ABSTRACT BOOK

10th International Beech Symposium / 2015

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The 10th International Beech Symposium

1-6 September, 2015, Kastamonu, Safranbolu / TURKEY

The 10th International Beech Symposium

By organized IUFRO Working Party

1.01.07 "Ecology and Silviculture of Beech" &

1.01.00 "Temperate and Boreal Silviculture"

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Kastamonu, August / 2015

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PREFACE

The 10th International Beech Symposium of IUFRO (International Union of Forest Research Organizations) Working Parties (WP) 1.01.07 & 1.01.00 will held at 3 Mart Konferans Salon of Kastamonu University, in Kastamonu and Safranbolu, Western Blacksea Region of TURKEY from September 1st to 6th, 2015. The symposium included 2,5 days for scientific presentations in Kastamonu and 1,5 days for field trip to the pure and mixed beech (*Fagus orientalis* Link.) stands of "Zonguldak-Yenice Forests. Yenice Forests is one of 9 Forest hotpoints in Turkey and 100 forest Hotpoints Europe by WWF announced.

Beech has a special importance because of its increasing economic market value as the main broadleaved species in Turkish forestry. Moreover, because of drought sensitiveness of *Fagus sylvatica* due to global climate change, *Fagus orientalis* is getting increase the ecological importance thanks to high adaption capability.

Fagus is the most abundant and economically important hardwood genera in northern hemisphere in temperate forests. In Turkey, most oriental beech (*Fagus orientalis* Lipsky) forests are distributed in northern of Turkey. However, relict oriental beech forests are distributed in the Eastern Mediterranean region of Turkey, including Adana, Osmaniye, Hatay, and Kahramanmaras provinces. Oriental beech forests in Turkey include *Abies nordmanniana*, *A. nordmanniana* subsp. *bornmülleriana*, *A. equi-trojani*, *Pinus sylvestris*, *P. nigra* Arnold subsp. *pallasiana* and *Picea orientalis* at higher elevations, and there are also single-species stands that cover large areas and are connected by corridors. Oriental beech forests have, however, been degraded, especially near villages and transport corridors. So, Natural or artificial regeneration, rehabilitation, and conversion from coppice to high forest are important practices in Oriental beech forests in Turkey.

The aim of the symposium is to provide an overview on latest research related to beech species and beech dominated ecosystem and their dynamics challenges and potentials in the light of climate change. Particular focus will be at the identification of scientifically based sustainable management solutions to meet these challenges and develop the potentials.

About more than 100 participants from 14 countries will attend the symposium, ranging from senior researchers to PhD students. During the symposium, 3 keynotes, 35 voluntary orals and 3 more oral presentations in the field and 45 posters will be presented. Presentations are welcome for the following session topics:

1) Paleoecology and distribution of beech
2) Ecology of beech (incl. pathology and pests)
3) Genetics of beech
4) Structure and dynamics of beech stands including silvicultural systems, approaches and thinning.
5) Regeneration of beech forests from flowering to the first thinning.
6) Management of the beech forests including economic value and importance of beech forest products.

The proceedings will be published as a collection of the extended abstracts or full text of oral and poster papers being approved by Scientific Committee.

First of all, I would like to emphasize my gratitude to the rector and honorary chair of the symposium, Prof. Dr. Seyit AYDIN, for his support to 10th International Beech Symposium. Also, I want to extend this appreciation to Assoc. Prof. Dr. Khosro SAGHEB-TALEBİ, Coordinator of IUFRO WP 1.01.07 (Ecology and Silviculture of Beech) and Prof. Palle MADSEN, Coordinator of IUFRO WP 1.01.00 "Temperate and Boreal Silviculture". Moreover, I would like to thanks to Ahmet Sırrı BEŞEL (M.Sc.), Forestry Regional Director in Zonguldak, for organizing field trip in Yenice Forest.

I would like to thank all of those who participated in the symposium, with special gratitude to the members of Scientific Committee, keynote speakers and moderators of these sessions. Furthermore, the members of Organizing Committee did a very good job in the hosting of the participants in Kastamonu. I, also, express my sincere thanks to all of the representatives' person of organizations that sponsored the symposium.

Prof. Dr. Sezgin AYAN

Editor

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A SURVEY OF REGENERATION DIVERSITY IN MANAGED AND UNMANAGED BEECH STANDS OF NORTH FORESTS OF IRAN

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INTRODUCTION

Biodiversity is essential for human's life continuation, economic issues, ecosystems' resistance and function (Singh, 2002). Beech forests of north of Iran are among the most valuable tree species such that this species alone includes 24 percent of numbers and 30 percent of the volume of Iran's industrial and business forests. Consistent decrease of the level of such forests because of a variety of reasons delineates the importance of performing research projects concerning such species. Indeed natural regeneration and rebirth of forest trees are among the most significant events in a forest's life cycle such that life continuance, persistent stability, and to some extent the mixture of forest species depend on them.

MATERIALS AND METHODS

The studied area

Nave-Asalem forests are located in the north of Iran at 38´, 37º northern latitude and 52´, 48º eastern longitude, 800 meters above the sea level. 75 sample pieces (disconnectedly 32 sample pieces in the managed area and 43 sample pieces in the unmanaged area) were examined in the area with a $100_m \times 100_m$ network inventory.

RESULTS

Comparing the diversity indexes regarding the tree species regeneration in the managed and unmanaged areas reveals that the amount of all indexes in the managed area is more than the unmanaged area, and these differences are more obvious with regard to the Shannon-wiener index, N_2 Hiill and Mc Arthur. As seen, except the Simpson diversity index the other diversity indexes after 40 years of managed management accomplishment and stand exploitation had a considerable difference with each other and with unmanaged areas wooden species regeneration diversity. Sapling and thicket have decreased in germination stage, and in this case the N_2 Hiill index with the amount of 1.973 and MC Arthur index with the amount of 2.127 have had the greatest increase in the managed stand. Among Shannon-wiener diversity index, N_2 Hiill and N_1 MC Arthur as noticed within the two stands, a statistically significant difference at a 5 percent level has been noticed. Also among Brillouins diversity index mean within the two stands a statistically significant difference in 1 and 5 percent level has been noticed. But with regard to the Simpson's diversity index no considerable difference has been noticed within the two stands at 1 and 5 percent level.

DISCUSSIONS

From tree species regeneration biodiversity point of view in the stage of sapling and thicket, the species diversity volume according to N_2 Hiill index, Shannon-wiener, Brillouins and N_1 MC Arthur within the two managed and unmanaged stands is a great difference, and in all cases the diversity index within the managed stand have greater amounts compared to the unmanaged stand. This was compatible with the results of Alijanpour et al. (2007) studies in Arasbaran region in which management based on protection led to the growth of tree species regeneration diversity in the area. Considering the regeneration diversity

situation within the two stands indicates that management based on exploitation in the unmanaged area has decreased the regeneration accumulation in this stand. This was compatible with the study of Smith (1996) who asserts that the main reason of natural resource management is biodiversity protection and regeneration continuance. In this study the main reason for the decrease in the stand's regeneration accumulation was known as Fagetum stand's shade tolerance and over-opening of the crown in exploited areas. This was also compatible with the studies of Brashears et.al (2004); Crow et al. (2002); Elliottand and swank, 1994; Schuler and Gillespie, (2000); and Tabari et al. (2003). Last but not least unmanaged stands from the respect of many indexes have an undesirable condition compared to managed stands, and we can point out to the main factors of such event as marking desirable and high quality trees in unmanaged stands, exploitation detriments, domesticated animals grazing and inaccurate management in these stands.

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AMOUNT OF DEAD WOOD AND ITS EFFECT ON FOREST BIODIVERSITY IN MANAGED BEECH FORESTS IN THE HUNGARIAN CARPATHIANS

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ABSTRACT

Quantitative and qualitative characteristics of dead wood were measured in 100 managed and 20 abandoned beech forest stands (forest reserves) in the Hungarian Carpathians. Bryophyte and polypore fungi communities related to dead wood were also surveyed. The amount of dead wood was four times higher in forest reserves than in managed forests (120 versus 30 m^3/ha). In the abandoned forests the proportion standing dead wood and stumps was lower, while the proportion of thick logs was higher than in managed forests. In managed forests the amount of dead wood and the proportion of logs increased with age. 84 bryophyte and 69 polypore species was recorded in the sample, for both organism groups the stand level species richness was higher in abandoned forest than in managed stands. Bryophyte diversity was mainly related to dead wood volume, while for polypore diversity the amount of fine wood debris was important. This study emphasizes the importance of dead wood retention in managed forest for forest biodiversity. Scattered abandoned stands with high amount of dead wood can maintain source populations of saproxylic species, while the matrix of managed forests with limited dead wood availability can proved permeable habitat for these organism groups.

Key words: Bryophytes, dead wood, Hungary, polypore fungi,

ANALYSIS OF VITALITY AND GROWTH FORM CLASS OF NATURAL YOUNG GENERATION'S IN A BEECH STAND IN DÜZKÖY DISTRICT

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ABSTRACT

Natural regeneration is generally realized as using shelterwood system according to its biological features because of being shade tolerant tree. Canopy effect especially during the early stage of regeneration is very important for young generation of beech specie. However, young generations take place under open canopy conditions are more affected from frost and drought. If young generations of beech grow freely and they are not in enough dense or their increasing light demand are not given, it causes to a decrease in crown growth of the young generations. Young generations of the beech are generally formed under canopy because of having heavy and big seeds. So, it is also important to create the useful stand structure during seed cutting and afterwards in order to make the vitality and growth forms of the young generations better.

In this study, the most suitable silvicultural treatments were tried to determine by analysing the young generation's vitality and growth form deal with the stand structure. For this purpose, vitality and growth forms of the young generations of beech were analysed in a stand during regeneration step. Three sampling pots were taken on upper, lower and middle slopes and each sampling plot was 30X50 meters in size. In each sampling plot stand structure and young generation communities were determined by stand profiles. Vitality and growth forms were determined on the young generations which were sampled systematically. Every young generation in 1 square meter between four meter intervals were measured. Average vitality was found as 2 in the sampling plots. If the numbers of seedlings increase in unit area, vitality improves as well. According to the obtained results, vitality is better at seedlings under canopy than seedlings under open crown closure.

Key words: Beech, natural regeneration, stand structure, vitality, growth form

APPLICATIONS OF ARTIFICIAL NEURAL NETWORK FOR PREDICTING THE RELATIONSHIPS BETWEEN HEIGHT AND AGE FOR ORIENTAL BEECH

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ABSTRACT

To predict the relationships between tree height and age that can be served as site quality estimations, many statistical models have been developed for constructing site index curves. The accurate predictions of forest site quality are critical for effective forest management and useful for stratifying forest areas into productive classes. To quantify site productivity and analyze stand structure, forest biometricians assess the relationship between tree height and age. The height-age data that were obtained from repeated measurements for the same individual trees result in autocorrelation problem, violations for independent of data, and these autocorrelations affect the statistical significance of the parameters, which may be biased. Although many studies using these procedures have been carried out in forest literature, these assumptions about autocorrelation problem for regression models are often not fulfilled owing to the inherent data structure variability in forestry studies. The autocorrelation problem of stem analysis data may overthrow standard regression hypothesis testing procedures and interval estimations. To correct this autocorrelation problem, some autoregressive procedures such as the first-order autoregressive parameter structure, the second-order autoregressive parameter structure and the continuous autoregressive error structure. In addition to autoregressive modeling, the nonlinear mixed effect modeling approach has been proposed to fit site index models with fixed and random effects parameters. Previous studies have shown inconsistent consequences regarding elimination of the autocorrelations from height-age data using these autoregressive structures or the nonlinear mixed effect modeling approach. As alternative method to these different approach and procedure to solve the autocorrelation problem in height-age data, artificial neural networks (ANNs) form a subset of artificial intelligence may offer a more flexible and relatively simpler corresponding without the restrictive assumptions of a particular statistical models. Artificial neural networks (ANNs) are a type of artificial intelligence system similar to human brain, having a computational capability which is acquired through learning. A neural network is composed of an interconnected group of artificial neurons and a connectionist way is taken to process information for it. Artificial neural network applications offer the ability to implicitly perceive complex nonlinear relationships between input and output variables, which are very helpful in tree height modeling. Although different statistical modeling techniques including the nonlinear regression prediction have been proposed to model the relationships between tree height and age, only a few studies concerning Applications of Artificial neural networks (ANNs) to predict tree height of Oriental beech. In this study, Applications of Artificial neural networks (ANNs) were carried out to predict the relationships between tree height and age for Oriental beech. To achieve tree height predictions, various artificial neural networks (ANNs) structures such as Cascade-forward backprop, Elman backprop, feed-forward backprop, Layer Recurrent and radial basis was used and compared with respect to residuals of these models, specifically, the evaluation criteria were; root mean square error (RMSE), Absolute mean error (AME), and the adjusted coefficient of determination (R^2_{adj}). Application of ANN was carried out using MATLAB-NNTOOL module including the development data set that was further subdivided into three subsets for ANN training (75%), validation (15%) and testing (10%). The artificial neural networks (ANNs) based on radial basis structures with $\mathrm{R}^2_{\mathrm{adj}}$ (0.970), Absolute bias (0.7808) and RMSE (1.170) provided much better fitting and precise predictions for tree heights than other network predictions. Based on this study's results, the efficiency and usability of

artificial neural networks (ANNs) as new modeling technique can be evaluated to predict the relationships between tree height and age.

Key words: Artificial neural networks (ANNs), difference approach, generalized algebraic, tree height predictions.

AUTOREGRESSIVE AND MIXED EFFECT PREDICTIONS IN STEM DIAMETER INCREMENT DATA FOR ORIENTAL BEECH TREES

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ABSTRACT

Individual tree diameter at breast height (DBH) and its increment values are important forest inventory measurements used for total and merchantable volume estimations, growth and yield modeling, and site index predictions. The diameter increment data that were obtained from stem analysis measurements for the same individual trees result in autocorrelation problem owing to the repeated data structures within same individual trees, which means the violations for independent of data. Two type modeling techniques, including autoregressive and mixed effect regression, were applied to fit tree stem diameter increment data obtained from tree stem analysis. Because stem analysis data that could be obtained from multiple measurements in tree stem resulted in a highly correlated data, also called as auto-correlation problem, the use of ordinary least squares (OLS) for linear models or nonlinear least squares (NLS) technique for nonlinear models leads to biased estimates of the confidence interval for model parameters. To correct this autocorrelation problem, some autoregressive procedures such as the first-order autoregressive parameter structure, the second-order autoregressive parameter structure and the continuous autoregressive error structure (CAR(p)) can be introduced in diameter increment predictions. In addition to autoregressive modeling, the nonlinear mixed effect modeling approach has been proposed to fit diameter increment models with fixed and random effects parameters. Autoregressive regression technique and mixed effect modeling approach have been increasingly used as an alternative statistical method to deal with the auto-correlation problems caused by hierarchical data structure. Autoregressive regression technique is an example and application of Time-Series Analyze Modeling and produces fitting results by minimizing auto-correlations among multiple measurements. In mixed effect modeling approach, the inclusion of random parameters into model structure enables the estimation of the residual variance of the relationships among clustered or nested sample units located in different stands. In this study, data from stem analysis of 199 dominant Oriental beech trees were used to dynamic nonlinear model based on the Chapman-Richards' equation for predicting diameter increment data of tree stem. In these models, tree diameter increments (mm) that were measured at different ages in 1.30 m cross-section were assigned to dependent variable. The tree age that tree diameter increments were measured, total tree age and total heights were nominated to independent variables in these models. Especially, the parameters for these models were predicted by autoregressive regression technique and mixed effect modeling approach. This results presented the new model for predicting tree diameter increment by accounting for the nested hierarchical data structure in highly correlated measurements with the autoregressive and mixed effect regression techniques.

Key words: Autocorrelation problem, autoregressive error structure, nonlinear mixed effect modeling approach

BONDING STRENGTH OF POLYVINYL ACETATE (PVAC) AND CASE IN ADHESIVES IN SMALL DIAMETER BEECH WOOD (*Fagus sylvatica* L.)

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ABSTRACT

As a matter of fact, beech wood is one of the most important commercial hardwood species in southeastern Europe. Beech is utilised mainly as round wood and fuel wood. Overall harvest of beech wood is comparable to those of pine and oak forests. Effective and maximum value use of small-diameter hardwood timber has long been of interest to forest managers and researchers. Gluing or bonding wood has been widely used for many centuries. Moreover, a wide variety of adhesives types is utilised, due to their extensive use in many different applications with wood. Beech wood (*Fagus sylvatica* L.), was used in order to investigate the bondability of beech wood. For the bonding the used adhesives were PVAc and casein glue, both of D3 Class. The adhesives were applied to one or two surfaces and the half of them were immersed in water in order to investigate the influence of moisture on bonding strength. According to the results, the average modulus of rapture was influenced by the type of adhesive. The samples of beech wood bonded with PVAc had higher modulus of rapture compared to the samples of beech laminated with glue Casein-gap from 1.03 to 2.2 N/mm². Additionally, the highest average modulus of rapture rate recorded in beech samples coated with PVAc on both bonding surfaces reaches 21.05 N/mm². The statistical analysis of the results revealed that the average bonding strength of those samples only air-conditioned, did not show any statistically noticeable difference from the average bonding strength of the samples immersed in water.

Key words: Beech wood, bonding, casein, PVAc, shear strength

BREEDING AND GENE CONSERVATION OF ORIENTAL BEECH (*Fagus orientalis*) IN TURKEY

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ABSTRACT

Tree breeding in Turkey was started in 1964. Seed transfer zones were determined for the economically important tree species. Until 1994, breeding activities have been carried out as seed stand selection, plus tree selection and seed orchard establishment in seed transfer zones for each sepecies. The National Tree Breeding and Seed Production Program (NTBSP) for Turkey was implemented at 1994. *Pinus brutia, Pinus nigra, Pinus sylvestris, Cedrus libani and Fagus orientalis* were determined as target species in the program. The proposed work with these tree species had all the components of intensive tree breeding, such as delineation of breeding zones, plus tree selection, seed orchard establishment and progeny testing. Progeny tests and gene conservation strategies were introduced by NTBSP. The main aim for breeding of oriental beech is to increase the height and volume growth while maintaining the high quality of the stem. Two geographical main breeding zones with three elevational sub breeding zones and one seed production zone with three elevational subzones were determined in NTBSP. A gene conservation zone was included to conserve oriental beech populations in the Amonos Mountain. Up to now, 3396.7 ha seed stands and 3238.4 ha gene conservation forests have been selected for oriental beech. Selection of plus trees and establishment of progeny test couldn't be done for oriental beech because of biological properties of the species and priorities of other species.

Key words: Breeding zone, gene conservation forest, seed stands.

CAN THE DROUGHT TOLERANCE OF EUROPEAN BEECH BE INCREASED BY THINNING INTERVENTIONS?

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ABSTRACT

Climate change is predicted to intensify summer droughts in Central Europe. In the long term, adaption may be achieved through changes in species and genetic composition of forests. In the short-term, adaptation measure must also reduce drought stress for existing forests. The reduction of stand density through thinning has been identified as a promising means to reduce drought-effects for even-aged stands from several tree genera. Despite the fact that the drought-sensitive European beech (*Fagus sylvatica*) is the naturally predominant and most important broadleaved tree species in Central Europe, knowledge concerning the suitability of thinning to enhance its drought-tolerance is lacking. We analyzed tree-ring data from a number of long-term thinning experiments in European beech stands in Southern Germany to determine the effects of two thinning intensities on the growth response during extreme drought-events (resistance) and afterwards (recovery and resilience). Radial growth of dominant trees (with a diameter > 70 % of all trees in a given stand) recovered significantly faster in heavily thinned stands compared to moderately thinned stands. However, for the same trees, thinning intensity had no influence on growth depressions during droughts, and the resilience of radial growth, i. e., and the relative growth level after drought events compared to that before the event. Furthermore, smaller trees (diameter < 65 % of all trees in a given stand) displayed a similar drought response of radial growth during and after a drought event in the differently thinned stands. The results support the development of more intensive thinning regimes in Central European beech forests.

Key words: Radial growth, recovery, resilience, resistance, tree rings, water stress.

COMPARISON OF DIFFERENTLY ORIGINATED ORIENTAL BEECH (*Fagus orientalis* Lipsky) SEEDLING GROWTH IN FIELD

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ABSTRACT

It is not possible to make artificial regeneration and afforestation areas optimum totally because of the fact that site area conditions have very different characteristics regionally. Based on these ecological conditions where seed origins and application area should be considered. Beside this seedling production, choice and usage, which has genetically, morphological and physiological characteristics, are important.

Within this study it is aimed to examine the land performances of seedlings grown from different origins. For this 11 natural population chosen from natural distribution oriental beech. The seedlings were sowed appropriate to the Randomized Blocks Design with 3 replications.

After grown along two-vegetation period in nursery, Trabzon-Maçka, Trabzon-Çaykara, Düzce-Çiçekli, Giresun-Kulakkaya, Ordu-Akkuş and Kahramanmaraş-Andırın populations were planted in the 1230 metres altitude experimental forest in Tonya Kalınçam. Sinop-Merkez, Sinop-Ayancık, Samsun-Kunduz, Samsun-Karapınar and Karabük-Yenice populations were grown in Of forest nursery for along three vegetation period and then they were planted on the same area.

After a vegetation period in the area conditions, morphological measurements like seedling height, root collar diameter and branch number were done on population and tree basis.

By making variation analysis with the SPSS 20 statistic program it was determined that these measurements variations within and among populations. It was found that variations in populations are more than variations among populations in terms of morphological characters. Besides it was determined there were significant correlations between morphological characters. On the other hand populations were grouped with hierarchical cluster analysis

Key words: Field performance, Oriental beech, origin, seedling, variation.

DETERMINATION OF HEAVY METAL POLLUTION LEVEL IN PURE ORIENTAL BEECH (*Fagus orientalis* Lipsky.) FORETS IN THE ÇAYCUMA DISTRICT IN TURKEY

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ABSTRACT

In this study carried out in pure Oriental beech (*Fagus orientalis* Lipsky.) forests of Çaycuma forest district the change of amount of heavy metals in both soil and needles of oriental beech depending on altitude was investigated. For this reason, sample plots were established in three different altitude levels (400m, 600m and 800m) and changes of heavy metals were determined in the soil and oriental beech leaves. According to the results obtained from this research, soil and plant contamination by heavy metals is increasing nowadays while the heavy metal (Pb, Zn, Ni, Cu, Cd, Mn, Cr and Fe) concentrations decreased with the increase in altitude. The highest levels of Ni, Pb, Cu, Fe and Zn were found in the composite soil and leaves of oriental beech adjacent between 400m and 600m altitude levels. However, there are significant differences at the $P<0.01$ level according to the results of ANOVA in the amount of heavy metals in both soil and leaves of oriental beech depending on the altitude ranges. The Duncan test was also applied and three different groups were found (exception Cd and Mn); the changes of the amount of heavy metals in soil and leaves of oriental beech depends on the altitude level at the $P<0.01$ significance level. In this context, the area should be carefully monitored in order to detect changes in the long-term risk due to the presence of high concentrations of trace elements in soils. Toxicological tests and risk assessment will also be carried out with newly polluted soils and trees from this site to evaluate the actual environmental risk of trace elements and their transfer to the food chain. The grape plant had behaved as a metal indicator for Pb, Mn, Zn, Fe, Cu, Cr and Cd, indicating that it can be used for testing changes in metal availability in soils. The concentrations of metals in both plant species exceeded the limits established for humans and grazing animals' impling a health risk linked with the spread of pollution from mining sites to oriental beech forests in the Çaycuma district.

Keywords: Altitude range, heavy metal, leaves, oriental beech, soil

DETERMINATION OF THE FACTORS AFFECTING THE SUCCESS NATURAL REGENERATION IN ORIENTAL BEECH (*Fagus orientalis* Lipsky.) FORESTS (DEVREK-PÜRENKAYA CASE STUDY)

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ABSTRACT

In this study, factors affecting the success of regeneration which was made using Uniform Shelterwood Method were determined in the oriental beech (*Fagus orientalis* Lipsky.) natural regeneration application in the 37a and 38c forest divisions in Devrek-Pürenkaya, Forest Range District, Zonguldak, Turkey. Moreover, number of oriental beech seedlings, height growths and root collar diameter of seedlings were investigated 20 sample plots which were taken in the regeneration area which was 26 hectares for 21 years (1994-2014). According to the last results of count and measurements in 2014, it was determined that number of natural oriental beech seedlings ranged from 5.2-11.4 per square meter, mean height growth 11.3-18.7 m and mean root collar diameter from 33.6-52.4 cm were determined. Furthermore, the results of factor analyses that it were found growth of seed trees, soil organic content, soil moisture, soil reaction, crown vitality of seed trees, damages of rodent and frost damage were the most effective factors on success of oriental beech natural regeneration.

Keywords: Factor analysis, growth, Oriental beech, natural regeneration

EFFECTS OF CLIMATE CHANGE ON SEED PRODUCTION IN SEED STANDS OF ORIENTAL BEECH (*Fagus orientalis* Lipsky.) IN THE BARTIN REGION IN TURKEY

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ABSTRACT

Oriental Beech (*Fagus orientalis* Lipsky.), one of the important main forest tree species of Turkey, has a wide geographical distribution, and it takes place in pure and mixed forest stands that are very valuable in terms of ecology and economics. Oriental beech, which is widely preferred by the forest product industry since its wood is easy-to-process and very durable, has 28 seed stands throughout the country, and the saplings used in artificial regeneration and forestation works for rehabilitating the ruined forests of the species are generally procured from these sources. However, the climate change, the most important disturbance, and the climate change have negative effects also on the seed productivity of the beech seed stands, as well as they have on all forest sources. In this case, it is likely that there might be some difficulties in ensuring the sustainability of pure and mixed beech forests and in procuring the beech saplings to be used in rehabilitation of degraded forests.

In this study that has been carried out within this context, the differences in beech seed productivities depending on the change in meteorological observations (precipitation, temperature, and carbon emission) during 15-year period (between 2000 and 2014) in a total of 5 plots (a total of 349.4 ha) in Bartın-Kumluca region that has been registered between 1984 and 1986 have been revealed. Phenological observations have been carried out for this reason, the seed index and seed life index values have been calculated in accordance with annual productivities, and these values have been compared through Palmer, De Martonne, Emberger, UNEP Drought Index and Maksimum Moisture Anomaly Index at *P>0.01* confidence level. In these comparisons, Mann-Kendall Sequential Analysis has been utilized. As a result of performed analyses, it has been determined that, as a result of rapid drought observed in the region in years 2001, 2004 and 2006, the seed productivity has decreased by 18.6-23.4% in proportion to the seed productivity values observed in previous period covering the years between 1995 and 2000, when normal climate conditions have been observed. And in period covering 2006-2010, the drought has been both severer and longer than the drought during 2001-2006 period. And in this period, the seed productivity has decreased by 38.4-53.7%, and it has been determined to be one of the most infertile periods in seed stands. In final period covering the years 2011-2013, the unexpected drought periods have been observed, carbon emission has decreased, and these conditions have created shock effect on beech seed stands, and led the seed productivity to decrease by 33.6-39.7%. And in year 2014, the longest and most severely drought periods have been observed in the region, and the healthy seed productivity in beech seed stands in Bartın-Kumluca region has decreased by 58.4-72.6% in proportion to previous periods.

Key words: Drought, Oriental beech, phenology, seed productivity, seed stand

EFFECTS OF DIFFERENT THINNING INTENSITY IN BEECH FORESTS IN DÜZCE

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ABSTRACT

This study was carried out in natural, even-aged, and pure oriental beech (*Fagus orientalis* Lipsky) stands in Düzce, Turkey and evaluated the fourth year results of thinning effects on stand and crop tree growth. A thinning experiment was conducted on three different sites using a randomized block design with three replications. Three thinning intensities (the control, moderate and heavy) were applied to the beech stands on all sites. The selective thinning intensities included the removal of initial basal area by 0% (the control), 21-28% (moderate) and 31-46% (heavy). Thinning has affected stand diameter increments on all sites. Generally, absolute and relative diameter increments increased with increasing thinning intensity. Thinning intensity didn't significantly affect stand basal area increment on all sites, but significantly influenced relative stand basal area increment, which was the highest for the heavy thinning treatment and the lowest for the control. Thinning intensity didn't make a significant difference for stand volume increment. Also, thinning intensity significantly affected relative stand volume increment, which was the highest on the heavy thinning sites and the lowest on the control sites. Height growth didn't vary significantly with thinning intensity. Diameter, basal area and volume increments of crop trees increased with thinning intensity. Overall, mean diameter, basal area and volume increments of crop trees were 1.8, 2.3 and 2.5 times greater than those of the whole stand with thinning, respectively. In conclusion, the diameter increment gain of crop trees increased with thinning when compared to that of the all trees in the stand. These results indicate that focus should be on crop trees for thinning operations. In addition, heavy thinning may be recommended for an enhanced wood quality and diameter for the stands with similar site quality.

Key words: Beech, crop tree, *Fagus orientalis*, increment, thinning.

EFFECT OF IMPREGNATION AND HEAT TREATMENT ON THE PROPERTIES OF BEECH WOOD

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ABSTRACT

Natural species of beech growth in Turkey is Oriental beech (*Fagus orientalis* L.) and it covers 1.961.660 hectares and 9% of Turkish forest areas that it ranks 4th. The wood color of Oriental beech varies from reddish to white. Beech wood is classified as a medium density wood (0.66 g/ cm³) and its wood is heavy, hard, strong and highly resistant to shock. It is suitable for steam bending but it need to attention for drying. Its wood is easily cleavable and processed. Oriental beech wood is principally used for fuel, but there are other uses such as particleboard, massive and bending furniture, flooring veneer (parquets), sports equipments, music equipments, railway tiles and paper. Heat treatment, as a wood modification method, serves to improve the natural quality properties of the wood, such as dimensional stability and resistance to bio-corrosion and equip the wood material with new properties. Heat treatment reduces certain mechanical properties, but the dimensional stability and the biological durability of wood increases through heat treatment. Impregnation is the impregnation of various chemical substances in different ways within the wood. Thus, wood is intended to increase the service life by protecting from harmful such as biotic and abiotic. In this paper, it will be investigated that the effects of impregnation and heat treatment on the properties of oriental beech wood.

Key words: Beech, heat treatment, impregnation, wood

EXAMINATION OF PHYSICAL AND MECHANICAL PROPERTIES OF BEECH (*Fagus sylvatica*) WOOD - UTILIZATION PERSPECTIVES OF THIS SPECIES IN GREECE

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ABSTRACT

Beech wood (*Fagus* species) is widely available across Europe, and one of the most important commercial hardwood species in European, as well as Greek, forestry. The scope of this research work is to enlighten the production of beech forests, the conditions of wood sawmills in Greece, the range of utilization possibilities of beech wood (*Fagus sylvatica* L.), by determining mechanical properties such as, bending strength, modulus of elasticity, radial and tangential hardness of beech wood and compare them with the respective values of other research results previously obtained, available in the literature. Indicatively, the production of Beech wood referring to lumber, materials for wood based panels and firewood in Greece the year of 2011 was 51,297, 7,472 and 219,653 m^3, respectively. Beech wood is classified as a medium density hardwood and it is a material of low price and low cost of machining. There is a big range of applications of this species with the most common application to be in flooring, furniture, brushes, blocks, handles, veneers and woodenware. In Greece beech lumber was intended mainly for the construction of furniture as steamed wood in the obvious parts of the structure, as well as in the upholstered furniture frames, boxes and pallets, as not steamed wood. For the machining of timber numerous small sawmills were used, while in some of them there were also steaming equipment. Generally, the quality of the sawn beech logs was not quite satisfying, a fact proved by the low percentage of the produced beech lumber of the quality class A, which ranged approximately to 10%. The previous decades in Greece, an increase in the production of beech round wood and a decrease in fuel wood were observed, attributed partly to the gradual improvement of forest quality. Despite this wood production increase, our country remained to a large extent a country based in imports, because our needs in wood could not be covered by the domestic production amounts. The financial crisis of the last years strongly decreased the demand of wood and wood products in the market and as a result many of the wood and furniture industries in Greece and especially the industries of larger capacity have been closed. Therefore, nowadays there is not enough demand of beech round wood and annually large quantities of this material conclude to be used plainly as fuel wood, reducing the added value of beech wood. In a period of an economical crisis such as the current one, the demand of low cost construction materials such as wood, it is expected to be increased, compared to other building construction materials. Especially the use of domestic beech wood, which is a material of good price, that requires low cost to be machined, while at the same time it is characterized by satisfying mechanical and physical properties, which was found to be similar to the properties of beech wood, coming from other European regions, could be increased and its utilization possibilities could be extended in a big range of applications, as solid wood or glued products. Instead of large wood industries that it is more difficult for them to survive through this economical crisis, several smaller local enterprises could be established, in order to cover the needs of the market in qualitative wood of affordable price, especially in Greece which is a country deficit in wood quantities. Finally, as our study showed, the wood industries that adopted an orientation in commerce based on exports, achieved to survive and maintain their profits and regular function inside these difficult economical conditions and this example could be included in proper utilization tactics of beech wood in Greece.

Key words: Beech, bending, hardness, mechanical strength, MOE

GROWTH AND YIELD FOR SCOTS PINE AND ORIENTAL BEECH MIXED STANDS IN DIFFERENT MIXTURE RATIO

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INTRODUCTION

Mixed forest ecosystems are important to human life. In general, there are many positive aspects of mixed stands compared to pure stands biologically and ecologically. In forestry, the importance of mixed stands has increased in recent decades due to the potential benefits which can be gained, such as increased production, greater diversity, improved nutrient cycling or reduced risk of biotic and abiotic damage. Scots pine (*Pinus sylvestris* L.) and Oriental beech (*Fagus orientalis* Lipsky) are two of the most important forest species in Turkey. Mixed Oriental beech and Scots pine stands with different forest structures and biodiversity are widespread in Black Sea Region, Turkey. The management of mixed stands of these species is of increasing importance to foresters in Turkey, and a crucial factor is knowledge of the growth and yield relationship for the sound management of these stands.

When analyzing the effect of interspecific interaction on stand growth in mixed species forests, the definition of species proportions plays an important role. Mixture is expressed as percentage and shown with the numbers between 10 %- 90 %. Species proportions can be defined in many different ways, by crown cover, stem number, basal area, volume, or biomass; depending on the objective of the study (Bravo-Oviedo et al., 2014). The most common way to define species proportion is by basal area. According to the forest management regulations in Turkey, 10% mixture percentage by volume is sufficient to be considered as a mixed stand (General Directorate of Forestry 2008).

This study aimed to determination of the growth and yield relationship for Scots pine and Oriental beech mixed stands in different mixture ratio in Black Sea Region.
Material and Methods: The study area is in the Black Sea Region, the North of Turkey. The study area covers the Forest Districts of Zonguldak, Kastamonu, Sinop, Ankara and Amasya. These sampled mixed stands were naturally regenerated and uniformly stocked stands (55-97% tree layer cover), without any evidence of historical damage such as fire or storms. Located between 750 m and 1750 m altitude, the study area is characterized geomorphological by high mountainous land, with moderate steep slopes ranging between 5% and 60% (30 % of the whole area).

The data were obtained from 162 temporary sample plots with ranging stand ages, site index, density and mixture percentage. The 162 regional-level sample plots obtained by Kahriman (2011) were used in this study. Within each plot, tree species and the diameter at breast height (d.b.h.) of trees ≥ 6 cm were recorded in the inventory. The diameters at breast height, stump diameter, total height, crown height, crown diameter, age, diameter increment and spatial coordinate were measured in trees of sample plots. The sample plots have 31-150 years for Scots pine and 33-117 years for Oriental beech of stand age range, 16.2-34.9 m Scots pine and 14.7-32.3 m for Oriental beech of site index range, 0.10-0.76 of Scots pine mixture ratio range, 2.9-10.0 of stand density range.

RESULTS AND DISCUSSION

The sample plots distribution for Scots pine according to the mixture percentages of Scots pine of 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 and 0.8 were respectively 1, 2, 25, 36, 32, 38 and 28. With the generated equation systems, stand age, site index, density and mixture ratio of the four such as age, site index, density and mixture percentage main factors in Oriental beech - Scots pine mixed stands, including the effects on the stands were determined numerically. Volume and mean annual volume growth of total stand show irregular depending on the mixture ratio for the same average age, site index, density and mixture percentage. The number of Oriental beech trees is increasing, while number of Scots pine trees and total number of trees are decreasing depending on the mixture ratio for the same average age, site index, density and mixture percentage. Average height for both species is increasing when mixture ratio is increased to 0.4 to 0.8 for the same average age, site index, density and mixture percentage. The results were in arrangement with the acknowledged growth rules.

Volume and volume increments for the same stand density and site index have the highest values for the 0.8 mixture percentage in the density-variable yield tables for Scots pine-Oriental beech mixed stands. Whereas volume and volume increments decrease from a mixture percentage of 0.8 to 0.6 and 0.4 for young stands, it generally decreases from 0.8 mixture percentage to 0.4 and 0.6 for the fine site indexes of old stands. The total volume of the stand increases in good site index in which the growing energy of the beech trees with wolf tree feature is given to stem growth instead of branching. This is observed in old stands with good site index. Mixture percentage of 0.6 in stands where Oriental beech individuals are generally overgrown and 0.4 mixture percentage in stands with more shapely stems which are not overgrown are ranked second. The fact that volume is greatest in the 0.8 mixture percentage can be explained by the facts that the Scots pine which is a light tree has higher volume since it is located at the upper layer and has greater diameter. The fact that volume is smaller when the mixture percentage is % 40-60 can be explained by the facts that the diameter and heights of Scots pine individuals are % 80 lower in comparison with the mixture and that the number of beech per unit area is smaller. That is, the diameters of Scots pine trees decrease depending on their diameter and height when the ratio of both species in the stand is equal while the total volume decreases since the number of beech trees is smaller. It can be concluded that the change in the volume and volume increase depending on the mixture percentage is natural for the Scots pine and Oriental beech mixed stands. The fact that volume and volume increase values are greater in stands with greater ratio of Scots pine in Scots pine-Oriental beech mixed stands shows that the volume and volume increase values are greater is greater as we move towards pure Scots pine stands. Çalışkan has determined that the stand volume and basal area is greater in stands with greater number of Scots pines in the Karabük Büyükdüz research forest with Scots pine, fir and beech mixed stands (Çalışkan, 1989).

CONCLUSIONS

The density variable yield tables prepared as part of this study were compared by the normal yield tables prepared by Alemdağ (1967) and Batu (1971) for Scots pine and by Carus (1998) for pure Oriental beech. It was determined that the total stand volume and mean increment values of Scots pine-Oriental beech mixed stand with 0.8 mixture percentage, I. SI and normal stand density (8.5 stand density) were highest for Oriental beech (Carus) until the age of 45, for Scots pine (Alemdağ) during the ages of 45-100 and for Scots pine (Batu) after the age of 100. It was determined that the mean annual increment was highest in Scots pine-Oriental beech mixed stand with a mixture percentage of 0.8 until the age of 60 and for Scots pine (Batu) stand after the age of 60.

The volume and volume increment values related with the density variable yield tables prepared for Scots pine-Oriental beech mixed stands were compared for both species at 8.5 stand density and site indexes in all mixture percentages. It was determined that the volume and volume increment values increased from 0.4 mixture percentage to 0.6 and 0.8 for Scots pine and from 0.8 mixture percentage to 0.6 and 0.4 for Oriental beech. It was put forth that the volume and increment values at 0.4 mixture percentage were highest in Scots pine until the age of 55, whereas it was highest for Oriental beech after 55 years of age. It was determined that the mean annual increment value increased from 0.4 mixture percentage to 0.6 and 0.8 for Scots pine and from 0.8 mixture percentage to 0.6 and 0.4 for Oriental beech.

It will be possible to continue the existence of Scots pine- Oriental beech mixed stands that are economically and biologically important for the Middle and Western Black Sea Regions only via the arrangement of forest management plans that take into consideration the growth relations of these forests as well as their stand structures. Hence, it is important for the development of forest management plans to have knowledge about the growth relations of species in Scots pine-Oriental beech mixed stands. This study will enable the development of growth models required for both management plans and civil culture applications by determining the production potentials related with Scots pine – Oriental beech mixed stands. The ecological, economic and social functions of Scots pine – Oriental beech mixed stands will be used most effectively by determining the growth legalities for both species separately and as a whole.

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GROWTH RESPONSE OF POLE STAGE EUROPEAN BEECH TO COMPETITION RELEASE IN UNEVEN-AGED STANDS

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ABSTRACT

In uneven-aged stands, foresters often focus on the change in quality and vigour of a few pole stage trees per hectare called "future trees". A central issue is to determine whether thinning at a given time, with a sudden change of environmental conditions, would be profitable for these trees that have been in a situation of competition for long periods (in some cases over a hundred years). In 2007, 85 European beech (*Fagus sylvatica* L.) trees ranging from 7,5 to 17,5 cm of diameter at 1.3 m (dbh) were selected and released of their local competition from the full range of morphotypes found in four sites in Northeastern France. We established a 12 m radius centered around the target tree where the following competitive trees were cut: (i) the three or four most competitive trees according to a competition index based on dbh and distances and (ii) all the trees with dbh inferior to 27,5cm but whose crown overlaps the crown of the selected tree. The same number of trees without competition release was measured in a second treatment, the control. For each target tree total height, dbh, the live crown ratio, crown height, and crown projected area were recorded in 2007 and six years later. Ring widths were measured along a representative radius to be able to incorporate growth history as pre-release diameter growth. In all sites beech trees responded rapidly to release. Maximal growth was detected one or two years after tree release. Trees in the control treatment showed a much lower growth. Initial size and the live crown ratio were important factors driving the response of released trees. Our results suggest that incorporating release dynamics is essential to predict succession in beech uneven-aged stands.

Key words: Crown morphology, Northeastern France, pre-release growth

GROWTH, ROOT AND SHOOT COMPETITION IN A YOUNG BEECH-ACER MIXTURE

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ABSTRACT

Our objective was to understand the dynamics of young mixtures of *Fagus sylvatica* and *Acer pseudoplatanus*. The two species grow in temperate western European forests and are considered as ecologically similar in the young stages. We analysed the effects of intra and interspecific competition on tree growth and resource (light, water) acquisition.

We investigated the effect of neighbour interactions in a 15-year-old experimental plantation in North-Eastern France according to a double gradient of density and species proportion. We used descriptors of local competition to model individual tree growth and to analyse individual crown allometry and tree root spatial distribution.

Stand density and tree size were primary factors determining individual growth, while species identity had a significant but less pronounced role. For both species, individual trees exhibited larger growth in uneven mixtures where the other species was more frequent. When pooling the two species, the highest growth occurred in the even mixture.

Allometric scaling was improved by including the effect of neighborhood interactions, although for both species much of the effect of competition was synthesized by variables at the stem and growth unit levels while branch characteristics were not severely altered by competition per se. In addition, the effect of competition and species mixing was accounted for by changes in different crown attributes among the two species. *Acer* exhibited greater plasticity in its height-diameter relationship and in its crown length, while *Fagus* displayed higher levels of branch development and leaf area plasticity.

Results on root distribution will be soon available and will be integrated in the presentation.

Collectively, our results suggest a complementarity between *Fagus* and *Acer* in their resource use, although the two species are usually described as having similar resource use strategies.

Key words: Competition, complementarity, crown plasticity, root distribution

IDENTIFICATION AND BIOINFORMATIC ANALYZES OF HEAT SHOCK PROTEIN 70 GENES (HSP 70) IN FAGACEAE FAMILY

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ABSTRACT

Heat shock proteins (HSPs) are a group of proteins found in all living organisms. They play key roles in regulating the stress response to salinity, drought, and extreme temperature changes in plants. HSPs also act as molecular chaperones that provide favorable conditions for the correct folding of other proteins, thus preventing protein aggregation. Many studies have been performed to identify molecular functions of individual family members. However, there is a limited study on genome-wide identification and characterizations of HSP70s in *Fagaceae* family (American beech, American chestnut, Chinese chestnut, European chestnut, Japanese chestnut, Oak, Red oak and White oak). In this study, we have identified 9, 14 and 15 *HSP70* genes in beech, oak and chestnut, respectively. Phylogenetic, conserved motifs and 3D protein structure analysis of identified *HSP70* genes were also performed. According to phylogenetic analysis, *HSP70* genes could be classified into different groups. Specific motifs were found in all predicted HSP70 proteins and were relatively conserved in beech, oak and chestnut genomes. The protein 3D structure of a total of thirty *HSP70s* were modelled at >90% confidence and the percentage residue varied from 80 to 100. These results provide characterization and functional information of HSP70 proteins for *Fagaceae* family. This genome-wide identification will enable researcher to open new perspectives for further studies to improve stress tolerant forest trees.

Key words: Bioinformatics analysis, heat shock protein, *Fagaceae*, genome-wide identification

IMPORTANCE OF DEADWOOD IN THE VIRGIN ORIENTAL BEECH STANDS OF THE CASPIAN FORESTS

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ABSTRACT

Deadwood is a major element in forest ecosystems and has an important role in the principles of close to nature silviculture and maintaining of biodiversity. In order to study the amount of deadwood in intact multi -aged forests for applying in our silvicultural interventions, four old-growth oriental beech stands were selected from west to east of the Hyrcanian forests, northern Iran. In each region, three development stages of initial, optimal and decay were recognized and three sample plots each 1 ha (100x100m), total of 12 plots, were laid out and all living and dead trees were assessed. Amount of deadwood, in term of number and volume, was calculated in each stage and each region. Moreover, the beetles and bugs of deadwoods were studied in an intact beech stand in Nowshahr, central Caspian forests, as well. Results indicated that the stem number and volume per ha of standing trees varied between 188 and 475, and 448 and 723 m^3, respectively. Stem number and volume of deadwoods varied between 7 and 30, and 7.4 and 123.7 m^3, respectively. We recorded 134 species of saproxylic beetles and five species of saproxylic true bugs; 23 of these species are endemic and 12 could be classified as virgin forest relict in compare to European species. It is evident from our results that the Hyrcanian beech forests of Iran support an impressive diversity and frequency of deadwood as well as saproxylic insects. This confirms the global importance for conservation of virgin Caspian beech forests for several purposes including biodiversity and ecosystem conservation. Despite this, the diversity and habitat associations of organisms associated with dying and deadwood remain largely unstudied in the Caspian forests.

Key words: Deadwood, intact stands, multi-aged, stem number, volume,

IS *Fagus sylvatica* UNDER DIVERGENT SELECTION AT REGIONAL SCALE? A GENOMIC-ENVIRONMENT ASSOCIATION STUDY BASED ON 144 SNPS AND CLIMATIC, EDAPHIC AND GEOGRAPHIC ENVIRONMENTAL DATA

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ABSTRACT

Local persistence of long-lived species such as trees is especially challenged under climate change because their potential for adaptation through accumulation of beneficial mutations is limited. Thereby, forests might face changes in species composition and productivity with a likely high economic impact on forestry. Yet, species occurring over a multitude of environmental conditions might be under differential selection resulting in populations with potential pre-adaptation to climate change. Determination of divergent adaptation is a first step towards an informed management strategy for climate-resistant forests. Here we investigate 79 natural *Fagus sylvatica* populations located within an area of 52 000 km^2 and representing the climatic range of this species within this topographic complex area. Neutral genetic diversity based on twelve SSR-markers revealed a small degree of relatedness up to 150 m inter-pair distance. But the absence of isolation by distance (IBD) and large scale spatial genetic structure indicate genetic mixture across the scale of study. A genomic-environment association (GEA) analyses, based on 88 environmental factors, 144 SNPs out of 52 candidate genes and the latent factor mixed model (LFMM) as well as a logistic regression approach, showed that 16 SNPs out of 10 genes responded to one or several environmental factors. This pattern was confirmed by the isolation by environmental distance (IBE) analyses. The GEA reflected the proposed gene functions in most cases, including indications for adaptation to water availability and temperature. Allelic divergence at candidate genes and the lack of large-scale neutral genetic patterns suggest that gene flow allows the spread of advantageous alleles in adaptive genes. Thereby, adaptation processes are likely at the scale studied which might contribute to the persistence of this species under climate change conditions.

Key words: Adaptation, climate change, isolation by spatial/environmental distance (IBE/IBD), landscape genomics, local persistence, micro-evolution.

NATURAL DISTURBANCES AS A BASIS FOR ADAPTED SILVICULTURAL MEASURES

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ABSTRACT

Natural disturbances are not only among the most important drivers of structure and composition in forest ecosystems, they also play a key role in regulating various forest functions, such as nutrient cycling, carbon storage, and habitat for biodiversity. All forest ecosystems are subject to a particular range of disturbance types that occur at various frequencies and severities, otherwise known as the disturbance regime. In most temperate forests ecosystems, such as those in Slovenia, forest management has largely replaced the natural disturbance regime. In the absence of management, the disturbance regime in temperate forests is characterized by relatively continuous mortality of individual canopy trees (small scale gap dynamics) that is interrupted by periodic intermediate severity disturbances at stand scales. Very large, stand replacing disturbances have return intervals of several thousand years. In Slovenia, an ice storm in 2014 was an exceptional event in terms of its severity and scale. Nevertheless, such events are within the natural range of historical variability for temperate forests, and may have return intervals within the lifespan of a tree cohort (e.g. 200-300 years) (Seymour et al. 2002). In fact, there have been reports about ice storms with similar extent and severity in Slovenia in the years 1975, 1980, 1985, 1995 and 2010.

The goal of this presentation is to highlight some of the effects of the ice storm from an ecological perspective. Without a doubt, disturbances like this are often viewed with a negative connotation, mainly because they cause short and long term economic losses from managed forests that may be difficult to recuperate. The media and public also view such events as “bad” or “harmful” to forests. Our goal is to point out that these large, rare disturbances are part of the natural disturbance regime that have a profound and long-lasting influence of the ecology of forests, which are not “bad” from an ecological standpoint (Turner and Dale 1998).

We first show some preliminary results of a study that quantified the pattern and severity of damage to trees and stands across seven mature forest sites in Slovenia that have not been recently managed. We chose such sites to show how the ice-storm influenced natural forest structure; heavily managed stands are likely to show a different pattern of damage. The sites ranged from beech dominated to mixed broadleaved-conifer stands with a minimum canopy age of about 120 years. In mature forest, at each site, we systematically distributed approximately 10 plots (each 1000 m2) throughout the stand. The diameter (dbh) and species of all trees greater than or equal to 10 cm dbh were recorded. The level of ice damage to each tree was classified with the following scale: (1): undamaged or less than 25% crown damage; (2): 25-75% crown damage; (3): more than 75% crown damage; or (4): tree uprooted or snapped.

Damage patterns were highly variable within and among the study sites (Figure 1). Small damage levels were recorded for *Abies alba* and *Picea abies*, presumably because of small cover and symmetry of the crowns. Tree species with highest numbers of uprooted trees were *Castanea sativa*, *Ostrya carpinifolia*, *Fagus sylvatica* and *Quercus peterea*. This could be a result of large and asymmetrical crowns, as well as the fact that some of the species have non-vertical growth or a subcanopy position.

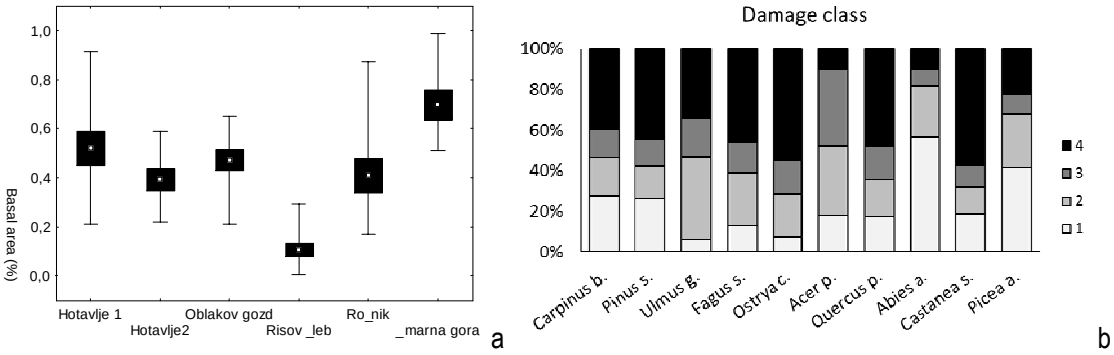

Figure 1. a) Box plots showing the distribution of plot level damage severity (% BA removed) for the seven mature forest sites in Slovenia. b) Per cent basal area damaged by species pooled across the seven sites.

These damage patterns, and particularly the heterogeneity of damage over space, influence the forest in a number of ways. Here we highlight three ice-storm effects that can be viewed as positive both from an ecological and economic perspective. First, the storm resulted in many large canopy openings. The resulting increased light levels will promote recruitment of many valuable broadleaved species, particularly in forests that would otherwise be dominated by beech regeneration. These species include valuable hardwoods, such as maple, ash, elm, and oak. Increasing the species diversity of the forest landscape leads to the second point. It is widely agreed that increasing both the structural and compositional heterogeneity of forest stands will increase resilience and facilitate adaptation to future climate change. This is one of the most feasible management strategies under climate change, and should be considered before widespread programs consisting of assisted migration and planting of drought and heat tolerant provenances are adopted. Much of the forested landscape damaged by the ice storm had intermediate levels of canopy damage, which will serve to increase structural heterogeneity, promote new generations of regeneration, and increase tree species diversity. Finally, the storm will benefit maintenance of a wide array of biodiversity. The habitat heterogeneity created by the storm will not only benefit less shade tolerant tree species, it will also create early successional habitats necessary for some species of wildlife. Most importantly, the large input of high quality dead wood (i.e. many different sized pieces) will provide food and habitat for saproxylic species. Given that dead wood volumes are relatively low across managed forests of Slovenia, the wood that remains unsalvaged will likely lead to a substantial increase in dead wood supply to a large area of Slovene forests. For example, the average amount of deadwood input from our study in mature forest, if we only consider boles of trees that were snapped or uprooted, was around 42 % of total basal area. This is a significant increase over the average volume of 14 m^3 in Slovene forests (Grce et. al. 2014).

Managing forests in the face of natural disturbance processes, such as the extreme ice storm in 2014, typically deals with two separate ideas. First, forest management can help to increase the stability of a forest stand, thereby making individual trees less susceptible to damage or death. Second, management can increase the resilience of a forest ecosystem, defined as the capacity of a forest to recover from disturbance. We can think of this as the time required for the structure, composition, and function of a forest to return to a state similar to that before the disturbance. Below we indicate some basic recommendations from the forestry literature to increase stability and resilience:

Stability:

- Young forests (pole stands) that have been recently thinned (e.g. < 5 years) are particularly vulnerable to ice damage because they have not had sufficient time to add bolewood and roots (Bragg et al. 2003). As such, in forest stands managed with even-aged silviculture, such as shelterwood or group selection systems, thinning large areas during single stand entries should be avoided. Rather, thinning treatments should be smaller and separated in space and time.

- As an alternative to adapted thinning regime, minimal intervention approach can be used to increase stability in young stands. With this approach, we use basic silvicultural measures to promote only 60 to 80 dominant trees per ha and do no intervention in the rest of the stand. Silvicultural treatment should be of low intensity and oriented towards promoting symmetrical crown growth of crop trees. This approach results in evenly distributed high quality trees, without decreasing stand stability.

- As with any disturbance agent (not just ice), forests with homogeneous structure and few species are at higher risk to disturbance, particularly if they are comprised of species that are vulnerable to a given disturbance agent and on sites that are at higher risk. This is one of the main advantages of mixed species, uneven-aged stands (Spiecker 2003).

- On sites that are highly vulnerable to repeat ice damage, it may be advisable to increase the proportion of species that are more resistant to crown breaking and bole snapping, make efforts to increase the health of stands (i.e. remove trees with disease and defects), and limit, if possible, the development of highly asymmetrical crowns (Bragg et al. 2003).

- It is important to monitor the surviving trees that were heavily damaged (more than 50% crown loss), but not removed from the stand during initial salvage treatments. Such trees are likely to become infected with pathogens and are high risk of mortality or future damage from disturbance (Bragg et al. 2003, Shortle et al. 2003).

Resilience:

- In addition to decreasing disturbance risk, mixed-species uneven-aged stands are more resilient to disturbance because they often have adult trees, subcanopy trees, and many cohorts of regeneration that survive disturbance and are able to quickly develop into a new stand. Therefore, to the extent that is possible, it is recommended to promote increased tree diversity, multi-aged structure at small scales, and relatively continuous regeneration. The resulting increase in diversity, age-cohorts, and genetic diversity should improve the potential of forests to adapt to climate change (Spiecker 2003, Lindner et al. 2008).

- If areas are to be planted following salvage logging, preference should be given to appropriate species and provenances that are drought tolerant, which should facilitate adaptation to climate change.

- Given the high density of deer across much of Slovenia, browsing could substantially reduce the speed and species composition of recovering forests (Nagel et al. 2015). Therefore, browsing damage needs to be carefully monitored and reduced in problematic areas.

It is important to note that, with the exception of sites that are clearly vulnerable to repeat ice disturbance, only focusing management on ice disturbances is not advisable because forests in Slovenia are subject to many different abiotic and biotic disturbance agents. For example, if future stands were mainly comprised of species less susceptible to ice damage, such as some conifer species, such forests might be at increased risk of bark beetles, windthrow, or drought. Finally, we emphasize that forest management that is focused on preventing damage from extreme events, like the 2014 ice storm, would be a futile

approach. Timber volume damaged by wind, bark beetles, and wildfires has tripled over the past 40 years in Europe (Seidl 2014). It is highly unlikely or even feasible that natural disturbances, particularly extreme events, can be controlled by management, particularly under climate change. In contrast, natural disturbances need to be viewed as part of ecosystem dynamics and incorporated into management strategies, particularly given the important role that disturbances play in creating habitat structures (e.g. dead wood, landscape heterogeneity) necessary for maintaining biodiversity in forests.

Key words: Adapted silviculture, biodiversity, climate change, natural disturbance

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NATURAL REGENERATION OF *FAGUS ORIENTALIS* IN PROTECTED AND NON-PROTECTED AREAS IN NORTH OF IRAN

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INTRODUCTION

The Caspian forest is home to different plant species and one of these species is oriental beech (*Fagus orientalis* Lipsky). Beech forests account for approximately 17.6% of total forest area, 30% of the standing volume and 23.6% of stem number in the Caspian forest in Iran (Rasaneh et al. 2001). Over the past decades, management of the Caspian forest has been changed considerably. In fact, forest management has been reinforced based on an ecosystem point of view strongly. Even-aged stands have been changed into uneven-aged stands, clear cutting in restoration areas largely has been stopped, spot cutting in limited areas has attracted attention and harvest rates have been diminished (Sagheb-Talebi et al. 2013). Several management methods, such as shelterwood system, employed in these forests in past decades, have not been very successful. One of the most important and obvious reasons of this issue is the presence of livestock in the forests and entrance of them into regeneration areas. Presence of livestock and villagers around the forests are the most important agents that accelerate destruction of the Caspian forest ecosystems as well. In order to converse the natural stands and regeneration, in recent years some parts of the Caspian forest have been protected. Although there are several protected areas in the Zagros forests, where locates in west of Iran, protected areas in the Caspian forests are limited. This study have been investigated the effect of 10 years protection regime on the natural regeneration and soil properties in one of the beech forests in the north of Iran.

MATERIALS AND METHODS

The study was carried out in two protected and non-protected areas (37˚ 19' N, 49˚57' E) located close to each other, as the altitude, the aspect and the slope were nearly the same. Thirty sample plots were randomly taken and the type of each tree, DBH and the height of them, the kind of natural regeneration and some characteristics of them were determined. In each plot, soil samples from 0-20 cm were taken and some soil physical and chemical properties were analyzed.

RESULTS AND DISCUSSION

The results showed that the trees in two areas are nearly similar to each other and included beech, alder, hornbeam and maple. Density of the stands and percentage of the canopy was also nearly the same. The natural regeneration showed significant differences between two areas, as in protected area the number and quality of beech, alder and hornbeam was significantly more than non-protected areas. The amount of sand, porosity, organic carbon, Ca and pH of soil showed significant differences between two areas and the amount of them was higher in protected area. The results of correlation showed that soil porosity, sand and organic carbon had positive correlation and soil saturation and bulk density had negative correlation with the number of beech regeneration. According to findings of this study, protection management regime led to improve of natural regeneration. It seems that improvement of soil status and reconstruction of it, based on protection management in ecosystems, have been caused useful situation for regeneration. Obviously, besides of the other environmental conditions, light and temperature are important conditions for natural regeneration, but as the density of the tree stands are nearly similar to each other, it seems that soil properties have had important role in improvement of natural regeneration in this area.

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NUMERICAL CLASSIFICATION AND ORDINATION OF THE FOREST VEGETATION AT YAYLACIK RESEARCH FOREST (KARABÜK – TURKEY)

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ABSTRACT

This study was carried out to determine the diversity of forest vegetation and main driving topographical factors of this diversity in the Yaylacık Research Forest. The research forest mainly dominated by oriental beech (*Fagus orientalis* Lipsky) is located in Karabük, which is placed at the Western Black Sea region of Turkey. The area is a part of the subeuxine phytogeographical region.

Vegetation samplings were carried out according to the Braun- Blanquet approach and total 122 releves were realized. The size of the releves was determined in accordance with minimal area method. All releves were stored in TURBOVEG database management program. Flexible Beta method and Jaccard distance measure were used for the vegetation classification in the PC-ORD Program. Diagnostic species of the accepted clusters were identified by a fidelity measure in the JUICE Program. The results of the classification were visualized by ordination techniques in the CANOCO Program.

In result, four associations were identified, one of which includes 4 subassociations. These associations are as follow: *Cardamino impatiendis – Fagetum orientalis* dominated forest, *Festuco heterophyllae – Quercetum ibaricae* dominated forest, *Pinetum nigro – sylvestris* dominated forest and *Ostryo carpinifoliae – Carpinetum betuli* dominated forest. All these forests show a clear gradient along the topographical factors (altitude, aspect and inclination).

Key words: Karabük –Yenice, numerical analysis, Oriental beech, phytosociology

PREDICTING STAND YIELD PARAMETERS BASED ON ARTIFICIAL NEURAL NETWORK FOR ORIENTAL BEECH IN KESTEL FORESTS, BURSA

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ABSTRACT

The beginning of modern forest growth and yield models extent to the development of a yield table by biometricians in Germany in late 18th century, nearly 200 years ago. The prediction of some stand attributes such as stand volume, basal area, number of tree, dominant height and quadratic mean diameter are required to foresters and others interested in planning and managing forests, whether planted or natural. These predictions are used for inventory updating, estimating stand structure and stand productivity and evaluating silvicultural alternatives, and in general for decision support in forest management and planning. The management of forest stands requires growth and yield models to support decision making for forest management policies. Yield models have been widely used to update inventories, predict future yield and explore forest management alternatives and silvicultural options and they are thus used in providing important information for decision-making in forest stands. There are various model type for predicting stand yield values, many normal yield tables and variable-density yield models and tables are developed and used to conduct forest management plans for tree species in Turkey. Especially, the statistical modeling procedure including multiple linear regression techniques have been used to model some stand attributes, e.g. stand volume, basal area, number of trees, quadratic mean diameter and height, by using stand age, site index and density. In the process for forest growth models, main reason for the suggestion and usage of various techniques for predicting the growth and yield are the efforts for satisfaction of some statistical assumptions including independent, normally distributed, and homoscedastic residuals, no multicollinearity among variables and spatial and longitudinal autocorrelations in data. The major drawback of this modeling technique are the requirements of regression analysis assumptions, e.g. normal and homoscedastic distribution of residuals and no collinearity among variables. Artificial neural networks (ANNs) are not bound by such assumptions and may yield improved predictive modelling of forest stand. Artificial neural network (ANN) modelling technique has been applied based on its ability to discover relationships from data without the requirement of assumptions about the form of a fitting function. An ANN is defined by neurons, topological structure, and learning rules. A neuron is the fundamental processing unit of an ANN for computation. Analogous to human brain's biological neuron, an artificial neuron is composed of inputs (dendrites), weights (synapses), processing units (cell bodies), and outputs (axons). In this study, data including 209 temporary sample plots from pure Oriental beech stands located in Kestel Forests, Bursa Forest District Enterprise, were used to model some stand parameters including stand volume, basal area, number of trees, quadratic mean diameter and height by using Artificial neural networks (ANNs) with some input variables of stand age, site index and stand density. Application of ANN was carried out using MATLAB-NNTOOL module including the development data set that was further subdivided into three subsets for ANN training (75%), verification (15%), and testing (10%). The feed-forward backprop algorithm had been used as the central algorithm to the training of multilayer perceptions, which is the layout of the most popular neural network. Analogous to Artificial neural network (ANNs) predictions, multiple linear regression models were developed these stand parameters by using stand age, site index and stand density as independent variables. The ANNs predictions accounted for 82.5 % of the total variance in quadratic mean diameter, 86.7 % of the total variance in quadratic mean height, 83.7 % of the total variance in stand number of

trees, 99.8 % of the total variance in stand basal area and 98.5 % of the total variance in stand volume. Also, variable-density yield tables based on Artificial neural network (ANNs) predictions were be produced and evaluated in agreement with the known forest yield rules and laws.

Key words: Artificial neural networks (ANNs), forest managements, multiple linear regression, stand yield predictions

PHYSIOLOGICAL AND MORPHOLOGICAL CHARACTERISTICS OF ORIENTAL BEECHNUTS (*Fagus orientalis* Lipsky)

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ABSTRACT

Oriental beech is one of the most important tree species in Turkey. In this study, the pysiological and morphological characteristics of oriental beechnuts coming from 14 different provenances in Turkey were studied. For morphological characteristics of oriental beechnuts, length, wideness, thickness and weight of beechnut and embryo/seed ratio were measured. Provenances varied greatly in terms of morphological parameters. General average 1000-seed weight was 307.3 (252.4-364.7) g. Oriental beechnuts reached the maturation stage both physiologically and morphologically from the end of September. Germination percentages and embryo/seed ratio was lower in the earlier collected seeds. The prechilling duration shortened as the collection time delayed. 15 °C was found optimum germination temperature for non-dormant oriental beechnuts. The temperature above 20 °C caused seconder dormancy. The prechilling at controlled hydration was very effective in breaking dormancy of oriental beechnuts. The study showed that optimum moisture content during stratification and stratification duration were about 30-33 %. The class of dormancy in oriental beechnut was physiological dormancy, pericarp had very limited effect on dormancy. The study showed that oriental beechnut can be stored in dormant and non-dormant condition. The moisture content during the storage should be between 7 % and 10 %. In non-dormant beechnuts, it shouldn't be lower than 8 % due to more sensitivity to desiccation. In oriental beechnut, average lipids, protein, starch, and ash were found 48.69 % 29.04 %, 3.16 %, and 4.10 % respectively. Some differences between provenances were appeared in terms of chemical composition.

Key words: Beechnut, chemical composition, dormancy, moisture content, provenance

QUANTITATIVE GENETIC VARIATION AND ENVIRONMENTAL DIFFERENTIATION OF EUROPEAN BEECH IN SWITZERLAND

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ABSTRACT

Fagus sylvatica (beech), one of the major native tree species in Central Europe, will likely be threatened by increased drought related to climate change. The ability of tree populations to adapt to environmental changes depends largely on their pre-existing genetic variation. Genecological studies can provide insight into the amount, the structure and the relationship of this genetic variation to the environment. However, experiments that investigate large numbers of provenances in more than one common garden are rare. In addition, little is known about the influence of soil properties on adaptive trait variation. Here, we present results from a common garden study incorporating populations of beech from across Switzerland, with the aim to identify patterns of genetic variation and to associate these with environmental factors important for adaptation.

Third-year growth and phenology of seedlings from 77 autochthonous beech populations sampled throughout the species' ecological range in Switzerland were recorded in two contrasting common gardens. Phenotypic and genetic variation was assessed, and quantitative genetic parameters were determined to elucidate the genetic characteristics of the studied traits. Variation among populations was related to physical and chemical soil properties, soil water balance and past climate at seed sources.

Population variation and differentiation was largest in phenological traits, especially in bud break timing and second flushing. Evolutionary potential was very high in second flushing and moderate in height growth. Significant differences between the two common gardens were detected for all traits. Thereby, bud break was later, growing period shorter, height growth fewer, and population differentiation stronger at the high-elevated xeric garden compared to the low-elevated mesic garden. The best genecological models were found for slenderness, bud break and leaf senescence. Both temperature and water availability were relevant for explaining trait variation among populations. Few associations of traits with soil characteristics were detected.

Our results show that Swiss beech populations are differentiated along gradients of temperature and water availability. Populations from the warm and dry end of the species' distribution could provide suitable genotypes for coping with future climate at many sites in Switzerland. Evolutionary implications and options for forest management are discussed in relation to climate change.

Key words: Climate change, common garden, *Fagus sylvatica*, growth, phenology, provenance trial

RESTORING BEECH FORESTS BY PLANTING OR DIRECT SEEDING

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ABSTRACT

Beech is an important tree species under climate change, but it may need to be introduced beyond its present distributions range. Particularly expansion to the north and to higher elevations is expected. Additionally, beech is a desired future species at many forest regeneration and restoration sites. Cost efficient regeneration methods are essential to implement such restoration and adaptation efforts in practice. Planting usually involve stock densities in the range of 4,000 – 6,000 beech seedlings per hectare depending on site, management goals, regeneration system as well as usual national forestry practices, legislation and subsidy schemes. This study is part of an overall effort to develop more cost-effective regeneration systems focusing on the use of young (3-14 month old) containerized stock types for planting. We view such small and young planting stock as a promising alternative for temperate forestry to the commonly used 2-3 years old bare-rooted stock types. Direct seeding is an alternative measure of artificial regeneration that offers even more cost-effective solutions but also involves less reliability of particularly the early phases of the regeneration. The objective of the study is to contribute to the development of planting and direct seeding methods and systems using small containerized or direct seeding. The field experiments to study effects of planting date and container volume were established from July 2006 until March 2009 at eight sites in total; each site comprising one to three planted tree species including beech. Field studies including direct seeding of beech were established in 2002-06 to develop artificial regeneration methods with high stock densities that are more robust towards deer browsing than the plantings. Main inventories were conducted in 2011-13. Both planting date and container type and –volume had significant but inconsistent effects on survival and height of the trees. The intolerance of beech to open site conditions in the regeneration phase was clearly demonstrated. As such small stock types for planting as well as direct seeding provided successful regeneration under shelter (shelterwood or nurse crop) whereas the beech regeneration was very unsuccessful at open sites like clear cuts.

Key words: Clear cut, containerized seedlings, deer, fence nurse crop, shelterwood

SILVICULTURE OF EUROPEAN BEECH – DEALING WITH THREATS AND UNCERTAINTIES

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INTRODUCTION

European beech (*Fagus sylvatica L.*) covers over 1.95 million ha of forests in Romania (about 30% of national forestland). It is found in naturally regenerated by seed, pure and mixed stands, along with sessile oak *Quercus petraea* (Matt.) Liebl., silver fir *Abies alba* Mill., Norway spruce *Picea abies* (L.) Karst, sycamore *Acer pseudoplatanus* L., etc.

European beech has long been regarded as a forest tree species that prefers to grow in dense and closed canopy conditions. Such stands are sometimes considered as a prerequisite for quick and "perfect" natural pruning of beech trees, with important and positive economic effects.

Unfortunately, even not very frequently or on a large scale, young and medium-aged, fully-stocked and closed European beech stands are affected by heavy snows (e.g., Nicolescu et al. 2007). This *abiotic, physical* disturbance is "an intrinsic element of forest ecosystems" along with other *abiotic* (wind, fire, ice, floods, drought), *biotic* (insects, fungi, diseases, wildlife browsing, domestic animal grazing) and *anthropogenic* (pollution, tillage, road building, timber harvest, etc.) disturbances (Notaro et al. 2009; Moore and Allard 2011; Fischer et al. 2013). The snowfalls mostly affect the trees composing the lower half of stand canopy or the thin and tall trees (with high slenderness indices *h/d* as in Photo 1) part of the upper canopy.

Photo 1. Young, thin and tall European beech trees, affected by snow

MATERIAL AND METHODS

The fieldwork on the effects of snow on European beech trees was carried out in an even-aged and pure European beech stand, fully-stocked, where three research and demo plots (RP1, RP2, and RP3) were established in 1999. Subsequently two silvicultural interventions (cleaning-respacing and thinning) mostly *from below* were carried out in RP1 and RP2, the remaining stocking/density in the two plots being very different whereas RP3 was kept as control. In April 2015, all trees in plots 1-3 were inventoried and their state (*healthy*: no damage; *damaged:* fallen-uprooted, broken, bent-over) was assessed.

RESULTS AND DISCUSSION

A snow damage, combined with a windfall, happened in the stand on January 31st, 2015, with the following main results:

- in RP1 (number of trees/ha = 1,467; basal area/ha = 35.77 sq.m), located on a 22 degree slope, out of the 69 existing trees, 17% were affected by snow, the majority of them (13%) being bent-over, followed by the uprooted-fallen trees (3%) and trees with broken tips (1%).

- in RP2 (number of trees/ha = 2,062; basal area = 31.79 sq.m), located in identical conditions but including slender (taller but thinner) than in RP1, out of the 97 trees, 60% were affected by snow; 33% were bent-over, 19% were uprooted-fallen, the rest having broken tips.

- the control plot (number of trees/ha = 2,470; basal area = 42.97 sq.m/ha), located on a flat and horizontal land, had no trees affected by snow. The most important ecological process encountered in this plot was the natural dieback of trees (from 5,771 individuals/ha in 1999 to 2,470 trees/ha in 2015).

Photos 2 and 3. European beech trees in control plot (left) and RP2 (right)

Based on these results some conclusions for the practical management of such stands in areas with important (heavy) snowfalls can be drawn as follows:

- The stands should not be left dense and untended, such high stocking/densities leading to the production of very slender trees, which are prone to snow damages (mostly bent-over).
- The forked trees are a major source of snow damages as they are prone to breakage (one or two forks) or fork split. When possible such trees should be removed no later than beginning of pole stage, during cleaning-respacing and first thinning interventions.
- The topography and aspect can play an important role in the dynamics of snow damages; the highest risk areas consist of sun-facing and steeper slopes, where a combined snow-ice accumulation could damage the European beech trees.

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SPATIAL DISTRIBUTION ANALYSIS OF BEECH (*Fagus orientalis* Lipsky) STANDS IN BÜYÜKDÜZ RESEARCH FOREST

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INTRODUCTION

Accurate predictions of site information for aforestation activities, silvicultural prescription, forest management decisions are essential in forest management, especially in site and species-specific decision making to develop appropriate actions for implementation. The models of site index based on ecological variables are instructive for forest management accordingly to considere local growth conditions. Forest managers tend to select the species and adjust the site conditions to ensure optimal growth of an appropriate tree species or mix. It is necessary to determine the site quality of each individual stand so that its future growth and development can be forecasted for the sustainability of forest ecosystems (Günlü et al. 2009). Site index is closely related to volume growth and and dominant height of most tree species in evenaged stands is relatively unaffected by stand density and species mixture (Carmean 1996) and a common potential site productivity measure for particular tree species (Socha 2008). Site index can be estimated from forest trees, soil, vegetation, and topography (Carmean 1996, Socha 2008). Oriental beech or eastern beech (*Fagus orientalis* Lipsky) is one of the most important tree species for the forest ecosystems of Turkey. It is distributed in Trachia and in the south of Marmara Sea and throughout the Black Sea Regions (figure 1), where it is possible to find oriental beech both as pure stands and mixed forests with conifers and other deciduous broadleaves (Kandemir and Kaya 2009). The total distribution of oriental beech forests in Turkey covers 1.96.166 million hectares that is 9% of the country's forest area (OGM 2014). The total size of growing stock for the beech forest in Turkey is 263.772.103 m³, annual net increment 6.130.147 m³ (OGM, 2006). Oriental beech is establishing pure and mixed forests in Turkey.

The spread of oriental beech in Turkey have been reported in different geographic locations between 150-200 m and 2000 m (Saatçioğlu 1976)(Suner 1978)(Atay 1982a). Generally, it is known to spread the oriental beech on shaddy hills (N, NW, NE and E) of the northern Turkey. And the beech stands are often very steep and steep sloped hills (Anonymus 1985). This is to be evaluated to avoid the roots by stagnant water and their request to well-drained and aireted soil. It is seen mostly that the beech is choosing the hillside lands in Turkey and which are upper and middle hills depending on the slope of classes. It prefers steep sloped lands to be needed the drainage in heavy textured soils (Atay 1982 b). It's reported for climate of beech in Turkey, the temperate humid climates which is characterized by cold winter and with summer temperatures less than 22 ° C (Suner 1978). The annual rainfall is 1200 mm in the areas where the beech spread and 22% of those occur at the same time as the vegetation period, and it is reported additionally that the relative humidity is 78% (Suner 1978). It is important for beech the absence of periodic drought and the continuous presence of available water in the soil. It can be explained by balanced distribution of the rainfall and high relative humidity across year (Anonymus 1985). Oriental beech is a shade tolerant tree species. Beech is resistant to shield in good habitat conditions throughout the 25-30 year (Atay 1982a). There are not significant parent materials that are preffered by beech. But, it is reported that the beech forests are distributing on calcareous and no calcareous bown forest soils (Anonymus 1985, Aksoy 1978). It's reported, clayey soils (clastic structure) are most suitable for beech stands which are characterizing by medium and high depth, medium clay content, loose porous and permeable, high water and air economy (Çepel 1965 ve Çepel 1978). The aim of this study is to determine the specification of spatial distribution for beech stands in the Büyükdüz Research forest. The beech

stands are specified by growing stock. This aims to contain an appraoch to growing stock in natural forests. Therefore, the growing stock is a function of the environmental site conditions.

Büyükdüz research forest is located within the borders of province Karabük which is in the western Black Sea region of Turkey. This forest was established in 1952. The annual average temperature for the study area is 6.2 °C and the vegetation period is 4 months. The average temperature during this period is 13.3 °C. The annual rainfall is between 1040-1372 mm and 1/3 of rainfall is occuring during the vegetation period. The average relative humidity is 75% and it was found that is the early frost in September and the latest frost in May (Aksoy 1978). The climate types of research area is characterized by moist - humid close oceanic climate types, which has least - not least water deficit in summer. While the bedrock is generally conglomerat, there are to find usually marl and sandstone. The soils with marl are generally high calcium carbonated, clay and very deep. The soils that are composed by sandstone are stony, sandy clay-loam and shallow to medium deep. They don't have very good water economy, while their air economy are good. Soils have medium and deep soil depths which are formed by conglomerat. Those soil types have better water and air economies than other bedrock soil types. They have the clay texturing. The total area of research forest is 2360.34 ha. 98,78 % of total area is forested which is 2331,69 ha. The area of beech stands are 2012,03 ha. It is 86,29 % of total area. Beech don't have any pure stand in this forest.

MATERIAL AND METHOD

In this study will be determined the distribution characteristics of oriental beech stands by the elevation, aspect, elevation, land forms and parents material. Beech stands were dissolved by their stand code in management plan. The stand types were classified and mapped by their ordination ranges in seven classes. Firstly, the oriental beech stands will be classified depending on the growing stock. And than the environmental features of those beech stands will be mapped. In this study will be applied the raster-based GIS overlay technics to characterize the environmental conditions of oriental beech stands which are performing different growing stock. The growing stock of the beech stands will be transformed from the forest inventure process of Büyükdüz Research Forest into this study. Observed percentages of growing stock classes are crosstabulated by a function of classes for elevation, aspect, slope, landforms, topografic wetness index, parent material. Chi-Square test was done and $p < 0.001$ expected. Each environmental features are overlayed by the layer of growing stock and net annual increment of the beech stands. Beech stands were obtained by classifying the stand types of management plan for Büyükdüz research forest that was updated in 2010. The growing stock of beech stands have been obtained from the 14. table of management plan. This table of plan was derived by distribution of tree species and diameter class table to the growing stock of stand types. This stand types are listed from large to small size by their growing stock per unit area. It is established an ordination in seven classes between large and small value of stand growing stock sizes. The maps of environmental variables were overlaid with the map of ordinated growing stock classes. In this way was obtained the rasterbased cell values of growing stock classes by considering values of environmental variables. The cell values of growing stock classes are pairwise crosstabulated with overlapped values of environmental variables.

RESULTS AND DISCUSSION

It was obtained 13 different stand types by dissolving the stands of management plan. The raster data for elevation, aspect, slope, landforms and topografic wetness index was created by digital elevation map in raster cell size of 10x10 m. The most of areas in growing stock classes are to find at medium level. The tables of crosstabulations for all environmental site conditions are given in this study. The annual net increment didn't considered for this study. It has same results with growing stock. Beech and fir stands

have the highest value for growing stock with 383.4 m3/ha which have fully closed stand canopy and their breast diameter are distributed between 36-52 cm. The stand types for fir-scots pine-beech (GÇsKnab3) have the lowest value for growing stock with 11.35 m3/ha which have fully closed stand canopy and their breast diameter are distributed between 1-19 cm.

Beech is the most widespread from 1400 up to 1500 m. It's percentage 27.6%. The lowest spread in the classes of elevation is from 594 up to 700 m. It's percentage 0.2%. The highest values of all growing stock classes are distributing from 1400 up to1500 m. The value of growing stock "very high" is distributing in the altitude of 1400-1500 m with 61.1%. 70,6 % of beech forest has distributed from 1300 m up to 1600 m in the study area. While the highest growing stock distribution is on the eastern hills with 31.1%, the lowest distribution of growing stock is on the northern hills with 13.5%. The value of growing stock "very high" is distributing on the western hills with 53,8 %. The value of growing stock " high" is distributing on the eastern hills with 51 %. Therefore, the western and eastern hills are very important for growing stock in the study area. The importance of those aspects is depending on the main flow direction of stream systems which is in north-south direction. This main flow direction enables to entry the Black Sea climate in the study area easily. 61.1% of beech stands have low TWI values. The highest values of all growing stock classes are distributing in low TWI. 55.5% of the beech stands are distributing in the landform classes " steep slopes". Therefore, the highest values of all growing stock classes are distributing in the class "steep slopes". The canyons are secondly important for growing stock. 50.5% of the beech stands are distributing in the slope classes " steep". Therefore, the highest values of all growing stock classes are distributing in the class "steep". 52,3% of beech stands are covered by conglomerat, 41,9% by sandstone and 5,8% by marl. The high grade growing stock classes are distributing mostly on conglomerat.

The stands with beech and fir have more distributed than other beech stand types. Therefore, the beech and fir stands have the most growing stock and net annual increment in other stand types. The study site is very complex accordingly to topography and tree diversity. Beech is able to find places in this complexity. In general, beech shows the same site characteristics which are given for the country (Anonymus 1985, Atay 1982b). Parrticulary, some special habitat requests have been identified in this study regarding to its growing stock size per ha. Consideration of site characteristics for beech in this study which are related to growing stock should be regarded in terms of site-based forestry in this region.

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SPECIES RICHNESS AND DIVERSITY OF ORIENTAL BEECH (*Fagus orientalis*) FORESTS IN TURKEY AND BULGARIA

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ABSTRACT

Oriental Beech (*Fagus orientalis*) forests were intensively subjected to phytosociological studies in Turkey and hundreds of relevés were carried out, which easily allows to understand the species richness and diversity of these forests. In this context, all available published and unpublished relevés from oriental beech forests were collected. A dataset with 922 relevés was constituted and stored in TURBOVEG data management program. The relevés from oriental beech forests in Bulgaria was also included in the database. Species richness (number of species) and diversity (Shannon index) were calculated for each relevés. The ordination analysis of the relevés was carried out using CANOCO program. Due to the high heterogeneity in the matrix of species, Detrended Correspondence Analysis (DCA) was applied and square root transformed percentage frequencies were used as the input data. On the ordination diagram, species richness and diversity were passively projected in addition to the topographical (altitude, aspect and slope) and geographical (latitude and longitude) variables. The correlation between species richness, species diversity and environmental parameters were analyzed by using Kendal coefficient. In result, the ordination reflected the wide geographical distribution pattern of Oriental Beech forests and there is a clear relation between species richness and diversity of these forests with environmental factors.

Key words: Biodiversity, species diversity, species richness

STAND STRUCTURE AND REGENERATION OF AMERICAN BEECH FOLLOWING PARTIAL CUTTING IN A MESIC-HARDWOOD STAND IN THE LOESSAL BLUFFS, WEST-CENTRAL MISSISSIPPI, USA

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ABSTRACT

American beech (*Fagus grandifolia* Ehrh.) is an important late-successional, shade-tolerant component of mature hardwood stands across eastern North America. Its historic range extends from eastern Canada through the southeastern U.S. American beech is relatively understudied throughout its range, and very few studies have evaluated stand structure or regeneration of American beech in its southern range. Late-successional forest types with an important component of American beech were once abundant in the southern U.S. However, repeated cutting and land clearing for agricultural purposes has greatly reduced their extent, and they are now considered of high conservation concern in the region. This study examines stand structural characteristics and regeneration of American beech within a mature, mixed-hardwood stand in the Loessal Bluffs in West Central Mississippi following partial-cutting. The Loessal Bluffs predominate on the eastern edge of the Lower Mississippi River Alluvial Valley, and are characterized by deep, well-drained soils which are very productive hardwood sites, but also highly eroded resulting in a landform that is now steeply dissected by ridge and gully topography. The study stand was dominated by an overstory of cherrybark oak (*Quercus pagoda* Raf.), yellow poplar (*Liriodendron tulipifera* L.), sweetgum (*Liquidambar styraciflua* L.) and white oak (*Q. alba*), with an intermediate canopy of American beech. Partial-cutting removed a portion of the stand in 2013, providing opportunities for regeneration and growth of residual American beech. An on-going regeneration survey coupled with spatial assessment of stand structural conditions will provide insights into regeneration and persistence following harvest disturbance. Findings from this study should enhance our knowledge of regeneration dynamics of American beech in its southern range. This knowledge should benefit silvicultural approaches to manage and maintain American beech as an important component of these complex, mesic-hardwood forest types in the southeastern U.S.

Key words: *F. grandifolia*, light, seedling, topographic gradient, understory

TEMPORAL AND SPATIAL CHANGES IN BEECH *(Fagus orientalis)* ECOSYSTEMS: A CASE STUDY IN GÖKÇEALAN PLANNING UNIT

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Introduction

Monitoring spatial and temporal changes is quite decisive in decision making during the planning process of forest ecosystems. Past interventions resulting in decrease or increase in forest area, course of crown closure, trend in development stages whether towards to thinner or thicker diameter classes or spatial conditions of forest is more like homogeneous or patch type structure will definitely affect the decisions. The findings of similar studies will also assist to determine the level of allowable cut, to decide merging the fragmented structure via afforestation, to begin the rehabilitation, to support species those existing in the past but tended to be disappearing or to evaluating sensitive habitats by allocating under proper forest functions.

There are numerous studies in the world and in our country in order to examine the temporal changes of forest resources. However, studies about displaying historical structure of beech forests to compare actual structure are quite a few and needed to be investigated considering temporal and spatial parameters. In the conducted study, it is aimed to display the changes in terms of tree species, development stage and crown closure and to demonstrate the spatial changes with the help of indexes such as number of patches, average patch size for beech dominated Gökçealan Planning Unit (PU) selected as the research area.

Material and Methods

In this study, changes in tree species, development stages and crown closure parameters were investigated in 39 years for the selected beech dominated planning unit called Gökçealan administratively work under Türkeli State Forest Enterprise and Kastamonu Regional Directorate of Forestry. Gökçealan PU has a 7839.4 ha general area of which 6050.8 ha is forested. Forests are dominated by beech forests as % 70.1 (4245.7 ha). Other dominated species are Anatolian black pine, Chestnut and Oak.

Geographic Information Systems (GIS) and Remote Sensing (RS) techniques are frequently used assistant tools to realize changes in forest ecosystems in recent years. The use of GIS is effective technique offering great conveniences for analysis and in the determination of temporal and spatial changes in forest resources to grasp a degree of forest dynamics, the collection, analysis and presentation of data on natural resources. To achieve the determined goals, Çatakgeriş and Cible stand type maps (GDF, 1970) produced in 1970 and digital stand type map (GDF, 2009) prepared in 2009 were used as the main data source in this study. Firstly, the stand type map for the first period was scanned, coordinated, digitized and spatial database were built including tree species, development stage and crown closure using ArcGIS 10.1™. After completion of the previous period database, layers for 1970 and 2009 were both overlaid using "intersect" command and exported in dbf format. After then, transition matrices were created using "pivot table" of “Microsoft Excel 2010”. In order to display spatial changes related to specified periods, "Patch Analsyt" program were used which can operate as extension to ArcGIS software. Indexes such as number of patches, mean patch size and area weighted average shape index were used to evaluate the spatial changes Gökçealan Planning Unit for nearly 40 years.

Results and Discussions

Between 1970 and 2009, degraded stands were reduced from 922.1 ha to 501.5 ha. In that period, 446.2 ha degraded forest was turned into mixed stands while 274.6 ha open lands turned into degraded forests. Beech forests turned into mixed stands with around 835.8 ha, while 626.7 ha of beech stands turned into beech stands. Another outstanding result is the extinction of 559.6 ha coppice areas, turning into mainly mixed forests (343.9 ha) as a result of translation those areas into high forests due to the legal procedures (Table 1). In short, there was a noticeable variation of forest dynamics with a distinctive change proportion of stands from one period to another over the last four decades.

Table 1. The transition matrix of forest cover from 1970 to 2009 in Gökçealan PU

Forest Cover	Open Lands	Degra.	Plane	B. Pine	Mixed	Beech	Chest.	Alder	Oak	S. Pine	Hornbeam	Total
Open Lands	1530.5	274.6	3.3	63.5	171.1	29.7	25.7	1.0	13.8	19.9	5.0	2138.1
Degraded	125.6	122.1	1.2	67.6	446.2	91.5	47.8	0.1	7.9	7.0	5.2	922.1
Plane	2.1	-	1.1	-	-	-	-	-	-	-	-	3.2
B. Pine	-	4.2	-	10.1	-	-	-	-	-	-	-	14.3
Mixed	9.7	10.7	-	28.1	669.9	626.7	7.7	-	10.6	14.5	13.4	1391.3
Beech	9.8	65.1	-	0.8	835.8	1483.5	131.5	3.3	3.0	-	3.3	2536.1
Chestnut	41.4	6.2	-	2.2	51.7	-	45.2	-	1.0	8.6	-	156.3
Alder	-	-	-	-	37.0	17.1	-	-	27.8	-	4.2	86.2
Coppice	50.3	18.7	-	27.3	343.9	107.3	3.2	0.8	4.7	0.9	2.6	559.6
Total	1769.3	501.5	5.6	199.6	2555.6	2355.8	261.1	5.3	68.8	50.9	33.6	7807.2

When development stages of two different periods were compared, it was observed that “a” and “c” stages were originated in 2009. The total area of the development stage “b” decreased from 2389.4 ha, while “d” increased from 1797.9 ha. in 1971 to 2260.8 ha in 2010.While, the total area of development stage “b” decreased from 2389.4 in 1971 to 894.8 ha in 2009 (Table 2).

In terms of crown closure, loose closure (11%-40%) and dense closure (>70%) were increased from 70.8 ha to 234 ha and from 1767.4 ha to 4589.1 ha respectively. On the other hand, middle closure (41%-70%) was decreased from 2349.3 ha to 713.2 ha of landscape in respective years. Similarly, degraded stands also decreased from 922.1 ha in 1970 and to 501.5 ha in 2009. Changes in crown closure show that, quality of forest structure is improved by decreasing the sparsely covered or degraded stands and increasing the densely covered stands between the two periods.

In conclusion, it is determined that from 1970 to 2009; total area in forests increased and open lands decreased markedly while the number of patches increased and the mean patch size decreased meaning to forest ecosystem become more susceptible to harsh disturbances. In conclusion, it is understood that integration of GIS has a powerful role in determining spatiotemporal dynamics of beech forests for effective forest planning.

Table 2. The transition matrix of development stages from 1970 to 2009 in Gökçealan PU

Dev. Stages	Open Lands	Degraded	a	b	c	d	Total
Open Lands	1530.5	274.6	29.3	119.2	155.9	28.6	2138.1
Degraded	125.6	122.1	18.4	271.7	281.0	103.4	922.1
Coppice	50.3	18.7	1.2	233.9	240.6	15.0	559.6
b	56.2	28.1	4.3	141.3	1106.4	1053.1	2389.4
d	6.8	58.0	8.1	128.7	535.7	1060.7	1797.9
Total	1769.3	501.5	61.2	894.8	2319.5	2260.8	7807.2

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THE ABOVEGROUND BIOMASS, CARBON SEQUESTRATION AND THE EFFECTS OF CLIMATE CHANGE FOR BEECH (*Fagus orientalis* Lipsky.) FORESTS IN ORDU-AKKUŞ REGION

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ABSTRACT

The use of fossil fuels began in 1850 with the Industrial Revolution, technological development, rapid population growth and the overexploitation threatens our world. Along with other gases in the atmosphere since the Industrial Revolution that the greenhouse effect, gradually increases in the amount of CO2 and destruction of forests by land use change, eventually leads to global climate change and temperature increase. Forests effecting the global carbon (C) conversion which contributes to global climate change.

Forest Ecosystems an effect on atmospheric CO2 is demonstrates with biomass and Carbon sequestration studies. For this purpose, first the amount of carbon in the forest mass is determined which produced by photosynthesis, then it is calculated that the amount of carbon equivalent to the CO2 content. Carbon balance with in specified time frames is determining with the differences between biomass produced by forests and biomass removed from the forest with silvicultural treatments in this time interval.

Beech's 4th biggest distribution in the world is in our country (Turkey) that is 2 million ha. in (Turkeys's) our total forest area. The beech is an important species for storing C with its wide distribution area in (Turkey) our country. In this study, Oriental beech (*Fagus orientalis* Lipsky.) stands aboveground carbon sequestration capacity is determined in Ordu-Akkuş where oriental beech has optimum distribution.

Key words: Beech, climate change, carbon sequestration

THE DOMINANCE OF EUROPEAN BEECH IS ANTICIPATED IN MIXED CONIFER-DOMINATED MOUNTAIN FORESTS GIVEN THE CLIMATE CHANGE

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ABSTRACT

European beech (*Fagus sylvatica*) is an important tree species of mixed mountain forests across Europe. Its ecological value is substantial while the economic value is much lower compared to the native conifers Silver fir (*Abies alba*) and Norway spruce (*Picea abies*). However, beech was recognized to be highly sensitive to climate change in some areas, some studies even anticipated beech to disappear from these forests. In contrary, the business-as-usual forest management seems to promote beech over the native conifers and other species. Thus, we aimed to evaluate the influence of climate change scenarios on dynamics of the main tree species, with a special focus on beech, in mixed mountain forests under various forest management strategies.

The study was conducted in the Dinaric Mountains (≈50 km^2), Slovenia, where fir-beech-spruce mountain forests prevail; currently, fir predominates with 53% in stand volume, followed by beech (26%) and spruce (18%). The most representative stand types in the area were included in the study (total of ≈1750 ha), distributed in an altitudinal gradient and different aspects. The climate-sensitive forest succession model ForClim was applied to simulate future development of representative stand types under three climate change scenarios (baseline, optimistic, and pessimistic), and given five forest management strategies (various silvicultural systems, various regeneration composition). Several stand parameters were examined to assess the status and dynamics of observed tree species in the studied forests. Tree species composition underwent significant changes during the last century, which are likely to continue for the next 100 years according to the model simulations. In general, simulated business-as-usual forest management anticipated notably higher proportions of beech within the most of representative stand types. Climate, in close relation to altitude and aspect, seems to play a great role in promoting beech, but is even more influential in decreasing or even vanishing of native conifers. Under the pessimistic climate change scenario, the proportion of beech would increase significantly in the next 100 years, while native conifers would decrease their proportion substantially, or in some stand types almost disappear. Different management strategies to both manage beech and enhance native coniferous species will be discussed.

Key words: *Abies alba*, Dinaric Mountains, *Fagus sylvatica*, ForClim, *Picea abies,* stand dynamics,

THE EFFECT OF IMPREGNATION WITH SILICON BASED COMPOUNDS ON SOME PHYSICAL AND MECHANICAL PROPERTIES OF WOOD

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INTRODUCTION

Beech has a high economical value and is one of primary forest tree species for Turkey. According to many research results made with beech wood showed important physical and mechanical properties. Furniture, plywood, parquet, toy, tool holder, packing crates, pallets, mold, shovel, business and carpenter bench, mine pole are one of the most using area of beech wood. But keeping these properties for longer wood must been impregnated with protective chemicals. Impregnation of wood is giving some protective chemicals to the wood structure by different methods. In this ecological era showed us importance of environmental and non-toxic chemicals for nature and people healthy instead of toxic and detrimental chemicals as Cupper, Chrome and Arsenic. In this study, the effect of impregnation with silicon based compounds on some physical, mechanical properties was investigated of beech (*Fagus orientalis* L.) wood species spreading widely at East Blacksea Region of Turkey. As a result of the study, impregnation of wood with silicon based formulations did not decrease water absorption rate (%) considerably. However, treated specimens showed slightly higher water repellent efficiency (%). Compression strength parallel to grain of treated specimens was nearly similar to untreated specimens whilst, shock strength of treated specimens was relatively lower than that of untreated specimens.

MATERIAL AND METHOD

Wood specimens were prepared from air-dried beech (*Fagus orientalis* L.*)* sapwood. Three different wood samples (20x20x30 mm^3, 30x30x15 mm^3, 20x20x300 mm^3) were formed for test methods. As silicon based compounds, Dow Corning (R) 1-6184, Z-6341, 2-9034, IE-6683 and Z-70 were chosen. Wood specimens were impregnated with these compounds having concentrations of 10% and 50%. Full cell impregnation method was used. As physical properties; density (g/cm3), water absorption rate (%) and water repellent efficiency (%) as mechanical properties; compression strength parallel to grain (N/mm2) and shock strength (J/cm2) were performed on both treated and untreated specimens.

RESULT AND DISCUSSION

In the study specific gravity values were similar results in the test and control samples of silicon treated wood samples. Maximum water absorption rate and minimum water repellent efficiency have been seen in one of silicon groups is Z-6341 %10. Minimum water absorption rate and Maximum water repellent efficiency have been seen in one of silicon groups is Z-70 %50. For mechanical properties; the compression strength parallel to grain had described 63,01 N/mm^2 for control groups and 1-6184 %10 treated wood samples showed 77,29 N/mm^2. Shock strength had described 7,90 J/cm^2 for control groups and Z-6341 %50 treated wood samples showed 8,74 J/cm^2.

Results indicated that specific gravities were pretty close one another and chemicals with silicon based leached from wood samples in leaching test, so these material could be used indoor purposes. Even though most of impregnation methods reduce wood mechanical properties, in this study, an increase was implemented in the direction of CSPG (Compression Strength Parallel to Grain) but impact strength. Thus,

chemicals with silicon based can be used in impregnation for solid wood used in which higher load is necessary, however; for the direction of perpendicular to grain in wood which is subjected to impact forces, some other impregnation materials can be used for wood.

THE IMPORTANCE OF BEECH SEED SOURCES IN SERBIA FOR ENHANCEMENT OF SEED AND SEEDLING PRODUCTION

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ABSTRACT

The quality of seed is the key of successful natural regeneration of forest and afforestation. In Serbia beech *Fagus moesiaca* (Domin,Maly) Czeczott is one of the most important and commercial broadleaf species. Beech is mainly regenerated naturally however for different silvicultural demands and afforestation, it is necessary to provide good quality planting material. To supply good quality seed and as a form of beech gene pool conservation in situ, in Serbia 19 seed stands of this species were designated. Selected seed stands are distributed trough all types of beech communities in Serbia. In the modern selection research the key part is held by the study of production potential of seed stands, which are best recorded in the level of seed, seedling, and nursery stock. To supply good quality seed and as a form of beech gene pool conservation in situ, in Serbia 19 seed stands of this species were designated. Selected seed stands are distributed trough all types of beech communities in Serbia. This paper presents their characteristic, significance and direction of further beech seed and seedling production..

Key words: Beech, seed stands genetically potential

THE LATE-QUATERNARY HISTORY OF BEECH (FAGUS ORIENTALIS) IN THE CENTRAL HYRCANIAN FORESTS OF NORTHERN IRAN

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ABSTRACT

Palynological studies of peatland deposits in the Hyrcanian region of central northern Iran allow the reconstruction of the history of oriental beech communities since 20,000 years calBP. During the cold and dry climate of the Last Glacial Maximum (LGM), beech was chiefly restricted to elevations below 1000 m. Only sparse stands of beech, oak (*Quercus* spp.) and birch (*Betula* sp.) associated with elm (*Ulmus* spp.) and hornbeam (*Carpinus betulus*) occurred at 1000-1300 m elevation. Higher up a dry and/or cold climate with steppe vegetation (consisting mainly of *Artemisia*, Chenopodiaceae and Apiaceae) prevailed. Climatic deterioration in the period 16,900-14,500 calBP led to a strong decrease of the already rare beech and a gradual replacement by the more cold- and drought-resistant Persian oak (*Quercus macranthera*) at mid-elevations (i.e. 1000-1500 m). In the warm and moist Allerød interstadial (i.e. 14,500-13,150 calBP), oak communities were widespread at mid-elevations whereas beech still occupied only lower altitudes. The extremely cold and dry Younger Dryas (13,150-12,100 calBP) was associated with a radical decline of forest stands and the reestablishment of steppe vegetation at elevations higher than 1000 m. In the early Holocene (ca. 12,100-8,100 calBP) the mid-elevation of the central Alborz Mountains was dominated by Persian oak, while beech gradually started to climb up from lower elevations. Hornbeam, which hitherto had merely been a minor - if any - constituent of the mid-elevation forest, gradually started to increase in abundance from the onset of the Holocene, became a major forest tree at around 10,000 calBP and remained abundant thereafter. Only after 8,500 calBP, the modern beech-hornbeam community replaced the oak stands at mid-elevation indicating the establishment of present-day temperate climate and vegetation. Late-Quaternary climate change thus triggered significant altitudinal shifts of vegetation belts in the central Hyrcanian forests, e.g. a timber line depression of around 1200-1300 m during the Allerød and early Holocene, and deeper depressions through the Younger Dryas. The Alborz foothills were a major Quaternary refugium for temperate deciduous broadleaf tree species of the Euxino-Hyrcanian province. Over the last decades, however, the beech communities have been subject to severe anthropogenic impact.

Key words: Euxino-Hyrcanian province, holocene, last glacial maximum, late-pleistocene, palynology, refugia

TREE MICROHABITATS IN SWISS BEECH FOREST RESERVES: A REFERENCE FOR BIODIVERSITY MANAGEMENT IN COMMERCIAL FORESTS?

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ABSTRACT

Integrating biodiversity concerns into forest management policies has been a priority since the Rio conference. For biodiversity conservation strict forest reserves play a key role, not only as a refuge for many forest species depending on habitat continuity and the unswayed sequence of natural processes, but also as reference system for managed forests. While several studies have established links between deadwood and biodiversity, for tree microhabitats such as cavities, cracks, bark characteristics, or giant trees (dbh ≥80 cm), ecological knowledge and practical recommendations are still lacking, despite the important role they play in forest ecosystems.

We use forest inventory data of 20 European beech (*Fagus sylvatica*) forest reserves distributed throughout Switzerland to investigate the abundance of different tree microhabitat types in unmanaged forests. We compare the microhabitat density in these reserves, in managed Swiss beech forests and in the virgin beech forest of Uholka (Ukraine) to assess the effectiveness of the federal strategy, which promotes the implementation of forest reserves for biodiversity conservation. Additionally, we identify the dominant factors explaining the occurrence of specific habitat structures by relating their occurrence to single tree and local forest stand characteristics, environmental factors and regional forest history.

Ultimately, we formulate management recommendations with respect to type, abundance and density of specific habitat structures typical for natural beech forests, and indicate what stand characteristics or environmental conditions favor specific tree microhabitats and thus, which factors should be considered for an effective and cost-efficient implementation of biodiversity enhancing measures in managed beech forests.

Key words: Ecosystem, *Fagus sylvatica*, services tree microhabitats, strict forest reserves, tree characteristics,

VARIABILITY AND BREEDING OF BEECH IN SERBIA

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ABSTRACT

The activities of beech breeding in scientific research and professional work were mostly directed to the conservation of genetic resources, the selection of the corresponding provenances for different sites, enhanced production and trade of planting stock, study of the species evolution development, and the establishment of live archives and seed orchards.

Based on the results of the biochemical and molecular analyses at the level of the selected population and individuals of different beech stands in Serbia, it can be concluded that the adaptation and survival capacities atthe level of population are favored by a higher genetic diversity, and at the individual level - by a higher degree of heterozygosis.

In Serbia, 19 seed stands of beech, total area 137.57 *ha*, were designated for the beech gene pool conservation in situ and for the enhancement of nursery production, i.e. sufficient quantities of healthy and selected seed and nursery material.

Breeding of beech in Serbia, depending on the current requirements of forestry and on the state of forests, should be performed in two directions: in the direction of improving the natural populations, and in the direction of obtaining the new selected beech genotypes and hybrids, which will have superior target characteristics than the existing types. The previous research shows that there are genetic differences between beech populations in Europe and Serbia. This requires the programs of closer research and of directed application of beech genetic variability.

Key words: Beech, breeding, Serbia, variability

VARIATIONS WITHIN AND AMONG POPULATIONS DEPENDING ON SOME LEAF CHARACTERISTICS OF ORIENTAL BEECH (*Fagus orientalis* Lipsky)

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ABSTRACT

At the beginning of the tree breeding programs, it is started over investigations of genetic variations. Thanks to the genetic variation investigations it is proved how does the scape of variations among populations and trees in populastions change according to the variations like altitude, distance from sea and rain.

Oriental beech is a very important tree species in the forestry. It is aimed in this study to determine variations on the seedling which are grown from seeds picked from 11 different Oriental beech populations (Sinop-Merkez, Sinop-Ayancık, Samsun-Kunduz, Samsun-Karapınar, Karabük-Yenice, Düzce-Çiçekli, Trabzon-Maçka, Trabzon-Çaykara, Giresun-Kulakkaya, Ordu-Akkuş ve Kahramanmaraş-Andırın) in terms of leaf width, leaf length, leaf area, leaf vein angle and leaf moisture. By making these measurements on the seedlings belong to the all populations, variations among populations connected to these characteristics are determined. Besides, measurements on tree basis was done by using 6000 leaves in 6 populations, ten trees from per populations, 10 seedlings from per tree, 10 leaves from per seedlings and differences within populations were determined by looking these characteristics.

As a result of the variance analysis which is done connected with leaf width, length, area and leaf vein angle it was determined that there are statistical differences among populations for all these characteristics. As a consequence of the variance analysis belong to the leaf measure, significance level is over 0.05. According to this result it is determined that 11 populations became homogenous depending leaf moisture. All the characters except for leaf moisture showed differences within 6 separate populations. Although populations are homogenous in terms of leaf moisture it is understood that trees within populations showed variations for these characters. According to the hierarchical cluster analysis Sinop-Merkez, Sinop-Ayancık and Karabük-Yenice populations are at the same group in terms of all leaf characters and other populations created other group

Key words: Leaf area, leaf length, leaf moisture, Oriental beech, origin, variation

WOOD PRODUCTION POTENTIAL OF BEECH (*Fagus sylvatica* L.) NATURAL FORESTS IN WEST CENTRAL GREECE

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ABSTRACT

Thermal modification at different temperatures especially at high temperatures is an effective method to change chemical, physical, and mechanical properties of wood. In this study, some mechanical and physical properties of heat treated beech (Fagus orientalis) wood at temperatures 170, 180, 190, and 212 °C for 2 h with ThermoWood method were investigated. The results were compared with oven-dried reference samples. Consequently, depending on the increase of heat treatment temperature, the modulus of rupture was decreasing, the compression resistance parallel to the fibre and modulus of elasticity increased. Also when the treatment temperature increased, equilibrium moisture content decreased. It was seen that a significant increase of dimensional stability and besides the color was darken uniformly.

Key words: Color change, compression resistance, dimensional stability, equilibrium moisture, modulus of rapture, thermowood

POSTER PRESENTATIONS

ACCUMULATION OF FINE WOODY DEBRIS IN THE STEM EXCLUSION PHASE IN THE MIXED ORIENTAL BEECH (*Fagus orientalis* Lipsky.) STANDS, NORTHERN IRAN

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ABSTRACT

Woody debris divides to main groups, including coarse and fine woody debris. Fine woody debris is known as feature of forest ecosystems. The Quantification of FWD amount in forest stands is necessary in forest management. Stem exclusion is the one of the most important phases in stand development. This research carried out in the undisturbed stands of Kheyroud forest to investigate quantitative and qualitative characteristics of FWD in the Stem exclusion phase. Three study sites in this phase had selected and four quadrats within sites laid out to FWD measurements. The characteristics of all woody debris with diameter smaller than 10 cm including length, diameter and decay class were recorded. Results showed Oriental beech (*Fagus orientalis*) was the most frequent (54 %) in the stand dead wood pool. European hornbeam (*Carpinus betulus*) and other minor species encompass 42 and 4 percent of dead wood frequency, respectively. Moreover the most of FWD was in 1-5 cm diameter class. The mean of dead volume in study sites was 15.3 m^3 ha^{-1} In this phase any FWD in the advance decaying class don't recorded. According to the results and high proportion of fine woody debris in dead wood pool, we should more consider to this component of forest stands in management of natural stands.

Key words: Dead wood, European hornbeam, Kheyroud forest, stand development.

ALTITUDINAL VARIATION OF LEAF AREA INDEX FOR MIXED STANDS OF *Fagus orientalis* LIPSKY WITHIN BARTIN REGION OF TURKEY

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ABSTRACT

Leaf Area Index (LAI) is a vegetation parameter which refers to the one-sided area of leaves over the projected crown area of a canopy. The usage of this parameter is prevalent in literature involving landscape ecology, forest stand growth and health, and vegetation hydrology studies. Identifying the variation of this LAI parameter among altitudinal gradients assists the further inquiries in order to comprehend the response of forest stands to climate alterations. Therefore in this study, LAI of three mixed stands of *Fagus orientalis* Lipsky with *Abies bornmülleriana* (Bornmüllerian fir), *Castanea sativa* (sweet chestnut) and *Quercus petraea* (sessile oak) were determined for different altitudes within Bartın region of Turkey. In total, from 13 altitudinal gradients, 38 hemispherical photographs were taken under the dense canopy (>70% closure) of these mixed stands. The photographs were then analyzed by image processing technique and consequently mean LAI of these stands were defined for each altitudinal gradient. The mean LAI of mixed *A. bornmülleriana* and *F. orientalis* Lipsky stand was about constant around 2.43 between 977 and 1080 m asl. On the other hand, the mean LAI of mixed *C. sativa* and *F. orientalis* Lipsky stand dropped from 3.14 at 360 m asl to 2.62 at 648 m asl. Besides, the mean LAI of *Q. petraea* and *F. orientalis* Lipsky stand declined from 2.48 at 650 m asl to 2.28 at 790 m asl. These results particularly denote the ecology of *F. orientalis* Lipsky which tend to constitute mixed forest stands with diverse tree species. In addition, the results, to some extent, indicate optimum growth gradients of altitude for mixed stands of *F. orientlis* Lipsky which spread through broad range of altitudes within the region. However, repetitive LAI analyses will be essential for mixed stands of *F. orientalis* Lipsky at alternative mountain transects of Turkey. Beyond the determination of optimum altitudinal growth ranges, similar analyses will also address the possible shifting of these ranges along the transects due to prospective climate alterations.

Key words: Altitudinal gradients, climate alterations, hemispherical photograph, LAI, mountain transect, Oriental beech

APPROPRIATE STEM NUMBER IN THE FIRST DIAMETER CLASS FOR OBTAINING SUSTAINABLE BEECH STANDS CONSIDERING CLOSE TO NATURE SILVICULTURE, IN NORTHERN FORESTS OF IRAN (CASE STUDY: SHAMUSHAK FOREST, GOLESTAN PROVINCE)

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ABSTRACT

Survey and monitoring of forest areas in which silvicultural interventions were conducted over at least one decade and comparing of quantitative and qualitative characteristics of them with untouched stands could be a useful guide for planning the next interventions considering the goals of close to nature silviculture. This study aims to compare the silvicultural characteristics between compartments 127 (managed) and 128 (unmanaged=control) in district one of Jahan-nama water catchment, Gorgan. Five sample plots, each one ha (100 x 100m), were laid out in each compartment, a total of 10ha, in random-systematic network. The results showed statistically significant differences of mean diameter and height of trees as well as regeneration number between the two studies compartments. Also, the frequency of stem number in the first diameter class (N_{10}) of the managed compartment was 7 times higher than that of the control compartment. This difference was statistically significant. Hence, the silvicultural interventions have led the managed stand to uneven-aged structure with sufficient stem number in N_{10}, that with executing of silvicultural tending we could obtain sustainable stands.

Key words: *Fagus orientalis,* n10, quantitative characteristics, regeneration

BEECHEN FORESTS OF AZERBAIJAN: THE MODERN CONDITION, AGE STRUCTURE AND RENEWAL

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ABSTRACT

Azerbaijan are forests low country with forests covered of land area 11,8%. Forests carry out the important water - soil protective functions and are the carrier of a biological diversity. In forests naturally grow 107 tree and 328 bush species. Despite riches dendroflora, forest covered only species are an order. Beechen (31,68 %), oak (27,4 %) and horn beech (26,01 %) woods grow on 85,09 % forests areas. At a total area of forests of 1021 thousand in hectares, beechen forests occupy 327 thousand in hectares. Beechen forests - a source of high-quality wood, its fruits, beechen nuts, find food and technical application, growing in mountains (from 600-800 m to 1600-1800 m above sea level), carry out ecological functions. Until recently beechen forests proceeding from prevalence in forest fund taking into account high efficiency acted as object wood productions, natural renewal did not cause fears, to artificial renewal was not given attention. Now efficiency and completeness of beechen forests have essentially decreased, natural renewal proceeds unsatisfactorily and as consequence there is a reduction of the area of beechen forests. For an estimation of a condition of natural renewal and the analysis of age structure 33,8 thousand in hectares beechen (*Fagus orientalis* Lipsky.) forests of Less Caucasus are surveyed. Results of researches specify in non-uniform distribution of beechen plantings on age classes. In structure plantings of middle classes of age (81,5 %) prevail, practically there are no young growths (8,5 %) and ripe plantings (10 %). Absence of young growths testifies to an unsatisfactory condition of natural renewal of beechen forest stands. In the past, up to 70-80th of the last century, restoration cabins (voluntary selective and mine) have been cut down ripe beechen forests, but these forest6s actually have not been provided by natural renewal. Are well provided by natural renewal of 10 % of beechen forests, natural renewal on 64 % of the area are poorly proceeds. Steady management of beechen woods demands their uniform distribution on age classes that first of all puts forward necessity of maintenance of beechen forest stands natural renewal. Carrying out of measures of assistance is required to natural renewal and creation of silva cultures of a beech.

Key words: Age structure, artificial renewal, beechen forests, *Fagus orientalis*, forest covered species, natural renewal,

CANOPY SPACE FILLING IN MIXED VERSUS PURE STANDS OF EUROPEAN BEECH AND SCOTS PINE

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ABSTRACT

Mixing of complementary tree species may provide multiple benefits compared to pure forests which include increasing productivity through a higher degree of canopy space filling. However, the positive relationship generally observed between species mixing and space filling remains unclear across large ecological gradients. In this study we test (i) whether mixing species allows trees to use the canopy space more efficiently; (ii) whether interspecific crown plasticity increases in mixed stands; and (iii) whether both depend on site characteristics. We selected 4 triplets i.e., sets of three plots with two in pure stands of Scots pine and European beech and one in a mixed stand of these species in equal site conditions. The four triplets range from the southern limit in Spain to the northern border in Sweden, with the other two locations in the central European area (France and Germany). The triplets therefore represent the stand productivity gradient covering the overlap of the natural range of Scots pine and European beech. Through the use of terrestrial laser scanning we quantified the differences in canopy structure between trees growing in mixed and in pure stands. We deal with some variables hardly accessible so far in dense stands such as crown volumes and crown displacement. Our preliminary results point to denser and more structurally complex canopies in mixed stands in all four sites, which can explain the higher productivity in mixed vs. pure stands.

Key words: Competition, crown plasticity, crown volume, terrestrial laser scanning,

CARBON SEQUESTRATION IN PROTECTED AND NON-PROTECTED AREAS IN BEECH STANDS IN NORTH OF IRAN

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INTRODUCTION

Carbon sequestration is the process of capture and long-term storage of atmospheric carbon dioxide (Sedjo & Sohngen, 2012). Carbon sequestration describes long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change. It has been proposed as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels (Hodrien, 2008). The increasing of global warming and climate change has caused more attention to potential of soil to sequestrate the carbon. Protection of forest areas is one of the most important agents that accelerate destruction of forest ecosystems and also have the noticeable effect to increase the carbon sequestration. In recent years some parts of the Caspian forest have been protected. Although there are several protected areas in Iran especially in the Zagross forest located in west of Iran, protected areas in the Caspian forests are limited. In fact, the role of the protection in carbon sequestration in north of Iran have been studied less. This study have been investigated the effect of 10 years protection regime on carbon sequestration.

MATERIALS AND METHODS

The study was carried out in two protected and Non-protected areas (37˚ 19' N, 49˚57' E) located close to each other, as the altitude, the aspect and the slope were nearly the same. The main tree species in two areas was beech, hornbeam, alder and maple. Thirty sample plots were randomly taken and in each plots, soil samples from 0-20 cm were taken. Organic carbon, bulk density, soil texture, soil porosity were analyzed for each soil sample.

RESULTS AND DISCUSSION

The results showed that the trees in two areas are nearly similar to each other and included beech, alder, hornbeam and maple. Density of the stands and percentage of the canopy was also nearly the same. The organic carbon, carbon sequestration, the amount of sand and porosity showed significant differences between two areas and the amount of them was higher in protected area. The amount of carbon storage in protected and non-protected areas was 194.86 and 126.53 tons per hectare respectively. The results of correlation showed that amongst soil physical properties, soil porosity and the amount of sand had positive correlation with the carbon sequestration. According to findings of this study, protection management regime led to improve of carbon sequestration. It seems that improvement of soil status and reconstruction of it in ecosystems based on protection management, there need more time for reaching ideal situation.

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CLOSURE OF LOGGING WOUNDS ON BEECH TREES (*FAGUS ORIENTALIS* LIPSKY) IN CASPIAN FORESTS OF IRAN: EFFECTS OF ALTITUDE AND SLOPE ASPECT

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ABSTRACT

Beech (*Fagus orientalis* Lipsky) is the most industrial and commercial tree species among more than 80 broadleaved trees and shrubs in the Caspian forests of Iran. The silvicultural method applied in these forests is selection cutting. Damage to residual stand during logging operation is one of the major concerns of forest managers responsible for implementing selection management. Closure of logging wounds on 106 residual beech trees stems was evaluated after 5, 10 and 15 years in Caspian forests of Iran. The results indicated that the wound occlusion rate depended on the size and intensity of wound, diameter of wounded tree, the time elapsed since the wound and site geographical conditions. The closed wounds after 5, 10 and 15 years were 7.5, 19.8 and 38.7 percent, respectively. The highest closed wounds were observed in trees with diameter at breast height of 20 to 40 cm. All small wounds (50 to 200 cm^2) were closed between 5 to 10 years. Intensive wounds (wood damaged) were not closed after 15 years from logging. The time required for wound closure in northern slopes was less than southern slopes ($P < 0.01$). The occlusion rates were decreased with increasing of altitude ($P < 0.05$). Overall, the results indicated that the most of logging wounds (61.3%) needs to more than 15 years for occlusion. Pre-harvest planning and identifying the winching area before logging operation can reduce damage to the residual stands in these forests. Recommendations are: minimize logging wounds on residual trees through more careful in designing of skid trails, tree felling and timber extraction, worker training and increase logging period from 10 years to 20 years.

Key words: Bole injury, ground skidding, logging wounds, residual trees, selection cutting,

COMPARISON CALCULATION AND ONE-FACTOR TABLE VOLUME MODEL OF BEECH (*Fagus orientalis* Lipsky) TREE IN THE SHAFAROUD AREA

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INTRODUCTION

There are different methods to calculate tree stem volume in forest measurements such as i) base on a taper equation and to estimate by integral calculus.ii)to use a volume equation where the volume obtained directly as a function of height, diameter, and total height. iii) to utilize a sectional method when no information of the original tree stem standard parameters or geometry is at hand. The generally accepted sectional methods for volume estimation of tree stem segments in the forest measurement literature are the Huber, Smalian and Newton methods. The purpose of this study is to determine the geographic aspect effects on volume and diameter decrease factor of beech trees. Another aim is to select best regression model between these parameters and diameter at breast height (DBH) and the results of selection volume model to campare with one-variable model of the wood and paper factory (Choka).

MATERIALS AND METHODS

The study was in Shafaroud forestry that situated in Guilan province-North of Iran. Data for this study were obtained from the total number of 411 beech (*Fagus orientalis* Lipsky) stem in different geographic aspects (North 96, North East 105,East 109 and North West 101 stem).

The data consisted of the diameter at breast height (DBH),diameter at middle and tree height in four geographic directions. tree volume was computed using huber's formula Eq1. In appling the formula diameter value was divided by 100 in order to convert it from centimeter to metre. Also diameter decrease factor (df) was measured using Equation2.

$$V = \pi \times \frac{dm^2}{40000} \times h (Eq.1) \; df = \frac{d1.30 - d0.5}{\frac{h}{2} - 1.30} (Eq.2)$$

Regression analysis was conducted to generate equation relating tree volume and diameter decrease factor(as dependent variable)-diameter classes(as independent variable).Linear and logarithmic functions were accepted and parameters of the functions were estimated using relevant Software such as Micro Soft Excel and Statistical package for Social Scientists(Spss) Version 13. Also to recognize the geographic aspect effects on tree volume and diameter decrease factor using One-way Anova and Duncan test at probability level of α=0.05 for compare means and Kolmogorov- Smironov test used for normality test of data. T-Student test used for mean of calculated volume with volume table in order to determine significant difference.

RESULTS AND DISCUSSION

In this research tree real volume and volume table calculated for number of 411 beech trees. Also diameter decrease factor of them was calculated. to calculation of real volume, trees should be cut down and theirs real volume should be calculated with measuring of pieces volume of two metre, (diameter at 0.1, 0.3, 0.5, 0.7, 0.9 heights of tree end).the Kolmogorov-Smironov test show that the distribution of beech tree volume was not normal therefore for normality used square root. Whereas diameter decrease

factor and diameter breast at height were normal. There is significant difference for diameter decrease factor. The volume values at four geographic aspects (North, North East, East and North West) are 3.53, 3.49, 3.92 and 3.48 m^3 respectively. The diameter decrease factor of North beech trees are lower than those which placed at North East, East and North West. According to Duncan test they are in one group and there is not significant difference between them. According to model summary and parameter estimates and figures among the four models, suitable model was selected power model for beech tree volume and the linear model for diameter decrease factor of beech trees. The two parameters (R Square and Std. Error) were considered to selection of model. The higher The R Square values the better and the lower the Std. Error the better. The Coefficient of determination (R^2) indicate that the variation in tree volume can be explained by the variation in DBH. The comparison of calculated volume model with one variable model of volume table shows there is not significant difference between them only we can see a little difference in higher diameter classes. The data of two power models tested with independent sample t-student. Results show there are no significant differences between them (p-value=0.978).Thus volume table is appropriate for determination of beech volume.

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DEFINITION OF *Fagus orientalis* Lipsky. (Oriental Beech) DOMINATED BIOTOPES IN GÜZELCEHİSAR, MUGADA AND KIZILKUM REGION OF BARTIN PROVINCE

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ABSTRACT

Oriental Beech makes its best spread and physical development. Slopes of hills extending paralel to Black Sea shoreline in Turkey. Pure and mixed *Fagus orientalis* Lipsky. forests are particularly located northern slopes. Study area covers slopes facing to Black Sea within coastal areas of the settlements of Güzelcehisar, Mugada and Kızılkum, Bartın Province. The route formed by these settlements represent the part of Northwest Euxine Broadleaved forests of Europe-Siberia Region.

The study area, at the same time, is located in the 'Eu-Euxine' part that is the most humid belt close to seaside. Euxine Beech forests intensely take part in this area and spread to the sea. This study was carried out in two stages. Initially abiotic ve biotic components of study area were defined and data belong to them were collected and stored in a GIS geodatabase. Then, with help of the most recent satellite images and contemporary land use map, abiotic and biotic components of Beech dominated biotopes and land use properties evaluated together. In this way, spread of biotopes dominated by *Fagus orientalis* in and around Güzelcehisar, Mugada ve Kızılkum, habitat characteristics and structural changes due to land uses were determined. According to the result of study, the most intense spread of Beech societies takes place around hilly areas of Güzelcehisar where Yemişliçay formation consisting of sandstone, sheyl and limestone exists. Beech societies disappear in low elevated areas around Mugada and Kızılkum. It was determined that the most effective factors on spread of species are elevation, aspects and geologic characteristic of habitats. It was also determined that *Fagus orientalis* often forms mixed forests with *Carpinus betulus*, *Castanea sativa* and *Quercus petraea* ssp. *iberica*. And also, with field works it was determined that Beech biotopes were adversely affected by man based factors such as grazing, defrostation for agricultural use, road networks and rural settlements. Definition of Beech forests which take place in habitat classification of EU and contribute to biodiversity will be a peliminary assessment for protection and sustainable use of Euxine Beech forests located in coastal areas of the Province of Bartın.

Key words: Bartın, *Fagus orientalis*, biotopes, Güzelcehisar, habitat classification, Kızılkum, Mugada

ECONOMIC ANALYSIS OF TENDING PATHWAYS IN BEECH STANDS: CASE STUDY OF TORUL DISTRICT

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ABSTRACT

It has been applied to forest a wide variety of silvicultural interventions such as tending, cleaning, and thinning or light partial cutting/overhead release felling to increase both the efficiency and sustainability of stand until rotation length. The cleaning activities have a great importance in beech forests in both economic and ecological terms. The tending pathways are usually 80-100 m in length and bare areas without tree, sapling and vegetation. In this study, study areas have been selected among oriental beech (*Fagus orientalis* Lipsky) stands having over 33% slope in Gümüşhane-Torul region. It was measured the width, the length and slope of pathways and distance between them. Also, it was determined the amount of understory and organic soil material and the stony rates on pathways. The using of tending pathways during skidding operations as skidding trail were evaluated. The cost-benefit analysis of the pathways was carried out taking into account the field loss due to the opening of the pathways, the amount of wealth removed and the construction costs of pathways.

Key words: Beech, cleaning activities, cost-benefit, Gümüşhane, tending pathways

EFFECT OF ALTITUDE ON BEECH REGENERATION (*Fagus orientalis* Lipsky) IN ASTARA WATERSHED FORESTS, NORTH OF IRAN

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INTRODUCTION

Forest regeneration as continuity of life and survival of trees is influenced by many factors such as the number and status of seed trees, the climate, the topography, canopy cover and soil properties (Pourmajidian & Moradi, 2009), direction (Khosrojerdi et al., 2008; Amiri et al., 2009), conditions of parent material and the social conditions of the region in terms of permeability for animals (Khosrojerdi et al., 2008) and fixed and nomadic herdsmen changed evenly. Knowledge of the status natural regeneration of tree species in a watershed can help improvement programs of natural resources plans. So that with comparison of the tree regeneration at different altitudes and soil condition can be selected as appropriate species for suitable conditions at reforestation. Amanzadeh et al (2006) investigated the natural regeneration of beech forest in the natural cavities of Aslam Forests and the results showed that there is a significant difference between the level of cavity and abundance of natural regeneration. According to research Razavi (2009), there was significant difference between the mean numbers of regeneration with altitude changes. Natural regeneration is of the most important factors affecting the survival and sustainability of natural forests. Amiri et al. (2009) showed that with increasing altitude, abundance of seedlings and tiny seedlings were not changed regularly. The aim of this study was to determine the status of regeneration in the beech forests of Astara region and its quantitative changes with increasing the altitude.

MATERIAL AND METHOD

The study area is located between altitudes of 500 to 1,700 m a.s.l. in Astara Watershed forests (Watershed 1), Guilan Province, Iran. This basin is one of 29 classified watersheds of Gilan forests that it is located in the end of northern of Guilan province. The area of this basin is about 24,000 ha (Figure 1). The hottest months of the year is July and August with average temperature of 30 °C and the coldest months is January and February with average temperature of 2.5 °C. Mean annual rainfall is 1200 mm.

To do this study, first the boundaries of the study area were identified on the map. To study the changes of the studied characteristics, the study area was classified into five classes including: 500-700, 700-900, 900-1100, 1100-1300, 1300-1500 and 1500-1700 m. The mean of minimum and maximum of each altitude class was used as representative of the same altitude class. Therefore, five studied altitude classes were consisted 600, 800, 1000, 1200, 1400, and 1800 m. Totally 203 circle sample plots with area of 0.1 ha were measured. All of beech species with diameter at breast height less than 7.5 cm were counted and recorded at each sample plot. To analyze the correlation between the studied variables and altitude classes (to determine the presence or absence a significant relationship between them), was used the Pearson coefficient.

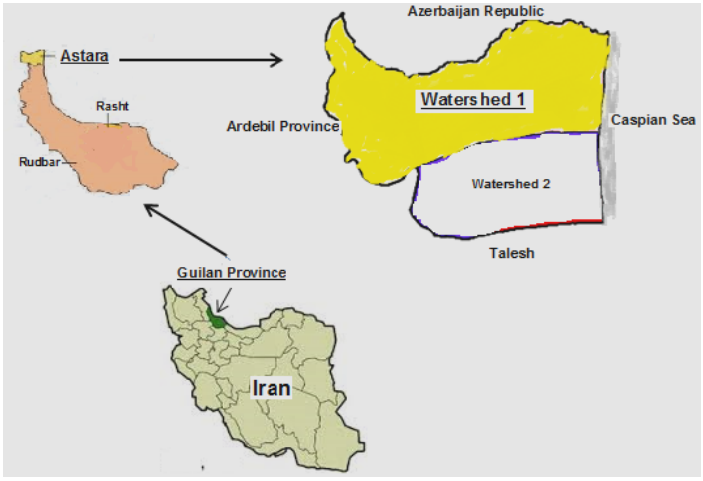

Fig 1. Situation of watershed 1 of Astara on the map

RESULTS AND DISCUSSION

Classification of regeneration was carried out according to diameter at breast height of 0-2.5 cm, 2.5-7.5 cm and seedlings with less than height of 1.30 m. The results of beech regeneration status in diameter and altitudes classes are shown in Table 1.

Table 1. Characteristics of beech regeneration in altitude classes at the study area

Diameter classes (cm)	Number of beech regeneration in altitude classes (N/ha)						
	600 (m)	800 (m)	1000 (m)	1200 (m)	1400 (m)	1600 (m)	Total
0 - 2.5	68	321	133	62	250	1417	2251
2.5 - 7.5	48	107	100	57	250	1500	2062
Height<1.30	40	143	256	300	617	917	2273
Total	156	571	489	419	1117	3834	6586

The results showed that there was a significant correlation (r = 0.864, N=6) between altitude classes and beech regeneration ($P \leq 0.0381$) at 0.05 confidence level. The results showed that the abundance of beech regeneration increased along to increasing altitude in the study area. The most abundance of beech regeneration has observed at the altitude of 1600 m a.s.l. and the least regeneration was observed at lower than altitude of 1600. 60 percent of observed regeneration in the study area was belongs to the altitude classes of 1600 m. There was a significant correlation between the number of beech natural regeneration per ha and altitude classes; that it is consistent with the investigation of Razavi (2009) and Amiri et al (2009). Haishan et al (2010) also concluded that environmental factors especially altitude, can play important role on establishment of the regeneration. Generally, the appropriate and abundant establishment of natural regeneration of beech at the high altitude class can be indicate the presence of suitable habitat conditions of beech in this altitude class. Marvi Mohajer (1976) showed that 900 to 1500 m above sea level is the appropriate altitude for the natural regeneration and establishment of beech. In another study, the best altitude for establishment of beech was obtained 1,000 to 1,200 m above sea level (Hasanzad Navroodi, 2001). So altitude is as one of the limiting factors for establishment of tree species and regeneration (Wang et al., 2004; Wangda & Ohsawa, 2006). The highest number of regeneration was observed in class with height less than 1.30 m and the least number of regeneration was in diametric class of 2.5 to 7.5 cm. In addition, with increasing the mean diameter of the regeneration, it has been decreased the number of regeneration per ha; so that average regeneration in class with height less than 1.30 m was 379 trees per ha and in the diametric class of 2.5-7.5 was 344.

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EFFECTS OF DIFFERENT FIRST THINNING DENSITIES ON FIBER MORPHOLOGY IN ORIENTAL BEECH (*Fagus orientalis* Lipsky) PLANTATIONS

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ABSTRACT

Trees are affected by some different factors during their growing period and shows different wood properties factors that couse to change some properties on wood structure are enviromental factors. One of the enviromental factors that is silvicultural thinning treatments. Wood anatomy, a branch of science that studies the structure of the wood. Wood anatomy, in addition to specifies usage areas of wood.

The objective of this research was to investigate the affects of four thinning treatments on wood anatomical properties in Fagus orientalis lipsky plantations in Trabzon. There is total 16 study plots in this Vakfıkebir study area. Thinning treatments were carried out at four levels in the study area (% 0 control, %10 light thinning, %25 heavy thinning and %40 very heavy thinning). On every plots 2 wood samples were be taken for anatomical properties. At the end of the sampling there are 32 wood samples. The wood samples were be taken of the last four years annual rings of the tree. For finding out of anatomical proporties, on 64 wood samples were maceration that is schulzes method. On wood sample,; lengths of fibre, widths of fibre, widths of fibre lümen and thickness of fibre wall were measured. As a result, this study for those interested on wood technology believe that useful useful information will be presented.

Key words: Anatomical proporties, thinning treatments of the beech

EFFECTS OF FOREST ROADS ON MORTALITY OF BEECH (*Fagus orientalis* lipsky) TREES IN NORTHERN FORESTS OF IRAN

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ABSTRACT

The forest roads are the base infrastructure foundations which provide access to forest lands for extraction, regeneration, protection, and recreation activities. Also the roads are recognized as having different ecological roles in forest ecosystems and environmental impacts to adjacent stands. In this research the mortality (ratio of dead trees to live trees) of beech (*Fagus orientalis* Lipsky) trees were compared in three distances (0-20, 20-40 and 40-60 m) and position (downhill and uphill) from road verges in a protected stand of Caspian forests in the north of Iran. For this reason we established six transects 20 m wide and one km length parallel to the road (3 transects on each fill and cut slopes) in a 40 yr old unpaved forest road. Along each transect five plots of 400 m^2 were established by systematic random sampling. The results indicated that the mortality of beech trees in 0-20 m stands was significantly higher ($P < 0.01$) than the distant stands from the forest road. Also the mortality of beech trees in the downhill stands was significantly higher ($P < 0.05$) than the uphill stands. The young beech trees (diameter at breast height < 30 cm) were more sensitive to forest road than the older beech trees. Overall, our results indicated that the beech trees are more sensitive to road effects and stand structure strongly differed between road verge and forest interior habitats. The greater mortality of beech trees in associated with forest road than interior stands is serious issue in management of biodiversity protection and tourism forests. Our suggestions are more careful designing and minimize forest roads density in these forests, especially in protective beech stands.

Key words: Biodiversity, Caspian forests, protective stands, road effect, tree death

EFFECT OF SEED PRODUCTION ON NITROGEN UPTAKE AND ALLOCATION IN MATURE *Fagus crenata* TREES

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ABSTRACT

Reproduction consumes enormous resources, particularly in masting plants, which refers to intermittent and synchronous production of large seed crops. It is generally considered to correlate with dynamics of resource storage. The latest studies indicate that nitrogen (N) may be the limiting factor for masting in *Fagus crenata*. Here, we tested to what extent seed production relies on N storage and uptake from soil by tracing seasonal variation of ^{15}N labeled N in fruiting and non-fruiting mature trees. The ^{15}N (NH_4Cl) containing water (equivalent to 10% of soil ammonium N) was sprayed to the soil surface around six trees in the middle of July after leaf mature. The same N concentration in ^{15}N labeled- and adjacent non-labeled-fruiting- trees indicated negligible fertilizing effect. N concentration in neither leaves nor branches differed between fruiting- and non-fruiting trees. However, ^{15}N abundance differed between the two trees. In current-year shoots particularly, ^{15}N was significantly higher early in the growing season in fruiting trees, suggesting additional uptake from the soil in response to stronger sink strength due to additional burden of fruits. In non-fruiting trees, N withdrawn from senescent leaves stored in twigs. In contrast, it was translocated to seeds in fruiting trees. These results suggest that compensatory uptake of N from the soil contributed to seed production as well as translocation from leaves and cupules during seed ripeness.

Key words: Japanese beech, mast seeding, resorption, resource.

EFFECTS OF SOIL PROPERTIES ON SOME ANATOMICAL CHARACTERISTICS OF BEECH WOOD, WHICH GROWS NATURALLY IN THE SINOP REGION

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ABSTRACT

In this study, the beech grows naturally in the Sinop area was conducted to determine the effects of some soil properties on the anatomical characteristics of the wood. From the pilot area, wood and soil samples were taken from 18 tree specimen, which are native to the Sinop area, and from their different growth environments (Depending on the (north and South) direction and the altitude (6 of different altitudes group)). In addition, soil samples were taken from three different (A, B, C) horizon.

Examples of wood from the felled trees were 1.30 meters in height. On samples of wood; tangential and radial diameters of vessels, number of vessels in 1 mm2, lengths of vessel elements, multiseriate ray width and height (micron), numbers of ray in 1 mm, lengths of fibre, widths of fibre, widths of fibre lumen and thickness of fibre wall for measures and countings were determined. For samples of soil; physical (ratio of sand, silt and clay) property soil were identified.

Correlation analysis to determine the relationship between the anatomical features of the soil samples taken from different horizons have been made. According to the ($p<0.01$) and ($p<0.05$) analysis results were significant relationships.

Key words: Anatomical proporties**,** soil proporties

ESTIMATING DOMINANT HEIGHT USING LANDSAT 7 ETM SATELLITE IMAGE IN PURE ORIENTAL BEECH STANDS IN GÖLDAĞ, SINOP

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ABSTRACT

Great attention is paid to gardening and beautification of cities and settlements in Kazakhstan. The Concept of transferring to the stable development was accepted in the country and ecological code of legal standards in the sphere of ecologization was developed. Research in the development of the effective system of landscape gardening of “Zheruiyk” Park in Astana was carried out on the base of complex environmental forest assessment of the potential of the existing park for the development of favorable environment for citizens. The object of research is “Zheruiyk” Park located in the capital of the Republic of Kazakhstan in “Almaty” district. The whole squire makes up 17,1 ha, green fence 1944 linear meter, lawn – 95 000 м^2 and flower bed - 217 м^2.

The study and assessment of green spaces including bushes, lawn and flower beds of different purposes in “Zheruiyk” Park of Astana was carried out on the base of conventional methodical developments.

Key words: Closed root system, ecosystem, green spaces, plant communities, urban planning

EVALUATION OF PHYSICAL ENVIRONMENT PROPERTIES IN *Fagus orientalis* Lipsky. (Oriental Beech) DOMINATED ECOSYSTEMS WITH ZONAL STATISTICAL ANALYSES

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ABSTRACT

Protection and sustainability of ecosystems in which biotic and abiotic factors are in interaction with physical factors has a vital importance for future. Abiotic factors ie. physical environment have direct effects on variety of species, their sociologic structure, food chain and also sustainability of habitats. Determination of effects of physical factors such as topographic and geomerphologic characteristics, soil structure, hydrology, so on enable planners for making decisions on future of natural assets. In this study, interactions between beech dominated ecosystems and physical environmental factors within administrative boundaries of the town of Amasra was determined with GIS based statistical analyses and evaluated in with regard to sustainable spatial planning. For this purpose, a number of spatial and zonal istatistical analyses were carried out for determination of results belong to that interactions. Finally all results were evaluated and recommendations were given for future land uses within the study area.

Key words: *Fagus orientalis*, GIS, physical properties, zonal istatistical

EVALUATING USE OPPORTUNITIES OF *Fagus orientalis* IN THE URBAN OPEN-GREEN SPACES

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INTRODUCTION

Generally, plants provide many advantages for urban open-green space users in terms of aesthetic, functional, psychological, ecological and economic characteristics. Plants used as landscape design material have many spatial (architectural), ecological and aesthetic functions. The spatial functions of plants are setting place, defining a boundary, filtering or blocking views (noise or dust), directing traffic or human, symbolization, creating background, focusing on an object or place, supporting/strengthening of structural design. Its ecological functions are controlling of light, temperature, rainfall, humidity, wind, noisy, air pollution, erosion, wildlife protection, soil and water conservation. At the same time, some plants which have some characteristics such as color and texture seen on their various organs with flowers, leaves, fruits, bark and their aesthetic forms are more advantageous than other landscape design materials. Thanks to such spatial, ecological and aesthetic characteristics of the plants used in landscape design have a positive impact on the psychology of people living in urban areas and increase the quality of urban life.

Before a design plant is being applied to an area, all functions of this plant species needs to be known and its land compatibility must be identified in terms of habitat. Preference of plant species that can serve the functional purposes increases the success of the applications. In this context, some functions and disadvantages of *Fagus orientalis* were tried to determine in relation to its usage of urban open-green space. Its use potential in Turkey was revealed and its positive/negative aspects were discussed about applying on land of it.

MATERIAL AND METHODS

The materials of this study are *F. orientalis* Lipsky. which spread naturally in Turkey and the literature regarding the usage of this species in landscape planning and design. *F. orientalis* is a suitable species to be grown in wide parks and gardens because of its functions as no curved body, light gray and smooth bark, the lack of growth problems (Genç, 2012). In this study, the literature was researched about using of *F. orientalis* in landscape planning and design. Its use opportunities were evaluated in open-green spaces by investigating current usage of it.

FINDINGS

The availability of *F. orientalis* in terms of its functions

It is possible to usage of *F. orientalis* in urban open-green spaces when being considered its functions like architectural (spatial), aesthetic (visual), ecological, healing (medical) or using as landscape structure equipment. Also, it is usually used for defining a boundary, shading, filtering or blocking views (noise or dust), directing traffic or human in there (Ekici, 2010). Both it is preferred as group and solitary in large-spacious grass areas, parks and gardens (Bekci et al., 2013). It is among species which is possible to use in industrial areas because it is strength against polluted air conditions (Var, 1992). That *F. orientalis* can hold dusts because its leaves have large surface makes desirable usage of it. So, especially, this species

can be utilized to prevent from extreme dust amount during summer. *F. orientalis* which its wood is used as landscape construction material is one of species that are able to resist outdoor conditions. For this, its wood can be used for producing landscape materials used in parks and gardens such as banks, playground equipment, surface covering.

Disadvantages caused from using *F. orientalis*

Beech is among the species that can be dangerous and harmful for handicapped in planting owing to its shallow root structure. Therefore, preference of it is inconvenient in where is near to roads which are used by them (Bekiroğlu, 2002). It must be avoided to use in children's playgrounds due to allergenic impact of its pollens. Also, Beech has wide crown and is tall. So that, the availability of it is not convenient in narrow places like housing gardens (Ayaşlıgil, 2007).

Current usage of *F. orientalis* **in urban open-green spaces in Turkey**

The being increased of usage of Beech is important due to benefits of its ecological, economic, aesthetic e.g. Thus, the done studies about usage case of it in our country were researched. According to that, Beech was used in open-green spaces located in Çanakkale and Düzce (Akıncı Kesim, 1996). Var (1992) stated that usage rate of this taxon which is natural in eastern Black Sea Region was about 1%. It was not seen in this city's parks, housing gardens, roads and refuges, was 3% in its gardens of public and private institutions. Also, according to another one, it was expressed that though Beech is one of natural species in Bartın, usage rate of it was low (Ekici and Sarıbaş, 2006).

F. orientalis is a natural taxon in Soma (Manisa), Kastamonu, Bartın and Trabzon but it has not been used into urban open-green spaces in there (Ekici and Sarıbaş, 2006; Sakıcı et al., 2013). This taxon is both not natural and has not been preferred in open-green spaces in Çankırı, Aksaray, Erzurum and Kahramanmaraş (Bilgili et al., 2014).

DISCUSSION AND RESULTS

Although benefits of Beech are determined, it is discussed why it is not used sufficiently in urban open-green spaces. In the same way, even the species is not almost used in our cities where the species is natural.

As a result, in our country, the species was not valued as compared to other plant species in urban open-green spaces. Whereas, it has come to the forefront as a species had high use potential because of aesthetic, ecological, economic, spatial and psychological features. This potential must be realized by municipalities and relevant public institutions. Land surveys must be done on the basis of plant species. In this way, planting of the species must be applied in appropriate urban and rural areas. Usage of Beech must be extended in urban areas by focusing on production of it in private and public nursery gardens.

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FLORISTIC AND PHYSIOGNOMIC CHARACTERISTICS OF *FAGUS ORIENTALIS* LIPSKY COMMUNITIES IN RELATION TO GRAZING AND HUMAN ALTERATIONS IN MASAL, NORTH

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INTRODUCTION

Hyrcanean forests are one of the most important floristic regions of Iran. Forest ecosystems are affected by biotic and abiotic factors (Portela and Santos 2009). Biotic factors such as human uses and livestock grazing can significantly contribute to modify plant communities. The presence of livestock, dairy farmers and local people in northern forests of Iran are associated with the degradation and even the destruction of ecological values. Considering the frequent occurrence of disturbances in these forests, forest typology can be a practical tool to determine the current ecological conditions and provide management solutions to protect and restore them. Physiognomic systems are associated with floristic systems because environmental conditions not only influence floristic characteristics, but also life forms. Therefore, this study aimed at investigating floristic and physiognomic characteristics of vascular plants. The specific objectives of this study were: to determine the effects of grazing and human activities on life forms, composition and dominance of plants and to identify forest types based on tree composition of areas that were protected and unprotected from grazing and human alterations.

MATERIALS AND METHODS

The study was conducted in a 100-ha forested area located in the Masal of Guilan province in northern, Iran. Dairy farmers and local people use the territory for animal husbandry during 2-4 months in each year. A conservation program was initiated 7 years ago by fencing about 50 ha. In this study, we selected a protected and an unprotected area of 50 ha each. In each area, 25 1000-m^2 circular plots were located according to a random-systematic sampling. In each plot, tree and shrub species were identified and percent cover of each herbaceous species was estimated according to the Domin criterion (Mueller & Ellenberg 1989). To identify and classify forest types in both areas, we used the proportion of each tree species ≥ 7.5 cm in DBH to determine species dominance (Table 1). Kuchler's physiognomic method was used to study the physiognomy of each of these types. Finally, life form and structural classes were determined for all plants according to the method of Kuchler & Zoneveld (1977).

Table 1. Classification method of forest's types according to mixture percent of trees (Gorji Bahri, 2000).

Type	Species	Species proportion(in number)		
		First species	Second species	Third species
Main	One species	≥ 90 %	-	-
	First species- second species	50- 90 %	≤ 50 %	-
	First species- second species	≤ 50 %	≤ 50 %	-
Secondary	First species- second species and third species	50- 90 %	≤ 50 %	≥ 10 %
	First species- second species and third species	≤ 50 %	≤ 50 %	≤ 10 %

RESULTS

We identified 60 species from 35 families, and 58 species from 33 families in the protected and unprotected areas, respectively. Main family identified in the protected area was the Rosaceae, while in the unprotected area the Asteracea family had the highest frequency. Deciduous broadleaved was the only tree form that was identified in both areas. Even though trees from both areas were in the same height classes, the percent canopy cover was significantly higher in protected than in the unprotected area. Life forms of the shrub species were also similar between the two areas. Deciduous broadleaved, including *Mespilus germanica*, *Prunus divaricata, Crataegus microphylla, Crataegus ambigua*, and evergreen broadleaved including *Ruscus hyrcanus* and *Ilex aquifolium* were present in both areas, while differences were significantly observed for deciduous broadleaved species in canopy cover percentage. There were three main forest types and two secondary types in the protected area and the most common type was the pure of *Fagus orientalis,* whereas in the unprotected area, six main forest types and two secondary types were identified. In the protected area, life forms of grass and forbs species were similar to those in the unprotected area. In the protected area, the percent cover of palatable and forbs species were higher and was composed of indicator species such as *Hordeum spontaneum, Sanicula europaea, Alium* sp. and etc. On the other hand, the unprotected area was characterized by higher percent covers of non-palatable and grazing-resistant species including *Crocus sativus, Tanacetum* sp., *Crisium arvense* and etc., as well as invasive species such as *Asplenium trichomanes, Pteridium aquilinum* and etc.

DISCUSSION

In most rural areas of northern Iran the activities of most of people are opposed to the conservation of the ecological integrity of these areas. In the unprotected area, local people reduced the tree canopy cover by harvesting and by girdling some other trees for fodder production and livestock grazing. The higher species frequency of the Asteraceae family in this area can be explained by appropriate edaphic conditions but also by the high degradation level of the forest. This degradation level also created inappropriate conditions for the presence of species such as *Prunus divaricata*, *Mespilus germanica*, and etc. In the tree layer, life forms and height distribution were similar between areas because of the short period of protection before sampling. In the protected area, the forest cover was dominated by the *Fagus orientalis* type by high tree density. This indicates that the forest of this area is near the climax state. However, in the unprotected area, human interferences and livestock grazing caused unfavorable conditions for beech regeneration and the forest climax state gradually disappeared (Pulido and Díaz 2005). In the protected area, the height and percent cover of shrub species were lower than in the unprotected area and canopy density was different in the herbaceous layer. Protection against livestock grazing and human disturbances considerably increased the species richness and the percent cover of forbs and palatable plant species. Whereas, in unprotected area, the presence of a tall and high-density cover of non-native shrub species is one of the negative consequences of livestock which is known to be an important changing factor of environmental conditions. Many species do not appear to be significantly affected by grazing. For example, the density of evergreen species did not significantly differ between areas, because they were less used than deciduous species in the unprotected area, while their shade tolerance promoted their establishment and development under the closed canopy of the protected area (Cesa & Paruelo 2011). According to these results, the application of an appropriate and efficient management program is required in areas submitted to grazing in order to control the density of invasive shrub and herbaceous species and to increase the percent cover of native species in beech communities.

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FOREST DAMAGE CAUSED BY SELECTION LOGGING OF ORIENTAL BEECH (*Fagus orientals* Lipsky) IN NORTHERN IRAN

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INTRODUCTION

Beech represents a very valuable tree species in Iranian Forestry with respect to its potential of wood production. Located at good quality sites, beech forests have a strong potential for further development in terms of wood quality and quantity with proper silvicultural treatments. Beech stands cover an area of 245,372 ha or 16.5% of the total Hyrcanian forest areas in Iran, and wood standing volume are estimated to 68.7 mil. m^3 (280 m^3/ha) which is 30% of the total wood volume. Site disturbance may result in degradation of soil properties and may cause a decline in site productivity.

MATERIALS AND METHODS

The study was conducted in the Sorkhekolah forest in Mazandaran Province of northern Iran (between 36°48'37" N and 36°51'39" N latitude and 50°43'10" E and 51°35'15" E longitude) is dominantly covered with *Fagus orientalis* stand. Canopy cover has been estimated as 0.75, average diameter 35 cm, average height 22 m, and stand density 185 trees/ha. Soil disturbance was assessed using the method developed by McMahon (1995). The disturbance assessment comprises the classification of disturbance types at 1-m intervals within a 30-cm radius, along transects orientated at right angles to the direction of log extraction (Table 1).

Table 1. Description of the visual disturbance classification system after McMahon (1995).

DISTURBANCE TYPE	DESCRIPTION		CODE
Undisturbed	No evidence of machine or log passage, litter and understory intact		1
Shallow disturbance	Litter still in place, evidence of minor disruption		2
	Litter removed, topsoil exposed		3
	Litter and topsoil mixed		4
	>5 cm topsoil on litter		5
Deep disturbance	Topsoil removed		6
	Erosion feature		7
	Topsoil puddled		8
	Rutted	5-15 (cm) deep	9
		16-30 (cm) deep	10
		>30 (cm) deep	11
	Unconsolidated subsoil or base rock deposit		12
Slash/understory residue	10-30 (cm)		13
	>30 (cm)		14
Non-soil (stumps, rocks)			15
Compacted	Evidence of tire, track and/or log passage		16

The impacts of skidding on the skid trail in the surface soil layer (0 to 10 cm depth) were examined using dry bulk density and rut formation at the different levels of slope (< 10%, 10–20% and > 20%) and traffic (3, 7 and 11). Each treatment was replicated thrice, so a total of 27 plots (plot was 10 m long by 4 m wide)

were obtained. Samples were taken along three randomized lines across the wheel track perpendicular to the direction of travel. The soil samples collected with a soil hammer and rings (diameter 5 cm, length 10 cm) then were dried in an oven at 105°C for 24 h. Ruts at least 2 cm deep from the top of the mineral soil surface and 2 m long were sampled. At logging gaps we assessed damage to saplings and trees. To assess the damages to residual trees at skid trails, a 100% survey has-been conducted after ground-based skidding system. All damaged trees greater than 10 cm DBH and within 3 m of the trail edge have been labeled and the type of damage has been defined (Table 2).

Table 2. Description of damage categories (DC 1 – 4).

Damage characteristics	Damage category			
	DC 1	DC 2	DC 3	DC 4
Location of damage	> 1 m	0.3 – 1 m	Stump	Root
Size of damage	< 10 cm^2	11 – 50 cm^2	51 – 200 cm^2	> 200 cm^2
Intensity of damage	Bark damaged	Bark squeezed	Wood visible, not damaged	Wood visible, damaged

RESULTS AND DISCUSSION

Results showed that most observations (65%) were slash cover (11%) and undisturbed soils (54%). Disturbed soils accounted for nearly 35% of observations with the most comprising shallow (21.5%) and compacted (11.6%) disturbed classes. Deep disturbed soils accounted for only just over 1.9% of observations. Rutting affected 86% of the deep disturbance classes. Solgi and Najafi (2014) indicated that after logging by conventional ground-based skidding from steep slopes the most observations (> 70%) were slash cover (9%) and undisturbed soils (61%). Results showed that soil was compacted faster on treatments of > 20% than those of < 20% (Fig. 1).

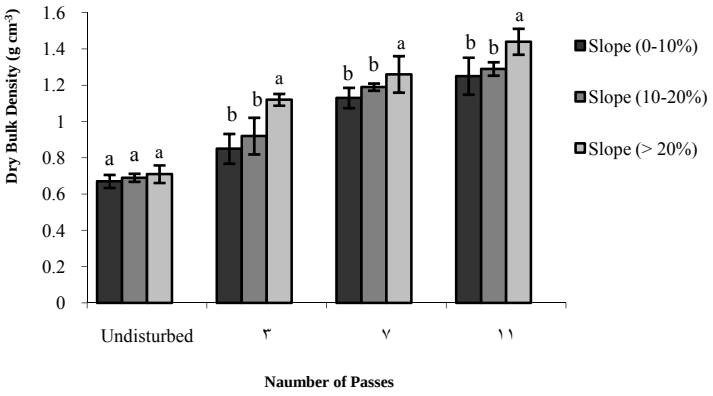

Fig. 1. Effect of skid trail slope on dry bulk density

The increase of bulk density and rut depth in the higher trail slope may be associated with the lower speed of skidders on slope steepness trail. The greatest rut depth (24.5 cm) was measured when the skidder passed 11 times on the trail with the slope of >20%. The strong effect of increasing slope of the skid trail on rates of rut depth increases has also been observed in previous studies (Najafi et al., 2009; Naghdi and Solgi, 2014). Results showed that the most common kind of damage at logging gaps included scraped bark, snapped tops, and run-over stems. The results showed that at skid trails the large majority

of damages were evident either on the root area (45%) or at stem heights between 0-1 m (41%) (Fig. 2). This is a very important finding, considering that most of the damages were located in the root area. This result, in combination to the fact that beech has a "heart-shaped" root system, explains the extensive damages, often combined with wood decay (Tsioras and Liamas, 2010). Also the greatest damage occurred within 1 m from the edge of skid trails.

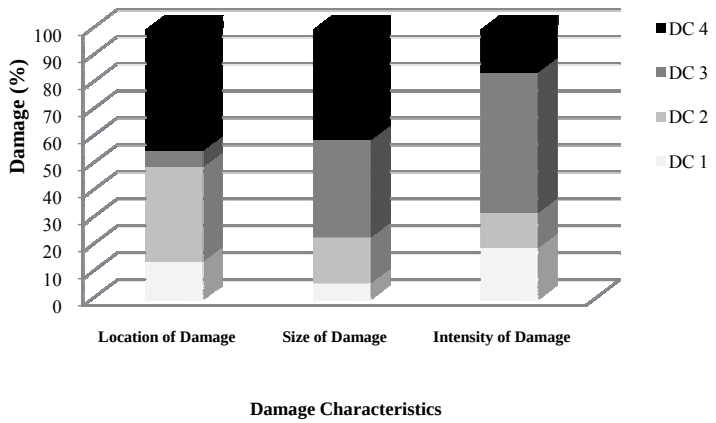

Fig. 2. Percentage of damage categories

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GAINING NATURAL SPECIES IN THE CITY CENTRE: THE EXAMPLE OF *Fagus orientalis* Lipsky.

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ABSTRACT

With dense construction and housing, cities are getting more and more away from nature. The people who live in urban areas are longing for green areas increasingly. Nowadays, it is clear that open green areas in the cities in Turkey all look similar and do not reflect the cities different landscape qualities due to using same alien species in all landscape arrangements. However, the urban identitiy is a very important matter. When tourists enter a city, the urban sluette, plantal arrangement and the plant species in the open green areas give informations about the city. Nevertheless, all the plant species which are used in landscape design in city centres are similar and do not contain the local species in general.

In the scope of this study, the usage of *Fagus orientalis* in the city centre of Kastamonu will be semtinized. *Fagus orientalis* is one of the natural species in Kastamonu. Morever, some pictures of the city centre will be edited with adding plantal landscape compositions which include *Fagus orientalis* to the open green areas via the help of the editing programme Adobe Photoshop. These edited pictures will be showed to the users for receiving their opinions. Thus, this study will help to contribute forming the urban identity of Kastamonu by suppoting the usage of the natural species not just in forrests but in the city centre.

Key words: *Fagus orientalis,* natural plant composition, urban identitiy

GENE DIVERSITY ACCUMULATION DURING INITIAL BEECH FOREST REGENERATION AT THE NORTHWARD DISTRIBUTION FRONT — RESULTS FROM EXPERIMENTAL AND EMPIRICAL POPULATIONS

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ABSTRACT

The natural distribution of Japanese Beech, *Fagus crenata*, shifted northward during the Pleistocene and Holocene epochs and is considered to be further expanding northward because of climate changes. Our previous study revealed that the northern continuous beech forests have ample genetic diversity, which gradually reduces toward trees distributed at the northernmost margin front, which comprises scattered small populations. This indicated that the northernmost populations are recently established, originate from the continuous beech forests, and have not yet achieved substantial gene diversity. However, we do not know how much gene diversity can be gained by a newly established founder population with each regeneration process. To estimate the genetic diversity at the initial regeneration, we used two populations—artificially planted trees and the most recently founded natural distribution front. For the first population, we selected the former arboretum of the Forestry and Forest Products Research Institute, which has been abandoned for the past 90 years. Although the site is located further north, beyond the northern distribution range, beech naturally regenerates very well. Dozens of ornamental and horticultural mature beech trees were located within a few kilometers from the study site. The average heterozygosity over 12 microsatellite loci was 0.664 for juveniles and 0.689 for the current year seedlings. For the latter population, we selected the most recently established natural distribution front, which was a small and extremely isolated population of only 25 mature trees, 72 juveniles, and 55 current year seedlings within 1 ha. The average heterozygosity was 0.696 for juveniles and 0.656 for seedlings. From these results, we assumed that the initial regeneration cohort from founder beech trees aided in improving genetic diversity accumulation from 0.65 to 0.70 average heterozygosity. Further studies need to address how the northern continuous beech population can gain further gene diversity and achieve an average heterozygosity of 0.807. We will discuss further on long-distance pollen flow and Wright's F_{IS} of the newly founded populations during the poster presentation.

Key words: Abandoned arboretum, *Fagus crenata*, founder population, heterozygosity, marginal population, nuclear microsatellite

HARVEST AMOUNTS OF THE BEECH LEAVES IN TURKEY

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ABSTRACT

It's known that Beech leaves to be used as urine enhancer, anti-bronchitis, toothache painkiller and in TB treatment as well. Due to the variety of usage areas, it is being harvested from forest ecosystems as non-wood forest products (NWFP). According to the data received from General Directorate of Forestry, Department of Non-wood Products and Services: First record belongs to year 1998 in the period of 1989-2014. In 1998, for the first time, 10,000 kg beech leaves collected and gained 15 TL incomes in the territory of The Forest Regional Directorate Balıkesir. Latest data is from The Forest Regional Directorate Kütahya in 2005, according to the data 6.175 kg beech leaves collected and gained 568 TL incomes. Beech leaves were harvested from The Forest Regional Directorate Balıkesir, Istanbul, Adapazarı and Kütahya till now. In total, 47.350 kg of beech leaves harvested and was earned as revenue 1.350 TL. Maximum amount of beech leaves harvested while performing from The Forest Regional Directorate Balıkesir with 28.000 kg, minimum amount of harvest was carried out from The Forest Regional Directorate Adapazari as 2.000 kg.

Key words: *Fagus orientalis*, harvest, leaf, Turkey

HARVESTING AND EXTRACTION OF BEECH TIMBER IN TURKEY: KASTAMONU SAMPLE

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ABSTRACT

Oriental beech and common beech are two natural beech species, spreading on east to northwest, mainly found in the northern region of Turkey representing the marginal distribution of beech, with the ratio of 9 percent of forest lands and average beech timber production in Turkey is more than 700.000 cubic meter in recent years.

Felling large trees and extraction of timbers are potentially very dangerous operations and highly skilled and well trained harvesting crews are required for these operations. Terrain conditions, stand characteristics and facilities are effective factors to determine the methods to carry out forest works. Forest harvesting is carried out using mechanised harvesters in most of the developed countries but chainsaw is still required for felling large trees, cutting large branches and cot-to-length method on very steep slopes. Forest lands including beech forests are generally spread on hilly-mountaionous lands in Turkey and most of the timbers are extracted with ground skidding by using human, animal or machine power. Winter harvesting is generally advised and preferred for beech timber harvesting if possible, to benefit from snow on the ground and to prevent beech timbers from harmful fungals. Terrain conditions, stand characteristics and facilities for actual beech timber harvesting and extraction operations are examined in this study with Kastamonu sample.

Key words: Chainsaw felling, ground skidding, logging

HEIGHT-DIAMETER MODELS IN PURE BEECH OLD-GROWTH STANDS, NORTH OF IRAN

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ABSTRACT

Hyrcanian mixed broadleaved forests, within middle elevations of the Alborz Mountains bordering the Caspian Sea in northern Iran, experience few human disturbances and provide an ideal study site to science research. Knowledge of diameter at breast height (DBH) and total tree height is fundamental to both developing and applying many growth and yield models. To sustainable forest management, the description of stand structure before applying silvicultural and utilization practices as well as investigation of induced changes in result of management activities are essential factor. This study was attempted to fitting Height-Diameter functions in Gorazbon district of Kheiroud forest, northern Iran, with an area about 1001 ha which is includes 27 compartments. One one-hectare area plot, representative of pure beech old-growth stands, were selected and within sampling plot was recorded some parameters such as species, DBH and total height. We used five models for describing the relation between DBH and height. Two models (Naslund, Curtis) with two parameters (a, b) and three models (Prodan, Chapman-Richards, Weibull) with three parameters (a, b, c) used. Results showed that number of beech stems is 131 ha^{-1}. The mean of DBH and height calculated 49.77 and 31.4, respectively. According to values of RMSE, Prodan and then Chapman-Richards was the best models for describing the relation between DBH and height in pure beech old-growth stands. All of models fitting were performed by using lmfor R-package.

Key words: Chapman-Richards function, Curtis function, lmfor package, Naslund function, Prodan function, Weibull function

HISTORY AND AGE STRUCTURE OF *Fagus crenata* IN THE NORTHWARD-EXPANDING MARGINAL POPULATIONS IN JAPAN

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ABSTRACT

Fagus crenata Blume (FC) is one of the representative canopy tree species of Japan, which often dominates cool temperate forests. The northern natural limit of the FC distribution lies in the areas around Kuromatsunai depression in Hokkaido, the northern-most main island of the Japanese archipelago. In this area (i.e., study area), FC forest and non-FC deciduous broad-leaved forest form vegetation boundary: FC dominated forest suddenly reduce its population density and change into the non-FC forest, which is dominated by *Quercus, Tilia, Acer, Betula*, or *Kalopanax*. However, within the non-FC forest, there are some small FC populations. These marginal populations are thought to be front line isolated populations of FC, which is still expanding northward but hindered by the existing non-FC forests. Nonetheless, ecology of these "isolated" FC populations is not well understood. For instance, age structure of these populations is unknown, and how they were successfully established is also unclear. Therefore, the objective of this study is to clarify age structure of these FC populations and discuss how these populations established into the non-FC forest. We visited 12 FC isolated populations in the study area and increment cores were sampled from representative large, midium, and small sized trees. After the standard preparation of increment cores, DENDROTAB 2003 was used to measure number and width of tree rings. Estimation of tree age was performed by summing the counted number of tree rings within the core, the estimated number of missing rings within the core, and the estimated number of years taken to reach the cored height. Analysis of tree ring with was also performed to examine any rapid growth periods (i.e., release period) exist by moving average analysis. The estimated age structure showed one peak shape between the age 60 and 100 for most of the 13 FC populations. The oldest single tree was estimated to be 301 years old. Many new recruitment of FC trees occurred in the 1920s, and rapid growth, or release, period was detected at around the 1950s and the afterwards. We then discuss how these results relate to the past disturbance events.

Key words: Age structure, history, Japanese beech, marginal population, northern limit

IN INVESTIGATION OF PLASTIC VALUES OF *Fagus orientalis* Lipsky AND *Fagus silvatica Purpurea* TYPE FOCUS USED IN URBAN TISSUE

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ABSTRACT

Urban landscapes that make up a large part of people's living area has a huge impact on people in terms of psychological and physical health. That is felt heavily on the people of this effect can be increased easily with plant species diversity and composition used by designers. The feature that can appeal to artistic perception with high aesthetic values in urban areas of *Fagus orientalis* and *Fagus silvatica* purpurea species constitutes main subject of the study. This study will be discussed How to have an effect on the plastic value of *Fagus* type, psychological impact on people and awareness of the artistic direction of the trees. The study were discussed visual effects *Fagus orientalis* Lipsky and *Fagus silvatica* purpurea species by considering 5 different points which were based on of five different elements of Kevin Lynch who developed for the space readability (1 Roads, 2. Border, Zone 3, 4th joint, 5. Reference Points) selected in the city center of Rize. These studies carried out in the urban landscape will be developed the appropriate solutions to use the urban landscape by evaluated with SPSS data obtained by questioning users and assessment %.

Key words:plastic value, urban forestry, landscape

INVESTIGATION OF PLANT SPECIES IMPORTANCE VALUE (SIV) IN BEECH FOREST OF IRAN (CASE STUDY: NAV DISTRICT 2 OF ASALEM, GUILAN)

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ABSTRACT

The aim of this study was to determine plant Species Importance Value (SIV) in the Fagetum orientalis, Nav District of Asalem, Guilan. Sampling procedure was using transect method. 73 plots was taken, type of tree, shrub and herb species were identified and their frequency and coverage percentage were measured within each sampling plot. Species Importance Value (SIV) was calculated in the tree, shrub and herbaceous layers. The diagrams were drowning based on Log SIV. The results indicated that mean richness of tree, shrub and herb species in Nav were 11, 12 and 79, respectively. Highest and lowest value of SIV tree species layer belong to *Fagus orientalis* (142.88%) and *Sorbus torminalis* (2.84%) in shrub species layer *Ilex spinigera* (86.23%) and *prunus divaricata* (1.40%) and in herbaceous layer *Asperula odorata* (83.06%) and *physalis alkekengi, Capsella bursa – pastoris, Carpesium abrotanoides, Humulus lupulus, Petasiles hybridus* and *physalis alkekengi* (1.38%), respectively. Diagrams of species frequency followed normal log pattern, it shows majority of species are moderate presence in the community and a few number of them have more frequent or rare.

Key words: Asalem, *Fagus orientalis*, species importance value

INVESTIGATION OF STAND STRUCTURE AND VEGETATION CHANGE BY SPATIAL PATTERN ANALYSES IN THE ORIENTAL BEECH (*Fagus orientalis* Lipsky.) DOMINATED MIXED BROADLEAVED FORESTS IN KDZ. EREĞLİ REGION IN TURKEY

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ABSTRACT

The spatial distribution pattern and population structure of trees are the direct results of comprehensive interactions among species characteristics, environmental factors, and intraspecific and interspecific plant–plant interactions over a long period. The spatial distribution patterns of trees depend on the plant's biological characteristics at a small scale and on environmental heterogeneity, such as soil, water and light at large scales. Considering the dual attributes (temporal and spatial scales) of spatial distribution pattern and stand structure, western Black Sea Region oriental beech (*Fagus orientalis* Lipsky.) dominated mixed broadleaved forests are one of the most common forests in the Kdz. Ereğli district to understand the biological characteristics of a secondary forest community and the interspecific relationship among the tree species in such community with spatial distribution and diameter class structure. The intrinsic reasons for the pattern formation and fluctuating population are also discussed. This study aims to provide a scientific basis for vegetation dynamics that aid in the interpretation of the secondary communities in the oriental beech dominated mixed broadleaved forest stands and in the development of regeneration strategies for other regions have to similar ecological conditions in the Western Black Sea Region characterized by plant disturbance and regeneration patterns. The forest in the study area had a distinct layer system of trees, shrubs, and grasses. The following tree species were identified in the sample plot: such as *Fagus orientalis, Quercus pontica, Quercus petrea, Quercus pubescens, Quercus hartwissiana, Carpinus betulus, Acer pesudoplatanus, Acer campestre, Populus tremula, Castanea sativa, Aesculus hipocastanum, Coryllus avellana.* In addition, 23 shrub and 52 grass species were found in sample plots, with the most abundant species being *Rosaceae, Gramineae,* and *Compositae*. *Fagus orientalis* showed a bimodal DBH distribution, and young (DBH<8 cm) and large trees (16cm ≤ DBH < 28cm) were more abundant than medium trees (10cm ≤DBH<18cm). The DBH distribution of *Carpinus betulus* approximated a Gaussian model (R^2 = 0.92). *Acer campestre* trees thrived in the middle diameter classes (10cm ≤DBH<18cm). The spatial distribution and intraspecific spatial relations among the size classes of each tree species were analyzed by single-variable and double-variable O-ring functions. *Fagus orientalis* had a random distribution at almost all scales, and no significant correlations were observed among size classes. *Q. petreae* individuals were clumped at small scales (less than 8 m and 10 m to 15 m), especially at scales of less than 8 cm. The sapling of *Quercus robur* had positive correlations with the middle-aged and adult trees at small scales. Meanwhile, *Quercus pubescens* dominated the second layer in the canopy of the sample plots. *Castanea sativa, Populus tremula* and *Coryllus avellana* had a random distribution at almost all scales.

Key words: Mixed broadleaved forests, oriental beech, shrub, spatial pattern, stand structure, vegetation.

MODELLING DIAMETER DISTRIBUTIONS IN PURE BEECH STANDS, NORTH OF IRAN

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ABSTRACT

Diameter distributions provide information about estimate the number of trees in different diameter classes in a stand, stand structure, age structure and stand stability. Various probability density functions have been widley used over the last 30 year to describe and predict stem frequency in even-aged and uneven-aged stands, such as the normal, beta, gamma, Johnson's SB and Weibull. The functions are used to describe diameter distribution can be classified into parametric and nonparametric methods. in parametric methods, the Weibull is the most commonly used probability density function for fitting tree diameter distributions. For the estimation of distribution functions parameters, many different methods have been applied, such as moment method, maximum likelihood method and percentiles method. The object of this study is comparing result of some popular distribution functions like Weibull, Beta, Johnson's SB, Gamma, Normal and finally Lognormal in the Gorazbon district of Kheiroud forest, northern Iran and introducing the best functions for pure beech stands. Overall DBH of 493 beech trees was recorded from 30 circular sample plots with an area 1000 m2. According to Kolmogrov-Smirnov goodness of fit test results showed three parameters Lognormal, Johnson's SB, three parameters Weibull and Beta, respectively, were satisfactory functions for DBH modeling. Gamma, Weibull and Normal functions had not acceptable for DBH modeling in the Gorazbon district of Kheiroud forest.

Key words: Beta distribution, gamma distribution, Johnson's SB distribution, lognormal (3P) distribution, normal distribution, Weibull (3P) distribution

PHYTOSOCIOLOGCAL STUDIES OF THE BEECH (*Fagus*) FORESTS IN EAST ASIA

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ABSTRACT

In our study, we aimed to combine published releves and our original releves, and compared the species compositions of beech forests on an East Asian scale in order to clarify phytosociological classifications. Since the 1950s, beech forests in East Asia have been studied intensively at a regional (or country) level, but no comparative studies across have been carried out. In this study, we have combined selected releves from the previous studies, as well as our original releves. As a result, we choose the total of 657 releves across East Asia. We compared the species composition in order to classify vegetation units and rank, and compared genus and life-form compositions, in order to clarify characteristics among vegetation rank. We also compared the climatic conditions to clarify climatic characteristics for each vegetation rank. The synthesis table contains the total of 1,545 species, with 657 releves. On the classification system of beech forests in East Asia, we classified 2 Classes, 4 Orders, 8 Alliances, and 20 Associations. Within the wide-ranging beech forests of East Asia, differences in flora can be seen to reflect differences not only in climatic conditions, but also in the migration history of each plant species since the last glacial maximum. There are 49 characteristic species groups. There are very few species that are common across the whole range. Only 68 species are mutually present in all study areas. Low similarity among study regions is equal to high endemism of species diversity. On the genus composition table, there were total of 455 genera, forming 20 distinct genus groups. Even though species were different, similar compositional properties were observed at the genus level.

Key words: Biodiversity, geographical distribution, plant association, species diversity

PREDICTIONS FOR ORIENTAL BEECH TREE HEIGHTS BASED ON ARTIFICIAL NEURAL NETWORK IN KESTEL FORESTS

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ABSTRACT

Individual tree heights can be commonly measured in a subset of trees in sample plots, however the diameter at breast height is recorded for all sampled trees in forest inventory. The measurement of diameter at breast height is simpler, more accurate, and cheaper than tree height measurements. Accurately, estimation of tree height is essential to forest managers and practitioners for decision making. In forest inventory, tree heights can be frequently measured in a subset of trees in sample plots, this is due to the fact that mensuration of tree height is hard, and takes a long time. Statistical models for predicting tree heights from diameter and other variables are used to estimate the tree heights in a forest inventory. Many statistical models based on nonlinear regression analyze for predicting tree heights have been developed in forest literature until today. However, these models have not been inadequate because of this nonlinear and complex relationships between tree height and diameter with other variables. Also, nonlinear regression analyze requires some statistical assumptions, like normally distributed residuals and homoscedastic trends in predictions, and if these assumptions are violated, tree height predictions can be biased and erroneously obtained in forest applications. To overcome this challenge in tree predictions, Artificial Neural Network Analysis (ANN) has been successfully used in different fields and many situations for modeling nonlinear relationships. Although applications of Artificial Neural Network (ANN) have been presented in many scientific area, e.g., electronic simulations, health diagnosis predictions, climatic estimations and agricultural product estimations, there are few studies concerning prediction of tree height using Artificial Neural Network (ANN). In this study, the objective is to obtain prediction of tree heights based on Artificial Neural Network (ANN) and to compare these tree predictions with ones obtained from nonlinear regression models using root mean square error (RMSE), the adjusted coefficient of determination (R^2_{adj}) and Akaike Information Criteria in Oriental beech located in Kestel Forests, Bursa Forest District Enterprise. In these predictions, tree height that was measured in subset trees in sample plots will be used as dependent variable and tree diameter at breast heights, dominant height, The Basal-Area-in-Larger Trees, quadratic man diameter, basal areas and Reineke's Stand Density Index as stand parameters will be used as independent variables. The back-propagation algorithm will be used as the central algorithm to the training of multilayer perceptions, which is the layout of the most popular neural network. Application of ANN was carried out using MATLAB-NNTOOL module including the development data set that was further subdivided into three subsets for ANN training (75%), verification (15%), and testing (10%). Consequently, it will be discussed that the ability of Artificial Neural Network (ANN) for predicting the relationships between height and diameter with other variables in Oriental beech (*Fagus orientalis* Lipsky) stands. The ANN predictions, including dbh, dominant height, BAL, quadratic mean diameter, basal area and density as input variables, accounted for 87% of the total variance in height values (R^2) with an and root mean square error (RMSE) of 1.7634 m. Therefore, the prediction of tree height based on Artificial Neural Network (ANN) may present an important tool in forest management planning and site quality evaluations of these studied stands located in Turkey.

Key words: Artificial neural network, Oriental beech, predictions, tree height

RELATIONSHIP PLANT COMMUNITIES WITH SOIL HABITAT IN IRAN NORTH FAGETUM

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ABSTRACT

The knowledge of the principles of growth and development is the first step in proper management of forest ecosystems. This study was performed aimed to investigate the relationship between plant communities and soil conditions in plant communities Fagetum in Iran north and Galandrood forest. Plant communities were determined by the method of (Brown-Blanquet 1923) and software Pc-Ordwin. After determination plant communities were overlay on the landform, land type and map plant communities. Soils were classified according to USDA-NRCS2011. The results showed that three communities of plants Rusco - Fagetum, Arctostaphyllo – Fagetum and Fagetum - orientalis. The results also showed that three categories of soil, Alfisoil, Entisoil and Inceptisoil. Rusco - Fagetum in other communities is more characteristics of clay silt the ratio of carbon to nitrogen, magnesium and soil depth. This Community is on the soil Alfisoil. Plant community Arctostaphyllo – Fagetum is in soil Inceptisoil and Alfisoil. Characteristic sand more is of other communities and also soil pH is lower than other communities in this community and other. Fagetum orientalis community is independent of soil characteristics and is there in all soil categories.

Key words: Beech, edaphic conditions, Galandrood, Iran, plant communities

ROCKFALL HAZARD ASSESSMENT IN BEECH PROTECTION FOREST IN A GORGE OF THE SLOVENIAN ALPS

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ABSTRACT

Protection forests have an important role of mitigating the influence of various natural hazards. In Slovenia the main natural hazards are rockfall, floods, debris flow, avalanches and landslides. Only 10% of all forests in Slovenia have an indirect protection function, out of which 30% perform a direct protection role. They protect state roads, railways and buildings. More than 40% of them are European beech (*Fagus sylvatica* L.) dominated forests. Since beech dominated protection forests have not received enough attention in the Alpine region, our goal was to make a contribution to the overall understanding of their protection functioning. We studied protection efficiency of beech dominated forests in the Soteska gorge in NW Slovenia, where a main state road and railway are endangered. We used RockyFor3D model for rockfall simulation. Three scenarios were used for simulation of rockfall: actual forests structure, single tree selection forest and no forest. Forest structure was obtained from 49 sample plots. Beech (59%), spruce (26%) and hornbeam (8%) were the main tree species of forest stands in the gorge. Regarding the sustainably of protection function the number of beech and spruce trees showed a lack of trees in the lower diameter classes as well as lack of regeneration. Road and railway sections endangered by rockfall were determined using energy data. Forest protective effect was insufficient to adequately reduce energy of falling rocks, and thereby ensure protection against rockfall. Data on the number of deposited rocks suggested that the forest provided a better protection against rockfall, than non-forested area. Forest protective effect on rockfall increased with increasing length between the rock source and infrastructure. Silvicultural measures should be focused primarily on perpetual regeneration across the whole area or distributed evenly in small gaps, thereby resulting in uneven-aged and uneven-sized structure. In areas where silvicultural measures cannot provide sufficient protection.

Key words: Beech forest, natural hazard, protective function, protection forest, rockfall, RockyFor3D

SEASONAL PATTERN OF RADIAL GROWTH IN *Fagus crenata* DURING A NON-REPRODUCTION AND A REPRODUCTION YEAR

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ABSTRACT

Reproduction event affects the resource allocation pattern in individual level. As a result, radial growth reduced in huge - reproduction year (full masting year) in some tree species. In *Fagus crenata*, radial growth usually starts at the beginning of growing season, but seed ripening occurs latter growing season. Therefore, there are two hypotheses that interpret the mechanism of the radial growth reduction; 1) reduction of growth rate due to resource allocation both to vegetative growth and reproduction during the growing season, and 2) bringing forward the radial growth saturation due to the switching of the resource allocation from vegetative growth to seed ripening. We aimed to evaluate the effect of masting on the radial growth of *F. crenata* from the point of view of the resource allocation. In this study, high-resolution patterns of radial growth from 17 mature trees of *F. crenata* were monitored by using digital dendro-meters in a non-reproduction year. A subset of individuals was measured also during latter growing season in the previous masting year. Data were fitted to a sigmoidal function, and the parameters of the function were evaluated using the hierarchal Bayesian approach as the properties of the seasonal radial growth pattern. Radial growth in the non-reproduction year started after leaf flushing (median of the radial growth starting date: 5/23), and ceased by the late summer (median of the radial growth settled date: 8/19). The radial growth started synchronously among individuals (95% C.I.: -4~6 days from the median), however the date of growth cessation varied widely (95% C.I.: -23 ~ 45 days from the median). Taken the individual-specific variation into account, the reproduction trees showed slower growth rate and tended to cease radial growth latter than non-reproduction trees in the masting year. These results suggest that radial growth of *F. crenata* was reduced in masting year due to reduction of allocation to vegetative growth during radial growing season.

Key words: Digital dendro-meter, hierarchal Bayesian, Japanese Beech, masting, resource allocation pattern

SNOW DAMAGE IN EUROPEAN BEECH FORESTS: EXPERIENCES FROM SLOVENIA

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ABSTRACT

Snow is an important disturbance agent in Central Europe that causes damage of up to 4 million cubic metres of timber in EU forests each year. Little research about snow damages has been conducted in decidious forests, inspite of their large extent on European scale. Our research was focused on snowbreaks in beech forests in Slovenia, which is suitable area for the study due to high diversity of natural conditions. The aim was to identify which climatic, site and stand factors influence the risk of snow damage.

The study was conducted in beech forests of Slovenia (≈8800 km^2) which account for 70 % of the whole forest land. The data about forest stand and site conditions was obtained from Slovenia Forest Service database and data about snow conditions from Slovenian Environment Agency. The binary logistic regression was applied to predict susceptibilty of forests to snow damage; 11 variables (3 climatic, 3 stand, 5 site) were examined in the model.

According to the model, the susceptibility of a stand to snow damage was increased by the amount of snow in spring months (march, april, may) and slope, and decreseased by rockiness and bedrock type (i.e. higher susceptibility on silicate bedrock compared to limestone). Considering phytogeographical regions, which reflect both climate and site conditions, beech forest in the alpine region had the highest risk of snow damage, followed by the subalpine, Dinaric and prae-Dinaric phytogeographical region. For the Pannonian region the results were not statistically significant ($p > 0.05$). Stand characteristics were surprisingly not included into the final model; however not all relevant stand factors were included into the modelling procedure due to the unavailability or low quality of data.

Knowing the risk factors for the occurrence of snow damage in beech forests may improve the management of beech forests in the areas with frequent occurrence of snow damages. However, snow cover in spring motnhs seems to have the highest influence on snow damage - a variable which cannot be influenced by forest managers. Therefore, further investigation is needed to examine the influence of other stand (and tree) characteriostics more thoroughly.

Key words: Binary logistic regression, *Fagus sylvatica*, risk factors, snow cover

SPATIAL DISTRIBUTION OF DEAD WOOD IN UNMANAGED HYRCANIAN BEECH (*Fagus orientalis*) FORESTS

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ABSTRACT

Unmanaged forests are remnants of natural ecosystems that provide a basis for close-to-nature silvicultural research and applications. These forests have high amounts of dead wood, and although this material is being increasingly studied, the diversity of dead wood in terms of different diameters, decay stages, and spatial distribution patterns is as important as its volume for understanding forest dynamics. Here, we study natural forests in northern Iran to investigate the spatial distribution, decay stages, and volume of dead wood in unmanaged temperate forests at different developmental stages. Three stem-mapped sampling plots (100 m × 100 m) were established in uneven-aged stands dominated by Caspian beech (*Fagus orientalis* Lispsky). The total dead wood ranged from 37 to 119 m^2 ha^{-1}. Our results imply a spatial distribution shift from aggregation to randomness for dead trees in Caspian beech forest succession. We detected significant spatial interactions (attraction) between living and dead trees at short to medium spatial scales (1–20 m) in the plot with the earlier successional stage, suggesting that intra-specific competition is a prevailing force causing tree mortality at the stem-exclusion phase. By contrast, as trees become dominant with the mortality of other trees, the random tree-mortality pattern prevails. The spatial distribution and volume of dead wood may serve as a management target in near-to-natural Caspian beech forest. On the basis of our results, conservation-oriented management strategies should take into account the increasing amount of dead wood, particularly of large diameter in a late stage of decay.

Key words: beech, Caspian forest; nature-based forest management, spatial-pattern analysis

SPATIAL PATTERN, COMPETITION AND SPATIAL ASSOCIATION OF TREES IN THE BEECH (*Fagus orientalis* Lipsky) BROADLEAF STANDS, CASE STUDY: SISTAN DISTRICT, GUILAN- IRAN

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ABSTRACT

The northern Alborz forests are considered part of the world ancient forests that are very rich in terms of number and variety of the species. Knowledge of the spatial pattern of existing species in forests is the most visible aspects of forest stand structure, Specification of particular functioning, description of ecosystem stability, preparation of appropriate management plan and the acts of silvicultural interventions. Competition is a fundamental ecological process that Understanding competition among tree species is especially important when management goal is to reach the dynamics of natural ecosystems. At first, to determine the spatial pattern, competition and spatial association of trees, travel through the forest, one sample plots of one hectare (100m×100m) were selected in mixed broadleaf stands of Zeilaki Watershed (parcel 1, district 4). Diameter of all trees with dbh greater than 7.5 cm together with their coordinates, using azimuth-distance method, were evaluated. In order to determine the spatial pattern of trees the univariate Ripley's K- function and investigate the intra-specific competition, spatial association of beech trees (*Fagus orientalis* Lipsky.) and inter-specific competition the beech-exiting species the bivariate Ripley's K- function were used. The results of this study represents a cluster pattern of trees in this sample plot. The results of the association patterns (i.e., attraction and repulsion) of small timber with medium, large and extra large timber (M، L and EL) of beech trees was no attraction or repulsion in short distances and showed the weak attraction in more distances. The result of inter-specific competition (beech whit Maple tree) showed repulsion in short distances and the inter-specific competition (beech whit Alder, Persimmon, Iron wood trees) was no attraction or repulsion in short distances and attraction in more distances. The results of this review can be used in effective marking in silvicultural interventions and plantations and reforestation programs was done due to intolerance of beech trees in more distances to better growth and achieve of the resources easily possible.

Key words: Association, competition, Guilan, mixed forest, Ripley's K- function, Sistan, spatial pattern

SPECIES POOLS OF VASCULAR PLANTS IN ORIENTAL BEECH (*Fagus orientalis* Lipsky) FORESTS OF TURKEY

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ABSTRACT

Oriental beech (*Fagus orientalis* Lipsky) belongs to the family *Fagaceae*. It is a deciduous broad-leaved tree which reaches height of 30-40 meters. Stem diameter can reach about 1 m at breast height. Oriental beech grows fast during the early stages and growth end at about 100 years of age. Then growth of mature beech stands will continue until the age of 160-200 years.

Oriental beech is indigenous to the Balkans in the west, through Anatolia (Asia Minor), to the Caucasus, northern Iran and Crimea. In Iran, the distribution of the species is limited to the southern coast of the Caspian Sea and it occurs as mixed forest in the northern slopes of the Elburz Mountains. In Turkey, the species is distributed in Tracia and in the south of Marmara Sea and throughout the Black Sea Regions where it is possible to find oriental beech both as pure stands and mixed forests with conifers and other deciduous broadleaves. There are also isolated natural enclave populations of the species north-east of the Mediterranean Sea on the Amanos Mountains (Turkey). These populations are known as the most southerly populations within the species' distribution. Oriental beech is found between 200 m and 2200 m above sea level.

Based on a combination of data from the Flora of Turkey and the East Aegean Island and phytosociological works and expert knowledge, a database of vascular plant species pools for various habitats in pure or mixed stands, representative of the diversity of Turkish vegetation, was compiled. This database will give knowledge about habitat usage, plant habit, Raunkiaer plant life classification, altitudinal range, endemism, IUCN threat categories, potentially dominant species and phytogeographic regions.

Key words: *Fagus orientalis* Lipsky, Oriental beech, Species pool, Turkey, vascular plants

STRATEGIES FOR PLANNING OF PRODUCTION AND MARKETING OF BEECH TREES (*Fagus orientalis* Lipsky.) (THE CASE OF YENICE DEPARTMENT OF FORESTRY OF THE ZONGULDAK REGIONAL DIRECTORATE OF FORESTRY)

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ABSTRACT

The General Directorate of Forestry produces and provides services for 21.7 million hectares of forest area, making up 27.6% of Turkey's total acreage. Pure and mixed Beech tree (*Fagus orientalis* Lipsky.) strands exist in the forest areas of 17 Regional Directorates of Forestry. The distribution of beech in the Yenice region comes second to the Kastamonu Department of Forestry in terms of the size of distribution of beech trees. 74% of the 2014 annual industrial raw timber production of the Zonguldak Regional Directorate of Forestry was met by beech. Therefore, strategies for processes of production and marketing of beech is of importance for the Zonguldak Regional Directorate of Forestry.

The forest area abundance of the Yenice Department of Forestry is twice the size of the total area of all forest areas of the other Departments of the Zonguldak Regional Directorate of Forestry, with a percentage area of 21.3%. 20% of the total annual industrial raw timber of the Zonguldak Regional Directorate of Forestry is produced by the Yenice Department of Forestry. Of this total, 57% of the annual industrial raw timber produced by the Yenice Department of Forestry is beech wood. Thus, strategies for planning of production and marketing of beech has importance for the Yenice Department of Forestry. To successfully market the product can only be possible by planning production. However, this process is the reverse for the Departments of Forestry: firstly the production is planned, and then planning is made for marketing. This creates problems for the marketing of the product, leading to a loss in value of the product and economic loss.

The objective of the study was to analyse the process of marketing beeches, to identify the effective aspects of marketing and to identify the problems experienced by forest villager cooperatives involved in production and local consumer companies, with the aim of reducing economic losses by developing strategies for the planning of production and marketing of beech trees.

In the scope of the study, approximately 108 tenders of the Yenice Department of Forestry, which took place between the years 2009-2014 were reviewed. A marketing strategy was developed after carrying out a statistical analysis on aspects such as the client profile, the difference between products marketed above the annual average price and other products and the level of effectiveness of main characteristics of products (quality of the product, product feature, marketing period, quality and quantity of unsold products). These strategies determine to what level economic gain is possible. A discussion was open to local companies purchasing beech trees in the study with semi-structured forms and focus group meetings to discuss the problems faced in the marketing process. The same method was used to discuss the problems identified in production with the presidents of the village development cooperatives, which carry out the labour for the production process.

Key words: *Fagus orientalis*, the analysis process of marketing of beech forest products, planning of production and marketing for beech forest production.

STUDY OF WOODY AND HERBACEOUS PLANTS DIVERSITY ALONG THE ALTITUDINAL GRADIENT IN BEECH (*Fagus orientalis* Lipsky) FORESTS OF IRAN

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ABSTRACT

One of the most important ideas in forest management, is maintaining and developing of biodiversity. The beech (*Fagus orientalis* Lipsky) forests of Iran is one of the richest ecosystems in temperate regions of the world in terms of plant diversity. In order to assess woody and herbaceous plants diversity, quantitative indices of biodiversity were used along the altitudinal gradient in beech forests, west of Mazandaran (Noor), Iran. The lowest altitude of this region is 200 m and the highest altitude is 1700 m. The average annual precipitation is 1308 mm and mean annual temperature is 15.8 ° C. For this purpose, 40 plots 400 m^2 (20×20 m) were established along the altitudinal gradient in the region using selective sampling method. Then, the names and canopy cover of all herbaceous and woody species was recorded in the plot. The results showed that Beech forests have distributed from 450 to 1700 meter above sea level in the region. The overall plants of the area constituted 110 species belonging to 59 families and 97 genera. The most families were Rosaceae (10 species) and Asteraceae (6 species). Most of the plants belonging to Phanerophytes (34.5%) life form and European-Siberia (49%) corotype. In the case of woody species results showed that indices of species richness and Margalef indices were reduced with increased of altitude. Higher altitude (1450-1700 m a.s.l.) showed higher (0.76) amount of evenness. The highest quantity of Shanon Wiener (1.6) and Simpson (0.37) indices were belong to the middle altitude (950-1450 m a.s.l.).The results about of herbaceous species showed that, elevation factor has a strong effect on species richness and Simpson indices. As, species richness (25.6) and Simpson's index (0.83) was the most in high altitude (1450-1700 m a.s.l.). Also, the effects of altitude were not significant on others of herbaceous species diversity indices.

Key words: Altitude, biodiversity indices, *Fagus orientalis* Lipsky, Hyrcanian forests, Mazandaran province, Noor

THE EFFECT OF MAGNETIC FIELD APPLICATIONS ON GERMINATION PHYSIOLOGY *OF Fagus orientalis* Lipsky. SEED

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ABSTRACT

According to last data, forest area of the country is 21.7 million hectares, reaching 27.2% of the total area. About 50% of it is degraded and coppice forest. Forestry sector and its contribution to Turkey share of the national economy to increase, unproductive forest areas must be streamlined. Oriental beech (*Fagus orientalis* Lipsky) is one of the major tree species in Turkey. In Turkey, the species is distributed in Thrace and in the south of Marmara Sea and throughout the Black Sea Regions where it is possible to find oriental beech both as pure stands and mixed forests with conifers and other deciduous broadleaves. There are also isolated natural populations of the species north-east of the Mediterranean Sea on the Amanos Mountains (Turkey).

Previous studies showed that a magnetic field can increase the germination of some seeds of agricultural crops. For this aim; in this study, the effects of electromagnetic field applications on *Fagus orientalis* seed were investigated. The seeds were exposed to different treatment period 20 min, 60 min and 120 min and varied magnetic field intensities 200 mT and 400 mT respectively. By the trials; The total soluble protein, α-amylase, glucose, fructose, starch amount in seeds and the germination rate is investigated. According to the findings, the MA (magnetic area) application with different duration and severity to cold stratified applied which were subjected to +4 °C during 45 days and cold un-stratified *Fagus orientalis* L. (beech) seeds –resulted with different effects on protein, enzyme, glucose and starch content depending on MA duration and severity.

MA had negative effects on protein amount of stratified seeds at 60 min 200 mT and 20 min. 400 mT; On the contrary, it had positive effects on protein effects of un-starified seeds at 60 min 200 mT and 20 min. 400 mT ($p<0.05$). The effect of MA to α-amylase activity of seeds is inversely correlated with its effects to protein amounts. While emzyme activity increases in stratified group at 60 min 200 mT and 20 min. 400 mT; it drops in un-stratified group at at 60 min 200 mT, 120 min. 400 mT and 20 min 200 mT. While % starch value of seeds drops in stratified group at 20 min 200 mT and 60 min. 400 mT; it increases in un-stratified group at 20 min 400 mT and 120 min. 200 mT ($p <0.05$).

In conclusion, the positive effect of MA on beech seeds is determined as 20 min 400 mT and 60 min 400 mT in terms of starch values; it has determined as 60 min 400 mT and 60 min 200 mT in terms of enzyme activity; and it is determined as 20 -60 min. 200 mT and 60 min. 400 mT in terms of protein amounts.

Key Words: Magnetic field, Germination physiology, Fagus orientalis, Seed, Forestry

THE *Fagus orientalis* DIAMETER FREQUENCY FIT WITH PROBABILITY DISTRIBUTION IN IRAN'S NORTH FORESTS

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ABSTRACT

In order to study the quality of the Beech tree diameter at breast height and its fit through the statistical distribution, two one-hectare sample pieces were randomly selected in a lozenge shape of Fagus orientalis of natural stand forests in the north slope of Iran's north forests. In these pieces all trees with more than 7.5 centimeters diameter were measured. Beta, Gamma, Weibull, Normal, Lognormal, Exponential, Power statistical models (distributions) were used in order to fit the data. The results obtained from chi-square test (χ^2) revealed that the Beta distribution in the west and east directions and also the exponential distribution in the west direction have produced a good fit for trees diameter distribution. But the other distributions didn't show much capability in explaining the studied trees diameter distribution.

INTRODUCTION

An essential programming on the field of natural resources needs qualitative and quantitative data which are usually obtained by measuring the stands' characteristics Zobeiri (2000). Diameter at breast height of trees is one of the most essential characteristics or external size of forest trees which can be studied from different aspects; for instance, the diameter distribution of the trees of a stand or a forest can be determined and considered in which this distribution itself shows the diameter structure of the stand or forest Mohamed Alizadeh et al. (2009). In this direction various statistical models (distributions) are used, because statistical models are among the factors that are used to prepare the growing models for estimating the site's future situation Mataji et al. (2000).

MATERIALS AND METHODS

The studied area

The studied area is located in the north slope of Dorfak peak in Iran's north forests, and it is situated at 36°, 54', 22" latitude to 49°, 36', 58" longitude with a minimum 350 meters and maximum 2720 meters height above the sea level. Its entire measurement is 5383 hectares, and its central parts have a relatively excessive slope, and it is covered with pure Fagus forests along with other species. In order to study the quality of Beech tree diameter at breast height distribution and its fit by means of statistical distributions, two one-hectare sample pieces with 100×100 square meters dimensions in a lozenge shape were randomly selected in the studied area at 1200 meters height above the sea level. These areas are pedologicaly and geologically similar, and their forests are un-even aged. In these pieces all trees with 7.5 centimeters diameter were measured.

RESULTS

It was specified that the Beta distribution in the two west and east directions were not significant with the observed frequencies. In other words, the observed distributions in the studied area have been randomly-selected samples from the community whose characteristics are explained through the Beta distribution. Therefore, since the Beta distribution has a lesser χ^2 in comparison to the χ^2 of the table it can be considered as a model with a better fit for describing the area's forests. It is observed that the Beta model

has made a fine fit in distributing the main parts in the west and east directions. Of course, the Weibull and Exponential models especially the Exponential model for having lesser χ^2 has made a very appropriate distribution in the west direction, and this fit has not been seen in other directions. Concerning the other probability distributions, it has been observed that the difference among Power, Gamma, Lognormal and Normal distribution with real quantities is significant, and this means that these distributions do not have high accuracy in order to demonstrate the manner of the trees' distribution in different diameter classes.

DISCUSSIONS

Based on the importance of diameter at breast height as the main biometric variable of the forest trees, the studies on it have a great importance. On the other hand, the frequency distribution or the distribution of this variable is also mostly used for determining the stand or forest diameter structure, but it can also have other usage such as growing models. The results obtained from this study are influenced by its information, and necessarily they may be different in other studies.

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THE ROOT MASS AND THE EFFECTS OF CLIMATE CHANGE FOR BEECH (*Fagus orientalis* Lipsky.) FORESTS IN ORDU-AKKUŞ REGION

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ABSTRACT

In the rapidly rising population at each passing day have brought the situations which makes life easier but gives greate damage to our world. The people's unconsciously use of nature and energy to require their needs had caused many environmental problems as well as climate change that is the world's most important issue now.

Many harmfull gases, particularly the amount of CO_2 showing rapid increase in the atmosphere has a big role on the climate change. Therefore, studies are done in the recent years focusses on how amount C stored by the forests that is the largest C pool.

Beech's 4th biggest distribution in the world is in Turkey that is 2 million ha. in (Turkeys's) our total forest area. The beech is an important species for storing C with its wide distribution area in (Turkey) our country. In this study, Oriental beech (*Fagus orientalis* Lipsky.) stands root mass is determined in Ordu-Akkuş where oriental beech has optimum distribution.

Key words: Beech, climate change, root mass

Dr. VASILIJE ISAJEV (SERBIA) & Dr. DERYA EŞEN (TURKEY) - 2nd September, 2015		
11:00 11:20	IRAN	IMPORTANCE OF DEADWOOD IN THE VIRGIN ORIENTAL BEECH STANDS OF THE CASPİAN FORESTS **KHOSRO SAGHEB-TALEBİ,** BEITOLLAH AMANZADEH, PEJMAN PARHIZKAR, MAJID HASSANI, MOHAMMAD AMINI, ZEYDOLLAH MIRKAZEMI, ARSALAN HEMMATI, BABA KHANJANI-SHIRAZ, SHIRZAD MOHAMMADNEJAD, ASSADOLLAH KARIMIDUST, KARIM MAGHSOUDLU
11:20 11:40	DENMARK	RESTORING BEECH FORESTS BY PLANTING OR DIRECT SEEDING **PALLE MADSEN,** NICLAS S. BENTSEN, ESBEN MØLLER MADSEN, TORBEN LYNGE MADSEN
11:40 12:00	ROMANIA	SILVICULTURE OF EUROPEAN BEECH – DEALING WITH THREATS AND UNCERTAINTIES **VALERIU-NOROCEL NICOLESCU,** EMANUIELA CAPRARU, IOANA-MIRELA STROE, MIHAI-FLORIN OSTAFI, MONICA-ELENA BARTI
	LUNCH TIME / 12:00 - 14:00	

Dr. KHOSRO SAGHEB TALEBİ (IRAN) & Dr. ERCAN OKTAN (TURKEY) - 2nd September, 2015		
14:00 14:15	SWITZERLAND	TREE MICROHABITATS IN SWISS BEECH FOREST RESERVES: A REFERENCE FOR BIODIVERSITY MANAGEMENT IN COMMERCIAL FORESTS? **CAROLİNE HEIRI,** PETER BRANG, URS-BEAT BRAENDLI, JAN WUNDER
14:15 14:30	TURKEY	SPECIES RICHNESS AND DIVERSITY OF ORIENTAL BEECH (*Fagus orientalis*) FORESTS IN TURKEY AND BULGARIA **ALİ KAVGACI,** MÜNEVVER ARSLAN, ÜMİT BİNGÖL, NESLİHAN ERDOĞAN, ANDRAŽ ČARNİ
14:30 14:45	SLOVENIA	THE DOMINANCE OF EUROPEAN BEECH IS ANTICIPATED IN MIXED CONIFER-DOMINATED MOUNTAIN FORESTS GIVEN THE CLIMATE CHANGE **MATIJA KLOPCIC,** MARCO MINA, HARALD BUGMANN, ANDREJ BONCINA
14:45 15:00	GERMANY	CAN THE DROUGHT TOLERANCE OF EUROPEAN BEECH BE INCREASED BY THINNING INTERVENTIONS? **MAGDALENA GERHARDT,** JULIA SOHN, MARTIN KOHLER, JÜRGEN BAUHUS
15:00 15:15	TURKEY	ANALYSIS OF VITALITY AND GROWTH FORM CLASS OF NATURAL YOUNG GENERATION'S IN A BEECH STAND IN DÜZKÖY DISTRICT **ZAFER YUCESAN,** ERCAN OKTAN, ALI ÖMER ÜÇLER, ELIF BERKER
15:15 15:30	**QUESTIONS & DISCUSSION**	
	Coffee / Tea Break – 15:30 – 16:00	

Dr. PALLE MADSEN (DENMARK) & Dr. MURAT ALAN (TURKEY)-2nd September, 2015		
16:00 16:15	IRAN	THE SURVEY OF REGENERATION DIVERSITY IN MANAGED AND UNMANAGED BEECH STANDS OF NORTH FORESTS OF IRAN **MİR MOZAFFAR FALLAHCHAİ**
16:15 16:30	TURKEY	VARIATIONS WITHIN AND AMONG POPULATIONS DEPENDING ON SOME LEAF CHARACTERISTICS OF ORIENTAL BEECH (*Fagus orientalis* Lipsky) DENİZ GÜNEY, HÜLYA TURNA, İBRAHİM TURNA, ŞEMSETTİN KULAÇ, FAHRETTİN ATAR, **ERTUĞRUL FİLİZ**
16:30 16:45	USA	STAND STRUCTURE AND GENERATION OF AMERICAN BEECH FOLLOWING PARTIEL CUTTING IN A MESIC-HARDWOOD SAND IN THE LOESSAL BLUFS, WEST-CENTRAL MISSISSIPI, USA **BRENT FREY**
16:45 17:00	TURKEY	COMPARISON OF DIFFERENTLY ORIGINATED ORIENTAL BEECH (*Fagus orientalis* Lipsky) SEEDLING GROWTH IN FIELD DENİZ GÜNEY, İBRAHİM TURNA, **ALİ BAYRAKTAR,** ERHAN SEYİS, EBRU ATAR
17:00 17:15	IRAN	NATURAL REGENERATION OF *Fagus orientalis* Lipsky IN PROTECTED AND NON-PROTECTED AREAS IN NORTH OF IRAN **ALİ SALEHİ,** MONA RAZAVİ, KAMBİZ TAHERİ ABKENAR
17:15 17:30	**QUESTIONS & DISCUSSION**	
19:30 22:30	**KASTAMONU ŞEHR-I DILARA TURKISH MUSIC GROUP & COCKTAIL AT THE UNIVERSITY, 3 MART CONFERENCE SALON**	

		Dr. ANDREA R. PLUESS (SWITZERLAND) & Dr. M. CENGİZ BALOĞLU *(TURKEY)- 3th September, 2015*
9:00 9:15	SWITZERLAND	QUANTITATIVE GENETIC VARIATION AND ENVIRONMENTAL DIFFERENTIATION OF EUROPEAN BEECH IN SWITZERLAND **ALINE FRANK**, ANDREA R. PLUESS, CHRISTOPH SPERISEN, PETER BRANG, CAROLINE HEIRI
9:15 9:30	TURKEY	BREEDING AND GENE CONSERVATION OF ORIENTAL BEECH (*Fagus orientalis*) IN TURKEY **MURAT ALAN**
9:30 9:45	TURKEY	IDENTIFICATION AND BIOINFORMATIC ANALYZES OF *HEAT SHOCK PROTEIN 70* GENES (*HSP 70*) IN *FAGACEAE* FAMILY ESRA NURTEN YER, **M. CENGIZ BALOĞLU,** YASEMIN ÇELIK ALTUNOĞLU, SEZGIN AYAN
9:45 10:00	SERBIA	VARIABILITY AND BREEDING OF BEECH IN SERBIA **VASILIJE ISAJEV,** VERA LAVADINOVIĆ, LJUBINKO RAKONJAC, VLADAN POPOVIĆ
10:00 10:15	SWITZERLAND	IS *FAGUS SYLVATICA* UNDER DIVERGENT SELECTION AT REGIONAL SCALE? A GENOMIC-ENVIRONMENT ASSOCIATION STUDY BASED ON 144 SNPS AND CLIMATIC, EDAPHIC AND GEOGRAPHIC ENVIRONMENTAL DATA **ANDREA R. PLUESS**, ALINE FRANK, CAROLINE HEIRI, HADRIEN LALAGÜE, GIOVANNY G. VENDRAMIN, SYLVIE ODDOU-MURATORIO
10:15 10:30	**QUESTIONS & DISCUSSION**	
	Coffee / Tea Break – 10:30 – 11:00	

***POSTER SESSION - I* / 11:00 – 12:30 - 03rd September, 2015**	
HALİL BARIŞ ÖZEL, EROL KIRDAR SELİM ÜZGÜN, NURİ ÖNER, RABİA KALMAZ KAPTAN	INVESTIGATION OF STAND STRUCTURE AND VEGETATION CHANGE BY SPATIAL PATTERN ANALYSES IN THE ORIENTAL BEECH (*Fagus orientalis* Lipsky.) DOMINATED MIXED BROADLEAVED FORESTS IN KDZ. EREĞLİ REGION IN TURKEY
RAMİN NAGHDİ, AHMAD SOLGİ	FOREST DAMAGE CAUSED BY SELECTION LOGGING OF ORIENTAL BEECH (*Fagus orientalis* Lipsky.) IN NORTHERN IRAN
MEHDİ KAZEMİ NAZİ, FARİD KAZEM NEZHAD MARYAM MOHAGHEGHİ	RELATIONSHIP PLANT COMMUNITIES WITH SOIL HABITAT IN IRAN NORTH FAGETUM
ESLAMİ, A., S.M. T. HOSEİNİ, KH. SAGHEB-TALEBİ	APPROPRIATE STEM NUMBER IN THE FIRST DIAMETER CLASS FOR OBTAINING SUSTAINABLE BEECH STANDS CONSIDERING CLOSE TO NATURE SILVICULTURE, IN NORTHERN FORESTS OF IRAN (CASE STUDY: SHAMUSHAK FOREST, GOLESTAN PROVINCE)
GAL FİDEJ, LUKA NOVAK, DEJAN FIRM, JURIJ DIACI	ROCKFALL HAZARD ASSESSMENT IN BEECH PROTECTION FOREST IN A GORGE OF THE SLOVENIAN ALPS
ALKAN GUNLU, MUAMMER SENYURT, EMIN ZEKI BASKENT, İLKER ERCANLI	ESTIMATING DOMINANT HEIGHT USING LANDSAT TM SATELLITE IMAGE IN PURE ORIENTAL BEECH STANDS IN GÖLDAĞ, SINOP
MİR MOZAFFAR FALLAHCHAİ	THE FAGUS ORİENTALİS (BEECH) DİAMETER FREQUENCY FIT WITH PROBABILITY DISTRIBUTION IN IRAN'S NORTH FORESTS
UFUK COŞGUN	STRATEGIES FOR PLANNING OF PRODUCTION AND MARKETING OF BEECH TREES (*FAGUS ORIENTALIS* LIPSKY.) (THE CASE OF YENICE DEPARTMENT OF FORESTRY OF THE ZONGULDAK REGIONAL DIRECTORATE OF FORESTRY)
DAISUKE KABEYA, KYOTARO NOGUCHI, YOSHIYUKI INAGAKI, QINGMIN HAN	SEASONAL PATTERN OF RADIAL GROWTH IN *FAGUS CRENATA* DURING A NON-REPRODUCTION AND A REPRODUCTION YEAR
ALİ SALEHİ, AFSHİN ESMAEELZADEH, HASSAN POORBABAİE	CARBON SEQUESTRATION IN PROTECTED AND NON-PROTECTED AREAS IN BEECH STANDS IN NORTH OF IRAN
HASSAN POURBABAEİ, SEPİDE SADAT EBRAHIMI, DAVID POTHIER	FLORISTIC AND PHYSIOGNOMIC CHARACTERISTICS OF *FAGUS ORIENTALIS* LIPSKY COMMUNITIES IN RELATION TO GRAZING AND HUMAN ALTERATIONS IN MASAL, NORTH OF IRA
İBRAHIM AYTAŞ, GAMZE TUTTU	EVALUATING USE OPPORTUNITIES OF FAGUS ORIENTALIS IN THE URBAN OPEN-GREEN SPACES
SOHRAB ALVANİNEJAD, MOHSEN ZAKERI PASHAKOLAEI, OMID ESMAILZADE, ROGHAYE ZOLFAGHARİ	STUDY OF WOODY AND HERBACEOUS PLANTS DIVERSITY ALONG THE ALTITUDINAL GRADIENT IN BEECH (*FAGUS ORIENTALIS* LIPSKY) FORESTS OF IRAN
FARZAM TAVANKAR, AMİRESLAM BONYAD	CLOSURE OF LOGGING WOUNDS ON BEECH TREES (*FAGUS ORIENTALIS* LIPSKY) IN CASPIAN

	FORESTS OF IRAN: EFFECTS OF ALTITUDE AND SLOPE ASPECT
MORTEZA MORİDİ, VAHİD ETEMAD, ELAHE ALİBABAEİ OMRAN, MEHDİ KAKAVAND	ACCUMULATION OF FINE WOODY DEBRIS IN THE STEM EXCLUSION PHASE IN THE MIXED ORIENTAL BEECH (*FAGUS ORIENTALIS* Lipsky) STANDS, NORTHERN IRAN
KEİKO KİTAMURA, NOBUKA KİKUCHİ, KANJİ NAMİKAWA, NOBUYUKİ TANAKA, TETSUYA MATSUİ, IKUTARO TSUYAMA, KAZUHİKO TERAZAWA, WATARU ISHİZUKA TSUKASA FUKUSHIMA	GENE IVERSITY ACCUMULATION DURING INITIAL BEECH FOREST REGENERATION AT THE NORTHWARD DISTRIBUTION FRONT — RESULTS FROM EXPERIMENTAL AND EMPIRICAL POPULATIONS
IRAJ HASSANZAD NAVROODI	EFFECT OF ALTITUDE ON REGENERATION OF BEECH (*FAGUS ORIENTALIS* LİPSKY) İN ASIARA WATERSHED FORESTS, NORTH OF IRAN
FERHAT BOLAT	PREDICTIONS FOR ORIENTAL BEECH TREE HEIGHTS BASED ON ARTIFICIAL NEURAL NETWORK IN KESTEL FORESTS
TUĞBA BOZLAR, BEDRİ SERDAR, VİLDANE GERÇEK, SELVİNAZ YILMAZ, MURAT YILMAZ	EFFECTS OF SOIL PROPERTIES ON SOME ANATOMICAL CHARACTERISTICS OF BEECH WOOD, WHICH GROWS NATURALLY IN THE SİNOP REGION
YELİZ SARI NAYİM	DEFINITION of *Fagus Orientalis* Lipsky. (Oriental Beech) DOMINATED BIOTOPES in GÜZELCEHİSAR, MUGADA VE KIZILKUM REGION of BARTIN PROVINCE
B. NİYAMİ NAYİM	EVALUATION of PHYSICAL ENVIRONMENT PROPERTIES in *Fagus orientalis* Lipsky. (Oriental Beech) DOMINATED ECOSYSTEMS with ZONAL STATISTICAL ANALYSES
ÇIĞDEM SAKICI, ELIF AYAN, TÜRKAN SULTAN YAŞAR	GAINING NATURAL SPECIES IN THE CITY CENTRE: THE EXAMPLE OF *FAGUS ORİENTALİS* LİPSKY.
LUNCH TIME / 12:30 - 14:00	

Dr. VALERIU-NOROCEL NICOLESCU (ROMANIA) & Dr. OYTUN EMRE SAKICI (TURKEY)- 3rd September, 2015		
14:00 14:15	TURKEY	GROWTH AND YIELD FOR SCOTS PINE AND ORIENTAL BEECH MIXED STANDS IN DIFFERENT MIXTURE RATIO **AYDIN KAHRİMAN,** İLKER ERCANLI, HAKKI YAVUZ
14:15 14:30	TURKEY	APPLICATIONS OF ARTIFICIAL NEURAL NETWORK FOR PREDICTING THE RELATIONSHIPS BETWEEN HEIGHT AND AGE FOR ORIENTAL BEECH İLKER ERCANLI, AYDIN KAHRIMAN, **FERHAT BOLAT**
14:30 14:45	TURKEY	AUTOREGRESSIVE AND MIXED EFFECT PREDICTIONS IN STEM DIAMETER INCREMENT DATA FOR ORIENTAL BEECH TREES **İLKER ERCANLI,** AYDIN KAHRIMAN, HAKKI YAVUZ
14:45 15:00	TURKEY	PREDICTING STAND YIELD PARAMETERS BASED ON ARTIFICIAL NEURAL NETWORK FOR ORIENTAL BEECH IN KESTEL FORESTS, BURSA **MUAMMER ŞENYURT,** İLKER ERCANLI, HAKKI YAVUZ, AYDIN KAHRIMAN
15:00 15:15	TURKEY	THE ABOVE GROUND BIOMASS, CARBON SEQUESTRATION AND THE EFFECTS OF CLIMATE CHANGE FOR BEECH (*Fagus orientalis* Lipsky.) FORESTS IN ORDU-AKKUŞ REGION NURAY MISIR, MEHMET MISIR, **SEÇİL ERKUT**
15:15 15:30	**QUESTIONS & DISCUSSION**	
	Coffee / Tea Break – 15:30 – 16:00	

POSTER SESSION - II / 16:00 – 17:30 - 03rd September, 2015	
NURAY MISIR, MEHMET MISIR, **SEÇİL ERKUT**	THE ROOT MASS AND THE EFFECTS OF CLIMATE CHANGE FOR BEECH (*Fagus orientalis* Lipsky.) FORESTS IN ORDU-AKKUŞ REGION
FARZAM TAVANKAR, AMİRESLAM BONYAD	EFFECTS OF FOREST ROADS ON MORTALITY OF BEECH (FAGUS ORIENTALIS LIPSKY) TREES IN NORTHERN FORESTS OF IRAN
GAMZE TUTTU, SERHAT URSAVAŞ	HARVEST AMOUNTS OF THE BEECH LEAVES IN TURKEY
TETSUYA MATSUİ, KEİKO KİTAMURA, MAKOTO KOBAYASHİ, KANJİ NAMİKAWA, HİTOSHİ SAİTO, AKEMİ ITAYA, NORİO KİTO, MASAHİRO HARUKİ, KAZUHİKO TERAZAWA, NOBUYUKİ TANAKA	HISTORY AND AGE STRUCTURE OF *FAGUS CRENATA* IN THE NORTHWARD-EXPANDING MARGINAL POPULATIONS IN JAPAN
VİLDANE GERÇEK, TUĞBA BOZLAR, CEYHUN KILIÇ, SELVİNAZ YILMAZ, MURAT YILMAZ	EFFECTS OF DIFFERENT FIRST THINNING DENSITIES ON FIBER MORPHOLOGY IN ORIENTAL BEECH (*FAGUS ORIENTALIS* LİPSKY) PLANTATIONS
IGNACIO BARBEITO, MATHIEU DASSOT, CATHERINE COLLET, FRANÇOIS NINGRE	CANOPY SPACE FILLING IN MIXED VERSUS PURE STANDS OF EUROPEAN BEECH AND SCOTS PINE
M. KAZEMPOUR LARSARY, K.TAHERİ ABKENAR, H. POURBABAEİ	SPATIAL PATTERN, COMPETITION AND SPATIAL ASSOCIATION OF TREES IN THE BEECH (*FAGUS ORİENTALİS* LİPSKY) BROADLEAF STANDS, CASE STUDY: SİSTAN DISTRICT, GUİLAN- IRAN
NEZAHAT TURFAN, ESRA NURTEN YER, BURCU HASDEMİR, AYBABA HANÇERLİOĞULLARI, SEZGİN AYAN	THE EFFECT OF MAGNETIC FIELD APPLICATIONS ON *FAGUS ORIENTALIS* SEED OF GERMINATION PHYSIOLOGY
ENDER BUĞDAY, KAYHAN MENEMENCİOĞLU	HARVESTING AND EXTRACTION OF BEECH TIMBER IN TURKEY: KASTAMONU SAMPLE
MAZİAR RAZAVİ, DAVOOD ZARE	INVESTIGATION OF PLANT SPECIES IMPORTANCE VALUE (SIV) IN BEECH FOREST OF IRAN (CASE STUDY: NAV DISTRICT 2 OF ASALEM, GUILAN)
ALPER UZUN, SEYRAN PALABAŞ UZUN, ALİ TOPAL, ALİ DURMAZ, CİHANGİR ULAŞ, ASLI TANKUT, RUKİYE ŞİMŞİR, CENNET KOCA, SERDAR DOLAŞKAN	SPECIES POOLS OF VASCULAR PLANTS IN ORIENTAL BEECH (*FAGUS ORIENTALIS* LIPSKY) FORESTS OF TURKEY
BANU BEKCİ, DERYANUR DİNÇER, GÜLŞEN ÇELİK, VİLDANE GERÇEK	IN INVESTIGATION OF PLASTIC VALUES OF *Fagus orientalis Lipsky* AND *Fagus silvatica Purpurea* TYPE FOCUS USED IN URBAN TISSUE
SALIHA ÜNVER-OKAN, **ERCAN OKTAN,** MAHMUT M. BAYRAMOĞLU	ECONOMIC ANALYSIS OF TENDING PATHWAYS IN BEECH STANDS: CASE STUDY OF TORUL DISTRICT
Z.A. IBRAHIMOV, V. R. NABIEV	BEECHEN FORESTS OF AZERBAIJAN: THE MODERN CONDITION, AGE STRUCTURE AND RENEWAL
QİNGMİN HAN, YOSHİYUKİ INGAKİ, DAİSUKE KABEYA, KYOTARO NOGUCHİ	EFFECT OF SEED PRODUCTION ON NITROGEN UPTAKE AND ALLOCATION IN MATURE *Fagus crenata* TREES
J. TORKAMAN, A.E. BONYAD, A. ROHİ	COMPARISON CALCULATION AND ONE-FACTOR TABLE VOLUME MODLE OF BEECH (*Fagus orientalis*

	LIPSKY) TREE IN THE SHAFAROUD AREA
BLANKA MALUS, MATIJA KLOPCIC, ANDREJ BONCINA	SNOW DAMAGE IN EUROPEAN BEECH FORESTS: EXPERIENCES FROM SLOVENIA
IGNACIO BARBEITO, THOMAS CORDONNİER, ESTELLE NOYER, DİDİER FRANÇOİS, FRANÇOİS NİNGRE	GROWTH RESPONSE OF POLE STAGE EUROPEAN BEECH TO COMPETITION RELEASE IN UNEVEN-AGED STANDS
BEİTOLLAH AMANZADEH KHOSRO SAGHEB-TALEBİ **BAHMAN SOTOUDEH FOUMANİ** FARHAD FADAİE JESÚS JULİO CAMARERO JUAN CARLOS LİNARES	SPATIAL DISTRIBUTION OF DEAD WOOD IN UNMANAGED HYRCANIAN BEECH (*Fagus orientalis*) FORESTS
GALA DINNER AT İKSİR HOTEL	

Dr. PÉTER ÓDOR (HUNGARY) & Dr. ZAFER YÜCESAN (TURKEY)-4rd September, 2015		
9:00 9:15	TURKEY	EFFECTS OF CLIMATE CHANGE ON SEED PRODUCTION IN SEED STANDS OF ORIENTAL BEECH (*Fagus orientalis* Lipsky.) IN THE BARTIN REGION IN TURKEY **HALİL BARIŞ ÖZEL,** SEZGİN AYAN, EROL KIRDAR, RABİA KALMAZ KAPTAN
9:15 9:30	IRAN	THE LATE-QUATERNARY HISTORY OF BEECH (*Fagus orientalis* Lipsky.) IN THE CENTRAL HYRCANIAN FORESTS OF NORTHERN IRAN **ELİAS RAMEZANİ,** HANS JOOSTEN
9:30 9:45	TURKEY	PHYSIOLOGICAL AND MORPHOLOGICAL CHARACTERISTICS OF ORIENTAL BEECHNUTS (*Fagus orientalis* Lipsky) **MUSTAFA YILMAZ**
9:45 10:00	SLOVENIA	NATURAL DISTURBANCES AS A BASIS FOR ADAPTED SILVICULTURAL MEASURES **DUŠAN ROŽENBERGAR,** TOM A. NAGEL, ANDREJ ROZMAN, DEJAN FİRM, DARJA KOCJAN, JURİJ DİACİ
10:00 10:15	SERBIA	THE IMPORTANCE OF BEECH SEED SOURCES IN SERBIA FOR ENHANCEMENT OF SEED AND SEEDLING PRODUCTION **VERA LAVADINOVIĆ** , VASILIJE ISAJEV, LJUBINKO RAKONJAC, ALEKSANDAR LUČIĆ
10:15 10:30	**QUESTIONS & DISCUSSION**	
	Coffee / Tea Break – 10:30 – 11:00	

Dr. HALİL BARIŞ ÖZEL & Dr. MATIJA KLOPCIC (USA) - (TURKEY) - 4th September, 2015		
11:00 11:15	FRANCE	GROWTH, ROOT AND SHOOT COMPETITION IN A YOUNG BEECH-ACER MIXTURE **CATHERINE COLLET,** IGNACIO BARBEITO, DAMIEN BONAL, ALEXANDRE FRULEUX
11:15 11:30	TURKEY	EFFECTS OF DIFFERENT THINNING INTENSITY IN BEECH FORESTS IN DÜZCE ALİ KEMAL ÖZBAYRAM, EMRAH ÇİÇEK, **DERYA EŞEN**, FARUK YİLMAZ
11:30 11:45	TURKEY	TEMPORAL AND SPATIAL CHANGES IN BEECH *(Fagus orientalis)* ECOSYSTEMS: A CASE STUDY IN GÖKÇEALAN PLANNING UNIT BAYRAM ÇIL, **UZAY KARAHALIL**
11:45 12:00	TURKEY	DETERMINATION OF HEAVY METAL POLLUTION LEVEL IN PURE ORIENTAL BEECH (*Fagus orientalis* Lipsky.) FORETS IN THE ÇAYCUMA DISTRICT IN TURKEY **HANDAN UCUN ÖZEL,** HALİL BARIŞ ÖZEL
12:00 12:15	HUNGARY	AMOUNT OF DEAD WOOD AND ITS EFFECT ON FOREST BIODIVERSITY IN MANAGED BEECH FORESTS IN THE HUNGARIAN CARPATHIANS **PÉTER ÓDOR**, GERGELY KUTSZEGİ, VİKTOR PAPP, ERİKA GUBA, JÚLİA JÓZSEF, PÉTER SZŰCS, CSABA NÉMETH, LAJOS BENEDEK
12:15 12:30	**QUESTIONS & DISCUSSION**	
	LUNCH TIME / 12:30 - 14:00	

Dr. BARBOUTIS IOANNIS (GREECE) & Dr. ANDROMACHI MITANI (GREECE)- 4th September, 2015		
14:00 14:15	GREECE	BONDING STRENGTH OF POLYVINYL ACETATE (PVAC) AND CASEIN ADHESIVES IN SMALL DIAMETER BEECH WOOD (*Fagus sylvatica L.*) **ANDROMACHI MITANI,** IOANNIS BARBOUTIS
14:15 14:30	TURKEY	THE EFFECT OF IMPREGNATION WITH SILICON BASED COMPOUNDS ON SOME PHYSICAL AND MECHANICAL PROPERTIES OF WOOD **CEYHUN KILIÇ**, ÜMİT CAFER YILDIZ
14:30 14:45	GREECE	EXAMINATION OF PHYSICAL AND MECHANICAL PROPERTIES OF BEECH (*Fagus sylvatica*) WOOD - UTILIZATION PERSPECTIVES OF THIS SPECIES IN GREECE **KAMPERIDOU VASILIKI,** BARBOUTIS IOANNIS
14:45 15:00	TURKEY	EFFECT OF IMPREGNATION AND HEAT TREATMENT ON THE PROPERTIES OF BEECH WOOD **M. HAKAN AKYILDIZ,** H. İSMAİL KESİK, MUSTAFA ÖNCEL
15:00 15:15	GREECE	WOOD PRODUCTION POTENTIAL OF BEECH (*Fagus sylvatica* L.) NATURAL FORESTS IN WEST CENTRAL GREECE DİMİTRİOS KOUTSİANİTİS, ELİAS VOULGARİDİS, **ANDROMACHİ MİTANİ**
15:15 15:30		**QUESTIONS & DISCUSSION**
	Coffee / Tea Break – 15:30 – 16:00	
	FINAL RESOLUTION 16:00-16:30 ***Dr. KHOSRO SAGHEB-TALEBİ & Dr. PALLE MADSEN & Dr. VALERIU- NOROCEL NICOLESCU & Dr. SEZGIN AYAN***	
		Departure from Kastamonu to Safranbolu "UNESCO Heritage City"

FIELD TRIP TO YENICE FOREST

Dr. HALİL BARIŞ ÖZEL & REGIONAL DIRECTOR OF FORESTRY AHMET SIRRI BEŞEL

Departure from Hotels at 6:30 am in Safranbolu - Arrival to Kastamonu at 23:00 pm

HALİL BARIŞ ÖZEL EROL KIRDAR RABİA KALMAZ KAPTAN	DETERMINATION OF THE FACTORS AFFECTING THE SUCCESS NATURAL REGENERATION IN ORIENTAL BEECH (*Fagus orientalis* Lipsky.) FORESTS (DEVREK-PÜRENKAYA CASE STUDY)
MÜNEVVER ARSLAN, ALI KAVGACI, OSMAN KETENOĞLU	NUMERICAL CLASSIFICATION AND ORDINATION OF THE FOREST VEGETATION AT YAYLACIK RESEARCH FOREST (KARABÜK – TURKEY)
CUMHUR GÜNGÖROĞLU	SPATIAL DISTRIBUTION ANALYSIS OF BEECH (*Fagus orientalis* Lipsky) STANDS IN BÜYÜKDÜZ RESEARCH FOREST

LIST OF PARTICIPANTS

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