in the absence of direct root herbivore attack.

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Monitoring and Assessing the Changes of Forest Using Landsat Data: A Case Study of Fagaras Mountains Region, Romania

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Abstract:

Monitoring and assessment of changes occured in forest is becoming more and more important given the complexity and variety of these ecosystems. The aim of this paper was to monitor and assess the forest changes for the 1987-2016 periods using Landsat data, in Tara Fagarasului region, Romania. After the processing of the temporal series of satellite images, the surfaces with changes according to their nature were identified and reclassified in different classes, with different degrees of intensity. The results show that after 1990 occured changes identifying areas affected by forest logging and areas undergoing reforestation. Conversions from different land cover categories in the forest and vice versa have also been identified. The analysis of these changes showed that their tendency was in correlation with the socio-economic changes that have occurred in Romania since 1990. The monitoring and assessment of forest changes in the studied area is necessary for the effective formulation and implementation of sustainable development policies, given that it could become the largest national park in Romania.

First results on the insecticidal effects of some new acyl hydrazine derivatives

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Abstract:

Acyl hydrazine derivatives have been developed successfully as a new group of insect growth regulators, called 20-hydroxyecdysone agonists or molting accelerating compounds. The following three new acyl hydrazide derivatives given in general structure were synthesized and tested against the pine processionary, *Thaumetopoea pityocampa* and the Colorado potato beetle, *Leptinotarsa decemlineata.*

The compounds tested were 1,2,4-triazole derivative acyl hydrazides 1 (N-tert-butyl)-4-methoxy-N'-(2-(4-(4-methoxyphenethyl)-3-methyl-5-oxo-4,5-dihydro-1H1,2,4-triazol-1-yl) acetyl) benzohydrazide) (1), N'-(tert-butyl)-2-(4-(4-methoxyphenethyl)-3-methyl-5-oxo-4,5-dihydro-1H-1,2,4-triazol-1-yl)acetohydrazide (2), and N'-(tert-butyl)-2-(4-(4-methoxyphenethyl)--5-oxo-3-(thiophen-2-ylmethy)-4,5-dihydro-1H-1,2,4-triazol-1-yl) (3). The administration of the compounds against the insects was carried out at 1mg/10 mL concentration. The compounds showed considerable antifeedant effect on *L. decemlineata.* Three compounds numbered as 1, 2 and 3 showed 60, 56.6 and 56.6% insecticidal effects on *T. pityocampa,* respectively.

Keywords:

Acyl hydrazine derivatives, insecticidal effect, *Thaumetopoea pityocampa*, *Leptinotarsa decemlineata*

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Microsporidial infection in adults of the predator beetle *Calosoma sycophanta* (Coleoptera: Carabidae)

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Abstract:

In the present study, it is aimed to determine the rate of microsporidial infection in the adult beetles in *Calosoma sycophanta* L. (Coleoptera: Carabidae) mass-rearing laboratories. Sixteen of the mass-rearing laboratories laboratories from 10 different localities in Turkey were sampled between the years of 2015-2017. A total of 6003 *C. sycophanta* adults were dissected from the mass-rearing laboratories and the presence of microsporidial infection was investigated. The microsporidial infection was determined in all localities. 266 of the dissected insects were infected and the infection rate was determined as 4.43%. The total infection rate was determined as 2% in 2015, 3.85% in 2016 and 5.7% in 2017 and it was observed infection rate an increase year after year.

Keywords:

Microsporidia, Calosoma sycophanta, Coleoptera, Thaumetopoea pityocampa

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