



AGFORWEB



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weaknesses and strengths**

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## ACRONYMS / ABBREVIATIONS

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

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## 1. OBJECTIVES AND SCOPE OF ACTIVITY

### Overall objective

The objective of the curricula analyses is to provide an overview of the existing curricula of the Agroforestry modules in the Western Balkans and to compare it with existing curricula in the field of Agroforestry in the EU countries that were proposed for analysis by the project proposal. Analyses should point out the gaps with contemporary expectations in the field of Agroforestry and to indicate the key points that need to be improved in the existing curricula. In other words, the objective is to create preconditions for curricula improvement of seven existing curricula and design of one new curriculum at University of Montenegro Biotechnical Faculty.

### Objectives of the report

The aim of the Curricula analyses report is to summarize the weaknesses and strengths of existing curricula as well as to identify which areas to highlight, improve and develop.

## 2. INTRODUCTION

*“Curriculum is a powerful lever for changing student performance and well-being, and for preparing students to thrive in and shape the future. Amid growing global debate on globalisation and migration, climate change and technological advancements, countries are revisiting questions on the kinds of competencies students need for the future and how these can best be fostered through curriculum.” [1]*

Around 2015, amid growing global debate on globalisation and migration, climate change mitigation, and technological advancements such as artificial intelligence, countries began to revisit questions on the kinds of competencies students would need for the future and how these could best be fostered through curriculum [1].

*Agroforestry* is an ecosystem-based approach that should provide solutions for the pressing global problems of environmental preservation and improvement: mitigation climate change, land degradation, biodiversity conservation and improvement of socio-economic status in the local community.

Agroforestry has a critical role and nature-based solution with the main aim of improvement of the structural and functional characteristics of agricultural systems and their long-term use.

By increasing structural landscape heterogeneity and agro-ecosystem functional complexity, enhancing habitat quality *Agroforestry* has a crucial potential in agricultural landscapes to halt and improve biodiversity on every level: landscape, ecosystem, species, and genetic level.

In that respect arises the need for education of the professionals in the field of agroforestry who should be recognized on the labour market. Agroforestry is a transdisciplinary approach that requires a wide range of knowledge in various fields such as agriculture, forestry, environment, ecology, economics, sociology. Professionals competent in the field of agroforestry should master the knowledge of state-of-the-art agroforestry systems and practices and digital skills and competences and should be able to apply knowledge and acquired skills in the sector of agriculture, forestry, environmental protection etc.

The aim of improved curricula would be to respond to the following far-reaching questions [1]:

- What kinds of knowledge, skills, attitudes and values are necessary to understand, engage with and shape a changing world towards a better future in 2030?
- What policies and practices have to be effectively considered and linked with Agroforestry to support young people's learning, skills acquisition, attitude formation and adoption of values in the context sustainable goals?

### 2.1. Competencies and key concepts of the 21<sup>st</sup> century in agroforestry curricula

Land degradation and desertification, climate change and pollution have a huge negative impact on the environment to the extent that it reflects on human well-being. Today's demands for solving environmental problems caused by growing human population and migrations, urbanization and industrialization require an approach that is based on ecological principles and favours nature-based solutions. Accordingly, there is an increasing need for professionals and increasing their competences on the knowledge and skills to solve these growing global problems.

A "**competency**" is a holistic and dynamic concept, which includes knowledge, skills, attitudes, and values [2]. To bridge the gap between "knowledge" and "skills, attitudes and values" according to OECD Education 2030 project<sup>1</sup> the actions should be taken toward:

- The knowledge that the student should acquire must be usable in terms of the ability to **apply knowledge at different cognitive levels**. In addition to mastering knowledge and skills, students should adopt attitudes and values through the teaching-learning process [3,4,5].

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<sup>1</sup>Project "The Future of Education and Skills 2030"

- Interdisciplinary competencies are in high demand today. Education toward acquiring these competences should encompass study of current policy knowledge, rising digital literacy, and training for strengthen cooperation between higher education and the local community and strengthen the link between science and practice. In that respect, it is important to provide students with functional knowledge. **Functional knowledge** is the knowledge that can be included in different domains [6] and presents any information that can be adapted and applied to different circumstances.
- Today's rapid changes in technology, science, and market demands, including the labour market, require a far-sighted view of the future needs for education of professionals in various fields. Curricula should generally be developed in such a way as to reduce the gap between today's curricula and future requirements. In the field of agroforestry and related fields, keystone for that is training students' digital skills in using and maintaining digital databases, performing analysis, and modelling for existing and newly designed agroforestry practices.

The learning framework – OECD Learning Compass 2030 [7] could be applied in higher education to educate the professionals for solving environmental problems using nature-based solution while respecting the principles of the sustainable development. In the first step, it is necessary to provide the modules in the curricula in various study programs which should provide core foundations, transformative competencies, and anticipation-action-reaction cycle as the keystones for achieving future-oriented education. This should be achieved by acquiring theoretical knowledge, practical knowledge, skills/digital skills, and policy knowledge.

- *Core foundations* should be achieved through theoretical knowledge and policy knowledge.
- *Transformative competencies* should be supported/enabled by acquiring practical knowledge, social skills and rising digital literacy.
- *Anticipation-Action-Reaction* cycle should be guided through practical work, applying digital skills and skills of reconciling dilemmas, trade-offs, and contradictions.

### 3. CRITERIA AND KEY PRINCIPLES OF CURRICULA ANALYSIS

The principles of the curriculum are norms, values, moralities, and philosophies that will benefit teachers, students, education system in order to benefit the whole society. The curriculum and instructional strategy are essential components of imparting knowledge to students in order to create professionals for overcoming the problems of contemporary society.

*Curriculum analysis* enables the identification of strengths to keep, but also the areas that have to be developed and improved [8]. Curriculum analysis encompasses analysing areas knowledge through learning objectives, learning outcomes, contents, and teaching-learning methods. Further analysis covers review of recommended literature and assessment strategy/methods.

*Learning objectives* are brief statements that describe what students will be expected to learn by the end of course [9].

*Learning outcomes* are measurable statements that articulate at the beginning what students should know, be able to do, or value as a result of taking a course [10]. Learning outcomes are descriptions of the specific knowledge, skills, or expertise that the learner will get from a learning activity [11]. Learning outcomes are measurable achievements. They reflect the obtained knowledge that student is able to understand, and also is able to understand the importance of the information and what will gain from the engagement with the learning activity. A well-written learning outcome will focus on how the learner will be able to apply their new knowledge in a real-world context, rather than on a learner being able to recite information [11].

*Course content* presents any informational material that is required for participation or understanding content such as assigned readings, video recordings, exams, and any other material needed for learning [12]. Module content is summary of the topics that module will study. In well-tailored module syllabi, module content and teaching-learning methods are adapted to enable students to achieve learning outcomes, and learning outcomes are set so that students achieve learning objectives.

*Teaching-learning methods* aims at the transmission of knowledge, imparting skills and formation of attitudes, values, and behaviour [13]. Teaching-learning methods are the broader techniques used to help students achieve learning outcomes. Teaching-learning methods help students master module content and learn how to apply the content in particular contexts [14].

*Literature* presents available and recommended references for reading and preparation of the exam.

*Assessment strategies and methods* include the ways and dynamics of evaluating student progress.

Table 1. Key principles and description of potential improvement of curricula

Key principles	Description of potential improvement
Comparison and overview of the current situation in higher education in the field of agroforestry. Indicating knowledge and skills gaps.	-To foster a range of competencies that go beyond preparing students for jobs
Possibilities for adopting an ecosystem approach to curriculum redesign and implementation.	- The sustainability of the engineering approach is made possible by integration of the ecological approach.



Key principles	Description of potential improvement
Possibilities for bringing and linking international and national environmental policies into Agroforestry curricula	<ul style="list-style-type: none"> <li>- UNCBD / Biodiversity Strategy</li> <li>- The European Green Deal, New EU Forest strategy 2030 i CAP 2021-2027.</li> <li>- Agroforestry and trees in the Nature Restoration Regulation<sup>2</sup></li> <li>- UNCCD</li> <li>- SDG/Goal 4 Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all</li> </ul>
Managing time lag between today's curriculum and future needs	- Digital skills

The development of expertise is a long process, during which theoretical, practical and metacognitive elements of expert knowledge are integrated into a coherent whole [15]. During the studying process, it is important to encourage student learning and integration of theoretical knowledge into practice, as well as the mastering of skills and software usage that will follow trends in current technology trend in order to improve work efficiency and increase student competence in labore market.

**Theoretical knowledge** in the Agroforestry implies knowledge of the fundamental principles and practices of agroforestry land use, the most common and suitable agroforestry practices in the country, as well as the recognition of ecological, economic, and social benefits of agroforestry.

**Practical knowledge** considers planning, design and managing woody components in various agroforestry practices.

**Skills/Digital skills** should include familiarity and use of current models, digital tools, databases etc.

**Policy knowledge** should be updated and aligned with international and national legislation and strategies based on the 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, etc.

Teaching-learning methods should provide translation of theoretical knowledge into practice, to balance between acquisition of basic theoretical and practical knowledge and a clearly defined connection and implications of theoretical knowledge for practical application.

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<sup>2</sup>[https://environment.ec.europa.eu/publications/nature-restoration-law\\_en](https://environment.ec.europa.eu/publications/nature-restoration-law_en)

### 3.1. Curriculum analyses methodology – EU Universities’ curricula of Agroforestry modules

Curriculum analysis is conducted with an aim of identifying the shortcomings and advantages of the existing Agroforestry module programs at universities in partner countries, as well as proposing a new curriculum for the Agroforestry module at the University of Montenegro Biotechnical faculty where Agroforestry module has not yet been established.

Curriculum analysis includes two phases: in the **first phase**, curricula of Agroforestry modules of European universities are analysed, and in the **second phase**, existing Agroforestry modules at partner universities are compared with European ones with an aim of identifying potential gaps, areas for improvement and harmonization with European trends in education in the field of agroforestry.

Curriculum analysis of agroforestry modules at European universities and universities of partner countries was conducted according to the **curriculum mapping method** developed at Cambridge University [16]. The method was adapted for curriculum analysis of agroforestry modules.

*Curriculum mapping* is a technique for indexing or diagramming a curriculum to identify and address academic gaps, redundancies, and misalignments for improvement purposes [17, 18]. A curriculum map is a document that is generated in the curriculum mapping process. Curriculum mapping method [16] for comparison of curricula propose **six key stages**:

- i. defining study aims and use,
- ii. selection of curricula for analysis,
- iii. determination of curriculum features as a basis for comparison,
- iv. collection of relevant documentation and data sources,
- v. extracting data and putting into chosen form of curriculum map and
- vi. consolidating findings through visual representation.

Curriculum analysis of the modules in the field of agroforestry of selected European universities should provide a basis for identifying potential gaps in curricula of agroforestry modules of consortium university institutions and harmonizing with trends in education in this field with curricula of other higher education institutions. As a result, an insight into trends in education in this field at European universities will be gained.

Analysis encompasses nine European universities where there are modules/subjects in the field of agroforestry: University of Greenwich, UK; Georg-August-Universität Göttingen Universität Kassel/Witzenhausen University of Kassel Faculty Organic Agricultural sciences, DE; Bangor University, UK; University of Freiburg, DE; National University of Life and Environmental Sciences of Ukraine, UA; Technical University Munich School of Life Sciences, DE; University of Reading, UK; Wageningen University and Research, NL, and University of Lisbon, PT. Selected universities are well ranked in the QS World University Rankings (Table 2).

Table 2. University ranking 2022-23 ([World University Rankings 2022-23](#) | [Global 2000 List](#) | [CWUR](#))

University	Rank				
	World	Education	Employability	Faculty	Research
University of Greenwich, UK	1281	235	1379	-	1258
University of Kassel, DE	-	-	-	1073	1122
Bangor University, UK	747	189	775	250	800
University of Freiburg, DE	108	127	215	100	161
National University of Life and Environmental Sciences of Ukraine, UA	QS World University Rankings 2023 #1201-1400				
Technical University Munich, DE	79	79	356	141	84
University of Reading, UK	245	116	122	110	398
Wageningen University & Research, NL	178	414	827	206	159

University	Rank				
	World	Education	Employability	Faculty	Research
University of Lisabon, PT	200	438	1256	234	168
University of Belgrade, SRB	348	474	-	-	316
University of Forestry Sofia, BG					
Josip Juraj Strossmayer University of Osijek, CRO	1948			1871	
University of Montenegro, MNE	QS World University Rankings 2023 #1500+				

The most relevant curriculum features were determined in the third stage of the analysis. Learning objectives, learning outcomes, contents and teaching-learning methods are detected as the key features for this analysis. These features best represent the module's effectiveness to provide students competencies for jobs that require those qualifications. In addition, recommended literature and assessment strategy/methods were reviewed.

Curricula of Agroforestry modules at European universities was collected from the module books of study programs. Then, data on selected curriculum features in third key stage is extracted and put into chosen form of curriculum map (Appendix II).

In the second phase, in the same way, the existing curricula of the consortium institutions (and other institutions in the consortium countries where there are modules in the field of agroforestry, if any) are analysed with respect to the local requirements and potential fields for improvement and harmonization with the European trend. After a review of consortium institutions' curriculum suitability and relevance follows *curriculum redesign* toward improvement and innovation.

#### 4. OVERVIEW OF THE KEY CONCEPTS IN ANALYZED EU UNIVERSITIES' CURRICULA OF AGROFORESTRY MODULES.

The Agroforestry is studied at both *study levels*: bachelor and master studies at universities in the EU. At most universities, the Agroforestry module is included in master's studies within curricula of study programs in the field Agriculture, Organic Agriculture, Plant Sciences, Sustainable Development, Sustainable Resource Management, Forest Ecology and Management, Forest and Nature Conservation. In the University of Reading, Agroforestry module is in bachelor's studies in the curriculum of the study course in the field of Agriculture.

*The status of module indicates the extent to which the subject area of the module is necessary for acquiring qualifications through study program. Mandatory modules represent the core courses of the study program that are compulsory to meet requirements of the study program. Electives are modules that students choose according to their interests.*

Agroforestry subject is **mandatory module** at 4 study programs (University of Greenwich, Georg-August-Universität Göttingen Universität Kassel/Witzenhausen University of Kassel Faculty Organic Agricultural sciences, Bangor University, and University of Lisbon School of Agriculture), and **elective module** at 5 programs (University of Freiburg, National University of Life, Environmental Sciences of Ukraine and Technical University Munich School of Life Sciences, University of Reading and Wageningen University & Research).

*Learning objectives describe what students should know or be able to do and represent the subset of learning objectives for the entire study program.*

Learning objectives of Agroforestry modules of the analysed European universities are set with an aim to students acquire knowledge in the field of agroforestry. They are divided into five areas of interest and linked to learning outcomes required to achieve them (learning objectives) (Table 3.):

Table 3. Connection of learning objectives and main groups of learning outcomes

Learning objectives	Learning outcomes (main groups)
<ul style="list-style-type: none"> <li>• 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</li> </ul>	<ul style="list-style-type: none"> <li>• Basic concept and trends in agroforestry</li> </ul>
<ul style="list-style-type: none"> <li>• 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</li> </ul>	<ul style="list-style-type: none"> <li>• Ecological interactions and effects of agroforestry systems</li> </ul>
<ul style="list-style-type: none"> <li>• Environmental benefits from agroforestry for climate change mitigation and adaptation and potential trade-offs with productivity</li> </ul>	<ul style="list-style-type: none"> <li>• Ecosystem services provision of agroforestry systems</li> <li>• Policy</li> </ul>
<ul style="list-style-type: none"> <li>• The role of woodlands in the rural sector; social and economic factors that influence adoption of agroforestry systems by farmers</li> </ul>	<ul style="list-style-type: none"> <li>• Social, economic, and cultural interactions in agroforestry systems</li> <li>• Adoption and implementation of agroforestry systems and practices</li> <li>• Policy</li> </ul>
<ul style="list-style-type: none"> <li>• Design and creation of agroforestry plantations, optimization of the ecological component of rural landscapes</li> </ul>	<ul style="list-style-type: none"> <li>• Design of agroforestry practices and maintenance of woody component in agroforestry practice</li> </ul>

In the curriculum of module **Plantation Forestry and Agroforestry** at the University of Munich goes beyond common learning objectives with two more aims to "*understand and evaluate the major issues of plantations in the context of international forest policy*" and "*assess forest management options for different purposes*

*within the framework of the international climate policy".* That is essential for the adoption of agroforestry by farmers, for recognizing agroforestry as land use pattern as well as to identify and develop concepts for mitigation projects.

*Learning outcomes* of the analysed Agroforestry modules syllabi are vary among the universities and study programs/courses.

Common learning outcomes of the Agroforestry modules in the European universities covering acquiring knowledge of:

#### Basic concept and trends in agroforestry

Students will and/or be able to:

- **Learn** basic concepts, principles, and drivers associated with agroforestry practices (University of Kassel),
- **Learn** of agroforestry and farm forestry systems (University of Freiburg),
- **Learn** and **understand** the types of agroforestry, key benefits of agroforestry, structure of agroforestry landscape (National University of Life, Environmental Sciences of Ukraine),
- **Classify** and **describe** agroforestry practices based on their components, spatial and temporal arrangement (Bangor University),
- **Understand** the fundamental principles and practices of agroforestry land use (Technical University Munich),
- **Explain** the concept of agroforestry, **describe** the diversity of agroforestry systems across the globe; **Critically evaluate** basic hypotheses in agroforestry (Wageningen University).

#### Ecological interactions and effects of agroforestry systems

Students will and/or be able to:

- **Learn** about biophysical relationships in agroforestry systems (University of Kassel),
- **Learn** about ecological interactions in agroforestry systems (University of Freiburg),
- **Learn** and **understand** types of environmental monitoring, principles of monitoring organization (National University of Life, Environmental Sciences of Ukraine),
- **Critically discuss** main tree-crop interactions and their effect on productivity (University of Greenwich),
- **Evaluate** agro-ecological interactions in agroforestry systems (Bangor University),
- **Analyze** the interactions among different components of agroforestry systems; **Assess** ecological effects of agroforestry systems and **develop** adequate management options (Technical University Munich),
- **Analyze** the ecological interactions among trees, crops and livestock and how farmers manage these for desired outcomes (Wageningen University),
- **Know** the vegetation of Portugal, in particular the woody, and **identify** landscape units; to **know** the factors that influence vegetation and the ways in which it reflects this influence through the formation of distinct communities, with emphasis on climatic constraints (University of Lisbon).

#### Ecosystem services provision of agroforestry systems

Students will and/or be able to:

- **Understand, analyze, model, simulate** and **optimize** plant production and carbon sequestration in agroforestry and farm forestry systems (University of Freiburg),
- **Learn** and **understand** agroforestry practices' place in achieving the Sustainable Development Goals (SDGs), agroforestry for Forest Landscape Restoration, contribution of agroforestry into combating climate change and its impacts, halting biodiversity loss due to functions of Windbreaks in the Landscape Ecological Network; **Learn** and **understand** wind features; **Use** in practice methods for determining the total wind protection, methods for determining the snow accumulation (National University of Life, Environmental Sciences of Ukraine),
- **Evaluate** climate mitigation and adaptation potential (University of Greenwich),
- **Demonstrate** and **justify** how agroforestry practices contribute to ecosystem services provision (Bangor University),

- **Understand** the role of woody component of agroforestry systems in global carbon cycle (Technical University Munich),
- **Identify** and **outline** the nature and potential of the main novel forms of forestry and agroforestry currently being developed (University of Reading),
- **Evaluate** the synergies and trade-offs between multiple products and services of agroforestry systems (across time and space) (Wageningen University),
- **Describe** management principles applicable to the conservation and maintenance close to nature of plant communities (University of Lisbon).

#### Social, economic, and cultural interactions in agroforestry systems

Students will and/or be able to:

- **Learn** about benefit effects of agroforestry systems on humans (University of Kassel),
- **Understand, analyse, and optimize** economical interactions in agroforestry systems (University of Freiburg),
- **Learn** and **understand** agroforestry practices for achieving food security and improved nutrition, agroforestry as a tool for sustainable agriculture promotion, challenges, and perspectives for rural youth employment (National University of Life, Environmental Sciences of Ukraine),
- **Evaluate** the potential trade-offs between environmental and productivity/ economic benefits of agroforestry (University of Greenwich),
- **Evaluate** the key agro-ecological and social-ecological interactions in agroforestry systems (Bangor University),
- **Assess** the economic effects of agroforestry systems and **develop** adequate management options (Technical University Munich),
- **Evaluate** how formal and informal socio-cultural institutions (including markets) affect agroforestry systems (Wageningen University),
- **Know** the effects of changes produced by human activities and how to minimize and mitigate them (University of Lisbon).

#### Adoption and implementation of agroforestry systems and practices

Students will and/or be able to:

- **Learn, understand, and review** the role of scientific institutions, NGO's, landowners etc. in reserve of agroforestry traditions, challenges and prospective in upgraded agroforestry practices implementation; **Analyse** experience of European countries in the implementation of agroforestry and develop prospects for the development of agroforestry in Ukraine; **Participate** in educational activities among the population to form in them ecological thinking and consciousness, attitude to nature as a unique value (National University of Life, Environmental Sciences of Ukraine),
- **Appreciate** the factors that influence the adoption of agroforestry (University of Greenwich),
- **Interpret** the scope and limitations of agroforestry practices considering local ecological and socio-economic conditions (Bangor University),
- **Address** problems in the context of rural development and identify AF-based solutions (Technical University Munich),
- **Explain** the role of forests and woodlands as commercial enterprises, and as aesthetic, recreational and environmental resources in the rural sector (University of Reading).

#### Design of agroforestry practices and maintenance of woody component in agroforestry practice

Students will and/or be able to:

- **Design** of an agroforestry system in specific contexts (in groups of 2-3), **explain** and **present** (University of Kassel),
- **Use** in practice methods of soil research, methods for determining the integrated coefficient of soil improvement. **Learn** and **understand** influence of single field protective forest strips and different systems on soil properties; **Identify** areas for modernization of technological and production processes and implement the latest information technologies (National University of Life, Environmental Sciences of Ukraine),
- **Design** an agroforestry case using an options-by-context approach (Bangor University),

- **Assess** forest management options for different purposes within the framework of the international climate policy; **identify** and **develop** concepts for mitigation projects (Technical University Munich),
- **Develop** initial plans for the planting and management of new woodlands for multi-purpose goals (University of Reading),
- **Design** an agroforestry system including management planning tailored to specific contexts and desired outcomes (Wageningen University),
- **Address** principles and techniques for conservation and restoration of ecosystems (University of Lisbon).

## Policy

Students will and/or be able to:

- **Learn, understand** and **review** of the regulatory framework, initiatives on shelterbelts and windbreaks restoration in Ukraine (National University of Life, Environmental Sciences of Ukraine),
- **Understand** and **evaluate** the major issues of plantations in the context of international forest policy (Technical University Munich),
- **Outline** the nature and influence of government policy on forestry and woodlands in the UK; **Learn** socioeconomic implications of forestry policies (University of Reading).

The need for policy knowledge was recognized still in BSc studies at the University of Reading.

In the analysed curricula of Agroforestry modules the acquired knowledge and skills are in accordance with Bloom's taxonomy at all levels: **(i)** level of Remember through learning outcomes that enable students to outline and identify, **(ii)** level of Understand through learning outcomes that enable students to describe, explain, interpret, understand and discuss, **(iii)** level of Apply through learning outcomes that enable students to present, appreciate, address, model, optimize, simulate and demonstrate, **(iv)** level of Analyse through learning outcomes that enable students to classify and analyse, **(v)** level of Evaluate through learning outcomes that enable students to assess, evaluate and justify, finally **(vi)** level of Create through learning outcomes that enable students to design and develop.

*Module content* in analysed Agroforestry modules are balanced with learning outcomes (Table 4).

Table 4. Connection of learning outcomes and contents of the analysed Agroforestry modules

Learning outcome (main groups)	Module content - topics/lessons
<p><i>Learn, understand, describe, and classify</i> the</p> <p>Basic concept and trends in agroforestry</p>	<ul style="list-style-type: none"> <li>● Techniques for characterization and evaluation of agroforestry systems (University of Kassel)</li> <li>● Introduction to agroforestry and farm forestry; Overview of land-use forms of agroforestry and farm forestry in temperate and tropical climates; Historical pathways of agroforestry and farm forestry (University of Freiburg)</li> <li>● Agroforestry as key element of land use; Structure of agroforestry landscape (National University of Life, Environmental Sciences of Ukraine)</li> <li>● What are agroforestry systems? (University of Greenwich)</li> <li>● Agroforestry classification; Temperate and tropical agroforestry systems (Bangor University)</li> <li>● Agroforestry (AF): Introduction (global land-use problems, definitions, terminology), Traditional AF Systems (Technical University Munich)</li> <li>● Agro-forestry systems; Concepts and typologies; Agroforestry systems in Europe and in the Mediterranean region: history and current trends; Agroforestry systems in Portugal: Portuguese "montados" (evergreen oak woodlands), "lameiros" (wet meadows) and "baldios" (fallow lands) as case studies (University of Lisbon)</li> </ul>
<p><i>Learn, know, identify, discuss, analyse, evaluate, assess, and develop</i> the</p> <p>Ecological interactions and effects of agroforestry systems</p>	<ul style="list-style-type: none"> <li>● Practical applications from multidisciplinary backgrounds (e.g. agroforestry science, practical planning) (University of Kassel)</li> <li>● Production characteristics of farmsteads, ecological interactions in subsystems (University of Freiburg)</li> <li>● Agroforestry monitoring (National University of Life, Environmental Sciences of Ukraine)</li> <li>● What determines whether there are productive advantages to agroforestry;</li> </ul>

Learning outcome (main groups)	Module content - topics/lessons
	<p>Tree-crop interactions in agroforestry (University of Greenwich)</p> <ul style="list-style-type: none"> <li>• Agricultural component of agroforestry systems; Food security and environmental resilience (Bangor University)</li> <li>• Interactions in AF systems; Important tree groups in AF (NFT's, MPT's, Palms) (Technical University Munich)</li> <li>• Bioclimatology and biogeography: history, principles, and concepts; Earth and Iberian biomes; Methods of vegetation analysis; Protected plant species and sites; Introduction to plant cartography; Hydrological balance and nutrient recycling in agroforestry systems (University of Lisbon)</li> </ul>
<p><i>Describe, understand, demonstrate, model, simulate, optimize, analyse, evaluate, and justify the</i> Ecosystem services provision of agroforestry systems</p>	<ul style="list-style-type: none"> <li>• Linkages to sustainability issues (e.g. climate change, water security management) (University of Kassel)</li> <li>• Co-generation of crop, animal and silvicultural products, including non-wood forest products and carbon sequestration (University of Freiburg)</li> <li>• Agroforestry for ecosystem services and environmental benefits; Methods of conducting research on wind speed and snow accumulation in field protective forest plantations (National University of Life, Environmental Sciences of Ukraine),</li> <li>• Environmental and biodiversity benefits of agroforestry; Climate mitigation potential of agroforestry (University of Greenwich)</li> <li>• Agroforestry and conservation; Food security and environmental resilience (Bangor University)</li> <li>• Forest management for carbon sequestration; Role of forests in global carbon cycle; Possible impacts of climate change on forests; Modelling Forest carbon sequestration with CO2FIX (Technical University Munich)</li> <li>• Forest ecology and climate change (University of Reading)</li> <li>• Restoration and requalification of vegetation and plant communities; Abandonment and its consequences as causes of vegetation degradation (University of Lisbon)</li> </ul>
<p><i>Learn, know, understand, optimize, analyse, evaluate, assess, and develop the</i> Social, economic, and cultural interactions in agroforestry systems</p>	<ul style="list-style-type: none"> <li>• Linkages to human well-being (University of Kassel)</li> <li>• Co-generation of crop, animal and silvicultural products, including non-wood forest products (University of Freiburg)</li> <li>• Social and economic implications of agroforestry for rural economic development (National University of Life, Environmental Sciences of Ukraine)</li> <li>• What determines whether there are productive advantages to agroforestry; Production and environmental benefits and trade-offs from agroforestry (University of Greenwich)</li> <li>• Agroforestry and livelihood systems (Bangor University)</li> <li>• Environmental, economic and socio-cultural aspects of AF (Technical University Munich)</li> <li>• Socio-economic and environmental remarks on agroforestry systems (University of Lisbon)</li> </ul>
<p><i>Interpret, explain, participate, appreciate, and address the</i> Adoption and implementation of agroforestry systems and practices</p>	<ul style="list-style-type: none"> <li>• Agroforestry practices implementation in Ukraine: current state, policy, challenges and prospective; Agroforestry as key element of land use (National University of Life, Environmental Sciences of Ukraine)</li> <li>• Adoption and socioeconomic benefits of agroforestry (University of Greenwich)</li> <li>• Important tree groups in AF (NFT's, MPT's, Palms); Legal aspects of agroforestry (Technical University Munich)</li> <li>• Forestry and woodland in UK, their historical development, main types, factors influencing them, the role of policy (University of Reading)</li> </ul>
<p><i>Identify, address, explain, present, assess, design, develop the</i> Design of agroforestry practices and maintenance of woody component in agroforestry practice</p>	<ul style="list-style-type: none"> <li>• Practical work on own agroforestry design, exploration, and critical discussion of key issues (University of Kassel)</li> <li>• Methods of planning and analysing soil research in field protective forest plantations (National University of Life, Environmental Sciences of Ukraine)</li> <li>• Planning in agroforestry; Plantation silviculture and management; Case studies and small exercises, presentation, and discussion (Technical University Munich)</li> <li>• Novel systems of forestry and agroforestry; Creating new woodlands and forests – planning for different objectives/uses; Species selection and options, planting materials and protection; Silvicultural practice; Management of existing small woodlands for multi-purpose use (University of Reading)</li> <li>• Methods of plant community restoration; phytoremediation; Case studies</li> </ul>



Learning outcome (main groups)	Module content - topics/lessons
	(restoration and requalification of woody riparian galleries, restoration and requalification after wildfire, new alternative vegetation uses as requalification tools, phytoremediation) (University of Lisbon)
<i>Learn, outline, understand, and evaluate the Policy</i>	<ul style="list-style-type: none"> <li>● Agroforestry practices implementation in Ukraine: current state, policy, challenges and prospective (National University of Life, Environmental Sciences of Ukraine)</li> <li>● International climate policy; Forest in Kyoto Protocol (KP); Flexible mechanisms of KP, REDD and REDD+, Forest management options (Technical University Munich)</li> <li>● Forestry policies in UK (University of Reading)</li> </ul>

*Teaching-learning methods* in agroforestry modules are lectures, practical work and exercises through creation of case studies, seminars, presentation of independent work, group discussions and field trips and excursions.

Lectures are the common method of teaching at all universities for analysed Agroforestry modules. In addition, at most universities, the creation of case studies is part of practical work as a teaching-learning method (University of Kassel, Bangor University, National University of Life, Environmental Sciences of Ukraine, Technical University Munich, University of Freiburg, Wageningen University). Seminars are practiced in the agroforestry module at the universities of University of Greenwich and University of Kassel. Presentations and discussions are practicing at universities University of Freiburg, Technical University Munich, University of Greenwich, University of Kassel Bangor University and Wageningen University. And field trips/excursions are conducting within agroforestry modules at the universities of University of Greenwich, the University of Freiburg, University of Reading and Wageningen University.

At the University of Kassel and Wageningen University, external speakers with diverse backgrounds are included in teaching to present agroforestry in a specific context. That kind of teaching-learning method contributes to student understanding of interdisciplinary nature of agroforestry.

*Literature.* Some universities provide a list of recommended reading materials for study. These are mainly the papers and monographs of renowned researchers and scientists in the field of agroforestry.

*Assessment* of student achievement, in most universities, is conducted through presentation, oral or written exam which weighs 50% of the grade and essay or term paper that weights the other 50% of the grade.

## 5. ANALYSIS OF EXISTING CURRICULA OF PARTNER INSTITUTIONS

### 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:
MSc; BSc level Nivo studija	MSc	BSc	BSc
Study Course Studijski program	Environmental engineering in soil and water resources protection	Environmental engineering in soil and water resources protection	Forestry
Module Naziv predmeta	Agroforestry systems	Forest amelioration 2	Trade and marketing of forest products
Type of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni	mandatory	mandatory	mandatory
ECTS credits Broj ESPB	5	5	2
Prerequisites; condition Uslov	-	Forest amelioration 1	-
Learning objectives; Aims Cilj predmeta	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 aeolian erosion, environmental conditions in degraded habitats on specific parent material such as limestones, serpentinites, peridotites 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.
Learning outcomes Ishod predmeta	Full ability to apply knowledge in this field in practice, as well as preparation for doctoral studies.	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 valorise 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 new knowledge about trade and marketing of forest products.
Course Contents; Overview	<i>Theoretical part:</i> The role and significance of the	<i>Lectures:</i> Protective Forest belts. Protective forest	<i>Theoretical part:</i> Forms of timber sales (auctions -

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
<p>Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)</p>	<p>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 components of agroforestry; Social and economic aspects; Ecological basics of agroforestry; Land degradation processes and agroforestry systems; Modelling and development of agroforestry systems. Agroforestry regional and national policies. Agroforestry future strategies. <i>Practical part:</i> Processes of soil degradation and agroforestry systems and practices (all types of protective forest belts – field shelterbelts belts, farm shelterbelts, shelterbelts for snow and noise control, biomass plantation, medicinal plants plantation, fish farming, beekeeping, livestock shelterbelts etc.); the application of certain agroforestry systems and practices in the given conditions through exercises. Modelling and development of agroforestry systems. Application of information technology and GIS in agroforestry.</p>	<p>belts for special uses (field shelterbelts, living snow fences, riparian forest belts, protective forest belts for noise control). Wind erosion and drought as dominant factors of degradation, assessment of soil losses in wind erosion for designing protective forest belts. Care and maintenance of established plantations of protective forest belts. 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. Preparation of the final paper. <i>Practical:</i> Preparation and design of living snow fences (structure, spatial distribution, species selection). Preparation and design of field shelterbelts (structure, spatial arrangement, species). Establishing and planting dynamics of field shelterbelts. Care and maintenance of protective forest belts. Design of degradation control facilities on limestones, serpentinites, peridotites. Design of amelioration facilities for binding sands and wind erosion protection. The module includes mandatory professional practice.</p>	<p>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 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</p>

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
			<p>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.</p> <p><i>Practical: -</i></p>
<p><b>Literature</b> Literatura</p>	<p>Young., A. (1991): <i>Agroforestry for soil conservation</i>, CAB International, International Council for Research in Agroforestry Nair P.K.R. (1993): <i>An Introduction to Agroforestry</i>. Kluwer Academic Publishers, ICRAF Schnabel, S., Ferreira, A. (2004): <i>Sustainability of Agrosilvopastoral Systems – Dehesas, Montados-</i>, A Cooperating Series of the International Union of Soil Science (IUSS) Riguero-Rodriguez A., McAdam J., Mosquera-Losada M.R. (2009): <i>Agroforestry in Europe. Current State and Future Prospects</i>. Advances in Agroforestry. Springer</p>	<p>Dožić, S., Lujčić, R. (2005): Šumske melioracije [<i>Forest amelioration</i>], autorizovana skripta, Univerzitet u Beogradu Velašević, V. (1970): Rejoniranje terena SR Srbije u cilju podizanja šumskih poljezaštitnih pojaseva [<i>Land suitability classification for field shelterbelts in SR Serbia</i>], doktorska disertacija, Univerzitet u Beogradu Šumarski fakultet</p>	<p>Ranković N., KečaLj. (2011): Trgovina marketing šumskih proizvoda, Univerzitet u Beogradu – Šumarski fakultet, Beograd ISBN 978-86-7299-185-7 Oreščanin D., Redžić A. (1994): Trgovina drvetom, I deo, Šumarski fakultet Univerziteta u Beogradu Bjelić P. (2018): Međunarodna trgovina, Ekonomskifakultet, Beograd 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) Lamb C.W., Hair J.F., McDaniel C. (2013): <i>Marketing</i>, Data Status, Beograd (386) Kotler F., Vong V., Sonders Dž., Armstrong G. (2007): <i>Principimarketinga</i>, Mate, (932)</p>
<p><b>Students Workload</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)</p>	<p>Lectures: 2 hours per week (13 weeks) Practical: 3 hours per week</p>	<p>Lectures: 3 hours per week (13 weeks) Practical: 3 hours per week</p>	<p>Lectures: 3 hours per week (13 weeks) Practical: -</p>
<p><b>Teaching and learning activity/methods</b> Metode izvođenja nastave</p>	<p>Lectures with introduction to the literature from this discipline. Practical knowledge and skills for</p>	<p>Lectures with an introduction to the literature from this discipline. Through practical and</p>	<p>Lectures, class discussions, consultations, seminar work and case studies.</p>

UNIVERSITY OF BELGRADE, FACULTY OF FORESTRY	Module No-1:	Module No-2:	Module No-3:
	<p>planning and application of appropriate agroforestry systems and practices in order to achieve ecological and economic benefits. Through the preparation of seminar papers, students should demonstrate a personal initiative in solving the problem of the application of the agroforestry practices.</p>	<p>exercises, students gain practical knowledge in the design of protective forest belts and ameliorative afforestation methods in areas of degraded habitats, and through the preparation of term papers, they show personal initiative in solving problems in this area.</p>	
<p><b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)</p>	<p>Activity during lectures: 10 Activity during practical: 20 Seminar/trm paper: 25 Oral exam: 45</p>	<p>Activity during lectures: 10 Activity during practical: 20 Tests: 20 Seminar/term paper: 10 Oral exam: 40</p>	<p>Activity during lectures: 10 Tests: 20 Seminar/term paper: 30 Oral exam: 40</p>

**Module No-1 Agroforestry systems** (Table 5-1): **MSc Ecological engineering for soil and water resources protection** (60 ECTS) at University of Belgrade Faculty of Forestry study program educate students for the profession and graduate profile of forestry engineer in the field of ecological engineering for soil and water resources protection who have competences for jobs of planning, design and construction of facilities for solving environmental issues: land degradation control, protection of soil and water resources, watershed management, amelioration of degraded lands and soil conservation. The Agroforestry systems module/subject is **mandatory** on *M2 - Degradation and protection of soil resources*. Through the Agroforestry systems module, students complete the competencies acquired in this study program through acquiring knowledge and skills about agroforestry as a specific land use pattern which offer nature-based solutions that has the potential to control land degradation, combat climate change and meet the SDGs.

**Learning objective** of Agroforestry system module 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 learning objectives of this module largely coincided with the learning objectives of the analysed Agroforestry courses at European universities. The potential gap in this module's curriculum is to better perceive social and economic factors that influence adoption of agroforestry systems by farmers and role of woodlands in the rural sector.

The **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. These learning outcomes should be specified in more detail through sentences that specify which abilities the student should achieve after completing the course.

The **content** of the Agroforestry systems module consists of theoretical part and practical part. In the *theoretical part* students acquire knowledge in fields of:

- 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 components of agroforestry
- Ecological basics of agroforestry
- Social and economic aspects
- Land degradation processes and agroforestry systems
- Modelling and development of agroforestry systems
- Agroforestry regional and national policies. Agroforestry future strategies.

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

- Processes of soil degradation and agroforestry systems and practices (all types of protective forest belts – field shelterbelts, farm shelterbelts, shelterbelts for snow and noise control, biomass plantation, medicinal plants plantation, fish farming, beekeeping, livestock shelterbelts etc.) and the application of certain agroforestry systems and practices in the given conditions through exercises.
- Modelling and development of agroforestry systems with the application of information technology and GIS in agroforestry.

Possibilities for curricula improvement lays in bringing and linking international and national environmental policies into Agroforestry curricula. Information and knowledge about existing legislation, where the contribution to the practice of agroforestry is recognized for the improvement of the environment and the social status of employees in rural sector, should be updated and supplemented 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.

*Teaching/learning methods* in Agroforestry systems module are:

- Lectures
- Practical exercises

- Individual preparation of the term papers (Seminar papers) with regular consultations during the preparation.

To better understand the potential of agroforestry 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.

As part of practical exercises, in small groups (2-3 students) prepare a case study, presentation and discussion should be incorporated to curriculum of Agroforestry systems module.

Although the proposed *literature* of the Agroforestry systems module is also suggested for reading at most of the analysed European universities, it needs to be supplemented with latest references as well as readings that include an overview of the agroforestry state and practices in the Western Balkans.

**Module No-2 Forest amelioration 2** (Table 5-1): The module Forest amelioration 2 is mandatory in undergraduate (BSc) study program Ecological engineering for soil and water resources protection (240 ECTS) includes learning about facilities for controlling different types of degradation, primarily water and wind erosion. Certain methods for land degradation control that are studied within this course are also recognized as elements of certain agroforestry practices. These are protective forest belts, afforestation and grassing of extremely degraded terrains in specific, most often unfavourable natural and socio-economic conditions.

**Learning objectives** of Forest amelioration 2 module are to introduce students with wind erosion control methods and facilities, environmental conditions in degraded habitats on specific parent material such as limestones, serpentinites, peridotites and sands and basics of designing of facilities for land degradation control in degraded habitats and habitats prone to degradation.

**Learning outcomes** of Forest amelioration 2 module are to enable students to independently observe, plan and maintain biological facilities for control of the degradation process (primarily erosion caused by anthropogenic impact) in degraded habitats to varying extents.

The **contents** of Forest amelioration 2 module are consisting of the theoretical and practical part. In *theoretical part* students have lectures in:

- Protective forest belts basics and protective forest belts for special uses (field shelterbelts, living snow fences, riparian forest belts, protective forest belts for noise control)
- Wind erosion and drought as dominant factors of degradation, assessment of soil losses in wind erosion for designing protective forest belts. Care and maintenance of established plantations of protective forest belts.
- 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 limestone, serpentinite, peridotite, rocky areas, and sandy habitats.

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

- Preparation and design of living snow fences (structure, spatial distribution, species selection).
- Preparation and design of field shelterbelts (structure, spatial arrangement, species). Establishing and planting dynamics of field shelterbelts. Care and maintenance of protective forest belts.
- Design of degradation control facilities on limestones, serpentinites, peridotites.
- Design of amelioration facilities for binding sands and wind erosion protection

*Teaching/learning methods* encompass:

- Lectures
- Practical exercises
- Individual preparation of term paper

Recommended **literature** includes references that mostly cover the material from this subject. 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. Considering that in the *Forest Amelioration 2* course, students learn about the elements of agroforestry practices, the connection between those elements and their place in agroforestry practices should be highlighted in the improved curriculum.

**Module No-3 Trade and Marketing of Forest Products** (Table 5-I): Subject T&M of forest products (T&M) is intended for B.Sc. 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 (NWFPs) and to enable successful planning and implementation of activities related to the marketing of these products on the market. Especially interesting is the connection of agroforestry systems and NWFPs in the sphere of organic production of organic food.

In that way the advanced program of the subject T&M should highlight the potentials of agroforestry for production of wood and NWFPs. The agroforestry potentials connected with the contents of the subject T&M could be researched in the 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) of products relevant for agroforestry, Foreign trade (structure and forms of foreign trade, historical development of foreign trade, foreign trade regimes and restriction measures, authorities and institutions in foreign trade) important for products connected with agroforestry, Customs and forwarding, Timber trade techniques relevant for agroforestry, Banks and banking operations, Application of standards in timber trade, International forestry products market, trade policy and legal regulation (EU Timber Regulation) relevant for agroforestry, international business organizations, development policy of small and medium-sized enterprises in trade in forest products particularly NWFPs in the field of agroforestry, 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 agroforestry sector, 3. Marketing activities (market, product, distribution, price, promotion, marketing management, and marketing environment) of NWFPs and examples of good practice, which is particularly important for stakeholders and farmers in the field of small and medium enterprises who are leaders in the sector of sale, processing and trade of NWFPs 4. Marketing of forest products relevant for agroforestry (branding, certification and its marketing function in forestry, marketing of wood forest products, marketing of NWFPs). 5. Special analysis of the orientation of production-placement, customer-marketing, through practical examples from the market analysis of forest products in the field of agroforestry. The concept of 4P/5P marketing which are applicable to agroforestry sector and Product life cycle.

Subject T&M of f.p. has theoretical and practical characteristics and predicted to students for B.Sc. of Forestry, stakeholders in the sector of forestry, agriculture and environment protection as well as business in different environmental, social and economic conditions. It will be used the broader techniques used to help students achieve learning outcomes, as well teaching methods help students B.Sc. module content and learn how to apply the content in particular contexts of Trade and Marketing of Forest Products relevant for agroforestry. Lectures are the common method of teaching, but the practical side of the subject will be the practical work and exercises through creation of case studies, seminars, presentation of independent work, group discussions, etc., as well as examples of good practices. Literature for the subject is provided by the University as well as a list of recommended reading materials for study. These are mainly the books (Ranković N., Keča Lj. (2011): *Trgovina i marketing šumskih proizvoda*, Univerzitet u Beogradu – Šumarski fakultet, Beograd ISBN 978-86-7299-185-7; 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)), manuals, papers and monographs of renowned researchers in the field of T&M and agroforestry.

Learning objectives and outcomes of T&M of F.P. is compatible with modules in some international Universities in Europe, as well in Turkey and Canada (Table 5 - II).



Table 5 -II. Comparison of Learning objectives and outcomes of T&M of F.P. is compatible with modules in some international Universities in Europe, as well in Turkey and Canada

Country	University	Faculty	Subject/Module	Hiperlink
<b>Bosnia and Herzegovina</b>	Univerzitet u Banja Luci	Šumarski fakultet	Trgovina drvetom	<a href="https://www.sf.unibl.org/sumarstvo-i-ciklus/">https://www.sf.unibl.org/sumarstvo-i-ciklus/</a>
<b>Croatia</b>	Univerzitet u Zagrebu	Fakultet Šumarstva i drvne tehnologije	Šumski proizvodi	<a href="https://www.sumfak.unizg.hr/hr/sumarski-odsjek/zavod-za-sumarske-tehnike-i-tehnologije/predmeti/sumski-proizvodi/">https://www.sumfak.unizg.hr/hr/sumarski-odsjek/zavod-za-sumarske-tehnike-i-tehnologije/predmeti/sumski-proizvodi/</a>
<b>Slovenia</b>	Univerzitet u Ljubljani	Biotehniška fakulteta	Grozni proizvodi	<a href="https://www.bf.uni-lj.si/sl/studij/studijski-programi/predmetnik/2020091415120959/20200914162156/gozdni-proizvodi">https://www.bf.uni-lj.si/sl/studij/studijski-programi/predmetnik/2020091415120959/20200914162156/gozdni-proizvodi</a>
<b>Macedonia</b>	Univerzitet „Sv. Kiril i Metodij“, Skoplje	Fakultet za šumarski nauki, pejzažna arhitektura i ekoinženering	Marketing i cene	<a href="https://sf.ukim.edu.mk/shumarstvo.htm">https://sf.ukim.edu.mk/shumarstvo.htm</a>
<b>Sweden</b>	Linnaeus University		Forest Products	<a href="https://lnu.se/en/course/forest-products/distance-international-part-time-spring/">https://lnu.se/en/course/forest-products/distance-international-part-time-spring/</a>
<b>Turkey</b>	University of Applied Sciences, Isparta		Forest Products and Marketing	<a href="https://obs.isparta.edu.tr/Public/EctsCourseDetails.aspx?DersNo=200200453191&amp;BolumNo=0&amp;BirimNo=20&amp;DersBolumKod=OEM-2453">https://obs.isparta.edu.tr/Public/EctsCourseDetails.aspx?DersNo=200200453191&amp;BolumNo=0&amp;BirimNo=20&amp;DersBolumKod=OEM-2453</a>
<b>Austria</b>	University of Applied Sciences, Salzburg		Markets for Forest Products	<a href="https://www.fh-salzburg.ac.at/en/study/ed/forest-products-technology-timber-constructions-bachelor/curriculum#meta-navigation-12">https://www.fh-salzburg.ac.at/en/study/ed/forest-products-technology-timber-constructions-bachelor/curriculum#meta-navigation-12</a>
<b>Germany</b>	Albert-Ludwigs-Universität Freiburg	Faculty of Environment and Natural Resources	Agro-forestry and Farm Forestry (master) Non-timber Forest Products and Bioresources (master)  Forsttechnische Produktion (osnovne studije) – Proizvodnja šumske tehnike	<a href="https://www.msc-forest-ecology-management.uni-freiburg.de/mscprogram/curriculum/elective">https://www.msc-forest-ecology-management.uni-freiburg.de/mscprogram/curriculum/elective</a>  <a href="https://www.bsc-wald.uni-freiburg.de/infos-studiengang/inf/forstbetriebliches-management">https://www.bsc-wald.uni-freiburg.de/infos-studiengang/inf/forstbetriebliches-management</a>
<b>Slovakia</b>	Technical University in Zvolen	Faculty of Forestry	Timber Trade	<a href="https://kmosl.tuzvo.sk/en/Education">https://kmosl.tuzvo.sk/en/Education</a>
<b>Greece</b>	Aristotle University of Thessaloniki	Agriculture, Forestry and Natural Environment	Forest Products Harvesting	<a href="https://qa.auth.gr/en/studyguide/600000475/current">https://qa.auth.gr/en/studyguide/600000475/current</a>
<b>Leetonia</b>	Latvia University of Life Sciences and Technologies		Forest product market	<a href="https://www.llu.lv/en/sustainable-forestry">https://www.llu.lv/en/sustainable-forestry</a>
<b>Great Britain</b>	University of Canterbury		Forest Products Marketing and International Trade	<a href="https://www.canterbury.ac.nz/courseinfo/GetCourseDetails.aspx?course=FORE426&amp;occurrence=23S1(C)&amp;year=2023">https://www.canterbury.ac.nz/courseinfo/GetCourseDetails.aspx?course=FORE426&amp;occurrence=23S1(C)&amp;year=2023</a>
<b>Canada</b>	University of British Columbia	Faculty of Forestry	Wood Products Processing	<a href="http://www.calendar.ubc.ca/VANCOUVER/courses.cfm?page=code&amp;institution=7&amp;code=WOOD">http://www.calendar.ubc.ca/VANCOUVER/courses.cfm?page=code&amp;institution=7&amp;code=WOOD</a>

## 5.2. University of Forestry (E10200449 - BG)

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

<b>UNIVERSITY OF FORESTRY</b>	<b>Module No-4:</b>
<b>MSc; BSc level</b> Nivostudija	<b>MSc</b>
<b>Study Course</b> Studijski program	<b>Forestry</b>
<b>Module</b> Nazivpredmeta	<b>Agroforestry systems</b>
<b>Type of Module (mandatory; compulsory/elective)</b> Status predmetaobavezni/izborni	<b>elective</b>
<b>ECTS credits</b> Broj ESPB	6
<b>Prerequisites; condition</b> Uslov	
<b>Learning objectives; Aims</b> Ciljpredmeta	The course is an upgrading unit of the discipline "Basics of agroforestry", included in the educational-qualification degree "Bachelor" in the program Forestry. It aims to develop the knowledge and skills of bachelors for more efficient land use by reasonably combining woody and / or shrub vegetation with agricultural crops and / or livestock animals.
<b>Learning outcomes</b> Ishodpredmeta	To acquire knowledge about agroforestry systems suitable for Bulgaria and skills to apply them in practice.
<b>Course Contents; Overview</b> Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	Detailed description of the main types of simultaneous and consistent agroforestry systems for temperate climates with specific examples from foreign and our experience. More detailed knowledge of the different agricultural crops used in the various agroforestry systems and of livestock animals as an element of agroforestry systems, as well as of the importance of useful insects in agroforestry systems. The occurrence of specific plant protection problems in agroforestry systems is noted and possibilities for their solution are indicated. An economic analysis of the productivity and efficiency of the various agroforestry systems and the prospects for their implementation are also env. In the course of seminars and practical classes students receive information about the design methodology and technology of establishment, cultivating and maintenance various agroforestry systems and prepare a coursework on an individual assignment. Students' research reports are also presented.
<b>Literature</b> Literatura	<ol style="list-style-type: none"> <li>1.Stancheva, Y., S. Bencheva, K. Petkova, K. Kalmukov, M. Milev, S. Mirchev, S. Dimitrov, S. Savev, N. Iliev. 2001. Agroforestry - a system for environmentally friendly and multifunctional use of natural resources. Publishing house at University of Forestry, Sofia, 99 (in Bulgarian).</li> <li>2.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).</li> <li>3.Stancheva, Y., K. Petkova, S. Bencheva, M. Broshtilova, K. Broshtilov, N. Tzvetkova. 2004. Agroforestry. Publishing house "Ruta", Sofia, 239 (in Bulgarian).</li> <li>4.Stancheva, Y. et al. 2008. Handbook of the entrepreneur</li> </ol>

<b>UNIVERSITY OF FORESTRY</b>	<b>Module No-4:</b>
	<p>in organic farming. Sofia, Publishing house Avangard Prima, Sofia, 216 (in Bulgarian).</p> <p>5. Stancheva, Y., K. Petkova, S. Bencheva. 2015. Agroforestry. Publishing house Avangard Prima, Sofia, 225 (in Bulgarian).</p> <p>6. Stancheva, Y., K. Petkova, S. Bencheva. 2015. A secure future for global crop production, Gora, 6–7, 16–17 (in Bulgarian).</p> <p>7. Alexandrov, A., K. Genov. 2001. Agroforestry in Bulgaria. Third Balkan Scientific Conference, Sofia, 2–4.10.2001, I, 278–284.</p> <p>8. Kachova, V., G. Hinkov, E. Popov, L. Trichkov, R. Mosquera-Losada. 2016. Agroforestry in Bulgaria: history, presence status and prospects. Agroforest Syst. doi:10.1007/s10457-016-0029-6.</p> <p>9. Trichkov, L., V. Kachova. 2016. Necessity, opportunities and priorities for development of agroforestry in Bulgaria. Forestry ideas, vol. 22, № 1 (51): 3–15.</p>
<b>Students Workload</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)	full time 30/30 part time 15/15
<b>Teaching and learning activity/methods</b> Metode izvođenja nastave	lectures, seminars, and practical courses
<b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)	research report – 15%, coursework – 25%, written exam – 60%.

**Module No-4 (Table 5-III):** The Agroforestry Systems discipline is included in the master's programmes of the specialisations 'Forest Management' and 'Forest use and economics', part of the Forestry specialism at the University of Forestry, Sofia, and contains a total number of 90 credits. It is elective course and is worth 6 credits. The discipline expands on the students' knowledge, acquired in the disciplines included in the curriculum: Forest Policy, Multifunctional Forest Management, Forest Protection, Forest Plantations, Stormwater Management.

**Learning objective:** The aim of the course is to give students sufficient knowledge about agroforestry as a form of land use in which tree and/or shrub species, agricultural crops and/or animals are grown together, and which can contribute to mitigating the effects of climate change. The course also has an impact on improving the environment, preserving the landscape and biodiversity, providing additional opportunities for farmers. The stated goals largely coincide with those of other European universities.

**Learning outcomes:** at the end of the course, the students acquire knowledge about agroforestry systems, suitable for application in Bulgaria and the necessary skills to apply them in their future practice. This information should be included in the curricula.

**The main teaching-learning methods** are lectures, seminars and practical classes, development of course work and a research report.

The theoretical part of the curricula **contains** the following important topics:

- Agroforestry concept. Classification of agroforestry systems.
- Main types of agroforestry systems suitable for application in Bulgaria – alley cropping, sylvopastoral system, protective forest belts, riparian forest buffers, forest farming, biomass plantations.
- Ecological aspects of agroforestry
- Socio-economic features of agroforestry
- Specific phytosanitary problems and pest control in agroforestry systems
- Main characteristics of major agricultural crops and domestic animals suitable for rearing in agroforestry systems

During seminars and practical classes, students get acquainted with the design methodology and the technology of establishment, growing and maintaining different agroforestry systems and prepare coursework, based on an individual assignment. Research reports with topics from the field of agroforestry are also developed and presented. Full-time students attend the Training and experimental field centre of the University of Forestry and learn on-site basic agronomic practices applicable in agroforestry.

For a more complete introduction to the various possibilities of agroforestry - lecturers, specialists in agronomy and plant protection are invited as guest speakers.

A notable omission in the curriculum is the insufficient information on legislation. It is also necessary to update the topic of environmental aspects in the field of agroforestry, which should be supplemented with information on UNCCD (United Nation Convention to Combat Desertification), UNCBD (United Nation Convention of Biological Diversity), The European Green Deal (EGD), New EU Forest Strategy 2030. The list of available literature in the field of agroforestry in Europe and the neighbouring Balkan countries should also be updated.

### 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 Nivo studija	BSc Level	MSc
Study Course Studijski program	Mediterranean fruit growing	Interdisciplinary studies - Agribusiness and rural development
Module Naziv predmeta	Mediterranean ornamental plants	Forestry in rural areas
Type of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni	elective	mandatory
ECTS credits Broj ESPB	5	6
Prerequisites; condition Uslov	no	No
Learning objectives; Aims Cilj predmeta	To introduce students with the types and methods of growing decorative Mediterranean plants, the production of reproductive material, erecting hedges and laying lawns.	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.
Learning outcomes Ishod predmeta	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; organizes maintenance of gardens.	After successfully completing the course, students will be able to: <ul style="list-style-type: none"> <li>• Use knowledge about the complex nature of the forest for the purpose of sustainable and permanent use and management of forests</li> <li>• Analyse specific problems of sustainable forest management with knowledge of legislation in this area</li> <li>• Integrate the knowledge of related disciplines into a comprehensive knowledge of how to better use these resources</li> <li>• Use non-timber forest products in a sustainable manner</li> <li>• Know the production methods and characteristics of wood processing products</li> </ul>
Course Contents; Overview Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	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 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	attending classes, doing colloquiums and tests, homework, seminar papers, etc  The role and importance of forest and forestry practices in rural areas.  Knowledge of the forestry disciplines

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; Flowering species: importance and possibilities of application. Basic division of flowering species; 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>	
<b>Literature</b> Literatura	<p>M. Radulović: Ukasno mediteransko bilje (Skripta), 1-119, 2015; Vukićević E., 1996: Dekorativna dendrologija, Univerzitet u Beogradu, Šumarski fakultet, Beograd; Lazarević S., 2000. Gajenje i razmnožavanje baštenskog cveća, Mala poljoprivredna apoteka, Nolit, Beograd; 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; 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.</p>	<ol style="list-style-type: none"> <li>1. Medarević, M., (2008): Forest management planning; Faculty of Forestry Belgrade 1-401</li> <li>2. Šoškić, B. (2002): Properties of wood. University textbook Belgrade.</li> <li>3. Ranković N., Keča Lj. (2011): Trade and marketing of forest products, University of Belgrade - Faculty of Forestry in Belgrade.</li> </ol>
<b>Students Workload</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)	<p>Lectures: 2 hours per week (13 weeks, ili 15 weeks ukupno) Practical: 1 hours per week</p>	<p>Lectures: 60 Practical work: 15</p>
<b>Teaching and learning activity/methods</b> Metode izvođenja nastave	<p>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.</p>	<p>Teaching, individual and group work of students, preparation of seminar papers, consultations</p>
<b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)	<p>Practical exam: 40</p> <p>Seminar/trm paper: 10 (seminarski) Oral exam: 50</p>	<p>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</p>

**Module No-5: Mediterranean fruit growing** (Table 5-IV) Study course at Biotechnical faculty University of Montenegro were created in response to the needs of agriculture and society in Mediterranean (and submediterranean) part of Montenegro. It educates students about overall plant production in this region, with emphasis on fruit growing, as a prevailing agricultural activity and important economic branch. Study courses use elementary knowledge from basic natural sciences and agriculture. Students/engineers will have some knowledge about biology and physiology of Mediterranean fruit species (as well as about their morphology). They will have a competence in application of agro-technical measures in the plantations of Mediterranean fruit species and the production of planting material, including soil preparation, selection of varieties and forms, adequate pest, and disease management/control, harvesting; as well as application of cultivation technology based on the principles of ecological production. Module **Mediterranean ornamental plants** is elective and includes learning about ornamental plants suitable for growing in this region. It deals mainly with woody ornamental plants (trees and shrubs). Attention is paid to the morphology and biology of selected ornamental plant species, production of their reproductive material; but also, on use of woody ornamental plants in the landscape, in the city green areas and private gardens, as well as in erecting hedges and laying lawns. It was created due to increased needs and interest on ornamental plants along the popular and touristic places along the Adriatic coast, having on mind different environmental and ecology aspects. (Similar topic is missing in national curricula).

Learning objectives and outcomes of study course Mediterranean fruit growing is partly compatible with modules in some Universities from Mediterranean region as University of Zadar (Croatia) and University of Alicante (Spain), who carry out study course Mediterranean agriculture. Considering the selected ornamental plants (narrow and just basic selection), learning objectives and outcomes of module Mediterranean ornamental plants is combined from different modules which belongs to the domain of the study course Landscape architecture and horticulture (at Faculty of Forestry University of Belgrade, as well as on the same study courses all over the Europe).

Considering that students learn about: not only ornamental but native tree species and their use, more attention will be paid on environmental issues, tree's importance, and functions. Students will learn about the elements of agroforestry practice; topics related to protective forest belts will be highlighted, and possibilities of use of autochthonous ornamental, forest, and fruit species in ecological restoration. List of recommended literature will be revised (with references related to protective forest belts, and similar).

**Module No-6 Forestry in rural areas** (Table 5-IV): The interdisciplinary master's academic studies Agribusiness and rural development were 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 agrarian economy, agroforestry and agribusiness. Within the program, academic skills related to analysing and creating agrarian policy, making appropriate decisions, etc. will be mastered.

After successfully completing the course, students will be able to:

- Recognize the importance of theoretical and practical knowledge in the field of agribusiness and rural development;
- Apply acquired knowledge in the field of agribusiness and rural development;
- have knowledge of agrarian policy and legislation;
- Organise the work process on farms (family farms)
- Evaluate projects of sustainable integral rural development;
- Develop new business ideas;
- Manage relevant scientific research in the field of agribusiness and rural development.

#### 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 Nivo studija	MSc level
Study Course Studijski program	
Module Naziv predmeta	Agroforestry
Type of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni	elective
ECTS credits Broj ESPB	6
Prerequisites; condition Uslov	none
Learning objectives; Aims Cilj predmeta	Describe agroforestry systems and their significance for the diversification of agricultural production and environmental protection.
Learning outcomes Ishod predmeta	Classify agroforestry systems and give examples of different systems and explain their significance for the diversification of agricultural production and environmental protection.
Course Contents; Overview Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	Lectures/field work/seminars Topics: Description and definition of agroforestry systems; Interaction of crops and trees; Modeling agroforestry systems; seminar
Literature Literatura	- 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.) - P.K. Ramachandran Nair. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p. - 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; 1112-1121
Students Workload Broj časova aktivne nastave (teorijska nastava/praktična nastava)	Lectures: 60 Seminar: 10 Filed work: 5
Teaching and learning activity/methods Metode izvođenja nastave	Frontal teaching, student-centred learning where students are given certain tasks or chapters that they need to present, field work where students conduct measurements and analysis of gathered data.
Assesment Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)	written exam and seminar

**Module No-7: Agroforestry** (Table 5-V): Due to the increased need for the creative application of knowledge and connection of different areas, the social community seeks the appearance of experts with appropriate knowledge and skills within the agricultural, forestry, and agroforestry areas. This need is additionally manifested in the need to train personnel who will educate the new generations and thus prepare them for the upcoming requirements and challenges based on the knowledge that encourages the preservation and sustainable management of agricultural land. In order to adequately respond to the demands of modern society and to contribute to its development, there is a necessary need in the education system to train personnel who can respond to both technological and market requirements. In this context, it is effective to



combine basic knowledge in the field of agroforestry with a strong emphasis on the application of this knowledge to the demands of the modern market, in order to enable students to acquire knowledge and skills that follow current progress and enable their future success and fruitful work.

The proposed 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. In this way, the student acquires the skills and competencies and will be able to:

- Explain the concept of agroforestry, classify agroforestry systems and give examples of different systems and explain their significance for the diversification of agricultural production and environmental protection.
- Describe the ways of managing agroforestry systems and choose the agricultural and woody species most suitable for agroforestry systems
- Recognize key woody species used in agroforestry systems based on morphological characteristics.
- Observe the importance of agroforestry systems on degraded soils and their role in mitigating the negative effect of climate change.
- Analyse the socioeconomic potential of agroforestry for rural development.
- Identify obstacles to the establishment of agroforestry systems

Through lectures, field practice, and independent preparation of the final seminar, students gain the necessary practical experience and become familiar with the application of acquired knowledge. A sufficient number of agroforestry courses at EU level enables the students to participate in the exchange between EU institutions.

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. The new curriculum will be improved by the contribution of the new lecturer, a research expert in the field of silvopastoral systems. Silvopastoral systems are the most common agroforestry systems in Europe, expanding the curricula on this topic in more detail will make agroforestry course in Croatia more compatible with courses of other Universities in Europe. The new curricula will also emphasize a bit more the aspect of environmental protection in the field of agroforestry as well as the legal aspects of land management for carbon sequestration. Such course with new curricula will ensure that students gain knowledge about the achievements of modern cultivation and sustainable agriculture production, with an increased emphasis on the impact on society and nature protection

## 6. FINAL CONSIDERATIONS AND PLAN OF FURTHER ACTIVITIES

Based on the analysis, the main observed gaps and guidelines for improving the curriculum are 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.

## 7. LIST OF REFERENCES

1. OECD. Brochure: Curriculum (re)design A series of thematic reports from the OECD Education 2030 project. OECD;2020
2. OECD. Technical Report: Curriculum Analysis of the OECD Future of Education and Skills 2030. OECD; 2020.
3. Bloom B.S. Taxonomy of Educational Objectives, handbook on cognitive domain. New York. David McKay Co.Int.; 1956.
4. Armstrong, P. Bloom's Taxonomy. Vanderbilt University Center for Teaching. 2010. Retrieved [February 24, 2023] from <https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/>
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## 8. APPENDIX I – EXISTING CURRICULA at partner university institutions

### 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 4 - 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 У RURALNIM ПОДРУЧЈИМА [Forestry in rural areas]

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

Module No-7; АГРОШУМАРСТВО [AGROFORESTRY]

## 9. APPENDIX II – Review of existing curricula of Agroforestry courses at EU universities

**APPENDIX I – EXISTING CURRICULA at partner university institutions (Original documentation)**

**Табела 5.2. Спецификација предмета**

<b>Студијски програм :</b> Еколошки инжењеринг у заштити земљишних и водних ресурса			
<b>Назив предмета:</b> СИСТЕМИ АГРОШУМАРСТВА			
<b>Наставник/наставници:</b> <a href="#">др Сара Лукић</a> , <a href="#">др Јелена Белонца</a>			
<b>Статус предмета:</b> обавезни			
<b>Број ЕСПБ:</b> 5			
<b>Услов:</b>			
<b>Циљ предмета</b> 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			
<b>Исход предмета</b> Потпуна оспособљеност студената за примену знања из ове области у пракси, као и припрема за докторске студије.			
<b>Садржај предмета</b> <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; Друштвени и економски аспекти; Еколошке основе агрошумарства; Процеси деградације земљишног простора и системи агрошумарства; Моделирање и развој система агрошумарства. <i>Практична настава</i> Процеси деградације земљишног простора и системи агрошумарства (сви типови шумских заштитних појасева - пољезаштитни појасеви, појасеви за заштиту фарми и саобраћајница од ветра/снега, буке и прашине, плантажно гајење биомасе, плантажно гајење лековитих биљака, узгој рибе, пчеларство, ремизе за дивљач и др.); Планирање и израда елабората за примену одређених система агрошумарства у задатим условима. Моделирање и развој система агрошумарства.			
<b>Литература</b> 1. Young., A. (1991): Agroforestry for soil conservation, CAB International, International Council for Research in Agroforestry 2. Nair P.K.R. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers, ICRAF 3. Schnabel, S., Ferreira, A. (2004): Sustainability of Agrosilvopastoral Systems – Dehesas, Montados-, A Cooperating Series of the International Union of Soil Science (IUSS) 4. Riguero-Rodriguez A., McAdam J., Mosquera-Losada M.R. (2009): Agroforestry in Europe. Current State and Future Prospects. Advances in Agroforestry. Springer			
<b>Број часова активне наставе</b>	<b>Теоријска настава: 2</b>	<b>Практична настава: 3</b>	
<b>Методe извођења наставе</b> Предавања са увођењем у литературу из ове дисциплине. Вежбама студенти стичу практична знања за планирање и примену одговарајућих система агрошумарства у циљу остваривања еколошких и економских бенефита, а кроз израду семинарских радова показују личну иницијативу у решавању проблема примене система агрошумарства.			
<b>Оцена знања (максимални број поена 100)</b>			
<b>Предиспитне обавезе</b>	поена	<b>Завршни испит</b>	поена
активност у току предавања	10	писмени испит	-
практична настава	20	усмени испит	45
семинар-и	25		

**Табела 5.2. Спецификација предмета**

<b>Студијски програм :</b> Еколошки инжењеринг у заштити земљишних и водних ресурса			
<b>Назив предмета:</b> ШУМСКЕ МЕЛИОРАЦИЈЕ 2			
<b>Наставник/наставници:</b> <a href="#">Сара Лукић</a>			
<b>Статус предмета:</b> обавезни			
<b>Број ЕСПБ:</b> 5			
<b>Услов:</b> Одслушан предмет Шумске мелиорације 1			
<b>Циљ предмета</b> 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.			
<b>Исход предмета</b> 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.			
<b>Садржај предмета</b> <i>Теоријска настава</i> <i>Шумски заштитни појасеви. Шумски заштитни појасеви посебне намене (пољезаштитни шумски појасеви, снегозаштитни појасеви, приобални заштитни појасеви, шумски заштитни појасеви за заштиту од буке). Еолска ерозија и суша као доминантни фактори деградације, процена губитака земљишта еолском ерозијом за потребе пројектовања шумских заштитних појасева. Мере неге и одржавања подигнутих засада. Противерозиони шумски појасеви и засади: илофилтри, колмациони појасеви, шумске капе, појасеви за заштиту малих акумулација; пројектовање и подизање. Мелиорације земљишта и вегетације на кришу. Мелиорације голети на серпентиниту и перидотиту. Мелиорације камењара и других неплодних површина. Услови станишта и мелиоративни радови на земљиштима на песку. Израда <a href="#">завршног рада</a>.</i>  <i>Практична настава</i> <i>Припрема и пројектовање снегозаштитних појасева (одређивање структуре, распореда појасева, избор врста за снегозаштитне појасеве). Припрема и пројектовање мреже пољезаштитних појасева (структура, распоред, избор врста). Динамика подизања пољезаштитних појасева. Мере неге и одржавања. 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 <a href="#">стручна пракса</a>.</i>			
<b>Литература</b> Дожић, С., Лујић, Р. (2005): Шумске мелиорације, скрипта, Универзитет у Београду Шумарски факултет; Велашевић, В. (1970): Рејонирање терена СР Србије у циљу подизања шумских пољезаштитних појасева, докторска дисертација, Београд;			
<b>Број часова активне наставе</b>	<b>Теоријска настава: 3</b>	<b>Практична настава: 3</b>	
<b>Методe извођења наставе</b> 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.			
<b>Оцена знања (максимални број поена 100)</b>			
<b>Предиспитне обавезе</b>	поена	<b>Завршни испит</b>	поена

активност у току предавања	<b>10</b>	писмени испит	
практична настава	<b>20</b>	усмени испт	<i>40</i>
колоквијум-и	<b>20</b>	.....	
семинар-и	<b>10</b>		
Начин провере знања могу бити различити наведено у табели су само неке опције: (писмени испити, усмени испт, презентација пројекта, семинари итд.....			
*максимална дужна 2 странице А4 формата			



**Табела 5.2 Спецификација предмета**

<b>Студијски програм:</b> Шумарство			
<b>Назив предмета:</b> Трговина и маркетинг шумских производа			
<b>Наставник:</b> Љиљана М. Кеча			
<b>Статус предмета:</b> Обавезан			
<b>Број ЕСПБ:</b> 2			
<b>Услов:</b> /			
<b>Циљ предмета</b> 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.			
<b>Исход предмета</b> 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.			
<b>Садржај предмета</b> <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, Трговинска 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 шумарских 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. <i>Практична настава</i> /			
<b>Литература</b>			
Ранковић Н., Кеча Љ. (2011): Трговина и маркетинг шумских производа, Универзитет у Београду - Шумарски факултет, Београд ISBN 978-86-7299-185-7			
Орешчанин Д., Рецић А. (1994): Трговина дрветом, I део, Шумарски факултет Универзитета у Београду			
Bjelić P. (2018): Međunarodna trgovina, Ekonomski fakultet, Beograd			
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)			
Lamb C.W., Hair J.F., McDaniel C. (2013): Marketing, Data Status, Beograd (386)			
Kotler F., Vong V., Sonders Dž., Armstrong G. (2007): Principi marketinga, Mate, (932)			
<b>Број часова</b> активне наставе: 30	<b>Теоријска настава:</b> 30 (предавања)	<b>Практична настава</b> /	
<b>Методe извођења наставе</b> Предавања, дискусија на часовима, консултације, семинарски рад и студија случаја.			
<b>Оцена знања (максимални број поена 100)</b>			
<b>Предиспитне обавезе</b>	поена	<b>Завршни испит</b>	поена
активност у току предавања	10	писмени испит	20
практична настава		усмени испит	40
колоквијум-и		.....	
семинар-и	30		



**UNIVERSITY OF FORESTRY**

**FACULTY OF FORESTRY**

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**Approved:**

Dean: .....  
(Assoc. Prof. Marius Dimitrov, PhD)

**COURSE SYLLABUS**

**AGROFORESTRY SYSTEMS**

Course Prefix and Number: **FOR 231**

Credits: **6**

INCLUDED IN CURRICULUM OF PROGRAM: **FORESTRY**

DEGREE: **MASTER**

FORM OF EDUCATION: **FULL-TIME and PART-TIME**

DEPARTMENT: **SILVICULTURE.**

April, 2022

## INFORMATION CARD

For the course: **Agroforestry systems**

Code: **FOR 231**

**Faculty of Forestry**

Program: **Forestry**

<b>Degree: MASTER</b>	Type of the course: elective	Year: Full-time: I Part-time: II	Semester: Full-time: 2 Part-time: 3
Methodical guidance: Department: Silviculture University of Forestry, floor III, room 337, tel.: 91 907 ext. 273	Teaching staff: Lectures: Assoc. Prof. Krasimira Petkova DSc; Prof. Sonya Bencheva PhD; Prof. Nikolina Tzvetkova PhD; Assoc. Prof. Milena Yordanova PhD Exercises/seminars: Assoc. Prof. Krasimira Petkova DSc; Prof. Sonya Bencheva PhD, Assoc. Prof. Milena Yordanova PhD		Credits: 6
<p><b>Course objectives:</b></p> <p>The course is an upgrading unit of the discipline "Basics of agroforestry", included in the educational-qualification degree "Bachelor" in the program Forestry. It aims to develop the knowledge and skills of bachelors for more efficient land use by reasonably combining woody and / or shrub vegetation with agricultural crops and / or livestock animals.</p>			
<p><b>Requirements:</b></p> <p>Lecture room (multimedia), internet access</p>			
Meeting the requirements of the National Qualifications Framework for Level 7			
<p><b>Course description:</b></p> <p>Detailed description of the main types of simultaneous and consistent agroforestry systems for temperate climates with specific examples from foreign and our experience. More detailed knowledge of the different agricultural crops used in the various agroforestry systems and of livestock animals as an element of agroforestry systems, as well as of the importance of useful insects in agroforestry systems. The occurrence of specific plant protection problems in agroforestry systems is noted and possibilities for their solution are indicated. An economic analysis of the productivity and efficiency of the various agroforestry systems and the prospects for their implementation are also envisaged.</p> <p>In the course of seminars and practical classes students receive information about the design methodology and technology of establishment, cultivating and maintaince various agroforestry systems and prepare a coursework on an individual assignment. Students' research reports are also presented. It is envisaged that the classes on topics 3, 5 and 9 of the course with seminars for students - regular training will be held at the Vrazhdebna Training and experimental field centre under real production conditions.</p>			
<p><b>Teaching methods:</b> lectures, seminars and practical courses</p>		<p><b>Assessment methods:</b> research report – 15%, coursework – 25%;, written exam – 60%.</p>	

### Excerpt from the curriculum

Type of activity	Semester		Class hours		
	Full-time	Part-time	Full-time, weekly	Full-time, total	Part-time, total
1. Lectures	II	III	2	30	15
2. Seminars	II	III	2	30	15
3. Coursework	II	III			
4. Course project	II	III			
5. Exam	II	III			

### Credits by type of activity

**Full-time:**

- 1) Contact credit hours – 2 credits;
- 2) Out-of-class credit hours – 4 credits: coursework – 0,6 credits, course project – 1,0 credits, exam – 2,4 credits.

**Part-time:**

- 1) Contact credit hours – 1,0 credits;
- 2) Out-of-class credit hours – 5,0 credits: coursework – 0,8 credits, course project – 1,2 credits, exam – 3,0 credits.

Code of activity	Out-of-class activities	Hours	Credits
<b>Full-time</b>			
A <sub>1</sub>	Preparation of coursework	18	0,6
A <sub>2</sub>	Preparation of course project	30	1,0
A <sub>3</sub>	Preparation for exam	72	2,4
	<b>Total:</b>	<b>120</b>	<b>4,0</b>
<b>Part-time</b>			
A <sub>1</sub>	Preparation of coursework	24	0,8
A <sub>2</sub>	Preparation of course project	36	1,2
A <sub>3</sub>	Preparation for exam	90	3,0
	<b>Total:</b>	<b>150</b>	<b>5,0</b>

**CONTENT OF SYLLABUS**  
**A. LECTURES**

№	Title and content	Class hours
1.	Concept of agroforestry. Need and importance. Advantages and disadvantages. Classification of agroforestry systems	2
2.	Shelterbelts - the main agroforestry system. Meaning and types of belts. Basic shelter belt parameters. Influence of shelterbelts on microclimate and soil conditions and on the productivity of crops and domestic animals	2
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	2
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	2
5.	Silvopastoral system - advantages and disadvantages, basic components, principles of establishment and maintenance	2
6.	Forest farming - essence and meaning. Additional forest products - subject to forest farming	2
7.	Agroforestry systems from consistent type – biomass production plantations, opportunities and prospects, technology of establishment and management	2
8.	Influence of agroforestry systems on some characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical)	4
9.	Relationships between components in agroforestry systems - positive and negative	2
10.	Ecological advantages and disadvantages of agroforestry systems	2
11.	Socio-economic advantages and disadvantages of agroforestry systems	2
12.	Ecology of useful insects and their importance for agroforestry systems	2
13.	Characteristics of livestock animals used in agroforestry systems	2
14.	Specific phytosanitary problems and pest control in agroforestry systems	2
<b>Total lectures:</b>		<b>30</b>

**B. SEMINARS AND PRACTICAL COURSES**

№	Title and content	Class hours
1.	Technology of establishment and maintenance of shelterbelts - choice of suitable tree and shrub composition, soil preparation, methods of afforestation and care	2
2.	Design and establishment of river-bank shelterbelts	2
3.	Features in the technology of establishment and cultivation of alley agroforestry system	2
4.	Features in the technology of establishment and cultivation of silvopastoral agroforestry system	2
5.	Features in the technology of establishment and cultivation of forest farming agroforestry system	2
6.	Features in the technology of establishment and cultivation of biomass production plantations	2
7.	Assignment for course work	2
8.	Influence of agroforestry systems on some characteristics of the basic agricultural crops (cereals, vegetables, leguminous, fruit, technical)	6
9.	Ecology of useful insects and their importance for agroforestry systems	2
10.	Characteristics of livestock animals used in agroforestry systems	2
11.	Specific phytosanitary problems and pest control in agroforestry systems	4
12.	Acceptance of course work and defense of a course project	2

**Literatur**

1. Stancheva, Y., S. Bencheva, K. Petkova, K. Kalmukov, M. Milev, S. Mirchev, S. Dimitrov, S. Savev, N. Iliev. 2001. Agroforestry - a system for environmentally friendly and multifunctional use of natural resources. Publishing house at University of Forestry, Sofia, 99 (in Bulgarian).
2. 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).
3. Stancheva, Y., K. Petkova, S. Bencheva, M. Broshtilova, K. Broshtilov, N. Tzvetkova. 2004. Agroforestry. Publishing house "Ruta", Sofia, 239 (in Bulgarian).
4. Stancheva, Y. et al. 2008. Handbook of the entrepreneur in organic farming. Sofia, Publishing house Avangard Prima, Sofia, 216 (in Bulgarian).
5. Stancheva, Y., K. Petkova, S. Bencheva. 2015. Agroforestry. Publishing house Avangard Prima, Sofia, 225 (in Bulgarian).
6. Stancheva, Y., K. Petkova, S. Bencheva. 2015. A secure future for global crop production, Gora, 6–7, 16–17 (in Bulgarian).
7. Alexandrov, A., K. Genov. 2001. Agroforestry in Bulgaria. Third Balkan Scientific Conference, Sofia, 2–4.10.2001, I, 278–284.
8. Kachova, V., G. Hinkov, E. Popov, L. Trichkov, R. Mosquera-Losada. 2016. Agroforestry in Bulgaria: history, presence status and prospects. Agroforest Syst. doi:10.1007/s10457-016-0029-6.
9. Trichkov, L., V. Kachova. 2016. Necessity, opportunities and priorities for development of agroforestry in Bulgaria. Forestry ideas, vol. 22, № 1 (51): 3–15.

April, 2022

Prepared by: .....  
(Assoc. Prof. Krasimira Petkova DSc)Head of Department: .....  
(Assoc. Prof. Georgi Kostov PhD)

Naziv predmeta: <b>Ukrasno mediteransko bilje</b>				
Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova
	<b>Izborni</b>	III	5	2+1

**Studijski program za koji se organizuje:** Osnovne primjenjene studije Mediteransko voćarstvo, 6 semestara (180 kredita)

Uslovljenost drugim predmetima: Nema

Ciljevi izučavanja predmeta: Upoznati studente sa vrstama i načinom gajenja ukrasnog mediteranskog bilja, proizvodnji sadnog materijala, podizanju živih ograda i zasnivanju travnjaka.

Ime i prezime nastavnika i saradnika: Dr Jelena Lazarević

Metod nastave i savladavanja gradiva: Predavanja, vježbe, seminarski rad, kolokvijumi i završni ispit.

Sadržaj predmeta:

I nedelja	Ukrasno bilje: značaj i mogućnosti primene. Osnovna podela ukrasnog bilja. Ukrasno bilje na Mediteranu. Poreklo ukrasnog bilja. Šumska vegetacija Crne Gore.
II nedelja	Ukrasno drveće i žbunje Mediteana . Osnovna podela, četinarske vrste i zimzeleni lišćari .
III nedelja	Autohtone vrste zimzelenih lišćara u ozelenjavanju
IV nedelja	Najzastupljenije vrste introdukovanih zimzelenih lišćara na Jadranskom primorju
V nedelja	Najzastupljenije vrste introdukovanih lišćara na Jadranskom primorju
VI nedelja	Palme, Kolokvijum I
VII nedelja	Ruže, upotreba ruža Klasifikacija ruža.
VIII nedelja	Žive ograde, biljne vrste za žive ograde. Vrste živih ograda i problemi kod njihovog održavanja
IX nedelja	Travnjaci prema nameni. Vrste trava, travne smeše.
X nedelja	Podizanje travnjaka, busenovanje, održavanje travnjaka
XI nedelja	Cvetne vrste: značaj i mogućnosti primene. Osnovna podela cvetnih vrsta. Autohtone cvetne vrste
XII nedelja	Višegodišnje cvetne vrste i lukovičaste vrste
XIII nedelja	Sezonsko cveće (jednogodišnje I dvogodišnje cveće)
XIV nedelja	Saksijsko cvijeće, rezano cvijeće Kolokvijum II
XV nedelja	TERENSKI Obilazak: Obilazak proizvođača ukrasnog bilja
XVI i XVII nedelja	Završni ispit

#### OPTEREĆENJE STUDENTA

<p><u>Nedeljno</u></p> <p>Struktura: 4 kredita x 40/30= 5 sati i 20 minuta</p> <p>Struktura: - 2 časa predavanja - 1 čas vježbi uključujući kolokvijume - 2 časa i 20 min. samostalnog rada -</p>	<p><u>U semestru</u></p> <p><u>U semestru</u></p> <p><b>Nastava i završni ispit:</b> 5 sati i 20 min. x 16 = 85 sati i 20 min</p> <p><b>Neophodne pripreme</b> prije početka semestra (administracija, upis, ovjera) 2 x 5 sati i 20 min. = 10 sati i 40 min.</p> <p><b>Ukupno opterećenje</b> za predmet: <b>4 x 30 = 120 sati</b></p> <p><b>Dopunski rad</b> za pripremu ispita u popravnom roku uključujući i polaganje popravnog ispita od 0 do 30 sata</p> <p><b>Struktura opterećenja:</b> 85 sati (nastava), 10 sati i 20 min. (priprema) i 24 sati i 40 min. (dopunski rad)</p>
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Navesti obaveze studenta u toku nastave: Studenti su obavezni da pohađaju nastavau i vježbe. Kolokvijum.

#### Literatura:

M.Radulović: Ukrasno mediteransko bilje (Skripta), 1-119,

Vukićević E., 1996: Dekorativna dendrologija, Univerzitet u Beogradu, Šumarski fakultet, Beograd

Lazarević S., 2000. Gajenje i razmnožavanje baštenskog cveća, Mala poljoprivredna apoteka, Nolit, Beograd

Cvijanović D., Bukvić R., Lazarević S., Popović S., Simonovć V., Vujošević A., 2005, Revitalizacija i unapreenje proizvodnje cveća, 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, Poljoprivredni fakultet Novi Sad, Poljoprivredni fakultet, Banja Luka;

Oblici provjere znanja i ocjenjivanje:

- Seminarski rad: 10 bodova
  - Kolokvijum: (2 x 20) 40 bodova
  - Završni ispit: 50 bodova
- Prelazna ocjena se dobija kada se sakupi najmanje 51 bodova

Posebnu naznaku za predmet: Predavanja se izvode u učionici i na terenu

Ime i prezime koji je pripremio podatke: Dr Jelena Lazarević

**Ishodi učenja:** Student će nakon položenog ispita biti u mogućnosti da:

- prepoznaje važnije vrste ukrasnog bilja, primijeni znanja i vještine u razmnožavanju ukrasnog bilja
- predloži najbolje načine gajenja ukrasnog bilja u mediteranskim uslovima Crne Gore
- planira i organizuje uređenje vrtova i bašta



Naziv predmeta:		ŠUMARSTVO U RURALNIM PODRUČJIMA			
Šifra predmeta	Status predmeta	Semestar	Broj ECTS kredita	Fond časova	
	Obavezni	I	6	3+2	
<b>Studijski programi za koje se organizuje : Master studije – AGROBIZNIS I RURALNI RAZVOJ (studije traju 4 semestra, 120 ECTS kredita)</b>					
<b>Uslovljenost drugim predmetima:</b> Nema					
<b>Ciljevi izučavanja predmeta:</b> Upoznavanje sa složenom prirodom šumskih ekosistema, funkcijama šuma, kao i osnovnim principima trajnog gazdovanja i korišćenja šuma.					
<b>Ishodi učenja:</b> Nakon uspješno savladanog predmeta studenti će moći da: <ul style="list-style-type: none"> <li>• Koristiti znanja o složenoj prirodi šume u cilju održivog i trajnog korišćenja i gazdovanja šumama</li> <li>• Analizirati konkretne probleme održivog gazdovanja šuma uz poznavanje legislative iz ove oblasti</li> <li>• Integrisati znanja srodnih disciplina u sveobuhvatno znanje o načinu boljeg korišćenja ovih resursa</li> <li>• Koristiti nedrvne šumske proizvode na održiv način</li> <li>• Poznavati načine proizvodnje i karakteristike proizvoda prerade drveta</li> </ul>					
<b>Ime i prezime nastavnika i saradnika:</b> dr Milić Čurović					
<b>Metod nastave i savladanja gradiva:</b> Predavanja, vježbe teoretske i praktične, konsultacije i ostali nastavni sadržaji.					
<b>Plan:</b>					
Nedelje					
I	Uvod-Osnovni pomovi: Pojam šume, vrste šuma, po sastavu, po postanku (šumske kulture, izdanačke šume i sjemenog porijekla), strukturi (jednodobne, prebirne i šume oplodne sječe), uzgojnom obliku (visoke i niske) i dr.				
II	Osnovne kategorije funkcija šuma, njihov značaj i vrednovanje; Namjena šuma				
III	Karakteristike šuma Crne Gore				
IV	Zakonska regulativa u šumarstvu i organizacija šumarstva u Crnoj Gori				
V	Dendrologija i fitocenologija				
VI	KOLOKVIJUM				
VII	Osnovni principi gajenja šuma				
VIII	Zaštita šuma				
IX	Planiranje gazdovanja šumama				
X	Svojstva drveta i primarna prerada drveta				
XI	Biomasa kao energent, brzorastuće plantaže				
XII	Nedrvni šumski proizvodi i legislativa vezana za tu oblast				
XIII	KOLOKVIJUM				
XIV	Lovstvo i lovna privreda				
XV	Završni ispit				
<b>Odgovornost studenata u toku semestra:</b> pohađanje nastave i vježbi, rad kolokvijuma i testova, seminarskih radova i sl					
<b>Konsultacije:</b>					
<b>OPTEREĆENJE STUDENATA</b>					
<u>Nedjeljno</u> 4 kredita x 40/30 = 5.3 sati struktura: 2 sata predavanja 1 sat vježbi 1,3 sata individualnog rada studenata (pripreme vježbi, izrada seminarskog rada) uključujući i konsultacije)		45+15 (60) Nastava i završni ispit: 5,3 sati x 16 = 96 sati; Neophodne pripreme (administracija, upis, ovjera semestra): 2 x 5,3 sati = 10,6 sati ; Ukupno opterećenje za predmet: 4 x 30 = 120 sati . Dopunski rad za pripreme ispita u popravnom roku uključujući i polaganje popravnog ispita od 0 do 42 sata. Struktura opterećenja: 96 sati (nastva) + 10 sati (priprema) + 14 sata (dopunski rad)			
<b>Literatura:</b>					
<ol style="list-style-type: none"> <li>1. Medarević, M., (2008): Planiranje gazdovanja šumama; šumarski fakultet Beograd 1-401</li> <li>2. Šoškić, B. (2002): Svojstva drveta. Univerzitetski udžbenik Beograd.</li> <li>3. Ranković N., Keča LJ. (2011): Trgovina i marketing šumskih proizvoda, Univerzitet u Beogradu - Šumarski fakultet u Beograd.</li> </ol>					
<b>Oblici provjere znanja i ocjenjivanje:</b>					
dva kolokvijuma sa po 20 poena, seminarski rad do 5 poena, prisustvo i aktivnost tokom nastave do 5 poena i završni ispit sa 50 poena. Prelazna ocjena se dobija ako se sakupi kumulativno više od 50 poena					
Ocjena	A	B	C	D	E
Broj Poena	90-100	80-89	70-79	60-69	50-59
<b>Posebnu naznaku za predmet:</b>					
<b>Ime i prezime nastavnika koji je pripremio podatke:</b> dr Milić Čurović					
<b>Napomena:</b>					

OZNAKA MODULA: **DBI**  
**Diplomski studij: Bilinogojstvo**  
SEMESTAR: **2**

ECTS BODOVI: **6**  
SATNICA: **75**  
MODUL **u bloku, izborni**

NAZIV MODULA: **AGROŠUMARSTVO**  
KOORDINATOR: **izv. prof. dr. sc. Vladimir Ivezic**

NAČINI PROVOĐENJA NASTAVE: **predavanja, vježbe**  
NAČINI PROVJERE ZNANJA: **usmeni ispit, pismeni ispit, seminar**

PREDUVJETI POLAGANJA ISPITA: **nema**

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SADRŽAJ MODULA:

Agrošumski sustavi i primjena drvenastih šumskih kultura u poljoprivredi. Ekološki i ekonomski aspekt agrošumarstva. Seminar.

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CILJ MODULA:

Upoznati agrošumske sustave te njihov značaj za diversifikaciju poljoprivredne proizvodnje i zaštite okoliša. Definirati funkciju drvenastih vrsta na poljoprivrednom zemljištu (vjetрозаштитни pojasevi, pročišćavanje tla, unos hraniva, sekvastracija ugljika, biološka raznolikost te proizvodnja bioenergije). Analizirati socioekonomski potencijal agrošumarstva za ruralni razvoj.

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TEMATSKE CJELINE:

1.	NAZIV: <b>Agrošumski sustavi</b>	SATNICA: <b>15</b>
	PREDAVAČ: <b>izv. prof. dr. sc. Vladimir Ivezic</b>	
	NASTAVA: <b>predavanja</b>	
	SADRŽAJ: Osnovna podjela agrošumskih sustava i njihove funkcije. Prakticiranje agrošumarstva u Europi i svijetu te njihova uloga u zaštiti okoliša. Zakonska legislativa vezana za agrošumarstvo.	
2.	NAZIV: <b>Poljoprivredne i šumske kulture u agrošumarstvu</b>	SATNICA: <b>30</b>
	PREDAVAČ: <b>izv. prof. dr. sc. Vladimir Ivezic</b>	
	NASTAVA: <b>predavanja</b>	
	SADRŽAJ: Odabir poljoprivrednih i šumskih vrsta pri zasnivanju kombiniranih nasada. Tehnološki aspekti pripreme tla, sadnje i održavanja nasada. Dizajn i gustoća sklopa. Fiziologija biljnih vrsta u agrobiotopu kombiniranih nasada. Utjecaj na mikroklimu te kvalitetu vode i tla. Sekvastracija ugljika i smanjenje stakleničkih plinova. Biološka raznolikost. Značaj agrošumskih sustava za održivi razvoj u poljoprivredi.	
3.	NAZIV: <b>Modeliranje agrošumskih sustava</b>	SATNICA: <b>10</b>
	PREDAVAČ: <b>izv. prof. dr. sc. Vladimir Ivezic</b>	
	NASTAVA: <b>predavanja, vježbe</b>	
	SADRŽAJ: Upoznati studente s agrotehničkim parametrima koji utječu na prinos poljoprivrednih i šumskih kultura te na poboljšanje kvalitete tla. Modeliranje odnosa poljoprivrednih i šumskih kultura. Modeli prinosa, kratkoročni (jednogodišnji) i dugoročni (višegodišnji) modeli.	
4.	NAZIV: <b>Seminar iz agrošumarstva</b>	SATNICA: <b>20</b>
	PREDAVAČ: <b>izv. prof. dr. sc. Vladimir Ivezic</b>	
	NASTAVA: <b>predavanja, seminari</b>	
	SADRŽAJ: Seminar na jednu od ponuđenih tema (studenti također mogu i sami izabrati temu koja se bavi problematikom agrošumarstva).	

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OBAVEZNA LITERATURA:

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. P.K.Ramachandran Nair. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p.
  3. 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; 1112-1121
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DOPUNSKA LITERATURA:

1. H. E. Garrett, W. J. Rietveld, and R.F. Fisher (2000): North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy Inc.
  2. 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
  3. L.E. Buck, J.P. Lassoie and E.C.M. Fernandes (1999): Agroforestry in Sustainable Agricultural Systems. CRC Press LLC (poglavljja: 1, 3, 5, 9, 13, 17)
  4. S. Jose and A. M. Gordon (2008): Toward Agroforestry Design – An Ecological Approach. Springer Science + Business Media B.V. (poglavljja: 10, 16, 18)
  5. 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
  6. 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
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MODULE CODE: **DBI**  
**Master's degree: Plant Production**  
SEMESTER: **2**

ECTS CREDITS: **6**  
HOURS: **75**  
MODULE **blocked, general elective**

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NAME OF THE MODULE: **AGROFORESTRY**  
COORDINATOR: **ass. prof. dr. sc. Vladimir Ivezić**

TYPES OF LECTURE: **lecture, practical**  
ASSESSMENT: **oral exam, written exam, seminar**

PREREQUISITE: **none**

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MODULE CONTENT:

Agroforestry systems and use of tree species in agriculture. Ecological and economical aspects of agroforestry. Seminar.

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LEARNING OBJECTIVES:

Definition and classification of agroforestry systems and their effect on diversification of agricultural production and environment. Define function of wood species in agroforestry systems. (windbreaking, soil purification, nutrient cycling, carbon sequestration, biodiversity, economic benefits). Discuss management practices, economic and policy strategies. Analyse socioeconomic potential for rural development.

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COURSES:

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1.	NAME:	<b>Agroforestry systems</b>	HOURS: <b>15</b>
	LECTURERS:	<b>ass. prof. dr. sc. Vladimir Ivezić</b>	
	LECTURE:	<b>lecture</b>	
	CONTENT:	Definition and classification of agroforestry systems. Current status of agroforestry in Europe and the world. Policy issues and legislation. Role of agroforestry in sustainable agriculture.	
2.	NAME:	<b>Crops and trees used in agroforestry</b>	HOURS: <b>30</b>
	LECTURERS:	<b>ass. prof. dr. sc. Vladimir Ivezić</b>	
	LECTURE:	<b>lecture</b>	
	CONTENT:	Crop and tree species used in alley cropping. Technical aspects of planting and maintenance. Design and planting density. Physiology of plant species in alley cropping. Impact on microclimate, soil and water quality. Carbon sequestration and positive impact on greenhouse gases. Biodiversity. Importance of agroforestry systems for sustainable development.	
3.	NAME:	<b>Modeling agroforestry systems</b>	HOURS: <b>10</b>
	LECTURERS:	<b>ass. prof. dr. sc. Vladimir Ivezić</b>	
	LECTURE:	<b>lecture, exercise</b>	
	CONTENT:	Determine main agro-technological parameters controlling the yield of agroforestry cultures and improvement of soil quality. Modelling the relationship between crops and tree species. Short and long term yield modelling.	
4.	NAME:	<b>Agroforestry seminar</b>	HOURS: <b>20</b>
	LECTURERS:	<b>ass. prof. dr. sc. Vladimir Ivezić</b>	
	LECTURE:	<b>lecture, seminar</b>	
	CONTENT:	Students are required to write a seminar on one of the proposed topics or they can come up with their own topic relevant to the course.	

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#### RECOMMENDED LITERATURE:

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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. P.K.Ramachandran Nair. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p.
  3. 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; 1112-1121
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#### ADDITIONAL READINGS:

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1. H. E. Garrett, W. J. Rietveld, and R.F. Fisher (2000): North American Agroforestry: An Integrated Science and Practice. American Society of Agronomy Inc.
  2. 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
  3. L.E. Buck, J.P. Lassoie and E.C.M. Fernandes (1999): Agroforestry in Sustainable Agricultural Systems. CRC Press LLC (chapters: 1, 3, 5, 9, 13, 17)
  4. S. Jose and A. M. Gordon (2008): Toward Agroforestry Design – An Ecological Approach. Springer Science + Business Media B.V. (chapters: 10, 16, 18)
  5. 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
  6. 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
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APPENDIX II. AGROFORESTRY MODULE ON EUROPEAN UNIVERSITIES

PART 1

UNIVERSITY	UNIVERSITY OF GREENWICH	GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN UNIVERSITÄT KASSEL/WITZENHAUSEN UNIVERSITY OF KASSEL FACULTY ORGANIC AGRICULTURAL SCIENCES	BANGOR UNIVERSITY
MSc; BSc level Nivo studija	MSc module	MSc module	MSc module
Study Course/Program Studijski program	Agriculture for Sustainable Development	Agriculture, Ecology and Society	Agroforestry and Food Security
Module Naziv predmeta	<b>Agroforestry</b>	<b>Agroforestry</b>	<b>Agroforestry Systems and Practices</b>
Status of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni		<b>Type of Module:</b> mandatory <b>Module Applicability:</b> Mandatory module according to §10 (7) Examination Regulations Master AGES	<b>Compulsory Module</b>
ECTS credits Broj ESPB	<b>Credits - 15</b>	<b>Credits - 6</b>	<b>Credits - 20</b>
Prerequisites; condition Uslov		<b>Recommended (Content) Prerequisites for Taking the Module:</b> none	
Learning objectives; Aims Cilj predmeta	<p><b>Aims</b> - Agroforestry systems offer alternative production options for farmers providing a diversity of products and supporting ecological processes that support sustainable production. <b>The course will introduce students</b> to the concept and different types of agroforestry, how the interaction between trees and crops determines the productivity and functioning of the system, the potential trade-offs between productivity and environment, the climate adaptation and mitigation potential of agroforestry, and finally the social and economic factors that affect their adoption by farmers.</p> <p>The course aims to:</p> <ul style="list-style-type: none"> <li>• Present the concept of agroforestry and the different ways in which it has been applied across the world.</li> <li>• Analyse the interactions between crops and trees in agroforestry systems and how this affects productivity.</li> <li>• Explore the environmental benefits of agroforestry and potential trade-offs with productivity.</li> </ul> <p>Understand the climate mitigation and adaptation potential of agroforestry.</p> <ul style="list-style-type: none"> <li>• Understand the social and economic factors that influence adoption of agroforestry systems by farmers</li> </ul>		

UNIVERSITY	UNIVERSITY OF GREENWICH	GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN UNIVERSITÄT KASSEL/WITZENHAUSEN UNIVERSITY OF KASSEL FACULTY ORGANIC AGRICULTURAL SCIENCES	BANGOR UNIVERSITY
<b>Learning outcomes</b> Ishod predmeta	<b>Learning outcomes</b> On successful completion of this module a student will be able to: 1 Critically discuss the main tree-crop interactions and their effect on productivity. 2 Evaluate the climate mitigation and adaptation potential of agroforestry. 3 Evaluate the potential trade-offs between environmental and productivity/ economic benefits of agroforestry. 4 Appreciate the factors that influence the adoption of agroforestry.	<b>Educational Outcomes, Competencies, Qualification Objectives:</b> This course introduces students to the basic concepts and current trends in the science and practice of agroforestry systems in temperate and tropical regions. Students will learn the basic concepts, principles, and drivers associated with agroforestry practices. A number of external speakers with diverse backgrounds will develop seminars focused on case studies of agroforestry in specific contexts, from a multidisciplinary and innovative perspective. Students will learn about the different biophysical relationships, and the benefit effects on humans and the environment. The socio-cultural systems that influence the management and sustainability of these systems will also be highlighted, as well as current challenges related to global and social change. An own design of an agroforestry system (in groups of 2-3) with written explanation and presentation will complete the module and as an exam performance will show if the principles covered in the course have been understood and can be implemented.	<b>Learning outcomes</b> – Students are able to classify and describe agroforestry practices based upon their components and their various spatial and temporal arrangements. - Students are able to demonstrate and justify how agroforestry practices can contribute to ecosystem service provision at multiple scales of analysis. - Students are able to evaluate the key agro-ecological and social-ecological interactions in agroforestry systems. - Students are able to interpret the scope and limitations of agroforestry practices taking into account local ecological and socio-economic conditions and use these to design an agroforestry case using a options-by-context approach.
<b>Course Contents; Overview</b> Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	<b>Indicative content</b> <ul style="list-style-type: none"> <li>• What are agroforestry systems?</li> <li>• What determines whether there are productive advantages to agroforestry</li> <li>• Tree-crop interactions in agroforestry</li> <li>• Environmental and biodiversity benefits of agroforestry</li> <li>• Production and environmental benefits and trade-offs from agroforestry</li> <li>• Climate mitigation and adaptation potential of agroforestry</li> <li>• Adoption and socioeconomic benefits of agroforestry</li> </ul>	<b>Course Contents:</b> This module provides participants with multidisciplinary insights into the ecological and social components of agroforestry systems and practices. This module will provide an overview on the agroforestry science and focus will be on the study of the: 1. techniques for characterization and evaluation; 2. practical applications from multidisciplinary backgrounds (e.g., agroforestry science, practical planning); 3. linkages to sustainability issues (e.g., climate change, water security management, or human well-being). Students will implement the principles they learnt in an own agroforestry design. Key issues will be explored and critically discussed.	<b>Overview - Agroforestry classification;</b> Biophysical principles and interactions; Agroforestry and livelihood systems; Food security & environmental resilience; Agricultural components of agroforestry systems; Temperate and tropical agroforestry systems; Agroforestry and conservation
<b>Literature</b> Literatura		<b>Literature:</b> <i>Jose, S.</i> 2009. Agroforestry for ecosystem services and environmental benefits: an overview. <i>Agroforest Systems</i> 76:1–10. <i>Fagerholm, N., et al.</i> 2016. A systematic map of ecosystem services assessments around European agroforestry. <i>Ecological Indicators</i> , 62:47–65. <i>Montagnini, F.</i> <i>Advances in Agroforestry</i> . Book Series: 2004 – 2017. <i>Integrating Landscapes: Agroforestry for Biodiversity Conservation and Food Sovereignty</i> . Springer.	
<b>Students Workload (contact hours)</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)		<b>Students Workload:</b> 180 hours, of which 60 contact hours	
<b>Teaching and learning activity/methods</b> Metode izvođenja nastave	<b>Teaching and learning activity</b> - Lectures, class-room debates, field visits, student seminars.	<b>Types of Courses</b> – Seminar 60h <b>Teaching and Learning Methods (Types of Teaching and Learning)</b> - Lecture, Seminar	
<b>Assessment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)	<b>Assessment</b> Presentation: 50% weighting, 50% pass mark. Learning Outcomes: 1 & 4. 15 minutes. Assessment of sustainability characteristics of an agroforestry system.	<b>Examination: Presentation (approx. 20 minutes, 50%) and Term paper (max. 10 pages, 50%)</b> <b>Examination requirements:</b>	Assessment strategy - threshold -- (C); good -- (B); excellent --(A) – with detailed explanation. Assessment method for each method given Assessment type; Description; Weighting; Due date

UNIVERSITY	UNIVERSITY OF GREENWICH	GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN UNIVERSITÄT KASSEL/WITZENHAUSEN UNIVERSITY OF KASSEL FACULTY ORGANIC AGRICULTURAL SCIENCES	BANGOR UNIVERSITY
	<p>Essay: 50% weighting, 50% pass mark. Learning Outcomes: 2 &amp; 3. 2000 words. 3 questions from 5.</p> <p>Nature of FORMATIVE assessment supporting student learning: Group exercise to analyse over 10 papers on Land Equivalent Ratios, tree-crop interactions and economic performance of Agroforestry.</p>	<p>Knowledge of the main concepts and characteristics of agroforestry systems and understanding of the role of different practices and human management in the sustainability of future landscapes.</p>	



**PART 2**

UNIVERSITY	UNIVERSITY OF FREIBURG	NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE	TECHNICAL UNIVERSITY MUNICH SCHOOL OF LIFE SCIENCES
<b>MSc; BSc level</b> Nivo studija	MSc	MSc	MSc
<b>Study Course</b> Studijski program	International MSc in Forest Ecology and Management	<b>Education academic program</b> Forest Management in Eastern Europe	Sustainable Resource Management
<b>Module</b> Naziv predmeta	<b>Agro-forestry and Farm Forestry</b>	<b>Agroforestry systems, practices, technologies</b> (sastoji se od 3 pod-predmeta)	<b>Plantation Forestry and Agroforestry</b>
<b>Status of Module (mandatory; compulsory/elective)</b> Status predmeta obavezni/izborni	elective	elective	elective
<b>ECTS credits</b> Broj ESPB	10	5	5
<b>Prerequisites; condition</b> Uslov			none
<b>Learning objectives; Aims</b> Cilj predmeta	<b>Relevance of the module</b> Development cooperation in rural areas requires in-depth understanding of farm forestry and agroforestry systems, based on practical experiences and modelling. Apart from this, the acquired skills and knowledge, e.g. regarding model formulation, linear optimisation, or CO2 sequestration provide a useful basis in many job situations.	Description of the course The aim of the discipline "Agroforestry systems, practices, technologies" is to study the impact of woody plant species on improving soil conditions and environment, increasing the agro-landscapes by creating different types of agroforestry plantations, their spatial location in agro-landscapes and urban landscapes and management of agroforestry landscapes. The objectives of the discipline are: - acquisition of skills to apply the theoretical knowledge obtained in the learning process on agroforestry, phytomelioration, urban ecology. - gaining experience in the ability to substantiate agroforestry approaches to the design and creation of agroforestry plantations, optimization of the ecological component of rural landscapes.	
<b>Learning outcomes</b> Ishod predmeta	<b>Learning goals and qualifications</b> Knowledge of agroforestry and farm forestry systems, understanding of historical development of such systems, ecological-technical-economical interactions, carbon sequestration and development perspectives. Skills in analysis, modelling, simulation and optimisation of agroforestry and farm forestry systems with emphasis on plant production, economics, carbon sequestration and project development.	<b>Program learning outcomes:</b> PLO 2. Know the basic concepts at the level of the latest achievements forestry, sustainable development, and scientific methodology knowledge. PLO 6. Be able to communicate in a foreign language in scientific, industrial, and social spheres of activity. PLO 13. Identify areas for modernization of technological and production processes and implement the latest information technologies. PLO 16. Participate in educational activities among the population to form in them ecological thinking and consciousness, attitude to nature as a unique value.	<b>Intended Learning Outcomes:</b> Students will be able to - understand and evaluate the major issues of plantations in the context of international forest policy, - explain the fundamental purposes of Plantation Forestry, - properly deploy the essential techniques of Plantation Silviculture, e.g. for establishment, tending and maintenance - critically examine plantation projects (management, work volume, economic results). - understand the fundamental principles and practices of agroforestry land use, - analyze the interactions among different components of an AF system, - assess the ecological and economic effects of AF-systems and develop adequate management options, - address problems in the context of rural development and identify AF-based solutions - understand the role of forests and forest management activities in the global C-cycle, - assess forest management options for different purposes within the framework of the international climate policy, - identify and develop concepts for mitigation projects.
<b>Course Contents;</b> Overview Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	<b>Syllabus</b> Introduction to agroforestry and farm forestry. Production characteristics of farmsteads, ecological interactions in subsystems, co-generation of crop, animal and silvicultural products, including non-wood forest products and carbon sequestration.	Dato po lekcijama za svaki pod-predmet (module) sa brojem časova i brojem bodova.	<b>Content</b> Plantation forestry: Background, Definitions, Plantations in the Context of International Forest Policy, Plantation Forestry Purposes, Plantation Silviculture, Management and Economics; Agroforestry (AF): Introduction (global land-use problems, definitions, terminology), Traditional AF Systems, Environmental,

UNIVERSITY	UNIVERSITY OF FREIBURG	NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE	TECHNICAL UNIVERSITY MUNICH SCHOOL OF LIFE SCIENCES
	<p>Overview of land-use forms of agroforestry and farm forestry in temperate and tropical climates.</p> <p>Historical pathways of agroforestry and farm forestry.</p> <p>Field visits to farmsteads and trials.</p> <p>Case studies of selected examples of farm- and agroforestry, use of metaplan technique.</p> <p>Analysis of systems of farm- and agroforestry with modelling: system concept and model, interaction diagrams, modelling of dynamic systems (e.g. pasture models).</p> <p>Computer exercise: development of different types of models, including spreadsheet programming, systems optimisation, linear optimisation theory, simulation of a farmstead.</p> <p>Computer exercise: Modelling of CO<sub>2</sub>-sinks.</p> <p>Conclusions regarding the development of farm forestry and agroforestry projects</p>		<p>economic and socio-cultural aspects of AF, Interactions in AF systems, Important tree groups in AF (NFT's, MPT's, Palms), Planning in AF, Legal aspects Forest Management for Carbon Sequestration: Role of forests in the global carbon cycle, Possible impacts of climate change on forests, International climate policy, Forest in the Kyoto Protocol (KP), Flexible mechanisms of the KP, REDD and REDD+, Forest management options, Modelling forest sequestration with CO<sub>2</sub>FIX, Case studies.</p>
<p><b>Literature</b> Literatura</p>	<p><b>Preliminary reading</b></p> <p>Batish, D.R. et al. (eds.) (2008): Ecological basis of agroforestry. CRC Press, Boca Raton, FL, USA, 382 p. LA 600</p> <p>Dupraz, C. et al. (2005): Synthesis of the Silvoarable Agroforestry For Europe project. INRA-UMR System Editions, Montpellier, 254 p.</p> <p>Gordon, A.M; Newman, S.M. (eds.) (1997): Temperate Agroforestry Systems. CAB International, Wallingford, UK and New York, USA, 269 pp.</p> <p>Kapp, G. B. (1998): Farm forestry and agroforestry in Central America. Research on forestry and agroforestry production systems with special reference to the wet lowlands of Costa Rica and Panama. Margraf Verlag, Weikersheim, 303 pp. (German) (Forstbibliothek LA)</p> <p>KAPP, Gerald (1998): Financial evaluation tools for smallholder forestry: A methodological comparison of two forms of cost-benefit analysis and optimisation. International Tree Crops Journal 9: 233 – 246. Mac Dicken, K.G.; Vergara, N.T. (ed.) (1990): Agroforestry: Classification and management. John Wiley &amp; Sons, New York, 382 p. (Forstbibl. LA 600/3)</p> <p>Nair, P. K. R. (1993): An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, Boston, London in Cooperation with ICRAF, Nairobi, 499 pp. (Forstbibl. LA 600/14)</p> <p>Reif, A.; Schmutz, T. (2001): Planting and maintaining hedges in Europe. Institut pour le développement forestier. Paris, 126 pp.</p>		<p><b>Reading List:</b></p> <p>ABARE - JaakoPöyry (1999): Global Outlook for Plantations. Australian Bureau of Agricultural and Resource Economics (ABARE) Research Report 99.9, www.abare.gov.au. Evans, J., Turnbull, J.W. (2004): Plantation forestry in the tropics. FAO, (1998): FRA 2000 - Terms and definitions. Forest Resources Assessment Programme, Working Paper 1. FAO (2001): Global Forest Resources Assessment 2000. FAO Forestry Paper 140. Pandey, D. and Ball, J. (1998): The role of industrial plantations in future global fibre supplies. Unasylva 193, Vol. 49, 37 - 43. Sawyer, J., (1993): Plantations in the Tropics. Smith, D.M., Larson, B.C., Kelty, M.J. and Ashton, P.M.S. (1997): The Practice of Silviculture: Applied Forest Ecology. Smith, J. (2002): Afforestation and reforestation in the clean development mechanism of the Kyoto protocol: implications for forests and forest people. Int. J. Global Environmental Issues 2 (3/4): 322-343. Shepherd, K.R. (1986): Plantation Silviculture. West, P. W. (2006): Growing Plantation Forests. Ashton, M.S. and Montagnini, F. (2000): The silvicultural Basis for Agroforestry Systems. Agroforestry: Principles and Practice: Special issue of Forest Ecology and Management, 45 (1991). Nair, P.K.R. (2012): Agroforestry, the future of global land use. Atangana et al. (2014): Tropical Agroforestry. Springer Verlag</p>
<p><b>Students Workload (contact hours)</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)</p>		<p><b>Total number of hours</b> 150 hours, including lectures - 30 hours, practical classes - 30 hours, self-work - 90 hours</p>	<p>150 hours: 90 self-study hours and 60 contact hours</p>
<p><b>Teaching and learning activity/methods</b> Metode izvođenja nastave</p>	<p><b>Teaching and learning methods</b> Lectures, excursions, computer exercises, case studies and student presentations</p>		<p><b>Teaching and Learning Methods:</b> Knowledge and skills are imparted by lectures, group discussions, presentation of case studies and small exercises; the learning methods are learning, reviewing scientific articles, and research reference articles. The lectures will provide theories and basic reference materials which will be deepened and proved by reviewing articles. The achieved skills will be used to develop and discuss solutions for specified problems.</p> <p><b>Media:</b> PowerPoint presentations, case studies, additional reading material</p>
<p><b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)</p>			<p>The learning outcomes are assessed by an oral examination. Based on specific problem statements the students have to demonstrate their ability to analyze and assess the situation, to understand the origin of the problem and to propose solutions adapted from the methodologies and techniques procured in the course.</p>

**PART 3**

UNIVERSITY	UNIVERSITY OF READING	UNIVERSITY OF NOVI SAD FACULTY OF AGRICULTURE	WAGENINGEN UNIVERSITY
MSc; BSc level Nivo studija	BSc	BSc	MSc
Study Course Studijski program	BSc Agriculture and BSc Agriculture with Foundation	BSc Landscape Architecture	Master Forest and Nature Conservation (2022) (MFN-2022) Master Organic Agriculture (2022) (MOA-2022) Master Plant Sciences (2022) (MPS-2022)
Module Naziv predmeta	Forestry and Woodlands	Agrošumarski sistemi [Agroforestry systems]	Agroforestry
Status of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni	Optional module	mandatory	compulsory/elective
ECTS credits Broj ESPB	5	5	6
Prerequisites; condition Uslov	none	none	none
Learning objectives; Aims Cilj predmeta	<b>Aims:</b> This module aims to provide an overall understanding of the role of forests and woodlands in the rural sector and of how they can be managed and created to meet environmental, aesthetic, recreational and commercial objectives. It also aims to develop understanding of temperate, boreal and tropical forest and plantation management for sustainability and the potential of novel forestry and agroforestry systems.	<b>Learning objective</b> is for students to acquire knowledge in the field of Agroforestry systems so that they can successfully design and raise windbreaks, eco-nets, beekeeping plantations and energy production plantations. In addition to this, the goal is to learn how to best use the advantages of growing agricultural and forest species on the same land unit.	Throughout the course, students will be trained in system thinking across spatial scales. The first week will focus on agroforestry systems and relevant socio-ecological processes at the plot to farm level, the second week will focus on the landscape/ territory level and the third week on the regional to global level. Throughout the course, examples from practice will be given.
Learning outcomes Ishod predmeta	<b>Assessable learning outcomes:</b> <b>By the end of the module, it is expected that the student will be able to:</b> • Explain the role of forests and woodlands as commercial enterprises, and as aesthetic, recreational and environmental resources in the rural sector • Outline the nature and influence of government policy on forestry and woodlands in the UK • Describe and explain the main considerations in the design, planning and management of forests/woodlands • Develop initial plans for the planting and management of new woodlands for multi-purpose goals • Identify and outline the nature and potential of the main novel forms of forestry and agroforestry currently being developed • Describe how natural regeneration and its management influences the composition of forests • Outline the role of plantation forestry and research conducted on its sustainability Additional outcomes: Students will enhance their research and problem-solving skills through the development of a woodland plan. Outline content: This module is designed to develop an understanding of the global role and the management of woodlands and forests. Theory and practical application of woodland design are explained, as well as socioeconomic implications of forestry policies.	<b>Learning outcomes</b> The student is qualified for further upgrading through master's and doctoral studies to engage in scientific work in the field of agroforestry.	After successful completion of this course students are expected to be able to: - explain the concept of agroforestry, describe the diversity of agroforestry systems across the globe; - analyse the ecological interactions among trees, crops and livestock and how farmers manage these for desired outcomes; - evaluate the synergies and trade-offs between multiple products and services of agroforestry systems (across time and space); - evaluate how formal and informal socio-cultural institutions (including markets) affect agroforestry systems; - critically evaluate basic hypotheses in agroforestry; - design an agroforestry system including management planning tailored to specific contexts and desired outcomes.
Course Contents; Overview Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	<b>Summary module description:</b> Everyone wants to plant trees, you probably want to plant trees, it looks like trees can save the world - but not all trees have been created equal. You will learn how we decide which trees to plant and where. You will discover how we can create the right tree community and how we manage it. Using your new skills, you will design an afforestation plan and learn how to show it off. Whether it is conservation, timber yield or carbon credits, you will have to have an opinion and have the opportunity to discuss it.	<b>Contents</b> <i>Theoretical lectures</i> The importance of agroforestry for agriculture and forestry in the plains of Serbia. Alley plantings of forest and agricultural plants. Definition. Choice of species. Design. Planting technology and spacing. Farm forestry. Other forest products. Planning and design. Economic and social importance. Protective forest plantations along the banks. Planning and design. Functions and significance. Soil and water	Agroforestry, a land use system where woody perennials are crops, and/or where perennials are grown in combination with annual crops or pasture and livestock, has received increasing attention as a means to contribute to sustainability, food security and resilience to climate change. Important commodity crops are grown in agroforestry systems (think of cocoa and coffee), but these systems have been much less studied than simpler annual cropping systems. Most knowledge on agroforestry systems is based on tropical systems though the last decade

UNIVERSITY	UNIVERSITY OF READING	UNIVERSITY OF NOVI SAD FACULTY OF AGRICULTURE	WAGENINGEN UNIVERSITY
	<p><b>The Lecture Content covers:</b></p> <ul style="list-style-type: none"> <li>•Forestry and woodland in the UK, their historical development, main types, factors influencing them, the role of policy</li> <li>•Forest ecology and climate change</li> <li>•Creating new woodlands and forests - planning for different objectives/uses</li> <li>•Species selection and options, planting materials and protection</li> <li>•Silvicultural practice</li> <li>•Management of existing small woodlands for multi-purpose use</li> <li>•Plantation forestry in the tropics and its sustainability</li> <li>•Novel systems of forestry and agroforestry</li> </ul>	<p>remediation. Impact on the water-air regime. Forest plantations and pastures. Planning and design. Choice of species. Management. Economic benefits. Significance for the environment. Windbreaks. Planning and design. Acting. Significance for rural development. Windbreaks and diversity. Importance for sustainable development in agriculture. Importance for animal husbandry. Influence on the microclimate. Impact on yields of agricultural crops. Special purpose plantings. Planning and design. Plantings of short rotations to obtain raw material for energy production and raw material for chemical processing of wood. Choice of species. Use of hybrids. Eco network. Eco corridors. Mitigation zones. The core of diversity. Surfaces for restoration. Diversity of forest ecosystems. Possibilities of restoration of autochthonous woody species. Conservation of forest woody species ex and in situ. Dynamics of floodplain forest ecosystems and conservation opportunities. Hillside plants, windbreaks, anti-deflation belts and belts for noise reduction, greenery with sanitation and revitalization effect. Functional surfaces, spatial and anti-noise specificities of widespread greenery. Criteria for an adequate selection of trees. Ways and technological procedures of establishing, planting, and maintaining greenery. The specifics of the renewal of landscape greenery and the procedures for its implementation. The issue of landscape revitalization using vegetation management. Technologies and procedures for the revitalization of areas affected by agricultural and industrial activities, recultivation.</p> <p><i>Practical lectures: Exercises, Other forms of teaching, Study research work</i></p> <p>Preparation of practical works related to the design of agroforestry plantations, alley plantations, forest plantations and pastures, protective plantations along watercourses, plantations for energy production, development of projects of local ecocorridors.</p>	<p>has seen an increased interest in agroforestry also in temperate zones (e.g. food forests). In this course, agroforestry systems are evaluated as part of farmers' livelihoods and embedded in economic, institutional and policy environments. Drawing from the disciplines of agronomy, forestry and social sciences (such as economics, management and politics), students will become familiar with the concept of agroforestry. They will understand the social and ecological mechanisms underlying their functioning and productivity. This course spans a range of fundamental concepts and practices using a socio-ecological systems approach. Examples from agroforestry systems from around the world are described and discussed. A central aspect of this course is to develop and spark students' critical and analytical thinking; [under what socio-ecological conditions] can an agroforestry system contribute to livelihoods, food security and resilience to climate change?</p>
<p><b>Literature</b> Literatura</p>		<p><b>Literature:</b></p> <ol style="list-style-type: none"> <li>1. Agrošumarski sistemi [Agroforestry systems] – skripta prof. dr Saše Orlovića. Udžbenik u pripremi.</li> <li>2. An Introduction to Agroforestry. 1993. By P.K.Ramachandran Nair. Kluwer Academic Publishers (in cooperation with ICRAF). 496 p</li> </ol>	<p>Literature is provided in the course guide which is needed to prepare for the lectures and assignments.</p>
<p><b>Students Workload (contact hours)</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)</p>	<p><b>Contact hours:</b> Lectures – 18h, Fieldwork – 4h, Guided independent study – 78h, Total hours for module – 100h</p>	<p><b>Contact hours:</b> Lectures – 2h per week Practical work – 2h per week</p>	<p>Excursion (one day) Contact hours 7 Credits 0,27 Group work Contact hours: 3 Credits: 1,31 Individual Paper Contact hours: 3 Credits: 1,00 Lecture Contact hours: 12 Credits: 1,87 Tutorial Contact hours: 14 Credits: 1,55</p>
<p><b>Teaching and learning activity/methods</b> Metode izvođenja nastave</p>	<p><b>Brief description of teaching and learning methods:</b> There will normally be two 50-minute lectures per week. Students will also visit the site for a proposed woodland as part of the project.</p>	<p><b>Teaching methods</b> Teaching is conducted with the use of modern technology. Method of oral presentation and conversation. Method of presentations, demonstrations, simulations and illustrations on the board and using computers and computer software QGis; R; Microsoft Office package.</p>	<ul style="list-style-type: none"> <li>- lectures, guest lectures;</li> <li>- reading scientific literature;</li> <li>- present and debate;</li> <li>- excursion;</li> <li>- modelling exercise (group assignment);</li> <li>- design an agroforestry system (group assignment);</li> <li>- writing position paper (individual assignment).</li> </ul> <p>Software used in this course R_including_R_studio</p>
<p><b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)</p>	<p><b>Summative Assessment Methods:</b> Written exam 50%; Project output other than dissertation 50% (<b>Summative assessment- Coursework and in-class tests:</b> 1. A project for a local woodland to be completed this term (50%) 2. A 1 hour exam in the summer term (50%)</p>	<p><b>Assessment:</b> Activity during lectures – 5%, tests – 20%, writing exam – 45%, oral exam – 30%.</p>	<p>Examination</p> <ul style="list-style-type: none"> <li>- written examination (40%);</li> <li>- position paper and presentation (30%);</li> <li>- modelling assignment (pass / fail);</li> <li>- agroforestry design and presentation (30%).</li> </ul>

Part 4

UNIVERSITY	UNIVERSITY OF LISBOA - THE SCHOOL OF AGRICULTURE
MSc; BSc level Nivo studija	MSc.
Study Course/Program Studijski program	Forestry Engineering and Natural Resources
Module Naziv predmeta	Management and Conservation of Vegetation and Agroforestry Systems
Status of Module (mandatory; compulsory/elective) Status predmeta obavezni/izborni	Mandatory
ECTS credits Broj ESPB	6
Prerequisites; condition Uslov	none
Learning objectives; Aims Cilj predmeta	
Learning outcomes Ishod predmeta	Students should know the vegetation of Portugal, in particular the woody, and identify landscape units; to know the factors that influence vegetation and the ways in which it reflects this influence through the formation of distinct communities, with emphasis on climatic constraints; describe management principles applicable to the conservation and maintenance close to nature of plant communities; know the effects of changes produced by human activities and how to minimize and mitigate them; address principles and techniques for conservation and restoration of ecosystems.
Course Contents; Overview Sadržaj predmeta teoretska nastava/praktična nastava (tematske celine)	Module 1: Bioclimatic and biogeographic framework of the Iberian vegetation. Methods of vegetation analysis. 1. Bioclimatology and biogeography: history, principles and concepts; 2. Earth and Iberian biomes; 3. Methods of vegetation analysis. Module 2: Protected plant species and sites. Introduction to plant cartography. 1. Introduction to plant cartography; 2. Valorisation of plant diversity and methods for plant conservation and management; 3. Management instruments: international conventions, European regulations and agro-environmental and forest-environment measures. Module 3: Agro-forestry systems. 1. Concepts and typologies; 2. Hydrological balance and nutrient recycling in agroforestry systems; 3. Socio-economic and environmental remarks on agroforestry systems; 4. Agroforestry systems in Europe and in the Mediterranean region: history and current trends; 5. Agroforestry systems in Portugal: Portuguese "montados" (evergreen oak woodlands), "lameiros" (wet meadows) and "baldios" (fallow lands) as case studies. Module 4: Restoration and requalification of vegetation and plant communities. 1. Abandonment and its consequences as causes of vegetation degradation; 2. Methods of plant community restoration; phytoremediation; 3. Case studies (restoration and requalification of woody riparian galleries, restoration and requalification after wild fire, new alternative vegetation uses as requalification tools, phytoremediation).

UNIVERSITY	UNIVERSITY OF LISBOA - THE SCHOOL OF AGRICULTURE
<b>Literature</b> Literatura	A Floresta em Portugal. Instituto Superior de Agronomia. Lisboa.: Fabião, A., Oliveira, A. 2007 null Los Bosques Ibéricos: una Interpretación Geobotánica. Editorial Planeta. Barcelona.: Blanco Castro, E., Casado González, M. A., Costa Tenório, M., Escribano Bombín, R., Garcia Antón, M., Génova Fuster, M., Gómez Manzaneque, Á., Moreno Saiz, J. C., Morla Juaristi, C., Regato Pajares, P., Sainz Ollero H. 1997 null
<b>Students Workload (contact hours)</b> Broj časova aktivne nastave (teorijska nastava/praktična nastava)	
<b>Teaching and learning activity/methods</b> Metode izvođenja nastave	
<b>Assesment</b> Ocena znanja (procentualni udeo ostvarenih bodova po aktivnosti)	In each module, the evaluation will be carried out by works of bibliographic review/practical application (with presentation) and/or by theoretical tests on the subject of the module. The final classification will be given by the arithmetic average of the classifications of each module (with a mandatory minimum score of 7.5 per module), with the possibility of access to the final exam in total or by modules on the regular dates.

