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Hodnocení testu potomstev borovice lesní u VLS ČR, s.p./Evaluation of Scots pine progeny tests under Military Forests and Estates of the Czech Republic, s. e.

BEDNÁŘOVÁ TEREZA

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Abstrakt

The master's thesis deals with evaluation of progeny tests in a seed orchard crop of Scots pine (*Pinus sylvestris* L.) belonging to the state- owned forestry company Vojenské lesy a statky. Scots pine is one of the most important tree species economically and therefore there is a need for quality, genetically-tested seed sources for reforestation of production forests. Another expected gain is also to bring the seed orchards into the broader awareness and practice of Czech forestry and to maintain gene sources of tree species and biological variability of our forests. The tested area „Zátočina“ is located in the nature forest area of Doupovské hory within division Karlovy Vary. There is a total of 733 individual trees from 61 testes families. The height parameter was evaluated for all the individuals and after comparing our results with the results from 2012, the growth increment was also investigated. The received results were analyzed in MS Excel and ASReml program with the intention of estimating heritability and general combining ability of the families. Relatively high mortality of 31,15% was detected on the tested area. The height and the growth increment of individual families were evaluated and a strong correlation between those two parameters was found. The ASReml analysis detected a moderately high heritability with low standard error ($0,2133 \pm 0,0947$).

Klíčová slova: borovice lesní, semenný sad, testování potomstev / Scots pine, seed orchards, progeny test

Ohrožení lesních porostů požáry na území České republiky/Threat of forest fires on the territory of the Czech Republic

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Abstrakt

Forest fire is a destructive factor, which affects all forest functions. Knowledge of forest fires behaviour, their forecasts and ways of firefighting are necessary for forest protection. Aim of study was create a map of vulnerability by forest fires in the Czech Republic and identify the most threatened regions.

Map vulnerability by forest fires was create by interaction of several factors like forest fires abundancy, human population, the rate of tourism (which is connected with the forest visiting), percentage of coniferous, percentage of pine forests and habitat moisture.

Analysing relationships of fire abundancy with other variables showed that vulnerability by forest fires is mostly affected by human population and rate of tourism and less by portion of coniferous forests. Map of vulnerability by forest fires showed that the most vulnerable regions are central Bohemia, The Giant Mountains, Jizerské hory mountains, Bohemian Forest mountains and vicinity of Plzeň city.

Klíčová slova: lesní požáry, riziko požárů, ochrana lesa / Forest fires, Risk of Fires, Protection of Forest

Genetická struktura ekotypů smrku ztepilého v České republice/Genetic structure of Norway spruce ecotypes in the Czech Republic

BÍNOVÁ ZUZANA

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Abstrakt

Norway spruce belongs to the highly widespread and economically significant conifer in Europe. In the Czech Republic, it is the most important tree species from economic point of view and therefore the appropriate attention should be paid also to its research. Although it is generally recognized as a species with significant level of gene flow, it could be differentiated based on several morphological characteristics into three phenotypically distinctive groups – ecotypes.

Our study aims to evaluate genetic pattern of these ecotypic groups utilizing genetic analysis of several presumably neutral loci.

Sampling of trees for DNA extraction was done in Krkonoše (high-elevated ecotype), Jizerské hory (medium-elevated ecotype) and České Švýcarsko (low-elevated ecotype). Every location is represented approximately by 150 individuals. Genetic data were generated using 7 highly polymorphic loci combined into one multiplex reaction. The level of polymorphism among these loci varies between 8 and 32 alleles. The newly established SSR 7-plex for Norway spruce provides data of high discrimination power and proved to be effective as well as low-cost tool for analysis of genetic composition.

We did not find out any significant clustering based on geographical and morphological grouping, i.e. ecotypic membership. However, we reveal high intrapopulation variability and low F_{st} that demonstrated high gene flow among moderately distant populations. It implies several conclusions for forestry practice such as the strict rules of seed material transfer in the Czech Republic might be at least in case of Norway spruce reconsidered.

Keywords: smrk ztepilý, *Picea abies* [L.] Karst, mikrosatelity, SSRs 7-plex, analýza genetické struktury/ Norway spruce, *Picea abies* [L.] Karst, microsatellites, SSRs 7-plex, genetic structure analysis

Implementation of the dual permeability model and application of population-based metaheuristics in inverse modeling

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Abstract

Soil is of immense importance to human society. Soil often exhibits a variety of heterogeneities such as fractures, fissures, cracks, and macropores and show dynamic instabilities of the wetting front during infiltration, which can lead to preferential flow. Preferential flow has strong implications in accelerating the movement of agricultural contaminants, radionuclides and non-aqueous liquids and other pollutants through the unsaturated zone to underlying groundwater and is therefore of concern to hydrologists, geophysicists and environmental scientists. The dual permeability model can be used to model preferential flow in soil. It was constructed around the assumption that the soil medium can be separated into two distinct pore systems. In the Gerke and van Genuchten approach the matrix and fracture systems are each treated as homogeneous media with separate hydraulic properties that can both be described with a Richard's equation. In this work, the dual permeability model was implemented in the free software DRUTES. The model was applied on different virtual realities to test under which conditions preferential flow occurs. To use the dual permeability model for inverse modeling, population-based meta-heuristic algorithms were created and a link to the software constructed. The inverse modeling set-up was tested on virtual benchmark functions and a case study.

Keywords: Preferential flow, dual permeability model, inverse modeling, metaheuristics

Comparison of biological and chemical pretreatments for bioethanol production from common reed

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Abstrakt

The aim of this thesis is to investigate the suitability of common reed in bioethanol production. This agricultural biomass has no economic value. Several biomasses were searched to produce bioethanol all over the world, but there are limited studies using common reed as a raw material for bioethanol production. This study was generally aimed at investigating the feasibility of common reed for bioethanol production by means of biological and chemical pretreatments. For this purpose, the efficiency of sodium hydroxide (NaOH), sodium borohydride (NaBH₄), boron oxide (B₂O₃) and sulfuric acid (H₂SO₄) for conversion of common reed to ethanol was investigated via biological and chemical pretreatments.

Klíčová slova: common reed, bioethanol production, agricultural biomass

The influence of climatic factors on the spatial behavior of red deer

HAMBÁLKOVÁ LUCIE

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Abstrakt

Climate change is already an integral part of the processes occurring on Earth. Its monitoring, evaluation and pursuit of any prediction is an object of many scientists from around the world. It is necessary to know the course of these changes and their impact on the environment, so we can better predict how the fauna and flora will respond in the future. We also need to know the consequences of our management and be aware of our actions. Then we will be able to adapt our thinking and management of the environment to be sustainable. Impacts of climate factors are engaged in work focused on the spatial activity of red deer. Telemetry monitoring and meteorological data is used for evaluating the movement of deer game from Doupovské mountains, with depending on the seasons of the year and the hunting season.

Klíčová slova: red deer, habitat preferences, home range, weather

Hodnocení testovacích výsadeb potomstev borovice lesní u VLS ČR, s.p./Evaluation of Scots pine progeny tests in the oweneership of Military Forests and estates of the Czech Republic

HEJTMÁNEK JAKUB

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Abstract

This diploma thesis is based on evaluation of progeny tests of parent trees chosen based on their phenotype. The observed tree species is Scots pine (*Pinus sylvestris* L.). The progeny testing falls under a large nationwide project of the Technology Agency of the Czech Republic. The data was acquired at three different test sites and consisted of two parameters: height and root crown thickness. All test sites fall under the Mimoň division of VLS ČR s.p. The analysis was done in ASReml using two distinct models. The results of both models were compared and analyzed. Despite the young age, the breeding values were estimated for each family and the heritability of the height and the root crown thickness were estimated. h^2 for height: 0,2876 (standard error of 0,0753) and h^2 for thickness: 0,1285 (standard error of 0,0478). The age of the trees was relatively low for progeny testing and in order to obtain more precise results the measurements need be redone in the future.

Keywords: borovice lesní, semenné sady, testy potomstev / Scots pine, seed orchards, progeny testing

Intraspecific plant-soil feedback as an explanation of plant invasiveness

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Abstrakt

Intraspecific plant-soil feedback is a relationship in which plant affects the composition of the soil and such modified soil affects growth of the same plant species. This relationship and its intensity may be linked with plant dominance and invasiveness. Dominant species can alter the composition of the soil in their favour and thus show positive intraspecific plant-soil feedback. As the invasive species are commonly being dominant in their new environment, it can be expected that intraspecific positive plant-soil feedback could be an important factor allowing the invasive species to achieve their dominant position and become invasive. To test if the existence of positive intraspecific feedback could be a general mechanism underlying plant invasiveness we compared intraspecific plant-soil feedback in a group of invasive and introduced, but non-invasive, plants in the Czech Republic. We did this using a preselected set of 34 species – 17 invasive and 17 non-invasive. For realization of the project we used the method of two-phase experiment. The first phase is called soil conditioning – influencing of soil by the plant. In the second phase the same plant species are planted in conditioned soil from the first phase and in control (unconditioned) soil. Then we compare plant biomass from conditioned and unconditioned soil. The results suggest that invasive species show more positive or at least less negative intraspecific plant-soil feedback than non-invasive species. It means that intraspecific plant-soil feedback could be the mechanism underlying plant invasiveness. These results may improve our understanding of invasive mechanism of plants and thus we can better predict which species are potential invasive.

Klíčová slova: Intraspecific plant-soil feedback, Invasive plants, Neophytes

Potrava psíka mývalovitého a mývala severního v České republice/Diet of raccoon dog and raccoon in the Czech Republic

KOŠÁTKO JOSEF

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Abstract

This thesis was focused on examining the food composition of Raccoon dog and Northern raccoon in the Czech Republic. Samples were mostly from around town of Mnichovo Hradiště and raccoon area in the Doupov Mountains. Food was examined by stomachs autopsy of caught, captured or otherwise dead specimens of these species, from different seasons of the year. Food composition was determined by leaching the stomach content out, followed by drying on filter paper. A total of 13 individuals for each species were investigated. For raccoon dogs, rodents, small birds and insects were found remains of fish, amphibians and plants – mainly wild berry fruits. In the food of northern raccoons were found remains of fish, amphibians and beetles. Problem with northern raccoons diet determination was that most of the samples were caught alive and as such they managed to process most of the food before autopsy. For both species it has been confirmed that they are omnivore species and they do not travel far for their food. Not even times of emergency. Their diet differed with regard to seasons and the site where they lived.

Keywords: pitva, žaludek *Nyctereutes procyonoides*, *Procyon lotor*, predace / beech, stomatal traits, leaf traits, provenances

Možnosti využití nových metod batymetrie vodních nádrží/Possibilities of use of new bathymetry method of water reservoirs

KUNDRATOVÁ FRANTIŠKA

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Abstrakt

It is essential from various reasons (for example hydrological modeling, monitoring of sediments, bioopes mapping or archeological researches) to measure water depths of rivers, water reservoirs, ponds and lakes. Hence, the bathymetry techniques for measurements of shallow waters are still evolving. The goal is to find the best method allowing fast and economic mapping of large-scale areas and providing high-resolution data. Currently, the most common method in Czech Republic is probably a depth measurement by an ADCP devices, which is a very accurate method, but still time-consuming. On the other hand, airborne laser scanning at wavelength of 532 nm (green laser pulse) has a great potential for shallow water mapping.

This work is focused on possibilities of use of the airborne laser scanning for bathymetry of rivers and water reservoirs in condition typical for Czech Republic. The methods of obtaining the bathymetric data are discussed in theoretical part of this work, as well as principles of its operation. The practical part is focused on evaluation of the airborne laser scanning data. Two study areas (a part of Vltava river and Hracholusky dam) were scanned using the laser scanner Riegl VQ-880-G. Digital terrain models (DEM) were created from acquired data of the study areas. After that the DEMs were compared with DEMs which were created from sonar data. The results of comparison are presented. The aim of this work is to assess the ability of airborne laser bathymetry in condition typical for Czech Republic and verify the accuracy of this method. This method saves time and economic costs and it has great potential to be usable for future research worldwide.

Klíčová slova: batymetrie, letecké laserové skenování, lidar, VD Hracholusky, Vltava / bathymetry, airborne laser scanning, lidar, Hracholusky dam, Vltava river

Bio-based adhesive from brewers spent grain

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Abstract

Brewers spent grain (BSG) is an abundant waste material from the brewing process, representing approximately 85 % of total by-products generated, is rich in cellulose and non-cellulosic polysaccharides and has a strong potential to be recycled. One of the main components of the BSG is protein, which has a potential to be modified and used as an adhesive for the woodworking adhesive. This work deals with the protein extraction through alkali treatment and its subsequent modification, crosslinking with glyoxal. The crosslinked adhesive was tested through ABES method to find, that ideal content of glyoxal is 20 %. Subsequent adjusted standard tests for the lap shear strength and bend strength (MOE and MOR values) were used to compare its values to commercially available PVAc adhesive. The lap shear strength results were 3,5 times lower to PVAc, the bend strength values were, on the other hand 1,5 times higher. The PVAc was partially replaced (50 and 25 %) by the adhesive showing that the extracted adhesive could serve as a partial replacement to lower the price of the PVAc adhesive.

Keywords: BSG, Brewers spent grain, Wood adhesive, protein, glyoxal, crosslinking, modification

Endo- and ecto-symbiotic microorganisms of *Nasutitermes octopilis* (Blattodea: Termitoidae: Termitidae: Nasutitermitinae)

SOUKUP PATRIK

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Abstract

Termites are the most important decomposers of dead plant matter at the global scale. Plant tissues are made of complex ligno-cellulose matrix, which is extremely difficult to break down. Termite digestion is aided by rich communities of microorganisms. While composition of endosymbiotic communities (i.e. microorganisms inhabiting termite digestive tract) was already studied in series of termite species, the only known example of ectosymbiotic association is fungus-growing termites (Termitidae: Macrotermitinae) cultivating in their nests *Termitomyces* spp. (Basidiomycetes: Agaricales) fungi. The interactions and relationships among the host and symbiotic association members are still unclear. I therefore decided to take a lead in project aiming at disentangling relationships between *Nasutitermes octopilis* Banks, 1918, a common wood-feeding termite of Amazon basin, and its microbial associates. The tested hypothesis is that the termites are active players at the field of microbial communities, and they can change microbial communities' composition according to their needs, using several glandular exudates. I used repeated samples of termite workers, their actual food and a control to the food in the form of wood with no influence of foraging termites (10 workers of approx. 0,8 mL of wood in 2 ml vial filled with RNAlater®). I processed 32 sample sets (96 samples in total) made of 11 fallen trees, and from each 3 independent sample sets (2 in one case) were taken in order to test for fidelity between both symbiotic partners at intra- and inter-colonial level. All samples were subjected to homogenization and DNA extraction. PCR was performed to amplify barcode sequences, 16S rRNA region for bacterial taxa and ITS2 region for fungal taxa. Tagged primers were used to recognize each sample after sequencing. All samples were sequenced using Illumina MiSeq platform, and yield in total 1494299 bacterial sequences and 654184 fungal sequences. I identified 157 bacterial and 54 fungal relevant operational taxonomic units (OTUs); additional 28 fungal OTUs could not be identified because of missing data in reference databases. Zygomycota were the only identified OTUs shared only between termites and their food source. Further studies are required to define real nature of this relationship. Last but not least, the final determination of metabolic capacities of *N. octopilis* holobiome members is planned as a topic of my PhD. Studies.

Keywords: symbiotic organisms, termites, fungal symbionts, sequencing, Isoptera

Výpočet teplotního a vlhkostního pole ve dřevě během sušení/The Calculation of Thermal and Moisture Fields in Wood During Drying

SUCHOMELOVÁ PAVLÍNA

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Abstract

The thesis is focused on comparison of several ways of the calculation of thermal and moisture fields in wood containing bound water during drying and their comparison with commonly used standards for wood drying processes. Each of the four models presents different way of the unsteady-state calculation of the coupled thermal and moisture field in wood. The first model describes linear simulation, other three models present nonlinear simulation using material coefficients dependent on temperature and moisture content, differing in the method of the thermodiffusion (Soret effect) coefficient settings.

The aim of the thesis is to establish the influence of Soret effect on the wood drying process and to describe the difference between commonly used presumption of this process and its presumption given by the unsteady-state computation of the coupled thermal and moisture fields in wood.

Keywords: vlhkostní pole ve dřevě, teplotní pole ve dřevě, umělé sušení dřeva, vázané šíření polí ve dřevě, Soretův efekt / moisture field in wood, thermal field in wood, wood drying process, coupled thermal and moisture fields Soret effect

Barokní nábytek a jeho povrchové úpravy/Baroque furniture and its finishes

ŠIMŮNKOVÁ KRISTÝNA

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Abstract

The aim of the thesis is to conceive a comprehensive overview about surface finishes used in the period. Work is focused not only for the surface finishes, but also to their components, such as pigments. Some of the finishes were used in period before baroque, some arose until parway. The individual species of surfaces is given their origin and history, also their production and coating technology. Further, there are those techniques repairs and maintenance, that are currently used.

Another aim is to research the original surface finish, with newr finish similar in appearance, which is, although not quite right, used for restoration furniture and production of replicas. Research is dedicated to testing the resttance to moisture on freshly applied surface finishes, when they were exposed to four selected liquids for 24 hours. They were selected Turkish coffee, black tea, red vine and water. In the same manner are researched two samples exposed to UV radiation for ten days. This samples were allowed to operate only water. Before and after exposed moisture on tested smples, were measure colour and luster at specific locations. Next were examined changes of colour and luster, which manifested after exposure finishes at xenon chambre for five and ten days. Last part of research was dedicated to hardness coatings, tested with pencil test, and adhesion, tested with riving. This two tests are performed on all of previous samples, that were tested by liquids and artificial aging.

Keywords: baroko, nábytek, povrchové úpravy, šelaková politura, testování / baroque, furniture, surface finishes, French polish, testing

Vybrané fyziologické parametry smrku ztepilého po napadení kloubnatkou smrkovou/Selected physiological parameters of Norway spruce with *Gemmamyces* bud blight

VLNIEŠKOVÁ TEREZA

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Abstract

The purpose of this thesis was to examine selected physiological parameters of Norway spruce with *Gemmamyces* bud blight, such as the rate of CO₂ assimilation and leaf area index (LAI). Physiological measurements were made in August and September 2016 on selected individuals of Norway spruce with a different disease infection rate. A total of 53 trees were examined by the gasometric methods – photosynthetically light curve which expresses the relationship between the amount of assimilated CO₂ and photosynthetically active radiation, and a CO₂ curve which expresses the relationship between the amount of assimilated CO₂ and CO₂ concentrations in the atmosphere.

Norway spruce with *Gemmamyces* bud blight shows a lower rate of CO₂ assimilation, photosynthesis, therefore have a lower conversion efficiency of light into a fixed carbon assimilation processes. Although the data were analyzed only from 45 trees (8 trees have to been removed as extreme or incorrect value) it can be said that *Gemmamyces* bud blight negatively affects physiological parameters of spruce, which is going to be probably reflected in a time lag in decreased immunity of the tree and its growth.

Keywords: smrček, rychlost asimilace, stomatální vodivost / Norway spruce, assimilation rate, stomatal conductance

Publikace neprošla jazykovou úpravou. Za obsah příspěvků odpovídají jejich autoři.

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