

Резюмета

на публикациите

на гл. ас. д-р Ивайло Величков Величков

1. Раев, И., П. Желев, М. Грозева, И. Марков, И. **Величков**, М. Жиянски, Г. Георгиев, С. Митева, В. Александров. 2011. Програма от мерки за адаптиране на горите в Република България и смекчаване на негативното влияние на климатичните промени върху тях. Изпълнителна агенция по горите при МЗХ, София, 212 с.

Глобалното изменение на климата, предизвикано от замърсяването на въздуха е факт, който налага всеобхватни координирани действия на учени и държавни ръководители за предотвратяване на световна катастрофа. По време на срещите на световния елит в Рио де Жанейро (1992), Йоханесбург (2002), Копенхаген (от 6 до 18 декември 2009 г. в Копенхаген, Дания, се проведе 15-та Световна конференция на страните (COP15)) и в Канкун, Мексико (COP 16) бяха постигнати споразумения за общи действия. Прие се, че са налице промени в климата с тенденция към глобално затопляне и че следва да се предприемат адекватни мерки, както на глобално, така и на регионално ниво (напр. Европейски съюз) и на национално ниво за изпълнение на общите решения.

Разработката "Програма от мерки за адаптация на горите в Република България и смекчаване на негативното влияние на климатичните промени върху тях" е отличен пример за успешното сътрудничество между научните среди и практиците, в резултат на което е изготвен много добре научно обоснован и същевременно практически насочен документ, подходящ за ползване както от тесни специалисти, така и от широката общественост.

Изготвянето на програмата е част от националните усилия на България в изпълнение на проекта "FUTUREtoForest" по програма INTERREG IV C на Европейския съюз. Тя ще допринесе и за изпълнение на ключово действие 7: "Принос към изпълнението на РКОНИК и Протокола от Киото", от Стратегическия план за развитие на горския сектор 2007-2011. Реализацията ѝ преминава през четири отделни етапа:

Етап 1: Изготвяне на "Анализ за състоянието на основните компоненти в горските екосистеми" в светлината на климатичните промени;

Етап 2: Разработване на климатични сценарии, въз основа на съвременни данни и модели, за еволюцията на климата в България през 20 и 21 век;

Етап 3: Определяне "зоните на уязвимост" на горските екосистеми в България при климатични промени, въз основа на разработените анализ и климатични сценарии;

Етап 4: Изработване на цялостна Програма с конкретни мерки за адаптиране горите към климатичните промени по зони на уязвимост на някои основни компоненти на горските екосистеми в България.

Разработването на Програмата от мерки се извърши от научен колектив - Обединение "Гора за бъдещето", съставено от 8 научни работници от Института за гората при БАН, НИМХ-БАН и Лесотехническият университет, в състав: ст.н.с. I ст. Иван Раев, доц. Петър Желев, ст.н.с. II ст. Мария Грозева, н.с. Ивайло Марков, инж. Ивайло Величков, н.с. Миглена Жиянски, ст.н.с. I ст. Георги Георгиев, инж. Силвия Митева и доц. Веселин Александров.

Разработката е изготвена в тясно сътрудничество със служителите на Изпълнителна агенция по горите към Министерство на земеделието и храните: д-р инж. Любчо Тричков, инж. Димитър Бърдаров, инж. Николай Василев, инж. Стефан Балов, Владимир Константинов, д-р инж. Анна Петракиева, инж. Валентин Чамбов, д-р инж. Деница Пандева, инж. Мария Чамбова, инж. Елена Величкова, ландшафт. арх. Иван Богданов, инж. Дарина Илчева и др.

Официално Програмата от мерки е одобрена от Министъра на земеделието и храните на 03.05.2011г. (http://www.iag.bg/data/docs/Programa_ot_merki.pdf). Същата е представена на Министерство на околната среда и водите, с цел да бъде използвана по предназначение при изготвянето на Националната стратегия за адаптация към изменението на климата и на Националния план за действие по изменение на климата 2013 - 2020 г.

Общият обем на разработката надхвърля 500 страници, което прави нейното отпечатване в такъв размер неподходящо. Това наложи нейната преработка с цел намаляване на общия обем. Редакционният екип се надява след извършената оптимизация да не е нарушена логическата последователност на разработката и нейния научно-приложен принос за очертаване на проблемите, свързани с измененията на климата и за разработването на конкретни мерки за адаптация на горите в Република България и смекчаване на негативното влияние на климатичните промени върху тях.

В изпълнение на целите на проект FUTUREforest, настоящата разработка е използвана и за актуализация на "Класификационна схема на типовете горски месторастения в България", която също е отпечатана в рамките на изпълнението на проекта.

2. Raftoyannis Y., Bredemeier M., Buozyte R., Lamersdorf N., Mavrogiakoumos A., Oddsdóttir E. and **Velichkov V.** 2011. Afforestation Strategies with Respect to Forest – Water Interactions. In: Bredemeier M, S Cohen, D Godbold, E Lode, V Pichler, P Schleppei (eds.). Forest Management and the Water Cycle: An Ecosystem-Based Approach. Springer, Ecological Studies. 225-245. ISSN 0070-8356.

Afforestation and reforestation are two forms of direct human-induced conversions of non-forest to forest land through planting, seeding, and/or anthropogenic dispersal of natural seed sources. The two terms are distinguished by how long the non-forest condition has prevailed and for the remainder of this chapter, afforestation is used to imply both afforestation or reforestation (Nabuurs et al. 2007).

Afforestation is a major environmental goal worldwide (Savill et al. 1997) and especially so in areas with a long history of human settlement, such as the Mediterranean basin. Intense exploitation of these areas has altered the original composition of species and the physical

environment (Blondel and Aronson 1999). Under such circumstances, planting is particularly necessary to recover the vegetation and to ensure the success of regeneration.

Afforestation and reforestation are included under Article 3.3 and in Articles 6 and 12 of the Kyoto Protocol and are the dominant mitigation options in specific regions such as Europe. To date, carbon sequestration has rarely been the primary driver of afforestation, but future changes in carbon valuation could result in large increases in the rates of afforestation. Accumulation of carbon in biomass after afforestation varies greatly by tree species and site, and ranges globally between 1 and 35 Mg CO₂ ha⁻¹year⁻¹ (Richards and Stokes 2004).

Afforestation may result in a more balanced regional water cycle by reducing run-off, flooding, and by increasing the control of groundwater recharge and watersheds protection. However, massive afforestation of grasslands may reduce water flow into other ecosystems and rivers, and affect aquifer water level and recharge, thus leading to substantial losses in stream flow (Jackson et al. 2005).

3. Lexer M J, M Bobinac, S Dekanic, T Dubravac, G Georgiev, M Georgieva, E Hochbichler, G Ivanov, D Jovic, E Kastner, S Krajter, L Nestorovski, B Nikolov, B Stajic, A Teischinger, P Trajkov, H Vacik, I **Velichkov**, B Wolfslehenr, T Zlatanov. 2009. CForSEE: Multifunctional Management of Coppice Forests. - In: Macháčová J, K Rohsmann (eds.) Scientific results of the SEE-ERA.NET Pilot Joint Call. Centre for Social Innovation (ZSI), Vienna, 49–56. ISBN 978-3-200-01567-8.

Coppice forestry in general including all its variants is a silvicultural system that is still widespread over many European countries where it covers an area of about 23 million hectares. While in Central and Northern Europe, coppice forests comprise just a small share of total forest area, they make up major parts of the forest resource in South and South-Eastern Europe. CForSEE gathers institutions in countries with substantial shares of coppice forests and intensive research experiences in coppice forest management. The network of partners provides the unique opportunity to review the state of coppice forests and their management from first hand for substantial parts of the coppice area in South Eastern Europe. These activities are part of the SEE-ERA.NET Pilot Joint Call Project CForSEE: Multi-functional management of coppice forests. Contributions to rural development, maintenance of biodiversity, and climate change mitigation and adaptation in natural resource management are presented in the context of coppice forests.

4. Малинов, И., В. Крумов, Н. Динев, П. Божинова, Е. Филчева, Н. Колев, Д. Николова, И. Вълчовски, Г. Попов, И. Ц. Маринов, Й. Станчева, И. Величков, Ц. Ценов, С. Лазаров. 2007. Устойчиво управление на земите. София, Минерва, 159 с. ISBN: 978-954-8702-07-2.

Публикацията е разработена и се издава с подкрепата на проект „Устойчиво управление на

земите“, който е съвместна инициатива на Министерството на околната среда и водите, Министерството на земеделието и горите и Програмата на ООН за развитие, финансиран от Глобалния екологичен фонд. Изданието е предназначено за ученици от професионалните земеделски и горски гимназии. Авторският колектив е разработил две отделни глави: Селско стопанство и Горско стопанство.

5. **Величков**, Ив., Цв. Златанов, Б. Николов, М. Георгиева, Г. Хинков (съст.). 2011. Състояние и перспективи на популацията от обикновен кестен (*Castanea sativa* Mill.) в Беласица: адаптация към климатичните промени; поддържане на биологичното разнообразие и устойчиво стопанисване на екосистемите. Институт за гората при БАН, София, 32 стр. ISBN 987-954-91423-7-2.

Настоящата брошура е изготвена с цел да представи накратко резултатите от изпълнението на проект BG0031 „Състояние и перспективи на популацията от обикновен кестен (*Castanea sativa* Mill.) в Беласица: адаптация към климатичните промени; поддържане на биологичното разнообразие и устойчиво стопанисване на екосистемите” към Финансовия механизъм на Европейското икономическо пространство (FM of EEA) в Приоритетна област 1: Защита на околната среда. Извършено е детайлно проучване на всички естествени кестенови насаждения в българската част на Беласица и са популяризирани придобитите знания и умения чрез прилагане на добри лесовъдски практики и обучение. Извършена е комплексна оценка на популацията от обикновен кестен на територията на Беласица чрез определяне на следните популационни параметри: площ, възрастова и пространствена структура, растеж, възобновителен потенциал, здравословно състояние, устойчивост на биотични и абиотични фактори, реакция към климатичните промени. Установен е произходът на обикновения кестен в Беласица; ефектът от досегашната стопанска дейност (лесовъдски системи и методи) и от липсата на такава върху естествените кестенови гори в Беласица; настоящето здравословно състояние на популацията от обикновен кестен, в зависимост от биотични и абиотични фактори, и от глобалните климатични промени; критичните елементи на биологично разнообразие (популациите на редките и застрашени растителни и животински видове), асоциирани с кестеновите дървостои и пряко зависими от тяхното състояние; благоприятният природозащитен (консервационен) статус на екосистемите, доминирани от обикновен кестен по северните склонове на Беласица.

6. Zlatanov T, I **Velichkov**, M Lexer, T Dubravac. 2010. Regeneration dynamics in aging black pine (*Pinus nigra* Arn.) plantations on the south slopes of the Middle Balkan Range in Bulgaria. *New forests* 40: 289–303, DOI: 10.1007/s11056-010-9200-5. ISSN: 0169-4286.

To study the regeneration dynamics in mature black pine (*Pinus nigra* Arn.) plantations in the Middle Balkan Range, Bulgaria, a total of 48 research plots (sized 0.1 ha) were established; 26 plots were established in the foothills of the mountains (foothill zone) and 22 in the main massive

(mountainous zone). Pine overstorey as well as advance regeneration in subplots were recorded. Analysis of variance and regression analysis showed that in general relative stand basal area (RSBA) was the most important predictor of deciduous advance regeneration density, top height as well as age span of the regeneration layer. In the mountainous zone soil depth (SD) and the presence of mature deciduous trees (MDT) explained a significant amount of the variation in regeneration features. Lower RSBA induced by earlier thinnings resulted in higher regeneration density, larger top heights and wider age span of deciduous species. Under the pine canopy oak regeneration can persist longer compared to natural broadleaved canopies. In the studied plantations pine regeneration was confined to few scattered seedlings and regeneration groups. Based on these findings silvicultural concepts for the further management of black pine plantations in the Middle Balkan Range are discussed.

7. Zlatanov T, I **Velichkov**, G Hinkov, M Georgieva, O Eggertsson, S Hreidarsson, M Zlatanova, G Georgiev. 2012. Site index curves for European Chestnut (*Castanea sativa* Mill.) in Belasitsa mountain. *Šumarski list 3–4 (CXXXVI)*, 153–159. ISSN: 0373-1332.

A study on height and age structure of the European chestnut (*Castanea sativa* Mill.) population on the northern slopes of Belasitsa mountain, Southwest Bulgaria was carried out in a systematic network of 67 permanent sampling plots (sized 0.125 ha). Richards, Lundqvist-Korf and Hossfeld growth functions were fitted to age-height data of European chestnut dominant trees. The model prediction performance was evaluated using quantitative (dominant height) as well as qualitative (damages caused by *Cryphonectria parasitica*) examinations. Two steps procedure was applied in order to select dominant chestnut trees for analyses. At the first step the three tallest chestnut trees per a plot were selected. The total number of dominant trees selected at this stage was 201. At the second step all selected dominant trees characterized by presence of *C. parasitica* blight disease symptoms were removed from the selection. Accordingly, 97 trees were finally selected from the systematic network of temporary plots. Goodness of fit of each model was estimated by the coefficient of determination, F-test for significance of the regression and t-tests for significance of the coefficients of the model. Models were further compared by the evaluation of the standard error of the model and Akaike's Information Criteria. Site index curves were constructed following the guide curve method procedure. In accordance with the evaluation tests, the Richards function was chosen as most adequate to express the age-dominant height relationship. Accordingly, it was further employed as a guide function to derive site index curves for studied chestnut population. It was recommended that the growth model and the site index curves elaborated in the current study are used within the data range 10–110 years.

8. Tonkov S, I **Velichkov**, G Popov, G Possnert, T Zlatanov, G Hinkov. 2012. On the Holocene history of sweet chestnut forests in Belasitsa mountain, Southwestern Bulgaria. *Compt. rend. Acad. bulg. Sci.*, 65 (11): 1549–1554. ISSN: 1310-1331.

The Holocene history of sweet chestnut (*Castanea sativa* Mill.) on the northern slopes of Belasitsa Mountain was studied by pollen analysis and radiocarbon dating of a core collected from a small mire. The results showed that more than 8000 years ago this tree was spontaneously growing in the mountain before the first Neolithic inhabitants settled in the Struma River Valley and its tributaries. The enlargement of the areas occupied by sweet chestnut started with its wide cultivation since the time of the Roman colonization. The new palynological information supports the hypothesis for possible existence of refugia for *Castanea sativa* in Southwestern Bulgaria.

9. Groen T, H Fanta, G Hinkov, I **Velichkov**, I Duren, T Zlatanov. 2012. Tree line change detection using historical hexagon mapping camera imagery and Google Earth data. *GISci Remote Sens* 49 (6): 933–943. DOI: 10.2747/1548-1603.49.6.933. ISSN: 1548-1603.

Monitoring the response of tree lines to climatic change requires long time series. Therefore ground-based studies, initially designed for other purposes, are used, causing a bias in the sampling design. Using historical satellite data might overcome this bias. This study explores the usability of historical spy-satellite imagery from the United States Hexagon missions to detect changes in tree lines. We find that both vertical and horizontal errors are within acceptable boundaries (± 18.0 m in horizontal direction and 5.5 m in vertical direction) to detect change. This opens opportunities to explore tree line changes globally with a more robust sampling strategy.

10. Zlatanov T, P Schleppe, I **Velichkov**, G Hinkov, M Georgieva, O Eggertsson, M Zlatanova, H Vacik. 2013. Structural diversity of abandoned chestnut (*Castanea sativa* Mill.) dominated forests: Implications for forest management. *For Ecol Manage* 291: 326–335. DOI: 10.1016/j.foreco.2012.11.015. ISSN: 0378-1127.

Components of structural diversity of abandoned chestnut (*Castanea sativa* Mill.) dominated and codominated forests along an altitudinal gradient in the Belasitsa mountain region of Southwest Bulgaria were evaluated, including: (i) tree species composition; (ii) differentiation in diameter, height and age; (iii) damages of chestnut blight disease caused by *Cryphonectria parasitica* and light transmission; and (iv) regeneration composition and abundance. Competition between tree species and its influence on current stand structure were analyzed. Distribution of sample plots according to diameter differentiation for chestnut showed positive differentiation values (dominance of chestnut with respect to other species) in 43 of a total of 46 plots sampled. Structure is much more balanced in terms of height differentiation. In the absence of management, chestnut blight disease has been a major stress factor and is likely an important driver of chestnut decline. The proportion of chestnut trees infected by chestnut blight disease exceeded 80% in 28 plots. Nearly one third (31%) of all sampled trees were characterized by a degree of defoliation of more than 60%. Despite the low levels of light at the forest floor, the density of the regeneration stratum was relatively high (averaging 19,300 ha⁻¹).

11. Eastaugh C, A Kangur, H Korjus, A Kiviste, T Zlatanov, I **Velichkov**, B Srdjevic, B Srdjevic, H Hasenauer. 2013. Scaling Issues and Constraints in Modelling of Forest Ecosystems: a Review with Special Focus on User Needs. *BALT FOR* 19 (2): 316–330. ISSN: 1392–1355.

Forest Ecosystem models are diagnostic tools to assess and understand ecosystem processes. Conflicting interests such as simplicity, observability and biological realism must be addressed to ensure a well-balanced modelling approach. Because field observations are usually only available for short time periods or for a limited number of locations, models are important to extrapolate in space and time. The key to a successful modelling approach relies on finding the appropriate scale but is often limited by the availability of input data. In the practice of forest modelling, it is often necessary to produce meaningful outputs on the basis of rather weak information. In this paper we discuss spatial and temporal scaling issues within empirical modelling. Following the case studies the paper demonstrates how models address cross-scaling problems as they are relevant for the required data as well as the decision making and implementation process of specific end user needs.

12. Lusini I, I **Velichkov**, P Pollegioni, F Chiocchini, G Hinkov, T Zlatanov, M Cherubini, C Mattioni. 2014. Estimating the genetic diversity and spatial structure of Bulgarian *Castanea sativa* populations by SSRs: implications for conservation. *Conserv Genet* 15, 2014, 283–293, DOI: 10.1007/s10592-013-0537-0, ISSN: 1566–0621.

Sweet chestnut (*Castanea sativa* Mill.) is a multipurpose species of great ecological and economic importance in southwest Bulgaria. Bulgarian chestnut forests are severely degraded, however, due to the intensive exploitation and bad management that have occurred over the last 2000 years. Given the urgent need to define conservation strategies to preserve the biodiversity of Bulgarian chestnut, we estimated its genetic variability. A set of eight microsatellite primers were used to analyze the genetic diversity and structure of six *C. sativa* populations distributed throughout the range of species in Bulgaria. Results showed a generally high level of genetic diversity but little divergence among populations. A significant, positive, within-population inbreeding coefficient (F_{is}) was observed in four populations. A *STRUCTURE* analysis revealed three genetic clusters. Using a landscape approach, significant genetic barriers among populations were found by integrating genetics with geographical distance. We hypothesize that one population is a relict from a glacial refugium; the structure of the remaining populations is probably the result of a combination of natural events and human impacts. For the purposes of conservation planning, we have identified populations that are particularly rich in diversity and private alleles that are good candidates for preservation.

13. Zlatanov T, **Velichkov** I, Georgieva M, Hinkov G, Zlatanova M, Gogusev G, Eastaugh CS. 2015. Does management improve the state of chestnut (*Castanea sativa* L.) on Belasitsa

Mountain, southwest Bulgaria? iForest – Biogeosciences and Forestry, vol. 8, 860-865, doi: 10.3832/ifor1420-008, ISSN: 1971-7458.

Chestnut forests in the Belasitsa Mountain region of southwest Bulgaria were traditionally intensively managed as orchard-like stands for nut production. More recently, management intensity has been sharply reduced as a result of rural abandonment, which combined with the effects of chestnut blight has led to marked structural changes in these forests. The focus of this paper is on the seed-based regeneration potential and seedling survival of chestnut in mixed stands managed over the past 15 years. Results suggest that management of stands under a high-forest system is appropriate, and regeneration from seed has advantages over coppicing if competing species can be controlled. An investigation into “sanitation cutting” performed since the 1990s shows that this had not a successful response to blight infestations.

14. Zlatanova, D., I. **Velichkov**, E. Velichkova, 2005. Ecological and economical characteristics of Ossogovo state game breeding in Bulgaria. Journal of Balkan ecology, vol. 8, № 2. ISBN ISSN 1311-0527.

The paper presents an ecological survey of the Osogovo mountain. It includes geographical description, climatic and soil features, vegetation and animal presenting. A special emphasis is put on game richness, its contemporary state and perspectives for future development.

15. **Velichkov**, I., T. Zlatanov, G. Popov. 2007. Response of the native deciduous tree vegetation in “Byala reka” state forest (Eastern Balkan Range) to clear cutting and reforestation with conifers. Silva Balcanica, 8 (1)/2007, 5–15. ISSN 1311-8706.

The study was performed in one of the first forests in Bulgaria, subjected to reconstruction (clearcutting followed, in this case, by artificial regeneration with *Pinus nigra* and *P. silvestris*), throughout its area. Despite the extensive reconstruction activities in the last 50 years the native deciduous tree vegetation represented by *Carpinus orientalis*, *Carpinus betulus*, *Quercus cerris*, *Q. frainetto*, *Q. petraea*, *Pyrus communis*, *Prunus avium*, *Fagus orientalis*, *Fraxinus ornus*, *Acer pseudoplatanus*, *A. campestre*, *Ulmus minor*, *Sorbus torminalis*, *S. domestica*, *Tilia tomentosa* and *Corylus colurna* still dominated the area of “Byala reka” state forest. Only small scattered pine woods were found. They were situated, in the main, on former agricultural and pasture lands. The reproduction stratum was also edified by the native deciduous species. *Pinus nigra* and *Pinus silvestris* seedlings were found mainly in small gaps and near forest edges. The following conclusions were made in the study: (i) the reconstruction of the native deciduous tree vegetation in “Byala reka” state forest was impractical and inappropriate silvicultural practice; (ii) ceasing of the reconstructions in the studied region in particular and in the whole Country in general was a necessary measure even though waited for more than 15 years; and (iii) the presence of valuable tree species (*Quercus frainetto*, *Q. cerris*, *Ulmus minor*, *Pyrus communis*, *Sorbus torminalis*, *S.*

domestica, *Tilia tomentosa* etc) in all vegetation storeys is a prerequisite for successful graduate restoration of the autochthonous oak dominated mixed deciduous tree communities.

16. **Velichkov**, I. 2007. Reproduction damages after different timber-harvesting techniques in shelterwood method in Osogovo mountain, Southwest Bulgaria. *Silva Balcanica*, 8(1)/2007, 25–31. ISSN 1311-8706.

The shelterwood method has been the most common regeneration method used in the mature beech and beech-coniferous forests in Osogovo mountain, Southwestern Bulgaria since 1950. Different harvesting techniques including oxen, horses and cable systems “Visen” and “Valtelina” were applied in the first 2-3 decades. They were replaced by cable skidders, modified agricultural tractors with winches and former military machines in the years 1975-2006. The impact of the most recently used cable skidder “LKT81”, tractor “Universal651M”, former military chain machines, horses and oxen was assessed on seedlings, residual trees and soil in 20 cutting areas for the period 2002-2006. Fewer damages on seedlings were established in winter cuts and in animal log extraction (9%) than in summer cuts and when machines were used (13%). The mean percentage of damaged seedlings (11%) was not an obstacle to the successful natural regeneration when applying shelterwood method. Nevertheless it could not be predicted what would the future health condition and stem quality of the wounded seedlings be. The number of the wounded residual trees ranged from 15% to 19% on less steep cutting areas (slope percentage < 44%) and in animal log extraction. This percentage was higher (up to 36%) on very steep slopes (slope percentage > 44%) and in machine log extraction. Soil damages were preferably caused by road and trail construction activities with heavy bulldozers. Erosion and soil compaction were not typical for the harvested areas. Preserving the present way of planning and performing of harvesting operations in the mountain unchanged would guarantee increase of damages to seedlings, residual trees and soil in future. Winter cuts with snow cover and frozen soil and cuts from August to November with dry soil are recommended. The use of cable cranes and restricted road construction on steep slopes are also suitable.

17. **Velichkov**, I., T. Zlatanov, G. Hinkov. 2009. Stakeholder analysis for coppice forestry in Bulgaria. *Ann. For. Res.* 52: 183-190. ISSN 1844-8135.

The study analyzes the state of coppice forestry in Bulgaria during last 18 years. Stakeholders, their interests and preferences in coppice forests are explored so that assessment and predictions about coppice forestry future development are elaborated. Forests restitution process in Bulgaria started in 1997 and has not been finished yet. Nevertheless, significant further changes of the current ownership distribution are not expected. By the end of 2007, state was the biggest coppice forest owner/stakeholder in Bulgaria with 71.3% of all coppice forests being state property. The other two important stakeholders are the municipalities (14.0%) and private owners (12.0%). Currently, forest owners' number in Bulgaria exceeds 1 million, the average holding area being

smaller than 1 ha. Only 150 individual plots are larger than 50 ha. The majority of private owners aim at taking maximum and immediate profit from their recently restituted forest properties. In most cases that reflects in clearcuts. Coppice forests management has been one of the problematic issues of Bulgarian forestry for decades. Despite of forest authorities significant efforts, the area of coppice forests in Bulgaria (1.78 million ha in 2007) remained unchanged for a period of 50 years. The official forest policy is still aimed at conversion of coppice forests into seed ones through different silvicultural methods. That policy is applied to almost all coppice forests regardless of their ownership. Bulgarian coppice forests have still preserved their important historical role as firewood and industrial wood source. They are also a significant potential source of renewable energy.

18. Stajic B., T. Zlatanov, I. **Velichkov**, T. Dubravac, P. Trajkov. 2009. Past and recent coppice forests management in some regions of South-eastern Europe. *Silva Balcanica*, 10 (1), 9–19. ISSN 1311-8706.

High diversity of site conditions and vegetation patterns in South Eastern Europe (SEE), accompanied by different socio-cultural background of countries, has produced a wealth of diverse coppice stands and a variety of management practices. The paper provides basic facts and concerns, and creates report on background data about past and recent coppice forests management in four selected countries in SEE: Bulgaria, Croatia, FYR Macedonia and Serbia, in which coppice forestry has been of significant importance. The following main coppice forest types have been recognised in respect to their past management and current condition: (i) simple (traditional) coppice forests; (ii) “High coppice” forests; (iii) Coppice forests for conversion and reconstruction; (iv) Coppice forests with standards and “Middle-aged” forests; (v) Pollarding forests; (vi) Selection coppice forests; (vii) Shelterbelts (windbreaks, erosion shelterbelts, etc); (viii) Oak coppices for shelling; and (ix) Coppice forests subjected to no management. The paper emphasizes contribution of sustainable management of coppice forests resources towards ecological stability and economic development of SEE region, which could be achieved by both considering the traditional management concepts and introducing new ecologically, economically and socially sounded management practices.

19. Wolfslehner, B., S. Krajter, D. Jovic, L. Nestorovski, I. **Velichkov**. 2009. Framing stakeholder and policy issues for coppice forestry in selected central and South-Eastern European countries. *Silva Balcanica*, 10 (1), 21–34. ISSN 1311-8706.

Still widespread all over Europe, coppice forests are of high abundance and importance especially in South and South-Eastern Europe. This fact calls for clarification of forest management issues as well as environmental and socio-economic aspects. Relying on the lessons learned from a recent European networking project called ‘CForSEE - the multi-functional management of coppice forests’, a comparative stakeholder analysis in coppice forestry is presented for Austria, Bulgaria,

Croatia, Macedonia and Serbia. The main interests of different stakeholder groups are discussed as well as potential conflicts among users of coppice resources. First, there are conflicts between land-use change and the requirements for maintaining livelihood in rural areas. Both conversion to high forests and abandonment of coppice management on marginal sites will counteract conservation interests. Second, there is an increasing competition for woody biomass by wood-processing industry and energy production from renewable resources. National forest policy and administration is expected to balance and steer multiple interests by strengthening law enforcement and involving stakeholders in participatory negotiation and conflict resolution processes.

20. **Velichkov I.**, G. Hinkov, T. Zlatanov, M. Zlatanova, H. Hristova. 2010. Area distribution dynamics of *Castanea sativa* forests on the northern slopes of Belasitsa Mountain. *Silva Balcanica*, 11 (2): 21–26. ISSN: 1311 – 8706.

In order to study the temporal dynamics of the area covered by sweet chestnut forests on the northern slopes of Bulgarian part of Belasitsa mountain, a field verification of the first detailed forest inventory (since 1964) was performed. All chestnut co-dominated and dominated forests (CCDF) were grouped into two categories (i) chestnut co-dominated forests (CCF) where chestnut basal area represented 5.5% to 55.5% of the total basal area and (ii) chestnut dominated forests (CDF) with chestnut basal area from 55.5% to 100% of the total basal area. CCDF have lost nearly 13% of their initial area during the studied period (from 1923 ha in 1964 to 1678 ha in 2009). CCF have increased their area from 604 ha to 1030 ha while the area of CDF has decreased from 1319 ha to 648 ha. Therefore, chestnut has lost its dominating role in a half of the initial area of 1319 ha where it used to be a dominant tree species 45 years ago and has become a co-dominant species. The distribution peak of CCDF have shifted with 100 m upwards (from 500 a. s. l. in 1964 to 600 m a.s.l. in 2009), CDF tending to decrease their area regardless the altitude.

21. Velizarova, E., I. Velichkov, V. Doichinova and I. Atanassova, 2013. Exchangeable properties of forest soils under beech ecosystems in Central Balkan and Osogovo. *Bulg. J. Agric. Sci.*, 19: 939-945. ISSN: 1310-0351.

For forest soils, which are naturally acidic, there is only a limited number of reports, concerning their cation exchange capacity (CEC) controlling mechanisms and on the possible impacts of acidic deposition, climate change and increasing harvesting pressure for biofuels. Therefore, the aim of this investigation was to characterize the cation exchange capacity of forest soils (Dystric and Eutric cambisols) under beech stands (*Fagus sylvatica* L.) from the Central range of the Balkan mountain and from the Osogovo Mountain. The cation exchange properties have been analyzed following the methodology of Ganev and Arsova (1980). The cation exchange capacity ($T_{8.2}$) in the surface horizons of soil samples from the Balkan mountain vary within a wide range of 10.6 cmol.kg^{-1} to 20.9 cmol.kg^{-1} . For the soil from the Osogovo Mountain, the total cation exchange capacity was higher ranging from 18.4 cmol.kg^{-1} - 34.4 cmol.kg^{-1} . The concentrations of negatively

charged strongly acid exchangeable sites (T_{CA}) were from 6.0 to 15.5 cmol.kg^{-1} , for the soil from the Balkan mountain, while for the Osogovo Mountain - they were about two times higher - from 12.0 cmol.kg^{-1} to 27.1 cmol.kg^{-1} . A similar trend for the exchangeable aluminium (Al) values for the surface horizons of the Balkan mountain soil (from 1.0 cmol.kg^{-1} to 2.5 cmol.kg^{-1}) and of the Osogovo Mountain, soil (from 1.6 cmol.kg^{-1} , to 5.9 cmol.kg^{-1}) was established. The slight increase in the content of Al in the soil from Osogovo Mountain suggests a stronger destruction of Al-bearing minerals, most probably due to isomorphic substitutions. It was found that podsolization was occurring more pronouncedly in the soils of the Balkan mountain. The base saturation (BS) in the studied soils varies from 33.0 to 75.0% of the total cation exchange capacity. For all studied sampling sites, the negative charges of soil colloids which behave as strong acids (T_{CA}) exceed the BS values, due to the additional proportion of H^+ and Al^{3+} acidic cations.

22. **Velichkov** I, B. Srdjevic, M. Lakicevic. 2014. An Example of AHP Application in Forestry. In: Zlatic, M., S. Kostadinov (eds.). Advances in GeoEcology 43 - Challenges: Sustainable Land Management – Climate Change, 243-249, ISBN 978-3-923381-61-6.

The paper presents an example of AHP application in addressing a forestry decision problem stated as: identifying the best multifunctional stand in Rila monastery, Bulgaria. The problem was evaluated by three forestry experts. The chief monastery forester (the first author of the paper) developed hierarchy of decision making problem and evaluated all its elements i.e. criteria, sub criteria and alternatives. Two other decision makers evaluated criteria and sub criteria, according to their competences. The paper presents one of the possible ways to aggregate decision makers' preferences within AHP framework, in cases in which some group members did not evaluate all hierarchy elements. The proposed aggregation procedure was supported by geometric mean method and applied on a selected case study example. As a result, the best multifunctional stand is recognized. These results were compared to the previous researches.

23. **Величков**, И., Г. Попов, Ц. Ценов, М. Борисов, С. Лазаров, 2007. Анализ на горите за реконструкция в България и възможности за тяхното устойчиво управление. Управление и устойчиво развитие 1/2007 (16), ЛТУ – София, 108-124. ISSN 1311-4506.

Извършен е анализ на реконструкцията като лесовъдско понятие и практика в България от въвеждането ѝ до настоящия момент. Установени са дървесния състав и разпределението на горите по видове собственост в стопански клас „Реконструкция”. Анализирани са ползването на дървесина и залесяванията при реконструкции, постигнатите резултати от реконструирането на горите и влиянието на това мероприятие върху биоразнообразието и устойчивостта на насажденията. Очертани са тенденциите пред предвидените за реконструкция гори при запазване на настоящата нормативна база и са посочени възможности за постигане на тяхното устойчиво управление според съвременните

лесовъдски изисквания.

24. Величкова, Е., Л. Тричков, И. **Величков**, 2007. Ресурси, добив и потребление на иглолистна технологична дървесина. Управление и устойчиво развитие 1/2007 (16), ЛТУ – София, 50-59. ISSN 1311-4506.

Проследена е динамиката на дървесните ресурси от иглолистни гори до 40г. за периода 1980-2005г. по площ и запас. Установени са тенденциите и е направена Прогноза за състоянието им към 2010г. Разгледани са възрастовата структура на иглолистните гори към края на 2005г. по площ и запас, както и площта и запаса на горите от 1 и 2 клас на възраст по регионални управления на горите. Изследвани и анализирани са статистическите данни за предвиденото ползване по лесоустройствен проект (ЛУП) и действителния добив на иглолистна дървесина от отгледни сечи за периода 1997-2006г. и е прогнозирано възможното ползване до 2008г. Съпоставени са данните от предвиденото ползване по ЛУП по площ и запас и отчета за действителното ползване по регионални управления на горите за 2005г. Анализирани са данните за потреблението на иглолистна техно-логична дървесина от заводите за преработка за периода 2003-2006г. Въз основа на изследването са направени изводи и краткосрочна прогноза за устойчиво ползване на дървесина при отгледни сечи от иглолистните гори в Р. България.

25. **Величков**, И., Е. Крижан-Величкова, Ц. Ценов. 2008. Възможности за производство на висококачествени сортименти дървесина в Родопите. Управление и устойчиво развитие 1/2008 (19), ЛТУ – София, 68-77. ISSN 1311-4506.

Проучени са добива и реализацията на ценни сортименти дървесина в Родопите. Събрани и анализирани са данни за ресурсите от едроразмерна дървесина, съсредоточена в зрелите иглолистни и широколистни високостъблени гори в планината. Направена е прогноза за производството и добива на ценни сортименти дървесина в Родопите в дългосрочен период. Установено е, че възможностите за производство и добив на по-голямо количество и по-качествени ценни сортименти дървесина в Родопите в бъдеще са свързани с промяна на досега практикувания начин на стопанисване и ползване от горите.

26. Златанов Ц, Г Гогушев, М Георгиева, Г Хинков, И **Величков**. 2012. Състояние на кестена (*Castanea sativa* Mill.) в смесени широколистни млади яци в Беласица. Наука за гората 1/2: 23–36. ISSN 0861-007X.

Оценени са числеността, конкурентноспособността и здравословното състояние на обикновения кестен (*Castanea sativa* Mill.) в млади яци, развили се в резултат на извеждането на възобновителни сечи на територията на Беласица. Общата численост на подраства в изследваните обекти е относително висока. Видовият състав включва 38

дървесни и храстови вида. В 30% от изследваните обекти числеността на семенния подраст от кестен надвишава 2000 бр./ha-1. Използваните факторни признаци не обясняват статистически значимо вариацията в числеността на семенния и издънков подраст от кестен. Вероятността от заразяване на фиданките от кестен с патогена *Cryphonectria parasitica* (Murrill) Barr намалява статистически значимо с увеличаване на надморската височина. Съответно числеността на жизнените и здрави семенни индивиди от кестен е съществено по-голяма на по-голяма надморска височина. Въпреки относително бързия растеж на кестена в млада възраст, средно 43% от семенните индивиди са потиснати от издънки на кестен и на други дървесни видове и храсти. В резултат на изследването е препоръчано увеличаване на площите на обикновения кестен във височинния пояс 700–1100 m в Беласица чрез извеждането на неравномерно-постепенни сечи, също както и провеждане на регулярни отгледни сечи във формираните смесени широколистни младинаци с участие на кестен.

27. **Величков, И.,** Г. Хинков, С. Тонков, Г. Гогушев, Ц. Златанов. Произход и стопанисване на обикновения кестен (*Castanea sativa* Mill.) в Беласица (обзор). Наука за гората, 1/2, 2014, 7–22. ISSN: 0861–007X.

Настоящата обзорна статия засяга две от най-дискутираните през последните десетилетия теми, свързани с обикновения кестен (*Castanea sativa* Mill.) в Беласица – произходът и стопанисването му. Използвани са публикувани резултати от извършените през изминалите 5 г. в българската част на планината Беласица комплексни проучвания на кестена в рамките на проект BG 0031 FM ЕЕА, изпълнен от Институт за гората - Българска академия на науките, съвместно с Исландската горска служба и договор DIR-5113326-C-001 към проект DIR-5113326-7-101, изпълнен от дирекция на Природен парк „Беласица“. Включени са също и резултатите от генетичните изследвания на останалите находища на вида в България – планините Огражден и Славянка, Северозападен Пирин (с. Брежани), Югозападен Пирин (с. Златолист) и Стара планина (гр. Берковица). Установено е, че обикновеният кестен е автохтонен за територията на Беласица. В генетично отношение кестеновата популация в Беласица също е много ценна и следва да се използва като източник на посевен материал при създаване на кестенови култури или подпомагане на възобновяването. За стопанисване на кестеновите гори в Беласица може да се обобщи следното: (1) все още е запазен известен потенциал за високостъблено стопанисване, който може да бъде успешно използван; (2) без отгледни мероприятия в младите насаждения не е възможно да се постигне оптимален бъдещ състав, където кестенът да доминира/съдоминира.

28. Villani F, Mattioni C, Martin M A, Martin L M, Cherubini M, Lusini I, Pollegioni P, Chiochini F, Beritognolo I, **Velichkov I**, Paule L. 2014. Integration of different approaches to explore genetic and adaptive variation of *Castanea sativa* Mill.: perspectives

for gene conservation. Acta Hort. (ISHS) 1043:91-98. ISSN 0567-7572.

An overview of recent studies on genetic diversity and adaptive response of European chestnut (*Castanea sativa* Mill.) in relation to major evolutionary factors and anthropogenic impacts is reported. This, in order to predict the future dynamics of this ecosystem and to develop strategies for conservation and sustainable management in the frame of environmental changes (climate and social). We summarized the results of populations genetics studies conducted on the whole distribution range of the species, highlighting the importance to integrate the genetic results with environmental data by GIS support. The results indicated three main gene pools from East to West according to the hypothesized glacial refugia. Common garden trials and ex situ germplasm collections were used to study the variation and phenotypic plasticity of adaptive traits in selected geographic provenances from Turkey, Spain, Greece and Italy. Results related to phenology, growth and drought tolerance are summarized and discussed in relation to environment variation of the original sites. We also reported the results of mapping studies conducted on full sib families from controlled crosses. Genetic linkage maps were constructed and QTL analysis revealed genome regions involved in the control of bud burst, bud set and water use efficiency. These results are discussed in view of future research and applied perspectives.

29. Попов, Г., И. **Величков**, Ц. Ценов, С. Лазаров, М. Борисов, Г. Гогушев, 2007. Оценка на реконструкцията на горите в България и перспективи за тяхното стопанисване. Доклади на Национално съвещание по проблемите на реконструкцията на горски насаждения, ДЛ Хисаря, МЗГ – НУГ, 5-20. ISBN 978-954-9557-01-5

Настоящият доклад има за цел да представи оценка на резултатите от многогодишната практика по реконструкцията на горите и да предложи решения за бъдещото на стопанския клас за реконструкция. За реализирането на така поставената цел, на база на съществуващата информация (отчетни данни за ГФ, досегашни оценки за мероприятиято "реконструкция", указания за стопанисване, прилагани лесовъдски практики и други) е направен анализ и оценка на реконструкцията и извършено изследване по следните задачи: - Преглед на литературата; - Ретроспективна оценка на мероприятиято "реконструкция"; - Поставяни и постигнати цели пред реконструкцията; - Перспективи.

30. **Величков**, И., Г. Попов, Г. Хинков, Ц. Златанов. 2009. Ресурси, проблеми и възможности за стопанисване на буковите гори в Родопите. Национална научно-практическа конференция по стопанисването на буковите гори. Обща редакция: проф. Г. Рафаилов. ДАГ и ЛТУ, УОГС "Петрохан", Бързия, 16–17.06.2009 г., "РУТА–ХБ", 87–100. ISBN 978-954-9557-09-1.

Извършено е проучване и обобщаване на данните за буковите гори в Родопите. Дискутирани са проблемите и възможностите за устойчиво стопанисване на тези гори.

31. Zlatanov, Tz., I. Velichkov, G. Hinkov, M. Georgieva, O. Eggertsson, S. Hreidarsson, M. Zlatanova, H. Vacik. 2011. Structural diversity of European chestnut (*Castanea sativa* Mill.) population on the Northern slopes of Belasitsa Mountain, Southwest Bulgaria: Implication to management regime alteration. In: Book of abstracts: International Conference „Managed Forests in Future Landscapes - Implications for Water and Carbon Cycles“, Santiago de Compostela, Spain, 8-11 May 2011. Book of abstracts, p. 154.

A study on the spatial and age structure of the European chestnut (*Castanea sativa* Mill.) population on the northern slopes of Belasitsa mountain, Southwest Bulgaria was carried out in a systematic network of 67 permanent sampling plots (sized 0.125 ha). A two-step cluster analysis was performed to classify the plots into groups according to the dispersion in DBH (respectively age) for chestnut. The variability of chestnut in height was evaluated at both plot and landscape scale. A multiple regression analysis was used to explain the variation of the relative proportion of chestnut as well as the total number of tree species in the plots along the site gradient. The DBH and height differentiation between chestnut and other tree species was described. Growing stock is compared between species and sample plots. All findings were related to past and recent management practices. In general, stand diversification in terms of age and spatial structure, is ongoing into recently abandoned but formerly (till the first half of 20th century) intensively managed, for chestnut fruit production, monodominant chestnut stands. Options for future performance of targeted silviculture in studied stands are discussed.

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