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ACRONYMS / ABBREVIATIONS

ERASMUS	European Community Action Scheme for the Mobility of University Students
EURAF	The European Agroforestry Federation
ICRAF	The International Centre for Research in Agroforestry
UNCBD	The United Nations Convention on Biological Diversity
UNCCD	The United Nations Convention to Combat Desertification
EGD	The European Green Deal
CAP	New Common Agricultural Policy 2023-27

Contents

ACRONYMS / ABBREVIATIONS	3
1. OBJECTIVES AND SCOPE OF ACTIVITY	5
2. INTRODUCTION	6
3. OVERVIEW OF THE CURRICULA IMPROVEMENTS OF AGROFORESTRY MODULES AT PARTNER UNIVERSITIES	8
4. OVERVIEW OF CURRICULUM IMPROVEMENT OF COMPLEMENTARY MODULES AT PARTNER UNIVERSITIES	14
5. IN-DEPTH EXPOSITION OF CURRICULA IMPROVEMENTS	18
5.1. University of Belgrade, Faculty of Forestry (E10208240 - RS).....	18
5.2. University of Forestry (E10200449 - BG).....	26
5.3. University of Montenegro Biotechnical faculty, Montenegro (E10208590 - ME)	29
5.4. University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences from Osijek, Croatia (E10167599 - HR)	34
6. FRAMEWORK FOR CRAFTING A PROPOSAL FOR A NEW AGROFORESTRY MODULE AT UNIVERSITY OF MONTENEGRO BIOTECHNICAL FACULTY	37
7. LIST OF REFERENCES	38
8. APPENDIX I – IMPROVED CURRICULA of Agroforestry and complementary modules at partner universities (Original documentation)	39
A-I: University of Belgrade, Faculty of Forestry (E10208240 – RS) .	
A-II: University of Forestry Sofia, Bulgaria (E10200449 - BG)39	
A-III: University of Montenegro Biotechnical faculty, Montenegro (E10208590 - ME).	
A-IV: University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences from Osijek, Croatia (E10167599 - HR).	

1. OBJECTIVES AND SCOPE OF ACTIVITY

Overall objective

The primary goal of the curricula improvement is to elevate the knowledge acquisition and learning within the current agroforestry modules offered at UB, UFS, and UNIOS and within the modules in the fields complementary to agroforestry at UB and UoM. Through the analysis of the existing curricula, gaps have been identified, comparing to the agroforestry modules found in universities across EU countries. Building upon this assessment, the subsequent phase of refinement focuses on harmonizing the curricula with the distinct prerequisites demanded of agroforestry professionals within each consortium country.

Objectives of the report

The objective of the Report of changed curricula is to furnish a comprehensive overview comprising analyses and in-depth clarifications of each curricula enhancement. This encompasses not only a thorough dissection of the improvements undertaken but also encompasses a clear framework of guidelines aimed at assisting in the formulation of proposal for the introduction of a novel Agroforestry module at UoM.

2. INTRODUCTION

Today's labor market needs for a wide range of educational profiles and professional qualifications are changing significantly faster due to the advancement of technology and the needs of modern society. This requires thorough changes in ways and directions in education, which has already been recognized by experts [1], and within the framework of various programs actions are taken to improve education at all levels [2]. The field of environmental protection significantly gaining importance due to the extensive pressure on nature and resources resulting from the growing needs of contemporary society, including food, housing, energy, and more. Furthermore, the accelerated climate change and the frequent occurrences of natural disasters like droughts, floods, torrents, and extreme meteorological events such as storms, high-intensity winds, and hail, require nature-based solutions. These solutions hold the promise of not only restoring the natural equilibrium but also fulfilling essential human requirements simultaneously. Agroforestry offers nature-based solutions that can reconcile the demands of man and nature. To effectively address a wide range of needs, it is necessary to thoughtfully design and proficiently implement education programs of future professionals for complex tasks in the design, implementation and promotion of agroforestry and its potential. Agroforestry is a transdisciplinary field that encompasses numerous disciplines, bridging agriculture and forestry, extending to ecology, environmental protection and further to economics and sociology. Therefore, it is necessary to properly integrate all disciplines and summarize knowledge into a coherent curriculum that is capable to facilitate the acquisition of knowledge, skills, attitudes and values needed to master the wide and diverse knowledge demanded for proficiency in the field of agroforestry.

2.1. Key concept in curricula improvement at partner universities

Knowledge is a familiarity, awareness, or understanding of facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning [3]. Knowledge acquisition in the field of agroforestry encompasses mastering of both practical skills and theoretical understanding of a topics which include both implicit and explicit knowledge. Consequently, it requires complex cognitive processes including perception, communication, and reasoning [3]. In order to achieve this, the aim of improving the existing curricula is to make them coherent and learner-centered.

Coherent curriculum, or aligned curriculum, should be (i) well organized and purposefully designed to facilitate learning, (ii) free of academic gaps and needless repetitions, and (iii) aligned across lessons, subject areas, and learning objectives and outcomes including teaching-learning methods, textbooks and other instructional materials, and assessments [4]. Curriculum coherence encompasses horizontal and vertical coherence. Vertically coherent curriculum prepares students for professional assignments and/or the next education levels. The BSc-level module curricula that complement agroforestry have undergone enhancements, primarily aimed at emphasizing and delivering the essential knowledge necessary for students for proficiency in the field of agroforestry. These improvements are designed to better prepare students for the following study levels. Horizontally coherent curriculum enables students to effectively acquire knowledge in some topic through various modules at the same education level. That is, to enable students to acquire knowledge that can be applied to the field of agroforestry, and which is studied within other modules at the same study level.

Contemporary requirements in education in addition to coherence, strongly recommend that the curriculum should be learner-centered. A **learner-centered curriculum** focuses on the needs of the students and provides learning pathways for effective knowledge acquisition [5]. It should be flexible enough to provide a range of pathways for acquiring of basic knowledge and mastering skills through establishing a contact and connection between students and teachers. A learner-centered curricula of modules are characterized by [6]:

- Sets the tone for the course
- Is written in positive language
- Describes your beliefs about learning, teaching and assessment
- Sets up the structure of the course
- Links to handouts or detailed assignment descriptions

- Defines student responsibilities for success
- Helps students determine their readiness for the course
- States how the course fits into the curriculum and overall program
- Describes available learning resources
- Communicates technology requirements for the course
- Contains difficult-to-obtain reading materials
- Describes effective student study habits
- Includes materials that support learning outside the classroom
- Serves as a learning contract

Key improvements are made through the process that encompass (i) a previous phase of curriculum analysis of EU Agroforestry modules and Agroforestry and selected complementary modules at partner universities and (ii) subsequent phase of refinement including alignment to unique demands of agroforestry professionals in individual countries.

Precise Objective Framing: The precise aim of enhancing the curricula is to advance not just learning, but the quality of knowledge acquisition. This emphasizes the deeper understanding and application of information.

Expanded Comparative Analysis: The process of identifying gaps has been expanded to incorporate a comprehensive comparison between the existing modules and those offered in EU universities. This strengthens the basis for recognizing areas of improvement.

The Curricula Analysis Report [7] has outlined key guidelines for improvement, as follows:

- better understanding the potentials of agroforestry practices and the possibilities for planning new or improving existing practices, consider the introduction of lectures by experts from other fields related to agroforestry such as medical plants growing, beekeeping, fisheries etc.;
- literature of the Agroforestry systems module needs to be updated and supplemented with latest references as well as readings that include an overview of the agroforestry state and practices in the Western Balkans;
- it is necessary to update the topic of environmental aspects in the field of agroforestry and link agroforestry with environmental issues;
- to master the skills and practically apply theoretical knowledge through the preparation, presentation, and discussion of case studies;
- possibilities for curricula improvement lays in bringing and linking international and national environmental policies into Agroforestry curricula Information and knowledge about existing legislation with a special emphasis on: introduction to UNCCD (United Nation Convention to Combat Desertification), UNCBD (United Nation Convention of Biological Diversity), The European Green Deal (EGD), New EU Forest Strategy 2030 and Common Agriculture Plan, Agroforestry and trees in the Nature Restoration Regulation, etc.
- curriculum redesign should include principles and strategies of Bloom's revised taxonomy.

Strategic Alignment: The term "further improvement" has been replaced with "subsequent phase of refinement" to underscore the strategic nature of the enhancement process. This highlights the progression towards aligning curricula with specific requirements.

According to that, the improvements were made by standards: learning objectives, learning outcomes, contents, teaching/learning methods, literature, and assessment.

Tailored Alignment: Instead of a general alignment, the curricula are now being aligned with "specific requirements for agroforestry professionals" in each country. This underlines the customization of the curricula to meet the distinct needs of professionals in different contexts.

Consortium Country Emphasis: The focus on "each consortium country" has been emphasized to illustrate the attention given to tailoring the curricula to match the unique demands of agroforestry in individual countries.

Incorporating these refinements will not only elevate the curricula's quality but also underscore the strategic and tailored approach taken to enhance knowledge acquisition and learning in the field of agroforestry across UB, UOM, UFS, and UNIOS.

3. OVERVIEW OF THE CURRICULA IMPROVEMENTS OF AGROFORESTRY MODULES AT PARTNER UNIVERSITIES

Agroforestry modules are on master *study level* as part of the master study programmes at University of Belgrade Faculty of Forestry, Serbia (UB), University of Forestry Sofia, Bulgaria (UFS) and University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences Osijek, Croatia (UNIOS). Agroforestry module is incorporated to master's studies within curricula of study programs in the field of: Ecological Engineering for Soil and Water Resources Protection at UB, Forestry at UFS, and Plant Production at UNIOS.

The *status of module* differs among partner universities. Module "Agroforestry Systems" at UB is core course (mandatory) since it is necessary for acquiring qualifications of the study program Ecological Engineering for Soil and Water Resources Protection. "Agroforestry Systems" at UFS and "Agroforestry" at UNIOS are elective modules.

Learning objectives of Agroforestry modules of the partner universities (UB, UFS and UNIOS) are set similarly and are in line with main common learning objectives of analysed Agroforestry modules of EU universities (Table 1).

Table 1. Groups of main learning objective of Agroforestry modules at EU universities compared to partner universities

Learning objectives (EU universities)	Learning objectives (partner universities)
<ul style="list-style-type: none"> • <i>The basic concept of agroforestry and principles and drivers associated with agroforestry systems and practices around the world including variety of agroforestry practices in different environmental, social and economic conditions</i> 	<ul style="list-style-type: none"> • Agroforestry land use systems (UB) • Potential of agroforestry as a form of land use (UFS) • Describe agroforestry systems (UNIOS)
<ul style="list-style-type: none"> • <i>Interactions between crops and trees in agroforestry systems and their impact on productivity; biophysical relationship; the role of woody plant species on the improvement of soil and environment</i> 	<ul style="list-style-type: none"> • Ecological interactions between agroforestry components (UB) • Upgrading of knowledge in interaction between components of agroforestry systems acquired in module "Basics of agroforestry" at undergraduate studies (UFS) • Functions of woody species on agricultural land (windbreaks, soil purification, nutrient uptake, carbon sequestration, biodiversity and bioenergy production) (UNIOS)
<ul style="list-style-type: none"> • <i>Environmental benefits from agroforestry for climate change mitigation and adaptation and potential trade-offs with productivity</i> 	<ul style="list-style-type: none"> • Role of forests in the systems of agricultural production (UB) • Ecological aspects of agroforestry with reference to specific plant protection problems (UFS) • Environmental protection provided by agroforestry systems (UNIOS)
<ul style="list-style-type: none"> • <i>The role of woodlands in the rural sector; social and economic factors that influence adoption of agroforestry systems by farmers</i> 	<ul style="list-style-type: none"> • Economic interactions between components in agroforestry systems (UB) • Socio-economic features of agroforestry (UFS)

	<ul style="list-style-type: none"> • Introduction to legislation related to implementation of agroforestry systems (UFS) • Diversification of agricultural production in agroforestry systems (UNIOS) • Socio-economic potential of agroforestry for rural development (UNIOS)
<ul style="list-style-type: none"> • <i>Design and creation of agroforestry plantations, optimization of the ecological component of rural landscapes</i> 	<ul style="list-style-type: none"> • Specific spatial distribution of agroforestry components (UB) • Knowledge and skills about design and establishment of agroforestry systems suitable for Bulgaria (UFS) • Management of forest component in agroforestry (UNIOS)

The learning objectives - *Basic principles and concepts of agroforestry* and *Interactions between components in agroforestry systems* are common for all partner universities and provide basic knowledge of agroforestry systems applicable in variety of environmental conditions. The learning objectives - *Environmental benefits from agroforestry* and *Design and creation of agroforestry plantations* are a bit more specific for each partner university because they cover common topics with emphasize to specific requirements in terms of country specific agroforestry systems and practices and their design and establishment principles. The learning objective - *The role of woodlands in the rural sector; social and economic factors that influence adoption of agroforestry systems by farmers* is also aligned with country specific requirements especially segments related to legislation applicable to agroforestry and potential for removing barriers for adoption of agroforestry by farmers, local self-government, and other stakeholders.

Learning outcomes of the Agroforestry modules at partner universities meet defined learning objectives (Table 2).

Table 2. Connection between learning objectives and learning outcomes at partner universities

Learning objectives	Learning outcomes
<i>University of Belgrade Faculty of Forestry</i>	
<ul style="list-style-type: none"> • <i>The basic concept of agroforestry and principles and drivers associated with agroforestry systems and practices around the world including variety of agroforestry practices in different environmental, social and economic conditions / Agroforestry land use systems</i> 	<ul style="list-style-type: none"> • Classify and describe agroforestry practices based on components, spatial and temporal arrangement • Explain the basic principles of agroforestry as a way of using land
<ul style="list-style-type: none"> • <i>Interactions between crops and trees in agroforestry systems and their impact on productivity; biophysical relationship; the role of woody plant species on the improvement of soil and environment / Ecological interactions between agroforestry components</i> 	<ul style="list-style-type: none"> • Relate the interactions between components within the agroforestry system/practice
<ul style="list-style-type: none"> • <i>Environmental benefits from agroforestry for climate change mitigation and adaptation and potential trade-offs with productivity / Role of forests in the systems of agricultural production</i> 	<ul style="list-style-type: none"> • Extrapolate, employ and assess the potential of agroforestry in the fight against climate change, degradation control and ecological restoration, sustainable agriculture and rural development
<ul style="list-style-type: none"> • <i>The role of woodlands in the rural sector; social and economic factors that influence adoption of agroforestry systems by farmers / Economic interactions between components in agroforestry systems</i> 	<ul style="list-style-type: none"> • Discuss and interpret legal frameworks of international, regional and national policies and initiatives
<ul style="list-style-type: none"> • <i>Design and creation of agroforestry plantations, optimization of the ecological component of rural</i> 	<ul style="list-style-type: none"> • Recommend, design and devise agroforestry practices adapted to the

landscapes / Specific spatial distribution of agroforestry components	specific ecological and socio-economic conditions of the locality/area
<i>University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences Osijek</i>	
<ul style="list-style-type: none"> • <i>The basic concept of agroforestry and principles and drivers associated with agroforestry systems and practices around the world including variety of agroforestry practices in different environmental, social and economic conditions / Describe agroforestry systems</i> 	<ul style="list-style-type: none"> • Classify agroforestry systems and give examples of different systems
<ul style="list-style-type: none"> • <i>Interactions between crops and trees in agroforestry systems and their impact on productivity; biophysical relationship; the role of woody plant species on the improvement of soil and environment / Functions of woody species on agricultural land (windbreaks, soil purification, nutrient uptake, carbon sequestration, biodiversity and bioenergy production)</i> 	<ul style="list-style-type: none"> • Connect knowledge from agriculture with newly acquired knowledge from forestry • Describe the methods of forest management
<ul style="list-style-type: none"> • <i>Environmental benefits from agroforestry for climate change mitigation and adaptation and potential trade-offs with productivity / Environmental protection provided by agroforestry systems</i> 	<ul style="list-style-type: none"> • Explain significance of agroforestry systems for environmental protection • Describe the role of agroforestry systems in mitigating the effect of greenhouse gases (carbon sequestration) • See the importance of agroforestry systems on degraded soils
<ul style="list-style-type: none"> • <i>The role of woodlands in the rural sector; social and economic factors that influence adoption of agroforestry systems by farmers / Socio-economic potential of agroforestry for rural development;</i> 	<ul style="list-style-type: none"> • Analyse the socioeconomic potential of agroforestry for rural development • Identify obstacles to the establishment of agroforestry systems • Explain significance of agroforestry systems for the diversification of agricultural production
<ul style="list-style-type: none"> • <i>Design and creation of agroforestry plantations, optimization of the ecological component of rural landscapes / Management of forest component in agroforestry</i> 	<ul style="list-style-type: none"> • Select the most suitable woody species for agroforestry systems

Learning outcomes of Agroforestry systems module at UFS are generally stated that students will be able to acquire knowledge about agroforestry systems suitable for Bulgaria and skills to apply them in practice.

Module content in analysed Agroforestry modules is balanced with learning outcomes (Table 3).

Table 3. Connection between learning outcomes and contents of the Agroforestry modules at partner universities (UB and UNIOS)

Learning outcome	Module content – topics and/or lessons
<i>University of Belgrade Faculty of Forestry</i>	
Explain the basic principles of agroforestry as a way of using land	<ul style="list-style-type: none"> • The role and significance of the agroforestry systems as sustainable land use in land management (<i>theoretical part</i>)
Classify and describe agroforestry practices based on components, spatial and temporal arrangement	<ul style="list-style-type: none"> • Agroforestry systems (Level I) (different combinations of land use patterns in agriculture and forest (forest plantations)) (<i>theoretical part</i>) • Spatial and temporal arrangement of agroforestry components (<i>theoretical part</i>)

Learning outcome	Module content – topics and/or lessons
Relate the interactions between components within the agroforestry system/practice	<ul style="list-style-type: none"> • Ecological basics of agroforestry (<i>theoretical part</i>) • Analysis of environmental conditions (<i>practical part</i>)
Extrapolate, employ, and assess the potential of agroforestry in the fight against climate change, degradation control and ecological restoration, sustainable agriculture and rural development	<ul style="list-style-type: none"> • Land degradation processes and agroforestry systems (<i>theoretical part</i>) • Social and economic aspects (<i>theoretical part</i>) • Proposal of a solution (<i>practical part</i>)
Discuss and interpret legal frameworks of international, regional and national policies and initiatives	<ul style="list-style-type: none"> • International, regional and national agroforestry strategies, policies and legislation (UNCCD, UNCBD, EGD, New EU Forest Strategy 2030, CAP...) (<i>theoretical part</i>)
Recommend, design and devise agroforestry practices adapted to the specific ecological and socio-economic conditions of the locality/area	<ul style="list-style-type: none"> • Modeling and development of agroforestry systems (<i>theoretical part</i>) • Planning and design of the proposed solution (<i>practical part</i>) • Elaboration of the concept for user education and promotion of the practice (<i>practical part</i>)
<i>University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences Osijek</i>	
Classify agroforestry systems and give examples of different systems	<ul style="list-style-type: none"> • Definition and classification of agroforestry systems • Current status of agroforestry in Europe and the world
Connect knowledge from agriculture with newly acquired knowledge from forestry	<ul style="list-style-type: none"> • Role of agroforestry in sustainable agriculture • Physiology of plant species in alley cropping • Modelling the relationship between crops and tree species
Describe the methods of forest management	<ul style="list-style-type: none"> • Forest management and short rotation coppice
Explain significance of agroforestry systems for environmental protection	<ul style="list-style-type: none"> • Impact on microclimate, soil and water quality • Biodiversity
Describe the role of agroforestry systems in mitigating the effect of greenhouse gases (carbon sequestration)	<ul style="list-style-type: none"> • Carbon sequestration and positive impact on greenhouse gases
See the importance of agroforestry systems on degraded soils	<ul style="list-style-type: none"> • Determine main agro-technological parameters controlling the improvement of soil quality
Analyse the socioeconomic potential of agroforestry for rural development	<ul style="list-style-type: none"> • Importance of agroforestry systems for sustainable development • Determine main agro-technological parameters controlling the yield of agroforestry cultures
Identify obstacles to the establishment of agroforestry systems	<ul style="list-style-type: none"> • Policy issues and legislation
Explain significance of agroforestry systems for the diversification of agricultural production	<ul style="list-style-type: none"> • Role of agroforestry in sustainable agriculture • Crop and tree species used in alley cropping • Short and long term yield modelling
Select the most suitable woody species for agroforestry systems	<ul style="list-style-type: none"> • Design and planting density • Technical aspects of planting and maintenance

Topic *Role of agroforestry in sustainable agriculture* in “*Agroforestry*” module at UNIOS, contains lessons that enable the achievement of two learning outcomes (Table 3).

As learning outcomes of “*Agroforestry Systems*” module at UFS are generally stated that *students will be able to acquire knowledge about agroforestry systems suitable for Bulgaria and skills to apply them in practice*, the module contents are linked to learning objectives in this analysis (Table 4).

Table 4. Connection between learning objectives and contents of the module Agroforestry systems at UFS

Learning objective	Module content – topics and/or lessons
<i>University of Forestry, Sofia</i>	
Potential of agroforestry as a form of land use	<ul style="list-style-type: none"> ● Concept of agroforestry. Need and importance. Advantages and disadvantages. Classification of agroforestry systems (lectures)
Upgrading of knowledge in interaction between components of agroforestry systems acquired in module “Basics of agroforestry” at undergraduate studies	<ul style="list-style-type: none"> ● Possibilities to use interactions between components in agroforestry systems (lectures) ● Shelterbelts - the main agroforestry system. Meaning and types of belts (lectures) ● River-bank shelterbelts - goals and functions (lectures) ● Alley cropping system - advantages and disadvantages, main components and requirements for them (lectures) ● Silvopastoral system - advantages and disadvantages, basic components (lectures) ● Forest farming - essence and meaning (lectures) ● Agroforestry systems from consistent type – biomass production plantations (lectures) ● Cultivation of useful insects and their importance for agroforestry systems (lectures) ● Setting up and reporting an experiment on the co-cultivation of tree and agricultural plants (exercises)

Learning objective	Module content – topics and/or lessons
Ecological aspects of agroforestry with reference to specific plant protection problems	<ul style="list-style-type: none"> ● Ecological aspects of agroforestry systems (lectures) ● Influence of shelterbelts on microclimate and soil conditions (lectures) ● Influence of agroforestry systems on some characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical) (lectures) ● Characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical) suitable for agroforestry in Bulgaria (exercises) ● Specific phytosanitary problems and pest control in agroforestry systems (lectures) ● Specific diseases and pests in agroforestry systems (exercises)
Socio-economic features of agroforestry	<ul style="list-style-type: none"> ● Socio-economic advantages and disadvantages of agroforestry systems (lectures) ● Influence of shelterbelts on the productivity of crops and domestic animals (lectures) ● Alley cropping system - economic efficiency (lectures) ● Forest farming - Additional forest products - subject to forest farming (lectures) ● Agroforestry systems from consistent type – opportunities and prospects (lectures)
Introduction to legislation related to implementation of agroforestry systems	<ul style="list-style-type: none"> ● Legislation related to the possibility of implementing agroforestry practices (lectures)
Knowledge and skills about design and establishment of agroforestry systems suitable for Bulgaria	<ul style="list-style-type: none"> ● Shelterbelts - Basic shelterbelt parameters (lectures) ● Technology of establishment and maintenance of shelterbelts - choice of suitable tree and shrub composition, soil preparation, methods of afforestation and care (exercises) ● River-bank shelterbelts - determination of suitable plant species and parameters of the river-bank shelterbelts, agro-technology of establishment and cultivation (lectures) ● Design and establishment of river-bank shelterbelts (exercises) ● Alley cropping system - criteria for selection of suitable tree and agricultural species, agro-technical measures (lectures) ● Features in the technology of establishment and cultivation of alley agroforestry system (exercises) ● Silvopastoral system - principles of establishment and maintenance (lectures) ● Features in the technology of establishment and cultivation of silvopastoral agroforestry system (exercises) ● Features in the technology of establishment and cultivation of forest farming agroforestry system (exercises) ● Agroforestry systems from consistent type – technology of establishment and management (lectures) ● Features in the technology of establishment and cultivation of biomass production plantations (exercises)

Teaching-learning methods in Agroforestry modules at partner universities are lectures, practical work and exercises through creation of case studies or individual research project reports, seminars, presentation of independent work, group discussions and field trips and excursions. At UB lectures are supplemented by guest lectures by experts from various fields complementary to agroforestry.

Special attention at each partner university is devoted to improving practical/exercises in order to strengthen students' skills in planning and design in agroforestry, especially in practice and the use of contemporary tools

in these activities – GIS tools and digital databases. These improvements are also intended to rise students' digital literacy and encourage them to use digital databases for various analyses.

At UB practical part is designed to be conducted through preparation of case studies in small groups (2-3 students) using real-world data from digital databases. Case studies should further be presented and discussed among students' working groups. During case studies preparation, students prepare term papers that cover topic of interest in their case study and improve their skills in literature search and in-depth analysis of the topic of their interest.

At UFS exercises contain two parts: laboratory exercises and practical course in UFS' training center (Vrazhdebna Training and Experimental Field Center) where full-time students conduct individual research work and prepare research project report.

At UNIOS students attend exercises and prepare seminar papers to master skills in writing in clear, accurate and relevant manner, to prepare technically and visually high-quality presentation and to effectively present their work.

Literature. Lists of recommended reading materials (literature) for preparation of Agroforestry modules' final exam at partner universities were updated with references relevant to the improved module contents. Among the deliverables of AGFORWEB project are educational resources, namely a textbook intended for students covering agroforestry topics in Southeast Europe and the Western Balkans, as well as a manual for using the digital database, both will be added to a list of recommended reading after publication.

Assessment of student achievement at partner universities involves an evaluation process that combines pre-examination activities and a final exam. Pre-exam activities consist of several key elements specific to each partner university and the final exam is conducted in an oral or written format.

Pre-examination activities at UB include activities during lectures and practical (preparation of the case study in small groups), term paper preparation and presentation and discussion of the case study. These activities account for 55/100 points (55%) of the overall grade. The case study and term paper preparation, presentation and discussion collectively contribute to 45/100 points (45%) of the total assessment and the activity during lectures carries a weightage of 10/100 points (10%) towards their final assessment. The remaining 45% of the assessment is based on the final exam, which is conducted in an oral format.

At UFS, pre-examination activities consist of research project report weighted at 30% and coursework assignments contribute 10% to the total assessment. The total weightage for before-exam activities at UFS is 40%. The final exam at UFS accounts for 60% of the overall grade.

At UNIOS, students' pre-exam work contributes 45% to the final grade, where class activity, preparation for class, reflective revive of class content collectively constitute 20% and seminar 25% of the total assessment. The evaluation of the seminar paper includes the clarity, accuracy, and relevance of the written seminar information and the presentation's overall both technical and visual quality. The remaining 55% of the assessment is based on the final exam, which is a written examination.

In summary, each partner university employs a distinctive assessment structure, with a combination of pre-exam activities and final exams, reflecting their specific educational priorities.

4. OVERVIEW OF CURRICULUM IMPROVEMENT OF COMPLEMENTARY MODULES AT PARTNER UNIVERSITIES

At UB and UoM is recognized the need for the improvement of modules that complement the field of agroforestry. The need is recognized in modules at BSc level "*Forest amelioration 2*" and "*Trade and marketing of forest products*".

The objective of enhancing the course materials is to identify and accentuate thematic elements that complement the field of agroforestry. Specifically, within the "*Forest Amelioration 2*" module, the **module content** is supplemented with thematic units that facilitate the recognition and integration of the material being

studied. This module's curriculum includes protective forest belts as a recognized agroforestry practice in Europe, as well as the restoration and rehabilitation of severely degraded sites and habitats where agroforestry can serve as a nature-based solution with benefits for both the environment and society.

These enhancements within the module serve a dual purpose: bridging the knowledge gap and highlighting the potential of agroforestry, while also introducing and guiding students towards further learning and knowledge acquisition in the field of agroforestry at advanced academic levels. In pursuit of this, the course content is enriched with additional thematic units in the *theoretical part*:

- *Protective forest belts as an element of agroforestry practices.* This thematic unit delves into the role and significance of protective forest belts within the context of agroforestry.
- *Agroforestry as a perspective in the improvement of bare land.* This thematic unit serves to explore the potential of agroforestry in enhancing barren lands, shedding light on its applications and benefits.

Moreover, the *practical part* of the course has been bolstered by supplementing the material with skill-building exercises, specifically:

- *Analysis of the dominant drivers of wind erosion by processing data from digital databases to determine the spatial arrangement of protective forest belts.*

This involves data processing from digital databases to determine the spatial arrangement of protective forest belts. Proficiency in data processing from digital sources is of great importance for subsequent analyses, planning, and design within the field of agroforestry, a vital aspect of the material that will be covered in the MSc module "Agroforestry Systems" at UB.

To facilitate a comprehensive teaching and learning experience, course *literature* is also updated with recent reference that primarily focuses on protective forest belts from both theoretical and practical standpoints. These enhancements aim to ensure that students gain a thorough understanding of agroforestry and its potential while acquiring practical skills that will be invaluable in their future endeavors in this field.

The module "Trade and Marketing of Forest Products" is designed to equip students with knowledge that can be directly applied to agroforestry, particularly its economic implications for stakeholders. With that respect, *learning outcomes* of this module are expanded by incorporating an additional outcome:

- *Getting to know the concept of bioeconomy and circular economy and mastering the access and use of official databases and market research techniques, as well as giving examples of good practice in the field of agroforestry through the prism of trade and marketing*

This learning outcome is focused on recognizing the potential application of the concepts of bioeconomy and circular economy. This encompasses a comprehensive understanding of these concepts and the mastery of accessing and utilizing official databases and market research techniques. Additionally, the module will provide certain examples of best practices in agroforestry, viewed through the lens of trade and marketing.

To achieve new learning outcome, the revision is made in *module contents* by adding thematic unit:

- *Market research of wood and non-wood forest products through the notion of a value chain creation and agroforestry*

A new thematic unit is intended to enhance the theoretical aspect of the module and bring connections between the principles of bioeconomy and circular economy with the commercial facets of agroforestry. This unit is designed to introduce students to the commercial aspects of forestry and agroforestry and market research for both wood and non-wood forest products. Knowledge in the creation of value chain within agroforestry, enabling students to gain understanding of agroforestry by combining modern concepts from various domains, including forestry, economics, marketing, and more. To achieve this, guest lectures by experts in close domains are added as one of *teaching-learning methods*.

In this way, students will not only gain a deeper understanding of agroforestry but will also learn to synthesize contemporary ideas and concepts from diverse fields. Additionally, the course *literature* is supplemented with up-to-date sources that offer comprehensive insights into this dynamic and evolving field.

At the UoM, a series of enhancements were undertaken within two modules: "*Mediterranean Ornamental Plants*" at the BSc level and "*Forestry in Rural Areas*" at MSc level.

The need for the inclusion of an Agroforestry module at UoM is already underscored in light of preliminary survey findings. Since the accreditation process takes a long time, actions were taken at UoM to prepare for the introduction of the new Agroforestry module through a transition period leading to the next accreditation round, when students will be introduced to the fundamentals of agroforestry through these two complementary modules.

In particular, the "*Ornamental Mediterranean Plants*" module already encompasses topics that can be readily applied to the field of agroforestry. The enhancements were included various learning standards of the curriculum, starting with revised *learning objectives*, which are complemented by the following:

- *Introduce students to the basic principles of agroforestry*
- *Ornamental Mediterranean plants in agroforestry systems*

Furthermore, the *learning outcomes* are expanded by introducing a new one designed to facilitate the achievement of the additional learning objectives:

- *Recognize the importance of agroforestry, and the possibilities of using ornamental plants in agroforestry systems*

To facilitate students in acquiring knowledge and attaining these predefined learning objectives and learning outcomes, the *module contents* are enriched with thematic units that cover a range of topics, including:

- *Agroforestry, definition and significance*
- *Main agroforestry systems*
- *Field protective belts in agroforestry in Mediterranean and submediterranean conditions, function and importance for the crop*
- *Ornamental trees in field protective belts*
- *Ornamental trees in apiculture*

The lessons on the specific uses of ornamental plants serve to introduce students to the potential of ornamental plants for utilization within agroforestry systems. Simultaneously, lessons on agroforestry fundamentals aim to bridge the gap until the formal introduction of the new Agroforestry module.

Recommended *literature* is also expanded to include references related to agroforestry. It is strongly suggested that a textbook, resulting from the AGFORWEB project, be added to the mandatory reading list for students.

The module "*Forestry in Rural Areas*" addresses topics that are integral to building an understanding of forest ecosystems. Its primary aim is to equip students, especially those in the field of agriculture, with essential knowledge about the role of forests in rural development.

Agroforestry has the potential to improve not only the environment but also the social and economic well-being of the rural population. The knowledge that students gain about forests and forest ecosystems from both ecological and economic aspects acquired within this module enables them to understand and recognize the potential of agroforestry and its role in the sustainable development of rural areas.

Improvements within this module are built into the *learning objectives* by following:

- *To get knowledge about agroforestry practices*

To facilitate the achievement of this new learning objective, *learning outcomes* are enhanced by incorporating:

- *Apply agroforestry practices*

The *module contents* are refined to facilitate students' knowledge acquisition in this field:

- *Agroforestry practices*
- *Protective forest belts*

In the new thematic units, students will gain knowledge in traditional silvopastoral practices and the potential of applying protective forest belts across the range of environmental conditions in Montenegro - encompassing both ecological and socio economic conditions. Also, through thematic units related to forest functions, their importance and evaluation as well as forest management and planning, students will learn about the role and nature of “forestry” component within agroforestry and its promising potential in agroforestry systems.

Recommendations for *literature* is supplemented with newer references related to forest management and protective forest belts.

Through improvements within this module, the gap will be bridged until formal introduction of the new Agroforestry module. Afterwards, students will be facilitated to build on the acquired complementary knowledge within the new Agroforestry module.

5. IN-DEPTH EXPOSITION OF CURRICULA IMPROVEMENTS

5.1. University of Belgrade, Faculty of Forestry (E10208240 - RS)

Table 5- I. Module specification and description - University of Belgrade, Faculty of Forestry (E10208240 - RS)

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
Study level	MSc	BSc	BSc
Study programme	Ecological engineering in soil and water resources protection	Ecological engineering in soil and water resources protection	Forestry and nature protection
Module	Agroforestry systems	Forest amelioration 2	Trade and marketing of forest products
Type of Module (mandatory; compulsory/elective)	mandatory	mandatory	mandatory
ECTS credits	5	5	2
Prerequisites; condition	none	Forest amelioration 1	-
Learning objectives	The main objective of this course is to enable students to acquire knowledge about agroforestry land use systems where forests develop in communities with agricultural production in a specific spatial distribution based on the principles of ecological and economic interactions between components: forests and agricultural crops and/or animals in the system.	The module will introduce students with ameliorative methods to control wind erosion, environmental conditions in degraded habitats on specific parent material such as limestone, serpentinite, peridotite and sands and basics of design in control degradation in degraded habitats and habitats prone to degradation.	For students to understand terms and relationships in the field of trade, especially in the field of trade and marketing of wood and non-wood forest products and to enable successful planning and implementation of activities related to the marketing of these products on the market, as well as mastering techniques for conducting market research. In addition, students will be introduced to the concepts of bioeconomy and circular economy as modern frameworks for trade and marketing in the field of forestry. Also, students will be trained to use official databases (Trade map, FAO, Eurostat, etc.), for the purposes of preparing their seminar papers and conducting market research of certain categories of (forest) products.
Learning outcomes	Full ability to apply knowledge in this field in practice, as well as preparation for doctoral studies. Learning outcomes proposed for next accreditation round: The student is able to:	Training for independent observation, planning and maintenance of biological facilities for control of the degradation process (primarily erosion caused by anthropogenic impact) in degraded habitats to varying extents.	Possession of knowledge that allows to successfully solve tasks and problems in the field of trade and commodity exchange in the field of forestry, that is, to valorize the production program in the best way on the market. Acquired theoretical and practical knowledge through the interpretation of teaching content with a problem-based approach, gaining

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
	<ul style="list-style-type: none"> – classify and describe agroforestry practices based on components, spatial and temporal arrangement – explain the basic principles of agroforestry as a way of using land – relate the interactions between components within the agroforestry system/practice – examine digital databases and tools for manipulation of digital databases – extrapolate, employ and assess the potential of agroforestry in the fight against climate change, degradation control and ecological restoration, sustainable agriculture and rural development – recommend, design and devise agroforestry practices adapted to the specific ecological and socio-economic conditions of the locality/area – discuss and interpret legal frameworks of international, regional and national policies and initiatives 	<p>Learning outcomes proposed for next accreditation round:</p> <p>The student is able to:</p> <ul style="list-style-type: none"> – analyse the dominant degradation factors; assess soil losses based on analysed degradation factors and recommend control measures – classify and describe protective forest belts and other erosion control and amelioration plantings and differentiate their functions and potential – implement and appraise protective forest belts and other erosion control plantings in different environmental conditions – recommend and design protective forest belts and other ameliorative measures and degradation control works in specific conditions adapted to pre-defined requirements and needs – manage and implement care and maintenance measures for raised plantings 	<p>new knowledge about trade and marketing of forest products. Getting to know the concept of bioeconomy and circular economy and mastering the access and use of official databases and market research techniques, as well as giving examples of good practice in the field of agroforestry through the prism of trade and marketing.</p>
Course Contents; Overview	<p><i>Theoretical part:</i> The role and significance of the agroforestry systems as sustainable land use in land management; Agroforestry systems (Level I) (different combinations of land use patterns in agriculture and forest (forest plantations)); Spatial and temporal arrangement of agroforestry components; Ecological basics of agroforestry; Social and economic aspects; Land degradation processes and agroforestry systems; Modeling and development of agroforestry systems; International, regional and national agroforestry strategies, policies and legislation (UNCCD, UNCBD, EGD, New EU Forest Strategy 2030, CAP...).</p> <p><i>Practical part:</i> Preparation of a case study/elaborate in small groups (2-3 students) for the implementation of the agroforestry system/practice in given conditions - analysis of environmental conditions, proposal of a solution, planning and</p>	<p><i>Lectures:</i> Wind erosion and drought as dominant factors of degradation, assessment of soil losses in wind erosion for designing protective forest belts. Protective forest belts. Protective forest belts for special uses (field shelterbelts, living snow fences, riparian forest belts, protective forest belts for noise control). Protective forest belts as an element of agroforestry practices. Protective forest belts and plantations for erosion control: ilofilters, colmation belts, "forest caps", plantations for the protection of small reservoirs; design and establishment. Ameliorative facilities and works on degraded and/or bare land on karst, serpentinite, peridotite, rocky areas and sandy habitats. Care and maintenance of established plantations of protective forest belts. Agroforestry as a perspective in the improvement of bare land. Preparation of the final paper.</p>	<p><i>Theoretical teaching:</i> Forms of timber sales (auctions - types, advertising, participants, enforcement, plots, submissions and sale according to the forest tax, sale according to the price list, long-term contracts), Internal trade (concept, types and actors of internal trade, development of the trade network of internal timber trade and wood products), Foreign trade (structure and forms of foreign trade, historical development of foreign trade, foreign trade regimes and restriction measures - incentives, restrictions, compensations, liberalization and stimulation of exports, related foreign trade operations, processing/refining and re-export operations, authorities and institutions in foreign trade), Customs and forwarding (concept, functions, types and role, customs area, customs tariff, customs union and control, concept, functions and role of forwarding), Timber trade technique (sales</p>

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
	<p>design of the proposed solution, elaboration of the concept for user education and promotion of the practice. Case study presentation and discussion.</p>	<p><i>Practical:</i> Analysis of the dominant drivers of wind erosion by processing data from digital databases to determine the spatial arrangement of protective forest belts. Preparation and design of field shelterbelts (structure, spatial arrangement, species). Establishing and planting dynamics of field shelterbelts. Preparation and design of living snow fences (structure, spatial distribution, species selection). Care and maintenance of protective forest belts. Design of degradation control facilities on limestone, serpentinite, peridotite. Design of amelioration facilities for binding sands and wind erosion protection.</p> <p>The module includes mandatory professional practice.</p>	<p>contracts, commercial representation contracts, forms, the meaning of certain elements, international chambers of commerce, arbitration and settlement of complaints in the international market wood wrapping, letter of credit - concept, importance and types of letter of credit, trade documents - transport documents, customs documents, documents on goods insurance, certificates and attestations), Banks and banking operations, Application of standards in timber trade, INCOTERMS rules in international timber trade, International forestry products market, trade policy and legal regulation (EU Timber Regulation), international business organizations, development policy of small and medium-sized enterprises in trade in forest products, as well as the business and development potential of Serbia's trade in the forestry sector. The concept, types and functions of marketing, methods and techniques of marketing research, the evolution of marketing and the relationship with the forestry sector, 3. Marketing activities (market, product, distribution, price, promotion, marketing management, marketing environment) and examples of good practice 4. Marketing of forest products products (branding, certification and its marketing function in forestry, marketing of wood forest products, marketing of non-wood forest products). 5. Special analysis of the orientation of production-placement, customer-marketing, through practical examples from the market analysis of forest products. The concept of 4P/5P marketing. Product life cycle. B2B and C2C business models. 6. Introduction to the concept of bioeconomy and circular economy, as well as production related to natural (forest) resources.]. Market research of wood and non-wood forest</p>

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
			products through the notion of a value chain creation and agroforestry. <i>Practical teaching:</i> -
Literature	<p>Nair P.K.R. (1993): <i>An Introduction to Agroforestry</i>. Kluwer Academic Publishers, ICRAF</p> <p>Riguero-Rodriguez A., McAdam J., Mosquera-Losada M.R. (2009): <i>Agroforestry in Europe</i>. Current State and Future Prospects. Advances in Agroforestry. Springer</p> <p>Lukić S. (2019): Šumski zaštitni pojasevi – praktikum. Univerzitet u Beogradu Šumarski fakultet</p> <p>Schnabel, S., Ferreira, A. (2004): <i>Sustainability of Agrosilvopastoral Systems – Dehesas, Montados-, A Cooperating Series of the International Union of Soil Science (IUSS)</i></p>	<p>Lukić S. (2019): Šumski zaštitni pojasevi – praktikum. Univerzitet u Beogradu Šumarski fakultet</p> <p>Dožić, S., Lujčić, R. (2005): Šumske melioracije [Forest amelioration], autorizovana skripta, Univerzitet u Beogradu</p>	<p>Ranković N., Keča Lj. (2011): Trgovina i marketing šumskih proizvoda, Univerzitet u Beogradu – Šumarski fakultet, Beograd ISBN 978-86-7299-185-7</p> <p>Oreščanin D., Redžić A. (1994): Trgovina drvom, I deo, Šumarski fakultet Univerziteta u Beogradu</p> <p>Bjelić P. (2018): Međunarodna trgovina, Ekonomskifakultet, Beograd</p> <p>Keča, Lj., Keča N., Marčeta M. (2015): Nedrvni šumski proizvodi, Socio-ekonomski i ekološki aspekti, Univerzitet u Beogradu, Šumarski fakultet (ISBN 978-86-7299-232-8), (270)</p> <p>Lamb C.W., Hair J.F., McDaniel C. (2013): Marketing, Data Status, Beograd (386)</p> <p>Kotler F., Vong V., Sonders Dž., Armstrong G. (2007): Principimarketinga, Mate, (932)</p> <p>Sarstedt M., Mooi E. (2019): A Concise Guide to Market Research, The Process, Data, and Methods Using IBM SPSS Statistics, 3rd Edition, Berlin, (396)</p> <p>Keswani C. (2020): Bioeconomy for sustainable development. Springer Nature Singapore Pte Ltd., (389)</p> <p>Nunan D., Malhotra N.K., Birks, D.F. (2020): Marketing Research, Pearson UK, London (951)</p> <p>Smith-Hall C., Chamberlain J. (2022): The bioeconomy and non-timber forest products, Taylor & Francis, London, (77)</p>
Contact hours	Lectures: 2 hours per week (13 weeks) Practical: 3 hours per week (13 weeks)	Lectures: 3 hours per week (13 weeks) Practical: 3 hours per week (13 weeks)	Lectures: 30 hours Practical: -
Teaching-learning methods	Lectures with introduction to the literature from this discipline. Guest lectures. Practical - through preparation of case studies, students acquire practical knowledge for the analysis of environmental conditions, planning and application of appropriate systems/practices of agroforestry in	Lectures with an introduction to the literature from this discipline. Through practical and exercises, students gain practical knowledge in the design of protective forest belts and ameliorative afforestation methods in areas of degraded habitats, and through	Lectures, class discussions, consultations, visiting experts, seminar work and case studies, presentations and interactive work in the class.

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
	<p>order to achieve ecological and economic benefits using available digital databases and training to show personal initiative in solving the problems of applying agroforestry systems. Term/seminar paper - through the preparation of a seminar paper, students are trained to search and use the available literature for a deeper analysis of the given topic, and through the presentation they acquire skills for the promotion of agroforestry practices. Field trip.</p>	<p>the preparation of term papers, they show personal initiative in solving problems in this area.</p>	
Assessment	<p><i>Before exam obligations</i> Activity during lectures - 10 points (of 100 max) Activity during practical - 20 points Seminar/term paper - 25 points <i>Final exam</i> Oral exam - 45 points</p>	<p><i>Before exam obligations</i> Activity during lectures: 10 points (of 100 max) Activity during practical: 20 points Tests: 20 points Seminar/term paper: 10 points <i>Final exam</i> Oral exam: 40 points</p>	<p><i>Pre-exam obligations</i> Activity during lectures: 10 points (of 100 max) Seminar/term paper: 30 points <i>Final exam</i> Written exam: 20 points Oral exam: 40 points</p>

Module No-1 Agroforestry Systems (Table 5-I): Qualifications obtained by completing MSc Ecological engineering for soil and water resources protection (60 ECTS) at University of Belgrade Faculty of Forestry study program meet the sector-specific professional expectations for the pursuit of the profession. Several points were detected in [7] as a gaps in the curriculum of this module and improvements were made.

Learning outcomes specified in the curriculum of “*Agroforestry Systems*” module are full ability to apply knowledge in this field in practice, as well as preparation for doctoral studies. According to the analysis of existing curricula [7], recommendation is to present learning outcomes more precisely. Changes in learning objectives and learning outcomes of curriculum are among extensive changes which require special and length approval procedure. Our goal is to make improvements that will allow easier and thoroughly learning and reaching predefined learning outcomes. With that respect the learning outcomes are specified in more detail through sentences that specify which abilities the student should achieve after completing the course and prepared for the procedure in the next accreditation round.

Basically, current learning outcome includes each particular learning outcome.

The student is able to:

- **classify** and **describe** agroforestry practices based on components, spatial and temporal arrangement;
- **explain** the basic principles of agroforestry as a way of using land;
- **relate** the interactions between components within the agroforestry system/practice;
- **examine** digital databases and tools for manipulation of digital databases;
- **extrapolate, employ** and **assess** the potential of agroforestry in the fight against climate change, degradation control and ecological restoration, sustainable agriculture and rural development;
- **recommend, design** and **devise** agroforestry practices adapted to the specific ecological and socio-economic conditions of the locality/area;
- **discuss** and **interpret** legal frameworks of international, regional and national policies and initiatives.

The improvement in *module contents* of the “*Agroforestry Systems*” module was made in lesson (thematic unit) *Agroforestry regional and national policies*. Introduction to UNCCD (United Nation Convention to Combat Desertification), UNCBD (United Nation Convention of Biological Diversity), The European Green Deal (EGD), New EU Forest Strategy 2030 and Common Agriculture Plan, Agroforestry and trees in the Nature Restoration Regulation, etc. should enable students to link international and national environmental policies with existing legislation to recognize the contribution of the agroforestry both to improvement of the environment and the social and economic status of local community, farmers and employees in rural sector.

The improved content of *theoretical part* of the “*Agroforestry Systems*” module was supplemented with the following thematic unit:

- *International, regional and national agroforestry strategies, policies and legislation (UNCCD, UNCBD, EGD, New EU Forest Strategy 2030, CAP...).*

In *practical part* students through practical work acquire the knowledge in the field of:

- *Preparation of a case study/elaborate in small groups (2-3 students) for the implementation of the agroforestry system/practice in given conditions - analysis of environmental conditions, proposal of a solution, planning and design of the proposed solution (with the application of information technology and GIS), elaboration of the concept for user education and promotion of the practice. Case study presentation and discussion.*
- *Planning and design of agroforestry systems with the application of information technology and GIS in agroforestry.*

Improvements have been made to the *teaching-learning methods* of the “*Agroforestry Systems*” module to enrich educational experience for students.

To gain deeper insights into the potential of agroforestry and enhance the planning of new practices or improvements to existing ones, guest lectures by experts from various fields related to agroforestry, including medicinal plant cultivation, beekeeping, fisheries, and more, are incorporated in lectures.

The improvement of practical exercises refers to preparation of case study/elaborate in small groups (2-3 students), presentation and discussion, instead of individual work. Case study encompasses preparation for the implementation of the agroforestry system/practice in given conditions using information technology and GIS - analysis of environmental conditions, recommendations for a solution, planning and design of the proposed solution, elaboration of the concept for user education and promotion of the practice, finally presentation and discussion of case study. In that way students are stimulated to form attitudes and adopt values, cooperate in team work, encouraged to exchange ideas and discuss potential solutions and strengthen trust among team members.

In *literature* the reference Protective forest belts (Lukić 2019) was added, where topics related to agroforestry are covered in certain chapters. Reference Agroforestry for soil conservation by Young (1991) has been moved from the list of mandatory readings to optional readings. Also, as the result of this project the textbook for students will be produced as one of the results of AGFORWEB project to cover the topics related to basic principles of agroforestry, practices and the state of agroforestry in the Western Balkans and should be added to the list of mandatory reading.

Module No-2 Forest amelioration 2 (Table 5-1): Improvements in the module “*Forest amelioration 2*” included several points.

The *learning outcomes* for the “*Forest amelioration 2*” module were revised to provide more specific statements and prepared for integration into the curriculum for the upcoming accreditation round. Each specific learning outcome is incorporated into the current set of learning objectives.

The student is able to:

- **analyse** the dominant degradation factors; **assess** soil losses based on analysed degradation factors and **recommend** control measures
- **classify** and **describe** protective forest belts and other erosion control and amelioration plantings and **differentiate** their functions and potential
- **implement** and **appraise** protective forest belts and other erosion control plantings in different environmental conditions
- **recommend** and **design** protective forest belts and other ameliorative measures and degradation control works in specific conditions adapted to pre-defined requirements and needs
- **manage** and **implement** care and maintenance measures for raised plantings

The “*Forest Amelioration 2*” course delves into the various components of agroforestry practices. In order to help students identify these elements and enhance their readiness for studying Agroforestry systems at MSc study level, the curriculum has been enhanced to include additional thematic units that establish the connection between these elements and their role within agroforestry practices. The *theoretical part* of the “*Forest Amelioration 2*” module is enriched by incorporating thematic units that explore the interplay between agroforestry and protective forest belts as integral elements of agroforestry practices and systems:

- Protective forest belts as an element of agroforestry practices
- Agroforestry as a perspective in the improvement of bare land.

In *practical part* students acquiring knowledge and training skills through exercises in:

- Analysis of the dominant drivers of wind erosion by processing data from digital databases to determine the spatial arrangement of protective forest belts

Recommended *literature* includes references that mostly cover the material from this subject. The improvement in mandatory readings is changed and the reference Velašević (1970) Rejoniranje terena SR Srbije u cilju podizanja šumskih poljezaštitnih pojaseva [Land suitability categorization for field shelterbelts in SR Serbia] is

replaced by newer one Lukić (2019) Protective forest belts, which covers a large part of the material taught in the course “*Forest amelioration 2*”. Considering that the material is mostly focused on protective forest belts, it is advantageous to supplement the list of recommended literature with references related to protective forest belts.

Module No-3 Trade and Marketing of Forest Products (Table 5-I): The improvement of the curriculum of the subject “*Trade and marketing of forest products*” is reflected in the following segments:

- the objective of the course;
- from the subject;
- subject content;
- literature and
- teaching methods.

Objective of the course. In the segment objective of the course, the improvement refers to the introduction of the area of planning and conducting market research. Also, students will get to know the concept of bioeconomy and circular economy, as modern frameworks for trade and marketing in the field of forestry. Also, students will be trained to use official databases (Trade map, FAO, Eurostat, etc.) for the purposes of preparing their seminar papers and conducting market research of certain categories of (forestry) products.

Learning outcomes. At the end of the course, students are expected to become familiar with the concept of bioeconomy and circular economy as well as giving examples of good practice in the field of agroforestry through the prism of trade and marketing. In this way, they will gain an additional dimension in the understanding of agroforestry, combining modern aspects and concepts from different areas (forestry, economics, marketing, etc.). In addition, one of the outcomes will be mastering the access and use of official databases and market research techniques. In this way, it will be possible to acquire both theoretical and practical knowledge, which will enable them to conduct research independently.

Course content. B2B (business to business) and B2C (business to customer) business models have been introduced into the course content. In addition, the course content is supplemented with the concept and elements of bioeconomy and circular economy, as well as production related to natural (forest) resources. In order to bring students closer to the commercial aspect of forestry and agroforestry, market research of wood and non-wood forest products was introduced. This is complemented by the inclusion in the teaching units of the concept of value chain creation and agroforestry.

Literature. In accordance with the changes, modern literary sources were added to the course curriculum, which provide knowledge from the above field. In this sense, students will have at their disposal, in addition to textbooks from the subject Trade and marketing of forest products, and appropriate additional literature:

- Nunan D., Malhotra N.K., Birks, D.F. (2020): Marketing Research, Pearson UK, London (951)
- Smith-Hall C., Chamberlain J. (2022): The bioeconomy and non-timber forest products, Taylor & Francis, London, (77)
- Keswani C. (2020): Bioeconomy for sustainable development. Springer Nature Singapore Pte Ltd., (389)
- Sarstedt M., Mooi E. (2019): A Concise Guide to Market Research, The Process, Data, and Methods Using IBM SPSS Statistics, 3rd Edition, Berlin, (396)

Teaching methods. In addition to lectures, discussions, consultations, preparation of seminar papers and case studies, teaching methods were complemented by presentations and guest appearances by relevant experts from the field of forestry and agroforestry.

5.2. University of Forestry (E10200449 - BG)

Table 5- III. Module specification and description - University of Forestry (E10200449 - BG)

UNIVERSITY OF FORESTRY	Module No-4:
Study level	MSc
Study programme	Forestry
Module	Agroforestry systems
Type of Module (mandatory; compulsory/elective)	elective
ECTS credits	6
Prerequisites; condition	
Learning objectives; Aims	To give detailed information about the possibilities of agroforestry as a form of land use, in which the cultivation of tree and/or shrub vegetation is combined with agricultural crops and/or animals, which builds on the knowledge acquired in the “Basics of Agroforestry” course for Bachelor degree, specialty Forestry
Learning outcomes	To acquire knowledge about agroforestry systems suitable for Bulgaria and skills to apply them in practice.
Course Contents; Overview	<p>Course description:</p> <p>The first part of the course provides information on the importance of the agroforestry, its application possibilities and classification of agroforestry systems.</p> <p>The second part of the course presents a detailed description of the main types of agroforestry systems for temperate climate conditions (shelterbelts, river bank shelterbelts, alley cropping system, silvopastoral system, forest farming, biomass production plantations) with specific examples from foreign and our experience. Attention is given to the more important agricultural crops suitable for agroforestry, as well as domestic animals and beneficial insects used in agroforestry systems.</p> <p>Specific plant protection problems in agroforestry systems, ecological aspects and socio economic features of agroforestry are the subject of the third part of the course. Students are also introduced to the legislation related to the implementation of agroforestry systems.</p> <p>In the exercises, students get acquainted with the design methodology and the technology of establishment, growing and maintaining different agroforestry systems and prepare a research project report according to an individual assessment. Coursework developed on the topic chosen by the student from the field of agroforestry is also presented. It is planned that the classes on topic 8 of exercises for the full-time students will be held in Vrazhdebna Training and experimental field centre under real production conditions.</p> <p>Content of syllabus:</p> <p><i>Lectures</i></p> <ol style="list-style-type: none"> 1) Concept of agroforestry. Need and importance. Advantages and disadvantages. Classification of agroforestry systems 2) Shelterbelts - the main agroforestry system. Meaning and types of belts. Basic shelterbelt parameters. Influence of shelterbelts on microclimate and soil conditions and on the productivity of crops and domestic animals 3) River-bank shelterbelts - goals and functions, determination of suitable plant species and parameters of the river-bank shelterbelts, agro-technology of establishment and cultivation 4) Alley cropping system - advantages and disadvantages, main components and requirements for them, criteria for selection of suitable tree and agricultural species, agro-technical measures, economic efficiency 5) Silvopastoral system - advantages and disadvantages, basic components, principles of establishment and maintenance 6) Forest farming - essence and meaning. Additional forest products - subject to forest farming 7) Agroforestry systems from consistent type – biomass production plantations, opportunities and prospects, technology of establishment and management 8) Influence of agroforestry systems on some characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical) 9) Cultivation of useful insects and their importance for agroforestry systems

UNIVERSITY OF FORESTRY	Module No-4:
	<p>10) Ecological aspects of agroforestry systems 11) Socio-economic advantages and disadvantages of agroforestry systems 12) Specific phytosanitary problems and pest control in agroforestry systems. Possibilities to use interactions between components in agroforestry systems 13) Legislation related to the possibility of implementing agroforestry practices</p> <p><i>Exercises</i></p> <p>1) Technology of establishment and maintenance of shelterbelts - choice of suitable tree and shrub composition, soil preparation, methods of afforestation and care 2) Assignment for research project report and coursework 3) Design and establishment of river-bank shelterbelts 4) Features in the technology of establishment and cultivation of alley agroforestry system 5) Features in the technology of establishment and cultivation of silvopastoral agroforestry system 6) Features in the technology of establishment and cultivation of forest farming agroforestry system 7) Features in the technology of establishment and cultivation of biomass production plantations 8) Characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical) suitable for agroforestry in Bulgaria 9) Setting up and reporting an experiment on the co-cultivation of tree and agricultural plants 10) Specific diseases and pests in agroforestry systems 11) Summarizing of the results of the coursework and acceptance of the research project report</p>
Literature	<p>Alexandrov, A., K. Genov. 2001. Agroforestry in Bulgaria. Third Balkan Scientific Conference, Sofia, 2–4.10.2001, I, 278–284.</p> <p>Fetting, C. 2020. The European Green Deal, ESDN,Report,December2020, ESDN Office, Vienna, 22 p., https://www.esdn.eu/fileadmin/ESDN_Reports/ESDN_Report_2_2020.pdf</p> <p>Kachova, V., G. Hinkov, E. Popov, L. Trichkov, R. Mosquera-Losada. 2016. Agroforestry in Bulgaria: history, presence status and prospects. <i>Agroforest Syst.</i> doi:10.1007/s10457-016-0029-6.</p> <p>New EU Forest Strategy for 2030, Commission staff working document, The 3 Billion Tree Planting Pledge For 2030, 53 p. https://knowledge4policy.ec.europa.eu/publication/commission-staff-working-document-swd2021651-3-billion-tree-planting-pledge-2030_en</p> <p>Ordinance No. 3 of March 10, 2023 on the conditions and procedure for implementing interventions in the form of direct payments included in the Strategic Plan, on inspections, reductions in payments and the procedure for imposing administrative sanctions, Ministry of Agriculture, SG No. 23/14/03/2023</p> <p>Stancheva, Y., S. Bencheva, K. Petkova, K. Kalmukov, M. Milev, S. Mirchev, S. Dimitrov, S. Savev, N. Iliiev. 2001. Agroforestry - a system for environmentally friendly and multifunctional use of natural resources. Publishing house at University of Forestry, Sofia, 99 (in Bulgarian).</p> <p>Stancheva J., Bencheva S., Petkova K., Tsvetkova N, 2003. Effect of Root Exudation on the Germination and Some Growth Indexes at an Intercropping of Agricultures and Forest Plants. In: PSP "50 years University of Forestry", session "Ecology and Environment Protection", p.103-106 (in Bulgarian with engl. Abstract).</p> <p>Stancheva, Y., K. Petkova, S. Bencheva, M. Broshtilova, K. Broshtilov, N. Tzvetkova. 2004. Agroforestry. Publishing house "Ruta", Sofia, 239 (in Bulgarian).</p> <p>Stancheva, Y. et al. 2008. Handbook of the entrepreneur in organic farming. Sofia, Publishing house Avangard Prima, Sofia, 216 (in Bulgarian).</p> <p>Stancheva, Y., K. Petkova, S. Bencheva. 2015. Agroforestry. Publishing house Avangard Prima, Sofia, 225 (in Bulgarian).</p> <p>Stancheva, Y., K. Petkova, S. Bencheva. 2015. A secure future for global crop production, <i>Gora</i>, 6–7, 16–17 (in Bulgarian).</p> <p>The Convention on Biological Diversity, 1993, https://www.cbd.int/convention/</p> <p>Trichkov, L., V. Kachova. 2016. Necessity, opportunities and priorities for development of agroforestry in Bulgaria. <i>Forestry ideas</i>, vol. 22, № 1 (51): 3–15.</p> <p>UNCCD (United Nation Convention to Combat Desertification), 1994, https://www.unccd.int/</p>

UNIVERSITY OF FORESTRY	Module No-4:
Students Workload	180 hours, of which 60 contact hours (full-time) and 30 hours (part-time)
Teaching and learning activity/methods	lectures, laboratory exercises and practical courses in Vrazhdebna Training and experimental field center, independent work, research project report and coursework preparation
Assessment	research project report – 30%, coursework – 10%, exam – 60%.

Module No-4 (Table 5-III): The following changes and improvements have been made to the curriculum “Agroforestry systems”:

The annotation (*course content*) has been reformulated in the following ways:

- In the *lecture part* of the course:

The topic ‘Interrelationships between components in agroforestry systems - positive and negative’ is reformulated as ‘Possibilities to use interactions between components in agroforestry systems’ and becomes part of the topic related to phytosanitary problems and pest control.

The topics ‘Ecology of beneficial insects and their importance for agroforestry systems’ and ‘Peculiarities of domestic animals raised in agroforestry systems’ are combined under the title ‘Cultivation of domestic animals and beneficial insects in agroforestry systems.

Inserting a new topic ‘Legislation applicable in the agroforestry practices’.

The topic ‘Environmental advantages and disadvantages of agroforestry systems’ has been amended to ‘Environmental aspects of agroforestry’.

- In the part of the course covering *exercises*:

The research project report and coursework assignment topic are moved from the seventh to the second place.

Topic 9 is reworded to ‘Setting up and reporting an experiment on co-cultivation of tree and agricultural plants’.

The final topic (11) has been supplemented and it now is ‘Summarising of the results from the course work and acceptance of the research project report’.

The following publications are added to the *references*:

1. Fetting, C. 2020. The European Green Deal, ESDN, Report, December 2020, ESDN Office, Vienna, 22 p., https://www.esdn.eu/fileadmin/ESDN_Reports/ESDN_Report_2_2020.pdf
2. New EU Forest Strategy for 2030, Commission staff working document, The 3 Billion Tree Planting Pledge For 2030, 53 p. https://knowledge4policy.ec.europa.eu/publication/commission-staff-working-document-swd2021651-3-billion-tree-planting-pledge-2030_en
3. Ordinance No. 3 of March 10, 2023 on the conditions and procedure for implementing interventions in the form of direct payments included in the Strategic Plan, on inspections, reductions in payments and the procedure for imposing administrative sanctions, Ministry of Agriculture, SG No. 23/14/03/2023
4. The Convention on Biological Diversity, 1993, <https://www.cbd.int/convention/>
5. UNCCD (United Nation Convention to Combat Desertification), 1994, <https://www.unccd.int/>

5.3. University of Montenegro Biotechnical faculty, Montenegro (E10208590 - ME)

Table 5-IV. Module specification and description - University of Montenegro Biotechnical faculty from Podgorica, Montenegro (E10208590 - ME)

UNIVERSITY OF MONTENEGRO BIOTECHNICAL FACULTY, MONTENEGRO	Module No-5:	Module No-6:
MSc; BSc level	BSc Level	MSc
Study Course	Mediterranean fruit growing	Interdisciplinary studies - Agribusiness and rural development
Module	Mediterranean ornamental plants	Forestry in rural areas
Type of Module (mandatory; compulsory/elective)	elective	mandatory
ECTS credits	5	6
Prerequisites; condition	no	No
Learning objectives; Aims	To introduce students with the types and methods of growing decorative Mediterranean plants, the production of reproductive material, erecting hedges and laying lawns. Introduce students to the basic principles of agroforestry; ornamental Mediterranean plants in agroforestry systems.	To get knowledge about the complex nature of forest ecosystems, the functions of forests, as well as the basic principles of sustainable forest management, and use of forests and agroforestry practices.
Learning outcomes	The student will be able to: <ul style="list-style-type: none"> – recognize the most important species of ornamental plants; – apply knowledge and skills in the propagation of ornamental plants; – suggest the optimal ways of growing ornamental plants in the Mediterranean conditions of Montenegro; – recognize the importance of agroforestry, and the possibilities of using ornamental plants in agroforestry systems – organizes maintenance of gardens. 	After successfully completing the course, students will be able to: <ul style="list-style-type: none"> – Use knowledge about the complex nature of the forest for the purpose of sustainable and permanent use and management of forests – Analyse specific problems of sustainable forest management with knowledge of legislation in this area – Integrate the knowledge of related disciplines into a comprehensive knowledge of how to better use these resources – Apply agroforestry practices – Use non-timber forest products in a sustainable manner – Know the production methods and characteristics of wood processing products
Course Contents; Overview	<i>Theoretical part:</i> Ornamental plants: importance and application possibilities. Basic division of ornamental plants. Ornamental plants on the Mediterranean. The origin of ornamental plants; Ornamental trees and shrubs of the Mediterranean. Basic division, coniferous species and evergreen broad-leaved trees. Use and ecological characteristics of these species; Indigenous species of evergreen broadleaves trees in greening. Ecology and significance; The most abundant /important species of introduced evergreen broadleaves on the Adriatic coast; The most important species of	Introduction: The concept of forest, forest types, by composition, by origin (forest culture, coppice forest and seed origin), structure (same-season, selection and fertile felling), cultivation form (tall and low) and others; Basic categories of forest functions, their importance and evaluation; Characteristics of the forests of Montenegro; Legal regulations in forestry and the organization of forestry in Montenegro; Dendrology and phytocenology - basic species and forest communities; Silviculture; Agroforestry practices;

UNIVERSITY OF MONTENEGRO BIOTECHNICAL FACULTY, MONTENEGRO	Module No-5:	Module No-6:
	<p>introduced deciduous trees on the Adriatic coast; Palm trees. Their Ecological and morphological characteristics, use; Roses, use and classification; Hedges, plant species for hedges. Types of hedges; Lawns according to purpose; Raising the lawn, sodding; Agroforestry, definition and significance. Main agroforestry systems; Field protective belts in agroforestry in Mediterranean and submediterranean conditions, function and importance for the crops. Ornamental trees in field protective belts. Ornamental trees in apiculture. Flowering species: importance and possibilities of application. Basic division of flowering species; Autochthonous flowering plants, and honey-bearing flowering plants; Perennial flowering species and bulbous species; Seasonal flowers (annual and biennial flowers); Potted flowers, cut flowers</p> <p><i>Practical:</i> Morphological characteristics of chosen species (from different categories of ornamental plants); The method of erecting hedges. Problems with their maintenance; Basic types of grasses, grass mixtures, maintenance; Forest vegetation in Montenegro; Indigenous flower species.</p>	<p>Protective forest belts; Forest protection; Forest management and planning; Properties of wood and primary processing of wood; Biomass as an energy source, fast-growing plantations; Non-timber forest products and legislation related to that area; Hunting</p>
Literature	<p>M. Radulović: Ukrasno mediteransko bilje (Skripta), 1-119, 2015 [Ornamental Mediterranean plants] Vukićević E., 1996: Dekorativna dendrologija, Univerzitet u Beogradu, Šumarski fakultet, Beograd [Decorative dendrology]; Lazarević S., 2000. Gajenje i razmnožavanje baštenskog cveća, Mala poljoprivredna apoteka, Nolit, Beograd [Breeding and propagation of garden plants]; Cvijanović D., Bukvić R., Lazarević S., Popović S., Simonović V., Vujošević A., 2005, Revitalizacija i unapređenje proizvodnje cveća, Institut za ekonomiku poljoprivrede, Šumarski fakultet, Poljoprivredni fakultet, Beograd [Revitalization and enhancement of flower production]; Đurovka M., Lazić B., Bajkin A., Potkonjak A., Marković V., Ilin Ž., Todorović V., 2006, Proizvodnja povrća i cveća u zaštićenom prostoru, Poljoprivredni fakultet Novi Sad, Poljoprivredni fakultet, Banja Luka [Production of vegetables and flowers in a protected areas/ under protected condition];</p>	<ol style="list-style-type: none"> 1. Medarević, M., (2008): Forest management planning; Faculty of Forestry Belgrade 1-401 2. Šoškić, B. (2002): Properties of wood. University textbook Belgrade. 3. Ranković N., Keča L. (2011): Trade and marketing of forest products, University of Belgrade - Faculty of Forestry in Belgrade. 4. Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, sveučilišni udžbenik, 322 str. 5. Lukić S. (2019): Šumski zaštitni pojasevi praktikum. Univerzitet u Beogradu Šumarski fakultet

UNIVERSITY OF MONTENEGRO BIOTECHNICAL FACULTY, MONTENEGRO	Module No-5:	Module No-6:
	Nair P.K.R. (1993): <i>An Introduction to Agroforestry</i> . Kluwer Academic Publishers, ICRAF; Dožić, S., Lujčić, R. (2005): Šumske melioracije [<i>Forest amelioration</i>], autorizovana skripta, Univerzitet u Beogradu.	
Students Workload	Lectures: 2 hours per week (13 weeks) Practical: 1 hours per week	Lectures: 60 Practical work: 15
Teaching and learning activity/methods	Frontal teaching, student-centred learning where students are given certain tasks or chapters that they need to know. Practical work where students learn about morphological characteristics of plant species; field visit of ornamental plants nurseries.	Teaching, individual and group work of students, preparation of seminar papers, consultations
Assesment	Practical exam: 40 Seminar/term paper: 10 (seminary) Oral exam: 50	Two colloquiums with 20 points each, a seminar paper up to 5 points, attendance, and activity during class up to 5 points and a final exam with 50 points. A passing grade is obtained if more than 50 points are accumulated cumulatively

Module No-5: Mediterranean ornamental plants (Table 5-IV) Existing lectures on the topics related to lawns, previously were placed in weeks IX and X. In new improved curricula they were combined into one (week IX): Lawns according to purpose; raising the lawn; sodding. On exercises - practical students will work on: Selection of grass types and grass mixtures (features and forming principles).

Previous lectures on the topics related to floricultures were placed to the weeks XI, XII and XIII.

- In new improved curricula main topics were combined as following:

Week XII: Flowering species: importance and possibilities of application. Basic division of flowering species; Perennial flowering species. Here, in connection with agroforestry, Autochthonous and honey-bearing flowering plants, were added.

Week XIII: Seasonal flowers (annual and biennial flowers); potted flowers, cut flowers; Bulbous species.

Since we merged lectures, students will learn a smaller number of grasses and flowers species, while the main principles will remained unchanged.

In weeks X and XI, lectures are dedicated to agroforestry: X: Agroforestry, definition and importance of agroforestry. Basic systems of agroforestry. XI: Protective forest belts in agriculture in Mediterranean and sub-Mediterranean conditions, function and importance for agricultural crops. Woody ornamentals in protective belts. Woody ornamentals in beekeeping. Practical will cover: (X) Key elements of agroforestry design and (XI) Description of main tree crops and mixtures appropriate for Mediterranean and submediterranean conditions, in different agroforestry systems.

New *literature* is also suggested:

- Nair P.K.R. (1993): *An Introduction to Agroforestry*. Kluwer Academic Publishers, ICRAF;
- Dožić, S., Lujčić, R. (2005): Šumske melioracije [*Forest amelioration*], autorizovana skripta, Univerzitet u Beogradu

A new publication that will be produced as one of the results of AGFORWEB project – a textbook for students will be added to the mandatory readings list.

Module No-6 Forestry in rural areas (Table 5-IV): The module “*Forestry in rural areas*” is a mandatory subject of the interdisciplinary master's academic studies Agribusiness and rural development.

This master study program was created in response to the needs of knowledge and skills in several areas that are necessary for successful rural development. The goals include skills and methods of acquiring knowledge in the field of agriculture, forestry, rural development and agribusiness. The goal of this program is to improve academic skills related to analysing and creating agrarian policy, in order to make appropriate decisions, etc.

The study program Agribusiness and rural development is mostly enrolled by students who have completed basic studies (BSc) in agriculture. In order to ensure an interdisciplinary approach, it was assessed during designing the structure of the program that it would be extremely important to provide students with the opportunity to become familiar with the basic information about characteristics of forests and Forestry. While attending the module Forestry in rural areas, students receive information about forest species, functions of forests, methods of cultivation, silviculture, forest protection and use of forests. Forests represent a significant source of income for the population of rural areas. In addition to wood products, there are also non-wood forest products (forest fruits, mushrooms, medicinal plants, etc.). Forest areas are also used for grazing, beekeeping, hunting, tourism and for many other activities.

By analysing all modules at the Biotechnical Faculty of the University of Montenegro, the project team of the AGFORWEB project determined that it would be very justified to improve the syllabus of the module “*Forestry in rural areas*” in such a way as to include part of Agroforestry in the curriculum and further to provide basic information for further improvement of knowledge in the field of agroforestry through new subject proposed to be incorporated in master program for the next accreditation round.

In the European framework, the field of agroforestry is recognized as extremely important, bearing in mind that the basic regional component of Europe is basically agroforestry by its characteristics. As stated in the EU forest Development Strategy until 2030 [8], it is extremely important to use abandoned rural areas wisely, and silvopastoral and other agroforestry practices are cited as examples.

The basic change of the curriculum consists in the addition of new lessons to *contents* related to Agroforestry practices. For the covering this issue, a fund of 3 hours of lectures and two hours of practical classes has been determined. New contains information on how agroforestry systems can be established and be a complementary part of traditional agricultural production.

It is planned to be covered the basic terms of Agroforestry, its history and importance. It is also planned to review the agroforestry practices in the world and in the region of Southeast Europe, as well as the basic economic and ecological benefits.

Particular attention will be paid to the current application of Agroforestry practices in Montenegro. Until now, these were mainly different forms of silvopastoral practices. Silvopastoralism is a system that combines animal husbandry on pastures in a partially wooded environment which beside of providing a variety of food resources also give protection to animals from wind and solar radiation. The importance of regular traditional use of high mountain pastures and forest clearings should also be seen from the point of view of preserving exceptional landscape and biodiversity values.

The new topic of the *practical exercises* will be regarded the importance, aim and design of the Wind Protection Belt System. Students will also get important information regarded this type of agroforestry practices. The effectiveness of the Shelterbelts/Windbreak in performing the desired functions depends on the correct choice of its structure. Students will be presented with basic inputs and decision-making principles for the correct choice of solutions.

The suggested *literature* list has also been expanded so that students can follow additional lessons. Literature related to protective forest belts, which is used at the Faculty of Forestry in Belgrade, has been added. It is proposed practicum: - Lukić S. (2019): Protective forest belts. University of Belgrade, Faculty of Forestry.

The innovative curriculum will result in additional skills and knowledge for which students will be trained. Improved *learning outcomes* are that after successfully completing the course, students will be able to:

- **Use** knowledge about the complex nature of the forest for the purpose of sustainable and permanent use and management of forests
- **Analyse** specific problems of sustainable forest management with knowledge of legislation in this area
- **Integrate** the knowledge of related disciplines into a comprehensive knowledge of how to better use these resources
- **Apply** agroforestry practices
- **Use** non-timber forest products in a sustainable manner
- **Know** the production methods and characteristics of wood processing products

Learning objectives are also reformulated in way that students will get knowledge about the complex nature of forest ecosystems, the functions of forests, as well as the basic principles of sustainable forest management, use of forests and agroforestry practices.

New curriculum is available on Biotechnical Faculty web site:
https://www.ucg.ac.me/predmet.php?oz_del=17&sif_del=1&sif_mat=13&oz_pred=12381

5.4. University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences from Osijek, Croatia (E10167599 - HR)

Table 5 -V. Module specification and description - University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences from Osijek, Croatia (E10167599 - HR)

UNIVERSITY JOSIP JURAJ STROSSMAYER FACULTY OF AGROBIOTECHNICAL SCIENCES OSIJEK, CROATIA	Module No-7: 244074-7380
MSc; BSc level	MSc level
Study Course	Plant Production
Module	Agroforestry
Type of Module (mandatory; compulsory/elective)	elective
ECTS credits	6
Prerequisites; condition	none
Learning objectives; Aims	Describe agroforestry systems and their significance in the diversification of agricultural production and environmental protection. Give examples of the functions of woody species on agricultural land (windbreaks, soil purification, nutrient uptake, carbon sequestration, biodiversity and bioenergy production). Analyse the socioeconomic potential of agroforestry for rural development.
Learning outcomes	After successfully completing the module, the student will be able to: <ol style="list-style-type: none"> 1. Classify agroforestry systems and give examples of different systems and explain their significance for the diversification of agricultural production and environmental protection 2. Describe the methods of forest management and select the most suitable woody species for agroforestry systems 3. To connect knowledge from agriculture with newly acquired knowledge from forestry. 4. Describe the role of agroforestry systems in mitigating the effect of greenhouse gases (carbon sequestration) 5. To see the importance of agroforestry systems on degraded soils 6. Analyse the socioeconomic potential of agroforestry for rural development. 7. Identify obstacles to the establishment of agroforestry systems 8. Create a seminar on the subject of agroforestry practice
Course Contents; Overview	
Literature	<p>Compulsory literature</p> <ul style="list-style-type: none"> – A. Rigueiro-Rodríguez, J. McAdam, and M.R. Mosquera-Losada (Eds.) (2009): Agroforestry in Europe. Springer Science + Business Media B.V. (3-89 p.; 321-349 p.) – A. Quinkenstein, J. Wöllecke, C. Böhm, H. Grünwald, D. Freese, B. U. Schneider, R. F. Hüttl (2009): Ecological benefits of the alley cropping agroforestry system in sensitive regions of Europe. Env. Sci. & Policy, 12; 1112-11214. New direction for agriculture, forestry and fisheries, SARD-Sustainable agriculture and rural development, Fao, p65,rome, 1995 (web adresa) – Tomašević, A. (1996): Vjetrozaštita Sinjskog polja. Šumarski list br. 1—2, CXX (1996), 19—34 – Dimitriou, I, Rutz, D. (2015): Kulture kratkih ophodnji – priručnik o održivom uzgoju. WIP Renewable Energies, Munchen, Njemačka (HRV. Izdanje Energetski institut Hrvoje Požar) <p>Additional literature</p> <ul style="list-style-type: none"> – P.K.Ramachandran Nair. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p.

	<ul style="list-style-type: none"> – H. E. Garrett, W. J. Rietveld, and R.F. Fisher (2000): North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy Inc. – M.R. Mosquera-Losada, D. Freese, and A. Rigueiro-Rodríguez (2011): Carbon Sequestration in European Agroforestry Systems. In: B. Mohan Kumar and P.K. Ramachandran Nair (eds): Carbon Sequestration Potential of Agroforestry Systems. Springer Science + Business Media B.V – L.E. Buck, J.P. Lassoie and E.C.M. Fernandes (1999): Agroforestry in Sustainable Agricultural Systems. CRC Press LLC (poglavlja: 1, 3, 5, 9, 13, 17) – S. Jose and A. M. Gordon (2008): Toward Agroforestry Design – An Ecological Approach. Springer Science + Business Media B.V. (poglavlja: 10, 16, 18) – Čavlović, J. (2013): Osnove uređivanja šuma. Izdavač: Šumarski fakultet Sveučilišta u Zagrebu, 2013, ISBN 978-953-292-028-4 – H. Grünewald, C. Böhm, A. Quinkenstein, P. Grundmann, J. Eberts and G. von Wühlisch (2009): Robinia pseudoacacia L.: A Lesser Known Tree Species for Biomass Production. Bioenerg. Res. 2:123–133 – H. Grünewald, B. K.V. Brandt, B. U. Schneider, O. Bensa, G. Kendzia and R. F. Hüttl (2007): Agroforestry systems for the production of woody biomass for energy transformation purposes. Ecological Engineering 29: 319–328
Students Workload	Lectures: 60 Exercise: 5 Seminar: 10
Teaching and learning activity/methods	Lectures/exercises/seminars
Assessment	<p>Class activity, preparation for class, reflective review of class content – 20% Seminar – 25% Written exam – 55%</p> <p>In forming the final grade for students, continuous class attendance and activity, preparation for class, reflective review of course contents, seminar work and written exam are considered. The evaluation of the seminar paper includes the clarity, accuracy, and relevance of the written seminar information and the presentation's overall (technical and visual) quality.</p> <p>Attending classes is mandatory in accordance with the regulations of J.J. Strossmayer University in Osijek. If the student is not present on more than 30% of the teaching hours, he loses the right to take the exam.</p>

Module No-7: Agroforestry (Table 5-V): The agroforestry course has been held as an elective course at the Faculty of Agrobiotechnical Sciences Osijek, at the Master study program plant production since 2013. The faculty's research and educational field of expertise is mainly focused on agricultural practices. The increased need for multidisciplinary of educational programs and creative application of knowledge and connection of different areas resulted with the development of agroforestry course at the Faculty of Agrobiotechnical Sciences in Osijek. The agroforestry course is established in order to promote interdisciplinarity and to train the personnel who will be able to cope with the requirements and challenges of sustainable agricultural management.

The student interest over the years showed that agroforestry is an interesting topic attractive to students especially to ERASMUS students who are attending the course regularly. Initial course curricula covered agroforestry topics mainly from an agricultural point of view. However, students' interest in forestry practices resulted in an adjustment to curricula where now forest management is considered as one of the *learning outcomes* of the course (learning outcome 2). The *literature* has been adjusted so that the literature on short rotation coppice (SRC), a tree species often used in agroforestry, is now considered a mandatory literature. The new curricula is prepared in a new form in which the learning objectives need to be specifically and clearly defined. Furthermore, the new curricula form requires a clear description of students' evaluation and grading process.

The adjusted curricula will be active from academic year 2023/2024. The curriculum changes applied in 2023 refer to a couple of points:

- In the new course curricula the learning outcomes are clearly defined.
- The topic of forest management is addressed in more detail and represented with more teaching hours.
- Literature has been updated addressing some national topics related to agroforestry and short rotation coppice.
- Students evaluation has been described in detail.

With these new changes, students have a clear insight in course outcomes as well as in evaluation procedure. Key course topics that will be covered are: agroforestry systems, forest management and short rotation coppice, crops and trees used in agroforestry, livestock and trees used in agroforestry and student seminar at the end. The forest management topic is addressed in more detail and since the Faculty of Agrobiotechnical Sciences has no forestry courses this aspect is necessary in the agroforestry course. The literature has been updated so that students can follow the lectures. Such an updated agroforestry course introduces the student to basic agroforestry discipline, in which the student becomes familiar with the agricultural and forest ecosystem as well as with the techniques of sustainable management of agricultural and forest land.

The course consists of lectures, field practice, and independent preparation of the final seminar. Throughout all three segments, student will gain the necessary practical experience and become familiar with the application of acquired knowledge. Agroforestry course as such fits into the vision of the Faculty of Agrobiotechnical Sciences in Osijek whose key strategic objectives are to create attractive courses for international students and to enable student exchange, encourage multidisciplinary, and create a connection between science and technology.

6. FRAMEWORK FOR CRAFTING A PROPOSAL FOR A NEW AGROFORESTRY MODULE AT UNIVERSITY OF MONTENEGRO BIOTECHNICAL FACULTY

One of the basic ideas of the AGFORWEB project is to improve acquiring knowledge and skills in Agroforestry at partner universities. Since Agroforestry is not represented as a separate module only at the University of Montenegro, part of the project activities related to the improvement of the curriculum is the design of a novel Agroforestry curriculum tailored to address the needs of the University of Montenegro Biotechnical Faculty.

This curriculum will be proposed for adoption during the next Reaccreditation process of master study programs of the University of Montenegro Biotechnical Faculty.

In the first part, the new curriculum will start from the general concepts and importance of agroforestry. In recent decades, the field of agroforestry is recognized as very important as a praxis which increase environmental, economic and social benefits in rural areas. EU strategies indicate a cross-sectoral, common approach to solving problems of in the loss of biodiversity, soil degradation, soil and water losses.

After the basic concepts and importance of agroforestry, a review of agroforestry practices in the region of Southeast Europe and the Western Balkans should be given, after which should be lessons regarded windbreaks/shelterbelts as the most commonly used type of agroforestry systems in the region. Since it is intended for students of agriculture, it will be also necessary to plan a few weeks for the basic terms in forestry, biomass use and wood plantation praxis.

After this, should be planed 4-5 weeks for the most used agroforestry practices in Montenegro, which are silvopastoral practices. Silvopastoralism is a usual type of production in many countries of the world. In Montenegro there are some forms of silvopastoralism, as about 60% of the territory is covered by forests. As a result, forests are found in mosaics at higher altitudes, where pastures and natural meadows predominate. Animal husbandry in the summer months is mainly based on the use of pastures at higher altitudes, i.e. on temporary summer settlements - katuns.

In these areas, forest areas are also used for livestock grazing. The animals move in the forests where they are protected from sunlight, wind, rain, etc. Therefore, in Montenegro there is silvopastoralism in this form. Due to the particular characteristics of our country (geographical and climatic), which is predominantly a land of livestock production, it is important that students in the agroforestry course have knowledge of this type of production. First of all, to see the types of silvopstoralism in the world, and also to become familiar with the represented production in our country. A special emphasis is placed on the use of katuns, which are also located at higher altitudes and are usually surrounded by different types of forests. It is also important that students learn about the establishment and management of silvopastoral systems. As part of the subject, it is important to introduce with the economics of this production system.

Within the course, special attention should be given to domestic animal breeds that make the most economical use of pasture and forest land. Studying of existing breeds of various domestic animal species is achieved by other specialties subjects at the Biotechnical Faculty of the University of Montenegro. The aim is to show the importance of certain breeds for this type of rearing and production within the agroforestry study programme. Special attention will be paid to local and autochthonous domestic breeds, which can be successfully used in such systems due to their modest nutritional and maintenance requirements. They therefore play an important role in silvopastoralism. These breeds are usually kept in an extensive or semi-extensive system that includes the use of pastures as long as weather conditions permit. There are also subsidies on national level for rearing of these native breeds and the use of these lands.

Therefore, it is necessary to give an overview of the legal framework related to this area. Insight should also be given into other possible benefits of agroforestry practices, such as: some types of beekeeping - apiforestry practices and activities related to the use of non-timber forest products.

7. LIST OF REFERENCES

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8. APPENDIX I – IMPROVED CURRICULA of Agroforestry and complementary modules at partner universities (Original documentation)

A-I: University of Belgrade, Faculty of Forestry (E10208240 - RS)

Module No-1; СИСТЕМИ АГРОШУМАРСТВА [Agroforestry systems]

Module No-2; ШУМСКЕ МЕЛИОРАЦИЈЕ 2 [Forest amelioration 2]

Module No-3; ТРГОВИНА И МАРКЕТИНГ ШУМСКИХ ПРОИЗВОДА [Trade and marketing of forest products]

A-II: University of Forestry Sofia, Bulgaria (E10200449 - BG)

Module No-4; АГРОЛЕСОВЪДСКИ СИСТЕМИ [Agroforestry systems]

A-III: University of Montenegro Biotechnical faculty, Montenegro (E10208590 - ME)

Module No-5; УКРАСНО МЕДИТЕРАНСКО БИЛЈЕ [Mediterranean ornamental plants]

Module No-6; ШУМАРСТВО U RURALNIM PODRUČJIMA [Forestry in rural areas]

A-IV: University Josip Juraj Strossmayer Faculty of Agrobiotechnical Sciences from Osijek, Croatia (E10167599 - HR)

Module No-7; АГРОШУМАРСТВО [Agroforestry]

Студијски програм : Еколошки инжењеринг у заштити земљишних и водних ресурса			
Назив предмета: СИСТЕМИ АГРОШУМАРСТВА			
Наставник/наставници: др Сара Лукић , др Јелена Белоица			
Статус предмета: обавезни			
Број ЕСПБ: 5			
Услов:			
Циљ предмета Основни циљ наставе из овог предмета је да студентима омогући стицање знања о системима коришћења земљишта у којима се шуме развијају у заједницама са пољопривредним облицима у карактеристичном просторном распореду на принципима еколошких и економских интеракција између шуме и осталих компоненти система			
Исход предмета Потпуна оспособљеност студената за примену знања из ове области у пракси, као и припрема за докторске студије.			
Садржај предмета <i>Теоријска настава</i> Улога и значај система агрошумарства у управљању одрживим коришћењем земљишног простора; Системи агрошумарства (I ниво) (различите комбинације распореда коришћења земљишта у пољопривреди и шума (шумских засада) и специјални облици); Просторни и временски распоред компоненти агрошумарства; Еколошке основе агрошумарства; Друштвени и економски аспекти; Процеси деградације земљишног простора и системи агрошумарства; Моделирање и развој система агрошумарства; Међународне, регионалне и националне стратегије, политике и закони везани за агрошумарство (UNCCD, UNCBD, EGD, New EU Forest Strategy 2030, CAP...) <i>Практична настава</i> Израда студије случаја/елaborата у малим групама (2-3 студента) за имплементацију система/праксе агрошумарства у задатим условима – анализа услова средине, предлог решења, планирање и пројектовање предложеног решења, разрада концепције за едукацију корисника и промоција праксе. Презентација студије случаја и дискусија.			
Литература 1. Nair P.K.R. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers, ICRAF 2. Riguero-Rodriguez A., McAdam J., Mosquera-Losada M.R. (2009): Agroforestry in Europe. Current State and Future Prospects. Advances in Agroforestry. Springer 3. Lukić S. (2019): Šumski zaštitni pojasevi – praktikum. Univerzitet u Beogradu Šumarski fakultet 4. Schnabel, S., Ferreira, A. (2004): Sustainability of Agrosilvopastoral Systems – Dehesas, Montados-, A Cooperating Series of the International Union of Soil Science (IUSS)			
Број часова активне наставе	Теоријска настава: 2	Практична настава: 3	
Методe извођења наставе Предавања са увођењем у литературу из ове дисциплине. Гостујућа предавања. Вежбе - кроз израду еlaborата студенти стичу практична знања за анализу услова средине, планирање и примену одговарајућих система/праксе агрошумарства у циљу остваривања еколошких и економских бенефита користећи расположиве дигиталне база података и показују личну иницијативу у решавању проблема примене система агрошумарства. Семинарски рад – кроз израду семинарског рада студенти се обучавају да претражују и користе доступну литературу за дубљу анализу задате теме, а кроз презентацију стичу вештине за промоцију праксе агрошумарства. Теренска настава			
Оцена знања (максимални број поена 100)			
Предиспитне обавезе	поена	Завршни испит	поена
активност у току предавања	10	писмени испит	-
практична настава	20	усмени испит	45
семинар-и	25		

Студијски програм : Еколошки инжењеринг у заштити земљишних и водних ресурса			
Назив предмета: ШУМСКЕ МЕЛИОРАЦИЈЕ 2			
Наставник/наставници: Сара Лукић			
Статус предмета: обавезни			
Број ЕСПБ: 5			
Услов: Одслушан предмет Шумске мелиорације 1			
Циљ предмета Овладавање мелиоративним методама за контролу еолске ерозије. Упознавање са условима средине на деградираним стаништима на кречњацима, серпентинитима, перидотитима и песковима. Основе пројектовања радова у циљу контроле деградације на деградираним стаништима и стаништима подложним деградацији.			
Исход предмета Оспособљавање за самостално сагледавање, планирање и одржавање биолошких метода контроле процеса деградације (пре свега ерозије настале антропогеним деловањем) у условима станишта деградираних у различитом степену.			
Садржај предмета <i>Теоријска настава</i> Еолска ерозија и суша као доминантни фактори деградације, процена губитака земљишта еолском ерозијом за потребе пројектовања шумских заштитних појасева. Шумски заштитни појасеви. Шумски заштитни појасеви посебне намене (пољезаштитни шумски појасеви, снегозаштитни појасеви, приобални заштитни појасеви, шумски заштитни појасеви за заштиту од буке). Шумски заштитни појасеви као елемент пракси агрошумарства. Противерозиони шумски појасеви и засади: илофилтри, колмациони појасеви, шумске капе, појасеви за заштиту малих акумулација; пројектовање и подизање. Мелиорације земљишта и вегетације на криу. Мелиорације голети на серпентиниту и перидотиту. Мелиорације камењара и других неплодних површина. Услови станишта и мелиоративни радови на земљиштима на песку. Мере неге и одржавања подигнутих засада. Агрошумарство као перспектива у мелиорацији голети. Израда завршног рада . <i>Практична настава</i> Анализа доминантних покретача еолске ерозије обрадом података из дигиталних база за одређивање просторног распореда шумских заштитних појасева. Припрема и пројектовање мреже пољезаштитних појасева (структура, распоред, избор врста). Динамика подизања пољезаштитних појасева. Планирање и пројектовање снегозаштитних појасева (одређивање структуре, распореда појасева, избор врста за снегозаштитне појасеве). Мере неге и одржавања засада. Пројектовање радова за мелиорације терена кречњацима, серпентинитима, перидотитима. Пројектовање мелиоративних радова за везивање живих пескова и искоришћавање земљишта на песковима. У оквиру предмета обавезне је стручна пракса .			
Литература Lukić S. (2019): Šumski zaštitni pojasevi – praktikum. Univerzitet u Beogradu Šumarski fakultet Дожић, С., Лујић, Р. (2005): Шумске мелиорације, ауторизована скрипта, Универзитет у Београду Шумарски факултет;			
Број часова активне наставе	Теоријска настава: 3		Практична настава: 3
Методе извођења наставе Предавања са увођењем у литературу из ове дисциплине. Вежбама студенти стичу практична знања у пројектовању шумских заштитних појасева и примени метода пошумљавања терена са неповољним условима станишта, а кроз израду семинарских радова показују личну иницијативу у решавању проблема у овој области.			
Оцена знања (максимални број поена 100)			
Предиспитне обавезе	поена	Завршни испит	поена
Активност у току предавања	10	писмени	
Практична настава	20	усмени	40
Семинарски рад	10		
колоквијум	20		

Табела 5.2 Спецификација предмета Студијски програм: Шумарство
Назив предмета: Трговина и маркетинг шумских производа
Наставник/наставници: др Љиљана М. Кеча , ред. проф.
Статус предмета: Обавезни
Број ЕСПБ: 2
Услов: Не постоји
Циљ предмета Да студенти разумеју појмове и односе у сфери робног промета, посебно из области трговине и маркетинга дрветом и недрвним шумским производима, и да омогући успешно планирање и спровођење активности везаних за пласман тих производа на тржишту, као и овладавање техникама за спровођење истраживања тржишта. Поред тога, студентима се настоје приближити концепти биономије и циркуларне економије као савремени оквири за одвијање трговине и маркетинга у области шумарства. Такође, студенти ће бити оспособљени за употребу званичних база података (Trade map, FAO, Eurostat и сл.) за потребе израде својих семинарских радова и спровођење истраживања тржишта одређених категорија (шумских) производа.
Исход предмета Располагање знањима која омогућавају да се успешно решавају задаци и проблеми из области трговине и робне размене у области шумарства, односно да се на тржишту на најбољи начин валоризује производни програм. Сечена теоријска и практична знања кроз интерпретацију наставног садржаја са проблемским приступом, добијање нових знања о трговини и маркетингу шумским производима. Упознавање са концептом биономије и циркуларне економије и овладавање приступом и коришћењем званичних база података и техникама истраживања тржишта.
Садржај предмета <i>Теоријска настава</i> Облици продаје дрвета (лицитације - врсте, оглашавање, учесници, спровођење, комплот, субмисије и продаја по шумској такси, продаја по ценовнику, дугорочни уговори), Унутрашњи робни промет (појам, врсте и актери унутрашње трговине, развој трговачке мреже унутрашње трговине дрветом и производима од дрвета), Спољнотрговински промет (структура и облици спољнотрговинског промета, историјски развој спољне трговине, режими спољне трговине и мере ограничења - стимулације, рестрикције, компензације, либерализација и стимулација извоза, везани спољнотрговински послови, послови дораде/оплемењивања и реекспорта, органи и установе у спољној трговини), Царине и шпедиција (појам, функције, врсте и улога, царинско подручје, царинска тарифа, царинске уније и контрола, појам, функције и улога шпедиције), Техника трговине дрветом (уговори о купопродаји, уговори о трговинском заступању, форме, значење појединих елемената, међународне трговинске коморе, арбитража и решавање рекламација у међународној трговини дрветом, акредитив - појам, значај и врсте акредитива, трговачка документа - транспортна документа, царинска документа, документа о осигурању робе, уверења и атести), Банке и банкарски послови, Примена стандарда у трговини дрветом, INCOTERMS правила у међународној трговини дрветом, Међународно тржиште производа шумарства, Трговинаска политика и правна регулатива (EU Timber Regulation), Међународне пословне организације, Политика развоја малих и средњих предузећа у трговини шумским производима, као и пословни и развојни потенцијал трговине Србије у сектору шумарства. Појам, врсте и функције маркетинга, методе и технике истраживања маркетинга, еволуција маркетинга и однос са шумарским сектором, 3. Маркетинг активности (тржиште, производ, дистрибуција, цена, промоција, управљање маркетингом, маркетинг окружење) и примери добре праксе 4. Маркетинг шумских производа (брендирање, сертификација и њена маркетиншка функција у шумарству, маркетинг дрвних шумских производа, маркетинг недрвних шумских производа). 5. Посебна анализа оријентације производња-пласман, купац-маркетинг, кроз практичне примере из анализе тржишта шумским производима. Концепт 4П/5П маркетинга. Животни циклус производа. B2B и C2C модели пословања. 6. Упознавање са концептом биономије и циркуларне економије, као и производњом везаном за природне (шумске) ресурсе. 7. Истраживање тржишта дрвних и недрвних шумских производа. <i>Практични настава /</i>
Литература Ранковић Н., Кеча Љ. (2011): Трговина и маркетинг шумских производа, Универзитет у Београду - Шумарски факултет, Београд ISBN 978-86-7299-185-7 Орешчанин Д., Реџић А. (1994): Трговина дрветом, I део, Шумарски факултет Универзитета у Београду Вјелић Р. (2018): Međunarodna trgovina, Ekonomski fakultet, Beograd

<p>Keča, Lj., Keča N., Marčeta M. (2015): Nedrvni šumski proizvodi, Socio-ekonomski i ekološki aspekti, Univerzitet u Beogradu, Šumarski fakultet (ISBN 978-86-7299-232-8), (270)</p> <p>Lamb C.W., Hair J.F., McDaniel C. (2013): Marketing, Data Status, Beograd (386)</p> <p>Kotler F., Vong V., Sonders Dž., Armstrong G. (2007): Principi marketinga, Mate, (932)</p>			
<p>Nunan D., Malhotra N.K., Birks, D.F. (2020): Marketing Research, Pearson UK, London (951)</p> <p>Smith-Hall C., Chamberlain J. (2022): The bioeconomy and non-timber forest products, Taylor & Francis, London, (77)</p> <p>Keswani C. (2020): Bioeconomy for sustainable development. Springer Nature Singapore Pte Ltd., (389)</p> <p>Sarstedt M., Mooi E. (2019): A Concise Guide to Market Research, The Process, Data, and Methods Using IBM SPSS Statistics, 3rd Edition, Berlin, (396)</p>			
Број часова активне наставе: 30		Теоријска настава: 30 (предавања)	Практична настава: /
Методe извођења наставе			
Предавања, дискусија на часовима, гостовање експерата, консултације, семинарски рад и студија случаја, презентације.			
Оцена знања (максимални број поена 100)			
Предиспитне обавезе	поена	Завршни испит	поена
активност у току предавања	10	писмени испит	20
практична настава		усмени испит	40
колоквијум-и		
семинар-и	30		

ИНФОРМАЦИОННА КАРТА

на дисциплината: „Агролесовъдски системи“ Код: FOR 231

Факултет: „Горско стопанство“

Специалност: „Горско стопанство“ – СГ, ЛИГС

Образователно квалификационна степен: „магистър“	Вид на курса: избираем	Курс: редовно – I заочно – II	Семестър: редовно: 2 заочно: 3
<p>Методично ръководство: Катедра: „Лесовъдство“ ЛТУ, ет. III, ст. 308, тел: 91 907, в. 265</p>	<p style="text-align: center;">Преподавателски състав:</p> <p>Лекции: доц. д.н. Красимира Петкова, проф. д-р Соня Бенчева, доц. д-р Милена Йорданова гл.ас. д-р Славчо Савев</p> <p>Лабораторни упражнения: доц. д.н. Красимира Петкова, проф. д-р Соня Бенчева гл.ас. д-р Славчо Савев</p>		<p>Брой кредити: 6</p>
<p>Цел и задачи на курса:</p> <p>Да даде подробна информация за възможностите на агролесовъдството като форма на земеползване, при която се съчетава отглеждането на дървесна и/или храстова растителност със земеделски култури и/ или животни, с която се надграждат познанията, придобити в курса по „Основи на агролесовъдството“ за ОКС „бакалавър“, специалност Горско стопанство</p>			
<p>Необходими условия: лекционна зала (мултимедия), достъп до интернет.</p>			
<p>Покриване на изискванията на Националната квалификационна рамка за Ниво 7.</p>			
<p>Съдържание на курса:</p> <p>В първата част на курса се дава информация за значението на агролесовъдството, възможностите му за приложение и класификация на агролесовъдските системи.</p> <p>Във втората част на курса се представя подробна характеристика на основните видове агролесовъдски системи за условията на умерения климат (защитни пояси, крайбрежни защитни пояси, алейна, горско-пасищна система, горско фермерство, плантации за производство на биомаса) с конкретни примери от чуждия и наш опит. Отделя се внимание на по-важните земеделски култури, подходящи за агролесовъдство, както и на домашните животни и на полезните насекоми, използвани в агролесовъдските системи.</p> <p>Специфичните растителнозащитни проблеми в агролесовъдските системи, екологичните аспекти и социално-икономическите особености на агролесовъдството са обект на третата част от курса. Студентите се запознават и със законодателството, свързано с прилагането на агролесовъдските системи.</p> <p>В упражненията студентите се запознават с методиката за проектиране и технологията на създаване, отглеждане и поддържане на различни агролесовъдски системи и изготвят курсов проект по индивидуално задание. Представят се и курсовите работи, разработени по избрана от студента тема от областта на агролесовъдството. Предвижда се занятията по тема 8 от упражненията за студентите – редовно обучение да се провеждат в УОП „Враждебна“ при реални производствени условия.</p>			

Методи на преподаване: лекции, лабораторни упражнения, практически занятия в УОП	Методи на оценяване: курсова работа – 10%; курсов проект – 30%; изпит – 60%.
Враждебна, самостоятелна работа, подготовка на курсова работа и курсов проект.	

Извадка от учебния план

Вид на занятията	Семестър		Хорариум, часове		
	PO	ЗО	PO – седмично	PO – общо	ЗО – общо
1. Лекции	II	III	2	30	15
2. Упражнения	II	III	2	30	15
3. Курсови работи	II	III			
4. Курсов проект	II	III			
5. Изпит	II	III			

Кредити по видове дейност

Редовно обучение:
1/ Аудиторна – 2 кр.;
2/ Извънаудиторна – 4 кр., курсова работа – 0,6 кр.; курсов проект – 1,0 кр.; подготовка за изпит – 2,4 кр.
Задочно обучение:
1/ Аудиторна – 1 кр.;
2/ Извънаудиторна – 5 кр.: курсова работа – 0,8 кр.; курсов проект – 1,2 кр.; подготовка за изпит – 3,0 кр.

Код на дейността	Извънаудиторна заетост	Часове	Кредити
Редовно обучение			
Д ₁	Изготвяне на курсова работа.	18	0,6
Д ₂	Изготвяне на курсов проект.	30	1,0
Д ₃	Подготовка за изпит.	72	2,4
	Общо	120	4,0
Задочно обучение			
Д ₁	Изготвяне на курсова работа.	24	0,8
Д ₂	Изготвяне на курсов проект.	36	1,2
Д ₃	Подготовка за изпит.	90	3,0
	Общо	150	5,0

СЪДЪРЖАНИЕ НА УЧЕБНАТА ПРОГРАМА

А. ЛЕКЦИИ

№	Наименование и съдържание на занятието	Ауд. часа
1.	Понятие за агролесовъдство. Необходимост и значение. Предимства и недостатъци. Класификация на агролесовъдските системи.	2
2.	Защитни пояси – основна агролесовъдска система. Значение и видове пояси. Основни параметри на защитните пояси. Влияние на защитните пояси върху микроклиматичните и почвени условия и върху продуктивността на земеделските култури и домашните животни.	2
3.	Крайбрежни защитни пояси – цели и функции, определяне на подходящи растителни видове и параметри на пояса, агротехника на създаване и отглеждане.	2
4.	Алейна система – предимства и недостатъци, основни компоненти и изисквания към тях, критерии за избор на подходящи дървесни и земеделски видове, агротехнически мероприятия, икономическа ефективност.	2
5.	Горско-пасищна система – предимства и недостатъци, основни компоненти, принципи на създаване и поддържане.	2
6.	Горско фермерство – същност и значение. Допълнителни горски продукти - обект на горското фермерство.	3
7.	Агролесовъдски системи от последователен тип – плантации за производство на биомаса, възможности и перспективи, технология на създаване и стопанисване.	2
8.	Влияние на агролесовъдските системи върху някои характеристики на основните земеделски култури (зърнено-житни, зеленчукови, зърнено-бобови, овощни, технически).	4
9.	Отглеждане на домашни животни и полезни насекоми в агролесовъдските системи.	3
10.	Екологични аспекти на агролесовъдството.	2
11.	Социално-икономически предимства и недостатъци на агролесовъдските системи.	2
12.	Специфични фитосанитарни проблеми и контрол върху вредителите в агролесовъдските системи. Възможности за използване на взаимодействията между компонентите в агролесовъдските системи.	3
13.	Законодателство, свързано с възможността за прилагане на агролесовъдски практики.	1
Общ брой часове за лекциите:		30

Б. УПРАЖНЕНИЯ



№	Наименование и съдържание на занятието	Ауд. часа
1	Технология на създаване и поддържане на защитни пояси – избор на подходящи дървесно-храстов видове състав, почвоподготовка, методи на залесяване и грижи.	2
2	Задание за курсов проект и курсова работа	2
3	Проектиране и създаване на крайбрежни защитни пояси.	2
4	Особености в технологията на създаване и отглеждане на алейната агролесовъдска система.	2
5	Особености в технологията на създаване и поддържане на горскопасищна агролесовъдска система.	2

6	Особености в технологията на създаване на горскофермерски агролесовъдски системи.	2
7	Особености в технологията на създаване и поддържане на плантации за производство на биомаса.	2
8	Характерни особености на основни земеделски култури (зърнено-житни, зеленчукови, зърнено-бобови, овощни, технически), подходящи за агролесовъдство в България	4
9	Залагане и отчитане на експеримент за съвместно отглеждане на дървесни и земеделски растения	4
10	Болести и вредители, характерни за агролесовъдските системи.	2
11	Обобщаване на резултатите от курсова работа и защита на курсови проекти.	6
Общ брой часове за упражнения:		30

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- UNCCD (United Nation Convention to Combat Desertification), 1994, <https://www.unccd.int/>

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Съставил: 
(доц. Красимира Петкова)
Ръководител катедра: 
(доц. Георги Костов)

Module No-5; UKRASNO MEDITERANSKO BILJE [Mediterranean ornamental plants]

University of Montenegro Biotechnical faculty, Montenegro	
MSc; BSc level	BSc Level
Study Course	Mediterranean fruit growing
Module	Mediterranean ornamental plants
Type of Module (mandatory; compulsory/elective)	elective
ECTS credits	5
Prerequisites; condition	no
Learning objectives; Aims	To introduce students with the types and methods of growing decorative Mediterranean plants, the production of reproductive material, erecting hedges and laying lawns. introduce students to the basic principles of agroforestry; ornamental Mediterranean plants in agroforestry systems.
Learning outcomes	The student will be able to: recognize the most important species of ornamental plants; apply knowledge and skills in the propagation of ornamental plants; suggest the optimal ways of growing ornamental plants in the Mediterranean conditions of Montenegro; recognize the importance of agroforestry, and the possibilities of using ornamental plants in agroforestry systems.; organizes maintenance of gardens.
Course Contents; Overview	<p>Theoretical part: Ornamental plants: importance and application possibilities. Basic division of ornamental plants. Ornamental plants on the Mediterranean. The origin of ornamental plants; Ornamental trees and shrubs of the Mediterranean. Basic division, coniferous species and evergreen broad-leaved trees. Use and ecological characteristics of these species; Indigenous species of evergreen broadleaved trees in greening. Ecology and significance; The most abundant /important species of introduced evergreen broadleaves on the Adriatic coast; The most important species of introduced deciduous trees on the Adriatic coast; Palm trees. Their Ecological and morphological characteristics, use; Roses, use and classification; Hedges, plant species for hedges. Types of hedges; Lawns according to purpose; Raising the lawn, sodding;</p> <p>Agroforestry, definition and significance. Main agroforestry systems; Field protective belts in agroforestry in Mediterranean and submediterranean conditions, function and importance for the crops. Ornamental trees in field protective belts. Ornamental trees in apiculture. Flowering species: importance and possibilities of application. Basic division of flowering species; Autochthonous flowering plants, and honey-bearing flowering plants. Perennial flowering species and bulbous species; Seasonal flowers (annual and biennial flowers); Potted flowers, cut flowers.</p> <p>Practical: Morphological characteristics of chosen species (from different categories of ornamental plants); The method of erecting hedges. Problems with their maintenance; Basic types of grasses, grass mixtures, maintenance; Forest vegetation in Montenegro; Indigenous flower species.</p>
Literature	<p>M.Radulović: Ukrašno mediteransko bilje (Skripta), 1-119, 2015;</p> <p>(Ornamental Mediterranean plants) Vukićević E., 1996: Dekorativna dendrologija, Univerzitet u Beogradu, Šumarski fakultet, Beograd (Decorative dendrology); Lazarević S., 2000. Gajenje i razmnožavanje baštenskog cveća (Breeding and propagation of garden plants), Mala poljoprivredna apoteka, Nolit, Beograd; Cvijanović D., Bukvić R., Lazarević S., Popović S., Simonovć V., Vujošević A., 2005, Revitalizacija i unapređenje proizvodnje cveća (Revitalization and enhancement of flower production), Institut za ekonomiku poljoprivrede, Šumarski fakultet, Poljoprivredni fakultet, Beograd; Đurovka M., Lazić B., Bajkin A., Potkonjak A., Marković V., Ilin Ž., Todorović V., 2006, Proizvodnja povrća i cveća u zaštićenom prostoru (Production of vegetables and flowers in a protected areas/ under protected condition? , Poljoprivredni fakultet Novi Sad, Poljoprivredni fakultet, Banja Luka.</p>

	Nair P.K.R. (1993): <i>An Introduction to Agroforestry</i> . Kluwer Academic Publishers, ICRAF Dožić, S., Lujčić, R. (2005): Šumske melioracije [<i>Forest amelioration</i>], autorizovana skripta, Univerzitet u Beogradu
Students Workload	Lectures: 2 hours per week (13 weeks) Practical: 1 hours per week
Teaching and learning activity/methods	Frontal teaching, student-centred learning where students are given certain tasks or chapters that they need to know.. Practical work where students learn about morphological characteristics of plant species; field visit of ornamental plants nurseries.
Assesment	Practical exam : 40 Seminar/trm paper:10 (seminarski) Oral exam: 50

**Biotehnički fakultet / AGROBIZNIS I RURALNI RAZVOJ /
ŠUMARSTVO U RURALNIM PODRUČJIMA**

Uslovljenost drugim predmetima	Nema
Ciljevi izučavanja predmeta	Upoznavanje sa složenom prirodnom šumskih ekosistema, funkcijama šuma, kao i osnovnim principima trajnog gazdovanja, korišćenja šuma i agrošumarskih praksi
Ime i prezime nastavnika i saradnika	doc.dr Milić Čurović
Metod nastave i savladanja gradiva	Predavanja, vježbe, konsultacije
I nedjelja, pred.	Uvod-Osnovni pomovi: Definicija šume
I nedjelja, vježbe	Vrste šuma: po sastavu, po postanku (šumske kulture, izdanačke šume i sjemenog porijekla), strukturi
II nedjelja, pred.	Osnovne kategorije funkcija šuma, njihov značaj i vrednovanje;
II nedjelja, vježbe	Namjena šuma
III nedjelja, pred.	Karakteristike šuma Crne Gore
III nedjelja, vježbe	Regioni, gazdinske jedinice, odjeljenje - sastojine
IV nedjelja, pred.	Zakonska regulativa u šumarstvu
IV nedjelja, vježbe	Organizacija šumarstva u Crnoj Gori
V nedjelja, pred.	Osnove dendrologije i fitocenologije
V nedjelja, vježbe	Glavne drvenaste vrste i šumske zajednice u Crnoj Gori - Latinski nazivi
VI nedjelja, pred.	Agrošumarske prakse
VI nedjelja, vježbe	Šumski zaštitni pojasevi
VII nedjelja, pred.	Osnovni principi gajenja šuma - Mjere njege i obnove šuma, Konverzija i rekonstrukcija
VII nedjelja, vježbe	Kolokvijum I
VIII nedjelja, pred.	Zaštita šuma
VIII nedjelja, vježbe	Mjere zaštite
IX nedjelja, pred.	Planiranje gazdovanja šumama
IX nedjelja, vježbe	Planovi i programi za gazdovanje šumama
X nedjelja, pred.	Građa drveta
X nedjelja, vježbe	Svojstva drveta
XI nedjelja, pred.	Primarna prerada drveta
XI nedjelja, vježbe	Proizvodi od drveta
XII nedjelja, pred.	Biomasa kao energent,
XII nedjelja, vježbe	Brzorastuće plantaže
XIII nedjelja, pred.	Nedrvni šumski proizvodi
XIII nedjelja, vježbe	Legislativa vezana za nedrvne šumske proizvode
XIV nedjelja, pred.	Lovstvo i lovna privreda
XIV nedjelja, vježbe	Organizacija lovstva u Crnoj Gori
XV nedjelja, pred.	Kolokvijum II
XV nedjelja, vježbe	Seminarski radovi
Obaveze studenta u toku nastave	pohađanje nastave i vježbi, rad kolokvijuma i testova, seminarskih radova i sl
Konsultacije	Srijeda u 12.00h

Opterećenje studenta u casovima	3+2 (6 kredita) Nedjeljno 6 kredita x 40/30 = 8 sati struktura: 3 sata predavanja 2 sata vježbi 3 sata individualnog rada studenata uključujući i konsultacije U toku semestra Nastava i završni ispit: 8 sati x 16 = 128 sati; Neophodne pripreme (administracija, upis, ovjera semestra): 2 x 8 sati = 16 sati. Ukupno opterećenje za predmet: 6 x 30 = 180 sati . Dopunski rad za
	roku uključujući i polaganje popravnog ispita od 0 do 36 sati. Struktura opterećenja: 128 sati (nastava)
Literatura	1. Medarević, M., (2008): Planiranje gazdovanja šumama; šumarski fakultet Beograd 1-401 2. Šoškić, B. (2002): Svojstva drveta. U niverziteti udžbenik Beograd. 3. Ranković N., Keča LJ. (2011): Trgovina i marketing šumskih proizvoda, U niverzitet u Beogradu - Šumarski fakultet u Beograd. 4. Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, sveučilišni
Oblici provjere znanja i ocjenjivanje	Dva kolokvijuma sa po 20 poena, seminarski rad do 5 poena, prisustvo i aktivnost tokom nastave do 5 poena i završni ispit do 50 poena Prelazna ocjena se dobija ako se sakupi ukupno više od 50 poena Ocjena (Broj poena): A (≥ 90 do 100 poena); B (≥ 80 do 90); C (≥ 70 do 80); D (≥ 60 do 70); E (≥ 50 do 60) F (manje od 50)
Posebne naznake za predmet	-
Napomena	-
Ishodi učenja	Nakon uspješno savladanog predmeta studenti će moći da: <ul style="list-style-type: none"> • Koristiti znanja o složenoj prirodnoj šumi u cilju održivog i trajnog korišćenja i gazdovanja šumama • Analizirati konkretne probleme održivog gazdovanja šumama uz poznavanje legislative iz ove oblasti • Integrirati znanja srodnih disciplina u sveobuhvatno znanje o načinu boljeg korišćenja ovih resursa • Primjenjivati agrošumarske prakse • Koristiti nedrvne šumske proizvode na održiv način • Poznavati načine proizvodnje i karakteristike proizvoda prerade drveta

AGROFORESTRY						
Course coordinator	Assoc. Prof. Vladimir Ivezić					
Study programme	Master study programme, plant production					
Course status	elective					
Year and semester	Second year, first semester					
Credits and type of lecture	ECTS	6				
	Nr. hours (L+E+S)	Lectures - 60, Exercise - 5, Seminar - 10				
COURSE DESCRIPTION						
Learning objectives	Describe agroforestry systems and their significance in the diversification of agricultural production and environmental protection. Give examples of the functions of woody species on agricultural land (windbreaks, soil purification, nutrient uptake, carbon sequestration, biodiversity and bioenergy production). Analyse the socioeconomic potential of agroforestry for rural development.					
Prerequisites for course	None					
Learning outcomes of the course						
After successfully completing the module, the student will be able to:						
9. Classify agroforestry systems and give examples of different systems and explain their significance for the diversification of agricultural production and environmental protection						
10. Describe the methods of forest management and select the most suitable woody species for agroforestry systems						
11. To connect knowledge from agriculture with newly acquired knowledge from forestry.						
12. Describe the role of agroforestry systems in mitigating the effect of greenhouse gases (carbon sequestration)						
13. To see the importance of agroforestry systems on degraded soils						
14. Analyse the socioeconomic potential of agroforestry for rural development.						
15. Identify obstacles to the establishment of agroforestry systems						
16. Create a seminar on the subject of agroforestry practice						
Evaluation of students' work during class and at the final exam						
Examination type		Oral		Written	X	Oral and written
Evaluation	ECTS			Share in the grade (%)		
Attending lectures	2,2			-		
Attending exercises	0,2			-		
Class activity, preparation for class, reflective review of class content	0,6			20%		
Seminar	0,8			25%		
Written exam	2,2			55%		
Total	6			100%		

In forming the final grade for students, continuous class attendance and activity, preparation for class, reflective review of course contents, seminar work and written exam are considered. The evaluation of the seminar paper includes the clarity, accuracy, and relevance of the written seminar information and the presentation's overall (technical and visual) quality.

Attending classes is mandatory in accordance with the regulations of J.J. Strossmayer University in Osijek. If the student is not present on more than 30% of the teaching hours, he loses the right to take the exam.

Compulsory literature

1. A. Rigueiro-Rodríguez, J. McAdam, and M.R. Mosquera-Losada (Eds.) (2009): *Agroforestry in Europe*. Springer Science + Business Media B.V. (3-89 p.; 321-349 p.)
2. A. Quinkenstein, J. Wöllecke, C. Böhm, H. Grünewald, D. Freese, B. U. Schneider, R. F. Hüttl (2009): Ecological benefits of the alley cropping agroforestry system in sensitive regions of Europe. *Env. Sci. & Policy*, 12; 1112-11214. *New direction for agriculture, forestry and fisheries, SARD-Sustainable agriculture and rural development*, Fao, p65,rome, 1995 (web adresa)
3. Tomašević, A. (1996): Vjetrozaštita Sinjskog polja. *Šumarski list* br. 1—2, CXX (1996), 19—34
4. Dimitriou, I, Rutz, D. (2015): *Kulture kratkih ophodnji – priručnik o održivom uzgoju*. WIP Renewable Energies, Munchen, Njemačka (HRV. Izdanje Energetski institut Hrvoje Požar)

Additional literature

1. P.K.Ramachandran Nair. (1993): *An Introduction to Agroforestry*. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p.
2. H. E. Garrett, W. J. Rietveld, and R.F. Fisher (2000): *North American Agroforestry: An Integrated Science and Practice*. American Society of Agronomy Inc.
3. M.R. Mosquera-Losada, D. Freese, and A. Rigueiro-Rodríguez (2011): Carbon Sequestration in European Agroforestry Systems. In: B. Mohan Kumar and P.K. Ramachandran Nair (eds): *Carbon Sequestration Potential of Agroforestry Systems*. Springer Science + Business Media B.V
4. L.E. Buck, J.P. Lassoie and E.C.M. Fernandes (1999): *Agroforestry in Sustainable Agricultural Systems*. CRC Press LLC (poglavlja: 1, 3, 5, 9, 13, 17)
5. S. Jose and A. M. Gordon (2008): *Toward Agroforestry Design – An Ecological Approach*. Springer Science + Business Media B.V. (poglavlja: 10, 16, 18)
6. Čavlović, J. (2013): *Osnove uređivanja šuma*. Izdavač: Šumarski fakultet Sveučilišta u Zagrebu, 2013, ISBN 978-953-292-028-4
7. H. Grünewald, C. Böhm, A. Quinkenstein, P. Grundmann, J. Eberts and G. von Wühlisch (2009): *Robinia pseudoacacia L.: A Lesser Known Tree Species for Biomass Production*. *Bioenerg. Res.* 2:123–133
8. H. Grünewald, B. K.V. Brandt, B. U. Schneider, O. Bensa, G. Kendzia and R. F. Hüttl (2007): *Agroforestry systems for the production of woody biomass for energy transformation purposes*. *Ecological Engineering* 29: 319–328