Contents and Abstracts of the Bulletin of Forest Science

Bulletin of Forest Science (Erdészettudományi Közlemények) is a new journal supported by the Hungarian Forest Research Institute and by the Faculty of Forestry of the University of West Hungary. The papers are in Hungarian, with English summaries. The recent issue (Vol. 4, Nr. 1 and Nr. 2, 2014) contains the following papers (with page numbers). The full papers can be found and downloaded in *pdf* format from the journal's webpage (www.erdtudkoz.hu).

Vol. 4, Nr. 1, 2014

Abstract – Results of nationwide analysis of Hungarian Forest Stand Database (date 01. 01. 2012) have been presented in this publication. We defined the potential natural forest communities of all forest compartments by the method of site evaluation. Comparison of potential natural forest communities and current forest stands makes it possible the analyses of relationship between the potential and current forest communities nationwide. This study makes an attempt to discover the background of current forest communities surveying the site conditions and former landscape use of forest compartments.

Abstract – This paper presents the four-year results of studies on 33, artificially created forest gaps of sessile oak-hornbeam forest in transform forest management subcompartments (Sopron Mts, Hungary). During the study the forest gaps have been divided into five segments: central circle and four sectors according to the point of compass; dominance of occurring plant species and number of specimens of natural regrowth has been recorded in five segments of gaps. During the study plentiful and species rich woody regrowth appeared in the studied forest gaps. Regrowth of Quercus petraea and Quercus cerris were the most prominent, although the renewal of Carpinus betulus, Tilia cordata and Cerasus avium were also considerable. The most specimens of woody regrowth occurred in the northern segment, followed by western, southern and eastern ones respectively; while the fewest specimens were experienced in the central circle. As our results demonstrated, the elongated elliptic and smaller, 250 m^2 > sized gaps proved to be the most optimal in regard to appearance and survival of woody regrowth in the studied forest subcompartment.

Abstract – The paper presents and discusses the relations of stand structure, richness of the herb layer and macrofungi occurrences in a submontane beech selection forest stand. Due to the selection system, the associate tree species are lacking in younger age classes, and the stand progressively develops to a pure beech forest. Ratio of coarse-limbed trees is significantly higher than in the case of a traditional rotation system. The understory vegetation is dominated by forest herbs, whereas role of non-forest weeds and invaders is neglilible. In case of increasing canopy cover the number and the cover of herbs tends to decrease; however, the reduction rate of forest herbs is significantly smaller. The microhabitat-rich stand structure and the remarkable deadwood proportion favour the occurrence of macrofungi.

Abstract – The aim of this study was the morphological analyses of generative organs of two native Fraxinus species. Fraxinus samples were taken mostly from populations of Rábaköz – Répce-sík and analysed with multivariate statistics separating the qualitative and quantitative morphological characteristics. Hierarchical clustering, Principal Component Analysis (PCA), Principal Coordinates Analysis (PCoA) and Non-metric Multidimensional Scaling (NMDS) have been applied to demonstrate the correspondences between morphological characteristics and specimens. Specimens of two different taxa could not be distinctive through quantitative characteristics; however they separated considerable during the analyses of qualitative characteristics. Our results draw attention to the significance of inflorescence structure as an important distinctive morphological characteristic, although specimens with atypical inflorescence have been analysed as well.

Abstract – The paper analyses the stand structure and yield of black locust (*Robinia pseudoacacia*) stands mixed with grey poplar (*Populus* × *canescens*) in various proportions, partly applying a new methodological approach. The main stand structure and yield factors were determined separately for each species, measured stem by stem, using the volume functions prepared for each species. The ratio of the volumes of the species (RVA and RVB) was determined based on the particular yield tables. A close relationship has been found between the ratio of relative volume and the proportion of the species calculated by number of stems. The relative surplus in the volume of the mixed stands varied between l.32–1.80 at age 16 and 21 years compared to the control, i.e. the yield of pure stands of the species concerned. The investigations have also proven that if two species have a fast initial growth rate and a similar rotation age, they can be planted in mixed stands resulting in mutual growing advantages.

Abstract – Among the tree forest blocks managed with transformation silviculture system by Zselic Forestry, we have made full forest inventory in the Töröcskei-Block on 21.5 respectively 43.75 ha. We have analyzed the stand structure of European Beech, Hornbeam, Silver Lime, Sessile Oak and Turkey Oak. In the course of comparison, we experienced that the variety of height and the volume of hornbeam is different but in the case of the others we admixed the tree species and only the volume was different. In the face of the results we have made a D-test (Welch's-test) of height and volume of hornbeam, respectively the result of the T-test of all the other tree species. Based on the results (p=0.05) the height and volume of the two sampling plots equaled.

Abstract – A gas exchange based ecophysiological performance of five regrowth species has been investigated in a xero-mesophilous oak forest. Seasonal light responses, capacities and variability of assimilation, transpiration and water use efficiency under light saturated conditions are discussed to reveal ecophysiological characteristics of the species in gap-phase dynamics. Species present assimilation maximum in autumn, followed by a continuously increasing carbon-dioxide fixation rate through the seasons. Transpiration peak is manifested differentially in summer and autumn. Autumn maximum of photosynthetic water use efficiency as the ratio of carbon input and water output is detected for all studied species. Limitation of gas exchange parameters is highly indicated by low level of water use efficiency in the summer season in case of Fraxinus ornus, Quercus cerris and Q. petraea. Carpinus betulus turned out to be a source saving species by a moderate gas exchange rate in every season. According to the moderate rate of carbon assimilation and transpiration but the highest rate of water use efficiency, Rubus fruticosus can be the most effective species in the early stage of gap-phase dynamics. Assimilation to transpiration rate in spring and summer is strongly coordinated, water use efficiency is a species and season dependent aspect. Autumn and summer season water use efficiency can serve an appropriate tool for indicating environmental limitation and scaling habitat suitability of the species in dry oak forests.

Abstract – We estimated the amount of carbon stored in the Hungarian harvested wood product pool, and the amount of annual inflow and outflow from the pool for the time period 1900–2020. We studied national and international data sources in order to find the best available and consistent data on production and trade. Because both the dataset and the methodology, i.e., the 2013 IPCC Supplementary Guidance that were used for this study differ from those in earlier studies, the results obtained are different as well. We now estimate that the carbon accumulation of the Hungarian HWP pool amounts to 9 million tonnes of carbon, and the average of annual net emissions from the pool is around ‑100,000 tonnes CO_2.

Abstract – The mini-rotation energy plantations are important on the one hand as a source of renewable energy, on the other hand, makes it useful the not suitable for agricultural use lands. We try to give an answer to the question, under what climate and soil conditions is the increase the most significant. Large number of variables, in the experiment was reduced to a minimum by means of multivariate statistics (principal component analysis and factor analysis). We found that the yields are affects primarily by temperature, by soil pH, by CaCO3 content and by Arany's value. As in the pilot areas significant difference in terms of rainfall was not, so the effect of this factor reduced the minimum.

Abstract – When constructing forest roads on cohesive soil, it is suitable to substitute sandy gravel sub-base course with lime stabilized subgrade. This solution reduces the volume of construction materials and at the same time moderates the unfavourable properties of cohesive soils. If the bearing capacity of the lime stabilized layer can be included in the bearing capacity of the pavement, then the costs of road construction can be reduced by reducing the thickness of the crushed stone course. To achieve this, the testing of the bearing capacity of the lime stabilized layer is necessary. It is suitable to complete the test on an experimental road-section practically in forest circumstances. Such an experimental road-section was constructed in cooperation between the Institute of Geomatics and Civil Engineering and the Zalaerdő Forestry Closed Company, within the frame of the Regional University Knowledge Centre of Forest and Wood Utilization. The results of this test clearly demonstrate that the local cohesive soil stabilized with suitable lime feeding can be the bearing layer of the pavement of forest roads.

Abstract – Most of the forest roads are used not only by forestry vehicles and staff, but by local inhabitants, tourists and others. Although heavy traffic is generated mostly by the vehicles connected to forestry operations. Different user groups have different needs against the geometry, the pavement type and the pavement condition of forest roads. To determine these needs, the traffic on the segments of a forest road network must be analysed. In this work, a traffic counting system and the obtained data are presented. The system consists of two retro-reflective photoelectric sensors, a safety camera and a control unit. A photo is taken whenever the light beam is interrupted. Combining the images with the data log of the sensors, the direction, the speed and the temporal distribution of the users of a particular forest road could be deduced. Based on this data, a proposal is made for the method of traffic analysis on whole road networks. As a result of this analysis the preferences of the forest road user groups could be determined. This information could be taken into account in the planning process of new forest road networks or the development of existing ones.

Abstract – In the last century the Wild T0 compass theodolite was the standard instrument of forest mapping and inventory. Nowadays this instrument is almost disappeared from the forestry surveying. Instead of theodolite we use GNSS instruments, which are easy to use even for not professionals. Data management is much faster with this instrument because of its compatibility with GIS software, but sometimes its accuracy is not so good as in the case of theodolite. In these days we can find digital surveying instruments, which can be operated by simple methods. The accuracy and efficiency of these instruments are suitable for today's engineers, and the processing of the data can be supported by geoinformatics. We examined the accuracy and effectiveness of the instrument, TruPulse 360B by test measurements. This instrument is a possible alternative of Wild T0, because we also can measure magnetic horizontal angle with it. We established a test field with surveying accuracy for the test measurements, where we can examine many kind of surveying methods. We found that the required accuracy can be achieved applying appropriate measuring mode and processing method. Therefore we can apply this instrument for engineer project.

Abstract – Coverage, richness and composition of bryophytes were compared between spruce and beech forest stands in the Sopron mountains. The highest coverage of bryophytes species in beech forests had *Hypnum cupressiforme*, which was followed by terricollous species like *Atrichum undulatum* and *Dicranella heteromalla*. The most dominant species in the spruce stands was *Brachythecium velutinum*; *Brachythecium rutabulum* and *Fissidens taxifolius* had slightly lower cover. The cover of bryophytes in beech stands was twice as high as in spruce stands. The total bryophyte coverage was very small in both forest types. The proportion of stands without bryophytes was the same in beech and spruce forest stands. Greater richness of bryophyte was found in beech stands than in spruce stands. The most frequent species were *Hypnum cupressiforme* and *Brachythecium velutinum* in both forest stands. The bryophyte flora was richer in native beech forests, than in spruce stands, which were planted on natural beech forests sites. However, the bryophyte composition of beech and spruce stands show considerable similarity. Generally, the older spruce plantations had unfavorable effect on the bryophyte diversity.

Abstract – In 2013, the ground beetle assemblageses of an artificial gap were studied in the field of Bálint-hegyi Erdőbirtokossági Társulat, in the subcompartment of Zánka 1B. We used 10 pitfall trapps filled with acetic acid solution. We collected altogether 4357 individuals of 20 carabid species. In our research, we examined the number of species and the number of individuals by dates and habitats. We trapped the highest number of species (16 species) on the 28th of June, while we trapped the highest number of specimens (1422 specimens) on the 31th of July. The number of species was the highest in the gap edge and in the mesic part of the forest (16 species each). The number of specimens was the highest in the gap edge (1308 specimens). We examined the dominance of the species and the distribution of the fauna elements. In all habitats *Carabus convexus* convexus had the highest dominance values. The

ground beetle fauna of the investigated locations (gap, gap edge, closed forest, mesic part of the forest) were compared with various ecological parameters (diversity, the level of consistency, similarity measures and hierarchical cluster analysis, based on Bray-Curtis).

Abstract – Macrolepidoptera communities and their diversity were compared in different age sessile oak-hornbeam forests, in the Sopron Mountains. The study was carried out in 2012-2013 from the end of March until early November each year, using portable light-traps. Our goal was to find any correlation between Lepidoptera diversity and the age of the forests. We used community and ecological characteristics to determine and compare Lepidoptera assemblages (Shannon and Simpson diversity indices, Pielou's evenness indices, Community dominance indices, Bray-Curtis similarity indices, Rényi's diversity ordering). Our result did not show a direct correlation between the Macrolepidoptera diversity and forests' age. However, our conclusions support the high influence the abundance of different vegetation layers on macromoth communities.

Abstract – During the hunting season 2012-13 we investigated occurrence of the Thorny-headed Worm Macracanthorhynchus hirudinaceus in 7 hunting areas. We dissected 618 wild boar (Sus scrofa) viscera. Worms were present in 4 areas, with a prevalence varying between 4.3-100%. M. hirudinaceus mostly occurred in areas characterised by sandy soils and a high density of cockchafers (Melolontha spp., Rhizotrogus spp.).

Contents and Abstracts of the Bulletin of Forest Science

Vol. 4, Nr. 2, 2014

Abstract – I show three relative brief episodes in relation to the history of Hungarian climate research. I investigate the peak of the climate controversy of the Great Hungarian Plain, i.e. the Kaán–Réthly debate, where not only two different personalities, but also two different imaginations of environmental or climate change faced with each other. Second, I show the effect of extreme weather on the media and public discourse through newspaper coverage, pointing out the similar attitude of the press compared to the present. Third, I recall the circumstances of the introduction of the global climate change theory in Hungary. I highlight that a representative of the old idea, i.e. stable climate with climatic fluctuations, raised the new theory first, but the new generation extended it with international impulses, partly with Soviet transmission in the background

Abstract – In this article we would like to give a picture of the characteristic features of sand-land forests concerning their water balance, and in relation to forest hydrology, that is we would like to outline how to apply those features in the course of nature conservation treatment. We based our survey both on special literature and on exchanges of practical experience with experts. More detailed investigation of the general hydrology of Duna-Tisza Sandrige started in the 1970s and expert opinions differ widely over the effects of crops on ground water level, that is, whether we can establish a connection between the growing afforestation in the area and the decrease in groundwater levels. This study confirms that we need to broaden our knowledge about this special field during forestry and nature protection management, and to explore the water management of sand-land sites, which are characterized by dry growing features, even more in the future. The local measurements and experiences must be determining in rational management and conservation treatment, because significant part of forests are in protected areas in Kiskunság.

Abstract – Today the Hungarian forest-steppe oak stands are grown mainly on unfavourable sandy sites. On these areas both the precipitation distribution and the water regime are unfavourable and the groundwater is in inaccessible depth for stands. In spite of that a lot of old high quality stem can be found in the investigated forest associations according to our experience the associations' regenerations sometimes encounter insolvable difficulties. In spite of that the rate of growth of the present stand relates to sufficient water quantity the growing of the planted seedlings and sowings is slow in the different forest regenerations. The state of health of the regrowth is bad, the stand becomes thinner and invasive weeds occupy on the area after a few years. We carried out root excavations to find out the reason of the different growth pattern between the regrowth and the original stand. On the area the investigated root systems of the three tree species – pedunculate oak (*Quercus robur*), white poplar (*Populus alba*) and common ash (*Fraxinus excelsior*) – show that the present old stand didn't evolve by means of dry sandy site but it developed due to the effect of the covered meadow soil.

Abstract – Considering the possible impacts of the climate change we investigated the time series of precipitation ranging from 1901 to 2013 at Nagykanizsa and Zalaegerszeg in Zala County. Firstly we aggregated seasonal sums from the monthly data according to the periods of the water cycle in the forest (storage: Nov-Apr, main consumption: May-July, maintenance: AugOct, hydrological year: Nov-Oct), then we studied the distributions and trends in time, and analysed the break points. We also carried out these analyses on the temperature data of Nagykanizsa (1972–2013). The results show great variety in the seasonal precipitation sums (CV is about 30%), while the CV of the seasonal mean of the temperature – except from the storage period – is smaller (5–7%). Depending on the station and the period, mostly a decreasing trend can be detected for precipitation and the seasonal means of the temperature are increasing significantly. Break points appear in the time series of the precipitation from 1941 till 2000, but they occur mostly in different years on the different stations, thus they are not valid for the whole region. In the time series of temperature there are break points in the recent past.

Abstract – Within the framework of AGRÁRKLÍMA project we prepared soil maps for both forest- and croplands of Zala County of Hungary. To achieve this we used a GIS database consisting of data on geology, relief, hydrology, (referred as environmental variables) and forestry, supported with data from the Digital Kreybig Soil Information System. The available set of site data from forestry and agricultural database was evaluated in relation to the environmental datasets. This process aimed at setting up signatures for all soil types by signature of the most strongly related environmental feature sets for each soil type. Using these signatures we trained hierarchical and non-hierarchical classification tools to identify the spatial extent of soils in Zala County. Neural networks were found to be the most effective

mapping tool. Making a validation with a data set of known soil characteristics we found 67% correct classification rate for the county. Additionally, we set up a joint soil type database for County Zala.

Abstract – Water balance of Zala County was analysed using remote-sensing based evapotranspiration maps for Hungary (Kovács 2011). Mean (1999–2008 period) annual evapotranspiration and runoff maps were evaluated in the context of land cover types (Corine Land Cover 2006). The mean annual evapotranspiration of Zala County (577 mm/year) was 88 percent of the mean annual precipitation (655.7 mm/year) in the examined period. The highest evapotranspiration values were determined for water bodies as well as forest and semi natural areas. For evaluating the effects of climate change on evapotranspiration we used the Budyko-type model (α-parameter), moreover a linear model with β-parameter was introduced for the extrawater affected pixels. Applying the two parameter maps and future data of climate models (mean annual temperature and precipitation) evapotranspiration and runoff predictions have been estimated by the end of the 21st century. According to the predictions, the mean annual evapotranspiration may increase by 5 percent while the runoff may decrease to the one third to the end of the century.

Abstract – One of the upcoming most severe issues in forestry in relation with climate change is set up a sound base for correct choice of applicable species. The current practice is unable to entirely solve this problem. Within the framework of AGRÁRKLÍMA project we investigated the site dependence of height growth for some species in County Zala. For the study we used data of different sources: forest management plans, long-term experimental plots of NARIC FRI for yield assessments, and site characteristics. We identified the factors from the dataset, which have main influence on height growth of the following species: beech, sessile oak, turkey oak, scots pine. Using multiple regressions we derived functions to assess height growth of above species. We found biologically high values of R-square between 0.65 and 0.87. Beside the age of the stands the most influencing factors were: forest aridity index, rootable depth, and soil texture. Using the regression equations and the new yield tables for the county we prepared maps showing the expected change in yield classes and growth-capacity according to the increase of aridity index due to climate change. This method makes us able to support yield based choice of tree species for future afforestations and regenerations.

Abstract – Out of the 1998 series of the international beech provenance trials, one experiment was established in Bucsuta, SW Hungary. The site is close to the low-elevation, xeric distributional limit of the species. The climatic conditions are the most extreme compared with other experiments. Bucsuta is therefore the most suitable site to model

responses of populations to sudden climatic changes, simulated by transfer. Plot averages of 15-year diameter, measured on the 5 largest trees per plot were analysed. Out of the climatic variables, the ones determined by summer temperatures (Tmax, TQW) and drought conditions (DMI, EQ) were significant. Not surprisingly, Ellenberg's drought index has shown the best correlation and was selected for the characterization of ecodistance. The climatic distance between the provenance origin and the test site, and the 15-year diameter data were used to establish a linear transfer function of high significance (p=0.0006). The regression (Fig. 3) indicates a monotonous decline which has no maximum value at "0" ecodistance, and may be used for the estimation of growth decline caused by changing climatic conditions.

Gábor VEPERDI:

Determination of site quality index based on the mean annual increment of the growing stock at or near the rotation age … 101–107

Abstract – Recent research activities have proven that in case of new local yield tables the mean annual increment of the total production cannot be used to determine site quality index as total production is not known in most cases. This paper suggests using the mean annual increment of the growing stock as a basis of determination of site quality index. On the other hand, this value is not comparable with site quality indices derived from existing global yield tables. The paper presents a new method of site classification where site quality index is derived from growing stock data in global yield tables. Both a graphical method and numeric values are presented.

Ernő FÜHRER, Imre CSIHA, Ildikó SZABADOS, Zoltán PÖDÖR and Anikó JAGODICS:

Aboveground and belowground dendromass in a stand of Turkey oak … 109–119

Abstract – In general view, the role of forests in carbon cycle is considered to be positive in reference to the impacts and mitigation of climate change. To verify this by results in Hungary, we have to assess the amount of carbon stored in forests in Hungary as a basis for comparison. Expecting warmer and drier climate as an effect of the climate change, we have to prefer the native tree species that are able to survive and maintain vitality under the new conditions. Therefore in a stand of Turkey oak we investigated the compartments of aboveground and belowground dendromass in terms of carbon equivalent. According to the results, 70% of the total dendromass was above and 30% of it was below the ground. Percentage of the compartments in descending order are as follows: stems: 55%, roots 24%, branches 13%, trunks 6% and foliage 2%. The ratio of aboveground (without foliage) and belowground carbon stock is 2.3. Taking our previous results of other forest stands into account, we could determine the correlation of Forestry Aridity Index (FAI) and this ratio. Hence the carbon amount in belowground dendromass can be estimated based on the stand volume and this climate-dependent ratio.

András BIDLÓ, Péter SZŰCS, Adrienn HORVÁTH, Éva KIRÁLY, Eszter NÉMETH and Zoltán SOMOGYI:

The effect of afforestations on the carbon stock of soil in Transdanubian Region (Hungary) … 121–133

Abstract – Forest ecosystems are the most important carbon sinks, and the forest soils play an important role in the global carbon cycle. We have little data on the carbon stock of soils and its change due to human activities, which have similar value to carbon content of biomass. In our investigation we measured the carbon stock of soil in six stands of *Quercus*

petrea and six stands of *Robinia pseudoacacia* after afforestations. We compared the carbon stock of forests with that of neighboring arable lands of the same soil conditions. We found larger quantity of carbon under the forest stands than in the arable lands (including the forest litter). However, differences were less clear in case of soil layers. In any event, the afforestations increase the carbon stock of soil (including the forest litter), and contribute to the mitigation of atmospheric carbon-dioxide

Abstract – We have analysed the genetic pattern of oak decline through the comparison of subpopulations composed viable and declined trees growing close to each other on various stands. The applied sampling method excluded most of the site effects influencing viability. For the genetic investigation 6 nuclear microsatellite loci (ZAG1/5, ZAG96, ZAG110, ZAG9, ZAG11, ZAG112) and 7 isoenzyme loci (IDH_B, PGI_B, AAP_A, AAT_B, ADH_A, SKDH_A, PGM_B) were applied. The genetic diversity of the analysed subpopulations were evaluated by different indices, such as number of alleles, effective number of alleles, Shannon diversity index, number of private allele, expected- and observed heterozygosity, fixation index. The different tendency of results regarding isoenzyme markers in case of pedunculate and sessile oaks was a conspicuous speciality of the study. Higher allele diversity was detected in the declined pedunculate oak subpopulation, while in case of the sessile oaks the viable subpopulation showed higher values. A very similar tendency could be revealed with the calculation of fixation index based on the heterozygosity values. In case of the microsatellite markers the outstanding allelic diversity of the viable pedunculate oak subpopulation was remarkable. Based on the genetic distance among the analysed subgroups the two oak species compose two distinct clusters, and also the viable and declined subpopulations separate within the two main clusters.

Abstract – The drought induced oak decline has been continuously observed for more than three decades in Hungary. We introduced a novel health assessment method based on the evaluation of the decline of stand density (compared to the density of the fully stocked stand) caused by drought-induced tree mortality. The health condition of the stand can only be assessed, if the decreased relative stand density due to the mortality is further reduced through concerning the health condition of the survived trees. Stands for the assessment were selected along a climatic gradient from the humid region in SW-Hungary to the continental-semiarid region in NE Hungary where no forest intervention was applied during the last decades. Results outline that the health status of the stands in SW Hungary is between 70–80% while near to its xeric limit around 50%.