



SVEUČILIŠTE U ZAGREBU, FAKULTET ŠUMARSTVA I DRVNE TEHNOLOGIJE
UNIVERSITY OF ZAGREB, FACULTY OF FORESTRY AND WOOD TECHNOLOGY

**Graduate Study Forestry; Programme: Silviculture and Forest
Management with Wildlife Management**

Syllabus

from Acad. Year 2022/23



LIST OF COMPULSORY AND ELECTIVE COURSES WITH CLASS HOURS
AND ECTS CREDITS

Year of study: I							
Semester: Winter							
COURSE	COURSE TEACHER	L	E	F	e-learning	ECTS	Compulsory / elective
Phytopharmacy in Forestry	Professor Boris Hrašovec, Ph.D.	30	15	0	3.	4	Compulsory
Forest Tree Breeding	Professor Saša Bogdan, Ph.D. Assistant Prof. Ida Katičić Bogdan, Ph.D.	30	15	16	3.	5	Compulsory
General and Landscape Ecology	Professor Ivica Tikvić, Ph.D. Associate Professor Damir Ugarković, Ph.D.	30	15	16	2.	6	Compulsory
Plant Nutrition	Assistant Prof. Krunoslav Sever, Ph.D. Prof. Željko Škvorc, Ph.D.	30	15	0	2.	4	Compulsory
Growth and increment	Professor Mario Božić, Ph.D. Assistant professor Ernest Goršić	30	15	0	2.	5	Compulsory
Photointerpretation in forestry	Prof. Renata Pernar, Ph.D. Assist. Prof. Jelena Kolić, Ph.D.	15	0	0	2.	2	Elective
Application of phytocenology in forestry practice	Professor Dario Baričević, Ph.D.	15	0	0	2.	2	Elective
Zoonoses in forest ecosystems	Asst. Prof. Marko Vucelja, Ph.D.	15	0	0	2.	2	Elective
Methods of plant taxonomy	Assoc. Prof. Martina Temunović, Ph.D.	15	0	0	2.	2	Elective
Bird ecology	doc.dr.sc. Kristijan Tomljanović	15	0	0	2.	2	Elective
Behavioural ecology	Asst. prof. Marko Vucelja, Ph.D.	15	0	0	2.	2	Elective
Monitoring of animal populations	Asst. prof. Marko Vucelja, Ph.D.	15	0	0	2.	2	Elective
Zoocology in forest ecosystems	Asst. prof. Marko Vucelja, Ph.D.	15	0	0	2.	2	Elective
Informatology and documentation in scientific research	Vibor Roje, Ph.D., Associate professor				2.	2	Elective
In total							



Year of study: I							
Semester: Summer							
COURSE	COURSE TEACHER	L	E	F	e-learning	ECTS	Compulsory / elective
Silviculture II	Prof. Igor Anić, Ph.D. Assistant Prof. Stjepan Mikac, Ph.D.	30	15	56	2.	5	Compulsory
Forest vegetation	Professor Dario Baričević, Ph.D.	30	15	16	2.	5	Compulsory
Integrated forest protection	Professor Boris Hrašovec, Ph.D. Professor Danko Diminić, Ph.D. Asst. prof. Marko Vucelja, Ph.D. Assistant professor Milivoj Franjević, Ph.D.	30	30	16	3.	6	Compulsory
Hunting management I	Prof. Marijan Grubešić, Ph.D. Prof. Krešimir Krapinec, Ph.D. Assistant Prof. Kristijan Tomljanović, Ph.D.	30	15	16	2.	4	Compulsory
Soil management of forest ecosystems	Prof. Nikola Pernar, Ph.D. Prof. Darko Bakšić, Ph.D. Assistant Prof. Ivan Perković, Ph.D.	30	15	8	1.	4	Compulsory
Biotechnology in Forestry	Asst. Prof. Ida Katičić Bogdan Ph.D Prof Saša Bogdan Ph.D	15	0	0	3.	2	Elective
Ecological Monitoring	Professor Ivica Tikvić, Ph.D. Associate Professor Damir Ugarković, Ph.D	15	0	0	2.	2	Elective
Game and Shooting Crops	Prof Krešimir Krapinec, Ph.D.	15	0	0	3.	2	Elective
Forest area measurement	Assistant Prof. Ernest Goršić, Ph.D	15	0	0	2.	2	Elective
Clonal forestry	Prof. Saša Bogdan, Ph.D Asst. Prof. Ida Katičić Bogdan, Ph.D	15	0	0	3.	2	Elective



Quantitative methods for planning in Forestry	Azra Tafro, Ph.D, Assistant Professor	15	0	0	1.	2	Elective
Hunting cinology	Prof. Marijan Grubešić, Ph.D	15	0	0	2.	2	Elective
Mechanization in Forest Silviculture	Assist. Prof. Zdravko Pandur, Ph.D	15	0	0	2.	2	Elective
Legislative and regulative for forest management planning	Professor Jura Čavlović, Ph.D Assistant prof. Krunoslav Teslak, Ph.D	15	0	0	1.	2	Elective
Communication and certification processes in forestry	Professor Ivan Martinić, Ph.D. Assist. Prof. Matija Landekić, Ph.D	15	0	0	2.	2	Elective
Dendrochronology	Ernest Goršić Ph.D	15	0	0	2.	2	Elective
European forestry	prof. Igor Anić, Ph. D. Ass. prof. Stjepan Mikac, Ph. D.	15	0	0	1.	2	Elective
In total							

Year of study: II							
Semester: Winter							
COURSE	COURSE TEACHER	L	E	F	e- learnin g	ECT S	Compuls ory / elective
Growing trees outside forests	Prof. Milan Oršanić, Ph.D. Assistant Prof. Damir Drvodelić, Ph.D	30	15	16	2.	5	Compuls ory
Economics of Forest Company	Assoc. Prof. Stjepan Posavec, Ph.D.	30	15	8	2.	4	Compuls ory
Hunting management II	Prof. Marijan Grubešić, Ph.D. Prof. Krešimir Krapinec, Ph.D. Assistant Prof. Kristijan Tomljanović, Ph.D.	30	15	8	2.	5	Compuls ory
Forestry Techniques and Technologies	Prof. Marijan Šušnjar, Ph.D. Assistant Prof. Hrvoje Nevečerel, Ph.D.	30	30	24	2.	5	Compuls ory



	Assistant Prof. Dinko Vusić, Ph.D. Assistant Prof. Kruno Lepoglavec, Ph.D.							
Forest Karst Meliorations	Professor Željko Španjol, Ph.D. Associate Professor Damir Barčić, Ph.D.	30	15	16	2.	5	Compulsory	
Spatio-temporal analysis in GIS	Prof. Renata Pernar, Ph.D. Assoc. Prof. Ante Seletković, Ph.D.	15	0	0	2.	2	Elective	
Bioenergy plantations and phytoremediation	Prof. Saša Bogdan, Ph.D. Asst. Prof. Ida Katičić Bogdan Ph.D.	15	0	0	3.	2	Elective	
Ecology of Forest Tree Species	Prof. Ivica Tikvić, Ph.D. Associate Prof. Damir Ugarković, Ph.D.	15	0	0	2.	2	Elective	
Population outbreaks and monitoring of forest insects	Prof. Boris Hrašovec, Ph.D. Assistant Prof. Milivoj Franjević, Ph.D.	15	0	0	2.	2	Elective	
Fire Management and Restoration	Prof. Željko Španjol, Ph.D. Associate Professor Damir Barčić, Ph.D. Assistant Professor Roman Rosavec, Ph.D.	15	0	0	2.	2	Elective	
Preparation and measurement of Hunting Trophies	Prof. Krešimir Krapinec, Ph.D.	15	0	0	3.	2	Elective	
Floodplain forests	Prof. Igor Anić, Ph.D. Assistant Prof. Stjepan Mikac, Ph.D.	15	0	0	1.	2	Elective	
Management by selection system and subalpine forest ecosystems	Assistant Prof. Damir Drvodelić, Ph.D. prof. Dario Baričević, Ph.D	15	0	0	2.	2	Elective	
Remediation of degraded land	Prof. Nikola Pernar, Ph.D. Prof. Igor Anić, Ph.D. Prof. Goran Durn, Ph.D.	15	0	0	2.	2	Elective	



Statistical methods and models	Professor Anamarija Jazbec, Ph.D.	15	0	0		2	Elective
European forest types	Professor Dario Baričević, Ph.D.	15	0	0	2.	2	Elective
Small scale forest management planning	Krunoslav Teslak Ph.D., Assistant professor	15	0	0	2.	2	Elective
In total							

Year of study: II							
Semester: Summer							
COURSE	COURSE TEACHER	L	E	F	e-learning	ECTS	Compulsory / elective
Forest management planning	Prof. Jura Čavlović, Ph.D. Assist. Prof. Krunoslav Teslak, Ph.D.	30	45	32	1.	6	Compulsory
Master thesis		0	0	0	0	20	Compulsory
Professional practice		0	0	0	0	4	Compulsory
In total							



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Boris Hrašovec, Ph.D., Assistant Prof. Milivoj Franjević, Ph.D.	1.7. Number of ECTS credits	4
1.2. Course title	Phytopharmacy in Forestry	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+0
1.3. Course code	33884	1.9. Expected enrolment in the course	25
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Course should enable the students to manipulate and understand the risks and means of action of pesticide use in forestry. Also, it should give them the skills and knowledge on the sound use of chemicals and other media in the integrated programme of forest protection.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B2. establish forest management programs and wildlife management programs		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Describe the emergence, development and role of contemporary phytopharmacy in the integrated protection of forests from plant pests. Explain the underlying concepts and vocabulary (active substance, carrier, working fluid, additives, powder, suspension, emulsion, etc.) and formulas for calculating the required concentration and dose in specific application. Present application methods of plant protection products (introduction to manual and motorized terrestrial devices for the application of plant protection products related to the production of different dimensions of wet particles - sprayers, sprayers).</p> <p>Present the basic groups of insecticides / acaricides (pyrethroids, naturalites, GABA receptor inhibitors, neonicotinoids, IGR formulations), fungicides / bactericides (emphasis on recent active substances and preparations - ingredients of contemporary fungicides), and herbicides, rodenticides and nematocides (in particular, of undesirable phytotoxic effects on a protected plant) according to their chemical, toxicological, functional and other essential properties.</p> <p>Recommend biological preparations, their basic properties, benefits and</p>		



	deficiencies (insecticidal biopesticides - entomopathogenic products fungi, viruses and bacteria with an emphasis on the most important bacterial biopesticides based on <i>Bacillus thuringiensis</i> bacteria). Establish legal regulations for the implementation of plant protection activities in forestry.								
2.5. Course content (syllabus)	LECTURES 1. Plant protection in general. Application approach. Principles of Integrated plant protection (4 hr.) 2. Plant protection products. Production, registration, toxicity, resistance (2 hr.) 3. Plant protection products by chemical composition (2 hr.) 4. Pesticide choice by target, mixtures, doses and concentrations (4 hr.) 5. Insecticides (4 hr.) 6. Herbicides (3 hr.) 7. Fungicides (3 hr.) 8. Forest rodent control (application and supervision). Use, formulations and professional application of rodenticides. Anticoagulants of 1st and 2nd generation (2 hr.) 9. The role of rodent control in forests with the aim of zoonoses suppression (2 hr.) 10. Other pesticides and biological control (4 hr.) LAB 1. Pesticide packaging, toxicity indices, instructions for use (2 hr.) 2. Safety measures in handling pesticides (2 hr.) 3. Pesticide application, soil disinfection (2 hr.) 4. The use of insecticides (2 hr.) 5. Biotechnical control measures in suppression of forest insect populations (2 hr.) 6. Application of fungicides (3 hr.) 7. Legal issues in pesticide use and safe handling of packaging material (2 hr.)								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:				
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper		NO	(other)		
	Preliminary Exam	YES		Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)		4



2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.		
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam, exam.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Androić, M., 1965: Aviokemijska metoda zaštite šuma. Poslovno udruženje šumsko-privrednih organizacija, Zagreb, 128 str.	YES	
	Maceljski, M., B. Cvjetković, J. Igrc Barčić i Z. Ostojić, 1997: Priručnik iz zaštite bilja, Zavod za zaštitu bilja u poljoprivredi i šumarstvu RH, Tiskara MD, Zagreb, 187 str.	NO	
	Grupa autora, 2015: Priručnik za sigurno rukovanje i primjenu sredstava za zaštitu bilja, 220 str.	NO	Dostupno na web-u Ministarstva poljoprivrede
2.12. Optional literature	1. Igrc-Barčić, J. & M. Maceljski, 2001: Ekološki prihvatljiva zaštita bilja od štetnika. Zrinski d.d., Čakovec, 247 str.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Saša Bogdan, Ph.D. Assistant Prof. Ida Katičić Bogdan, Ph.D. Marko Bačurin, mag. Ing. Silv	1.7. Number of ECTS credits	5
1.2. Course title	Forest Tree Breeding	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	225916	1.9. Expected enrolment in the course	60
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.



1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Interpretation of the forest tree breeding theoretical settings. Selection and application of classical methods of forest tree breeding (selection, controlled generative and vegetative reproduction, genetic testing, mass production of forest reproductive material).		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B6. organize and carry out ornamental plant production tasks B8. carry out professional tasks of nurseries and seedlings B9. collaborate on environmental and spatial plans C1. plan and organize integrated environmental management C2. plan and organize professional tasks of implementing economic programs of protected nature facilities D1. perform the duties of scientific and professional associate in scientific research institutions in the field of urban forestry, nature protection and the environment D2. lead teaching courses in vocational secondary and related schools D4. professionally and scientifically improve through various educational forms and postgraduate studies D5. collect, process, and interpret sources of literature and prepare a simpler written professional or scientific work.</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>1. To explain the process of classical breeding of forest tree species, methods of selection; To choose suitable candidates in the process of mass selection; to evaluate individual candidates and choose plus individuals. 2. To perform basic cloning techniques. To explain and compare basic traditional as well as modern methods and techniques of cloning forest tree species. 3. To explain the process of genetic testing of plus trees and the choice of elite trees; To calculate genotypic and additive values of individuals, heritability and genetic gain based on data from a genetic test; To choose elite trees based on genetic testing results. 4. To explain the role of controlled crossing and the activities necessary for the implementation of controlled crossing in the breeding cycle; To choose an option and devise a plan for controlled crossings of elite trees; To design mass production of genetically improved varieties.</p>		
2.5. Course content (syllabus)	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Polygenic inheritance, quantitative traits, and the environment. 2. Modifications, mutations, extranuclear inheritance. 3. Basics of breeding of woody species. General terms, historical development. 4. Techniques of cloning of forest tree species. 		



	<ol style="list-style-type: none"> 5. The breeding cycles. Creation of starting plant material, a mother population. 6. Mass selection methods. The selective population. 7. The reproductive and breeding populations. 8. Genotypic selection based on genetic testing. 9. Development of a breeding strategy. 10. Controlled crossing in breeding; Design and techniques. 11. Breeding by hybridization (intraspecies and interspecies hybridization). 12. Breeding for resistance to abiotic factors. 13. Breeding for resistance to biotic factors. 14. Methods of macro-propagation and micro-propagation in tree breeding. 15. Methods of biotechnology in tree breeding <p>Exercises:</p> <ol style="list-style-type: none"> 1. Introduction to the goals and purpose of forest tree breeding and the traits for which breeding is performed (practicum) 2. Selection of candidate trees based on given criteria (practicum) 3. Calculation and evaluation of candidate trees according to the given criteria for plus trees (practicum) 4. Application of RCB design in setting up a clonal seed orchard on a given area (practicum) 5. Introduction to the concept of genetic test, planning test blocks in a given field (practicum) 6. Design of a genetic test of half-sibs (practicum) 7. Setting up a genetic test on a scale depending on the conditions of the given terrain (practicum) 8. Measurements of metric traits in a genetic test (practicum) 9. Calculation of descriptive statistics parameters in a genetic test (practicum) 10. Calculation of general combination ability and additive value (practicum) 11. Analysis of variance, interpretation of statistical significance of effects (practicum) 12. Calculation of heredity of analyzed traits (practicum) 13. GxE interaction (calculation) (practicum) 14. GxE interaction clone evaluation (practicum) 15. Tour of the molecular-biological laboratory, introduction to the selection with the help of molecular markers (laboratory) <p>Field work</p> <p>Introduction to the candidate tree selection process, tour of seed stands, selected plus pedunculate oak trees, clonal pedunculate oak and field ash seed orchards, lowland elm clone archive and genetic test of half-sibs from clonal seed orchard.</p>		
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input checked="" type="checkbox"/> laboratory	2.7. Comments:



	<input checked="" type="checkbox"/> field work			<input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	5	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library			Availability via other media		
	Bogdan, S. and I. Katičić Bogdan, 2016. Genetics and breeding of trees and shrubs. Internal peer-reviewed script. 224. p. (selected chapters)			NO			YES, Merlin		
2.12. Optional literature	Ballian D., Kajba D. Oplemenjivanje šumskog drveća i očuvanje njegove genetske raznolikosti, Šumarski fakultet Sveučilišta u Zagrebu i Šumarski fakultet Univerziteta u Sarajevu 2011. White, T. L., W. T. Adams, D. B. Neale, 2007: Forest Genetics. Wallingford, UK, Cambridge, CAB International. p682. Forest Genetic Resources Conservation and Management: In Managed Natural Forests and Protected Areas (in situ). International Plant Genetics Research Institute (2002). Young, A., Boshier, D., Boyle, T. 2000. Forest Conservation Genetics: Principles and Practice. CABI. 368 str								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Ivica Tikvić, Ph.D. Associate Professor Damir Ugarković, Ph.D	1.7. Number of ECTS credits	6
1.2. Course title	General and Landscape Ecology	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	33886	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Acquiring knowledge about the main types of organisms in forest ecosystems, their condition and endangerment. Introduction to the life processes of plants, animals and microorganisms and ecological processes that affect them in forest ecosystems. Training for defining ecological problems of endangered species of organisms in forest ecosystems, causes, consequences and measures for their solution or mitigation. Introduction to measures for the protection of endangered organisms and their habitats in forest ecosystems.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course	B3. implement forest management programs B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region B7. organise and manage professional works on inventorying forests		



contributes	B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests	
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<ol style="list-style-type: none"> 1. Adopt basic principles for the protection of forests against abiotic and biotic factors and apply basic procedures and means for forest protection. 2. Participate in the implementation of the forest management program. 3. Perform professional field work on founding, care and restoration of forest stands. 4. Perform professional work on melioration and landscaping of forest areas in the Mediterranean area. 5. Cooperate on the development of ecological studies and spatial plans. 	
2.5. Course content (syllabus)	<p>Lectures</p> <ol style="list-style-type: none"> 1. Introduction to General and Landscape Ecology. Fundamentals of general and landscape ecology. History of general and landscape ecology. 2. Organisms, environment and habitats in forest ecosystems 3. Life processes of organisms and the environment in forest ecosystems. 4. Ecological processes and functioning of forest ecosystems. 5. Relationships of organisms and light in forest ecosystems. Relationships of organisms and heat in forest ecosystems. 6. Relationships between organisms and water in forest ecosystems. Relationships between organisms and air in forest ecosystems. 7. Relationships of organisms and chemicals in forest ecosystems. Relationships of organisms and mechanical factors in forest ecosystems. 8. Relationships between organisms and climate in forest ecosystems. Relationships of organisms and relief in forest ecosystems. 9. Relationships between organisms and soil in forest ecosystems. Relationships of organisms and geological substrates in forest ecosystems. 10. Relationships of organisms in forest ecosystems - plants, animals, microorganisms and humans. 11. Ecological problems in forest ecosystems. 12. Protection of organisms and their habitats in forest ecosystems. 13. Improving the condition of forest habitats and forest organisms. 14. Forest ecosystem services 15. Monitoring the condition of forest ecosystems. <p>Exercises</p> <ol style="list-style-type: none"> 1. Ecological projects in the field of forestry 2. Biological relations between organisms in the ecosystem - mycorrhiza 3. Monitoring, protection and improvement of forest habitats - National Ecological Network 4. Assessment and improvement of public forest functions 5. Analysis of environmental impact studies 6. Determining the biodiversity index of forest ecosystems <p>Field work</p> <ol style="list-style-type: none"> 1. Protection and conservation of forest habitats and species within NATURE 2000. 2. Improving the state of OKFŠ and forest ecosystem services 	
		2.7. Comments:



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work		<input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	6	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the tests and exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Ekološki leksikon, gl. ur. Oskar Springer, 2001., Barbat, Ministarstvo zaštite okoliša i prostornog uređenja Republike Hrvatske, str 361.			YES					
	Vjekoslav Glavač, 1999., Uvod u globalnu ekologiju, Državna uprava za zaštitu prirode i okoliša			YES					



	Priroda Hrvatske Riznica za bolju budućnost, 2015., Državni zavod za zaštitu prirode, str. 52		Website of the Ministry of Economy and Sustainable Development, Merlin
	Pregled stanja biološke i krajobrazne raznolikosti RH, 1999., Ministarstvo zaštite okoliša i prirode.	YES	Merlin
	Tikvić, I., D. Ugarković, 2020: Opća i krajobrazna ekologija. Skripta, Šumarski fakultet Sveučilišta u Zagrebu	YES	
	Crveni popis ugroženih biljaka i životinja Hrvatske, 2004., Državni zavod za zaštitu prirode, str. 112.		Website of the Ministry of Economy and Sustainable Development, Merlin
2.12. Optional literature	Daniel B. Botkin, Edward A. Keller; : ENVIRONMENTAL SCIENCE EARTH AS A LIVING PLANET (1-649 str.) Eugene P. Odum, 1971.: FUNDAMENTALS OF ECOLOGY (1-574 str.) Robert E. Ricklefs, 1990.: ECOLOGY (1-885 str.) BIOLOŠKA I KRAJOBRAZNA RAZNOLIKOST HRVATSKE, Državna uprava za zaštitu prirode i okoliša, Zagreb 1999, str. 151. Richard T.T. Forman, Michel Godron, 1986: LANDSCAPE ECOLOGY. John Wiley and Sons, Inc. New York, p. 1-620. BIODIVERSITY, E.O.Wilson, Editor, National Academy of Science, 1988, p. 521 Mackenzie, A., A. S. Ball, S. R. Virdee, 2001: Ecology. BIOS Scientific Publishers Limited, UK, str. 339		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assistant Prof. Krunoslav Sever, Ph.D. Prof. Željko Škvorc, Ph.D.	1.7. Number of ECTS credits	4
1.2. Course title	Plant Nutrition	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+0
1.3. Course code	33887	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Acquiring basic knowledge related to recognizing the symptoms of suboptimal mineral nutrition of forest trees and undertaking certain activities with the aim of repairing the disturbed nutritional status of trees.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B4. manage and make independent professional (business) decisions in the field of breeding, forest protection, forest management and hunting.</p> <p>B6. to organize and carry out the work of land reclamation and arrangement of forest areas in the Mediterranean area.</p> <p>B13. apply methods of preparation and planning of works in forestry.</p> <p>D1. perform the duties of a scientific and professional associate in scientific research institutions in the field of forestry and hunting.</p> <p>D2. lead teaching courses in vocational high schools and related schools.</p> <p>D4. professionally and scientifically improve through various educational forms and postgraduate studies.</p> <p>D5. collect, process and interpret sources of literature and prepare simpler written professional or scientific paper.</p>		



<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Valorize soil as a source of plant nutrients and their absorption mechanisms (soil nutrients, nutrients in helat form, nutrients in mineral and organic matter, dynamic equilibrium among nutrients forms in the soil).</p> <p>To determine the macronutrients (nitrogen, sulfur, phosphorus, potassium, calcium, magnesium; forms of nutrients and their availability, their assimilation in the plant, role in plant metabolism, symptoms of insufficiency) and micronutrients (iron, manganese, copper, zinc, molybdenum and chlorine, their forms in the soil and availability, their role and symptoms of insufficiency).</p> <p>Interpret redistribution of nutrients in the plant (transfer of nutrients among the roots, stems and leaves, the impact of nutrients on vegetative growth and reproductive cycle).</p> <p>To determine the nutrient status of trees in natural ecosystems (absorption, efficiency of nutrients use in forest stands and loss of nutrients form plant and ecosystem).</p> <p>Plan soil fertilization (soil sampling for chemical analysis with the aim of determining appropriate fertilization treatments - mineral, organic or natural fertilizers).</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures</p> <ol style="list-style-type: none"> 1. Historical development of plant nutrition as a scientific discipline, definition and classification and division of biogenic elements and plant nutrients. 2. Soil as a source of plant nutrients; chemical composition of soil, colloidal properties of soil, pH reaction of soil, soil buffering capacity, forms of nutrients in soil, dynamics of nutrients in soil. 3. Potential, uptake and transfer of nutrients through the plant; potential and availability of plant nutrients, root nutrient uptake, leaf nutrient uptake, nutrient transfer between cells. 4. Factors affecting nutrient uptake; plant species and genotype, mycorrhiza, soil fertility, soil moisture, root metabolism. 5. Nutrient uptake in extreme conditions; acidic soils, basophilic soils, flood soils. 6. Supply of plants with biogenic elements; antagonism and synergism of biogenic elements, retranslocation of mineral nutrients within the plant. 7. Loss of nutrients from the plant organism and general symptoms of deficiency and excess elements of plant nutrition. 8. Macronutrients and Nitrogen; forms of nitrogen in the soil and their accessibility to the plant, reduction of nitrates in the plant, the role of nitrogen in plant metabolism, signs of insufficient nitrogen nutrition. 9. Phosphorus; forms of phosphorus in the soil and their accessibility to plants, the role of phosphorus in plant metabolism, signs of insufficient phosphorus nutrition. 10. Sulfur and potassium; forms in the soil and their accessibility to the plant, their role in the plant and the symptoms of their deficiency on the plant. 11. Calcium and magnesium; forms in the soil and their accessibility to the plant, their role in the plant and the symptoms of their deficiency on the plant. 12. Trace elements and iron; forms in the soil and the availability of iron to the plant, its role in the plant and the symptoms of its deficiency on the plant. 13. Manganese and boron; forms in the soil and their accessibility to the plant, their role in the plant and the symptoms of their deficiency on the plant. 14. Zinc, copper, molybdenum, chlorine and nickel; forms in the soil and their accessibility to the plant, their role in the plant and the symptoms of their deficiency on the plant. 15. Fertilizers in general, their classification and chemical analysis.



	<p>Exercises</p> <ol style="list-style-type: none"> 1. Problems of sampling and chemical analysis of soil in order to determine the concentration of mineral nutrients in the soil. 2. Problems of sampling and analysis of plant material with the aim of determining the level of mineral nutrition of forest trees. 3. Limit values of mineral nutrients in soil and plant material. 4. Influence of different doses and formulations of mineral fertilizers on the physiology and growth of forest trees: <ul style="list-style-type: none"> • Concentration of macro and micro nutrients in the leaves. • Concentration of photosynthetic pigments in leaves. • Visual symptoms of malnutrition with mineral nutrients. • Anatomical and morphological features of leaves. • CO₂ assimilation and H₂O transpiration. • Chlorophyll a fluorescence. • Growth. 5. Interactive influence of drought and suboptimal nutrition with mineral nutrients on the physiology and growth of forest trees. 6. Non-destructive estimation of nitrogen nutrition of forest trees. 								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper		NO	(other)		
	Preliminary Exam	YES		Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)	4	



2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.		
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, Taking exams.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Sever, K. i Ž. Škvorc, 2018: Ishrana bilja – Interna skripta, Zagreb, 89 str.	YES	YES, Merlin
	Vukadinović, V. i V. Vukadinović, 2011: Ishrana bilja, Poljoprivredni fakultet Osijek, 442 str.	YES	
2.12. Optional literature	Bergmann, W., 1993: Bergmann, W., 1992. Nutritional Disorders of Plants. Gustav Fischer Verlag, Jena - Stuttgart - New York. 377 p. Marschner P., 2011: Mineral nutrition of higher plants. 3rd edition. Edited by P. Marschner. Amsterdam, Netherlands: Elsevier/Academic Press, 684 p.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Mario Božić, PhD Assistant professor Ernest Goršić	1.7. Number of ECTS credits	5
1.2. Course title	Growth and increment	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+0
1.3. Course code	225917	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian



1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Together with the basic goal of acquiring of necessary knowledge with the lawfulness of growth and increment in individual trees and the stands consisting of main tree species, influential factors for growth and increment, and the methods of measuring and determining of increment in trees and stands, by this course of lectures special emphasize on acquiring of knowledge regarding growth and increment in the field of cultivation of natural and artificially raised stands are given.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>B2. establish forest management programs and wildlife management programs</p> <p>B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management</p> <p>B7. organise and manage professional works on inventorying forests</p> <p>D1. conduct buisnesses of scientific and professional associate in scientific-research institutions in the field of forestry</p> <p>D2. conduct courses in professional secondary and other similar schools</p> <p>D4. professionally and scientifically upgrade through different educational ways and postgraduate study</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Determining factors which affect growth and increment</p> <p>To analyze growth and increment of individual trees (height, diameter, cross section area and volume increment)</p> <p>To present development and stand increment (in even-aged stands, pure and mixed; growth and increment of uneven-aged stands, influence of management and habitat changes on tree and stand increment)</p> <p>To determine stnad increment when making management plans (methods of stand growth, data quality of increment calculated for management unit/class level)</p> <p>To present growth and increment models (simple and complex models with stratified and nonstratified samples).</p>		
2.5. Course content (syllabus)	<p>CLASSES</p> <p>1. Introduction. Definition of basic terminology. Getting information on tree and stand increment.</p> <p>2.Factors that affect growth and increment.</p> <p>3. Growth and increment of individual trees. Influence of ecological (enviromental) variables on growth.</p> <p>4. Tree growth space. Influence of structural (stand) factors on growth.</p> <p>5. Height growth and increment.</p> <p>6. Diameter growth and increment. Surface growth and increment.</p>		



	<p>7. Growth and increment of tree volume and value. 8. Definition of stand quality as production capability of stand environment. 9. Development and increment of even aged stands. 10. Development and increment of uneven aged stands. 11. Influence of management actions on increment of trees and stands. 12. Influence of stand changes on increment of trees and stands. 13. Sample size for determining increment on stand and management unit level. 14. Methods for stand growth assessment. 15. Basics of growth and increment modeling.</p> <p>PRACTICE (computer, field work, laboratory) 1. Introduction. Instruments for measurement and growth analysis. 2. Problems in defining annual diameter increment (false and missing tree rings). 3. Collection of tree increment data (increment cores, continuous measurement, sample for total tree analysis). 4. Analysis of tree height growth and increment. 5. Analysis of tree diameter growth and increment. 6. Analysis of tree cross section surface area growth and increment. 7. Longitudinal tree cross section. 8. Analysis of tree volume growth and increment. 9. Assessment of stand quality of even aged and selection stand. 10. Analysis of increment cores in even aged stands. 11. Analysis of increment cores in selection stands. 12. Analysis of tree increment based on continuous measurements 13. Calculation of increment in even aged stands based on Meyer differential method. 14. Calculation of increment in selection stands based on increment percentage table. 15. Stand increment based on method of control measurement. Computational revision of stand structure.</p>										
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:				
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES			
	Experimental work		NO	Report		NO	(other)				



	Essay		NO	Seminar Paper		NO	(other)		
	Preliminary exam	YES		Practical Work	YES		(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)		4
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Continuous attending and active engagement in lectures and exercises, making and submitting of exercises in required time schedule. Passing the colloquiums and exams.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Klepac, D., 1963: Rast i prirast šumskih vrsta drveća i sastojina, 299 pp., Znanje, Zagreb.				YES				
	Božić, M., Goršić, E.: Presentations from classes and practice.						Merlin		
	Pranjić, A., Lukić, N., 1997: Izmjera šuma. Šumarski fakultet Sveučilišta u Zagrebu, 410 pp, Zagreb				YES				
2.12. Optional literature	Pretzsch, H., 2009: Forest Dynamics, Growth and Yield. 664 pp., Springer-Verlag Berlin Heidelberg Maunaga, Z., Đukić, V., 2019: Prirast šuma. Univerzitet u Banjoj Luci Šumarski fakultet., 334 pp., Banja Luka								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Renata Pernar, PhD. Assist. Prof. Jelena Kolić, PhD.	1.7. Number of ECTS credits	2
1.2. Course title	Photointerpretation in forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33918	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students will get to know the latest achievements in the field of photointerpretation in our country and in the world, theoretical fundamentals, types of photographing systems and methods of photographing, and possibilities for application of aerial and satellite images in forestry..		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways B2. establish forest management programs and wildlife management programs B9. prepare ecological studies and forestry parts of spatial plans B15. develop current technologies as well as implement new technologies D4. professionally and scientifically upgrade through different educational ways and postgraduate study		
2.4. Expected learning	Pronounce the definition of photo interpretation. Explain the visual, measured and digital interpretation. Observe the influence of individual factors on the readability of the images.		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Prepare and describe the image components. Present procedures for image analysis. Describe the types and characteristics of Photo interpretation keys. Explain how to make a Photointerpretation key. Analyze the application of photointerpretation in breeding, managing, protection of forests, hunting, ... Define scale of aerial photographs. Show aerial photographs orientation. Explain the methods of measurement interpretation to determine the constituent and structural parameters. List the methods of digital image processing Explain the digital interpretation Identify and compare a controlled and uncontrolled classification Explain the accuracy of the classification</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. In general about photo interpretation, definitions, basic concepts 2. Ways of interpreting images (visual, measured, digital) 3. The influence of certain factors on the legibility of shots (shadows, clouds, scale, image quality, recording time, type of photo layer), photointerpretation tools for photo interpretation 4. Photointerpretation of different types of aerial photographs (images from drone, aerial or satellite images) 5. Recognition way of recorded objects to images (color, pseudocolor) 6. Types and characteristics of Photointerpretation keys; ways of making, application in forestry 7. Image components important for photointerpretation (color, tone, size, pattern, shape, ...) 8. Image analysis procedures (detection, delineation, measurement, differentiation, classification, coding...) 9. Success of photointerpretation and possible errors 10. Visual interpretation of images 11. Assessment of trees damage and stands on multispectral images, monitoring of changes 12. Measurement interpretation with the aim of determining stand and structural parameters 13. Aerial photo appraisal (height of trees, crown width, area, number of trees, volume, canopy ...) 14. Digital interpretation, classifications, vegetation indices, determining the accuracy of classification 15. Application of image interpretation results in silviculture, management and forest protection, wildlife management, ecology,...
	<p>2.7. Comments:</p>



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES		
	Experimental Work		NO	Report	NO	(other)			
	Essay		NO	Seminar Paper	YES	(other)			
	Preliminary Exam		NO	Practical work	NO	(other)			
	Project		NO	Written exam	NO	ECTS credits (total)	2		
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures, production and presentation of seminar work. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library		Availability via other media					
	Tomašegović, Z., (1986): Fotogrametrija i fotointerpretacija u šumarstvu, Zagreb, 154 str.	YES							
	Oluić, M. (2001): Snimanje i istraživanje Zemlje iz svemira, HAZU, Zagreb, 580 str.	YES							
	Pernar, R. (2019): Prezentacije s predavanja			YES					



	Konecny, G. (2002): Geoinformation: Remote Sensing, Photogrammetry and Geographic Information Systems. CRC Press. 280 str.		YES
	Donassy, V. (1987.): Fotogrametrija II, Geodetski fakultet, Sveučilište u Zagrebu,	YES	
2.12. Optional literature	1. Lillesand T.M., Kiefer R.W. and j. W. Chipman (2004): Remote sensing and image interpretation, Wiley & Sons, 763 str. 2. Huss, S., (1984): Luftbildung und Fernerkundung in der Forstwirtschaft, Karlsruhe, 375 str. 3. Oštir, K. Mulahusić, A. (2014): Daljinska istraživanja. Građevinski fakultet, Univerzitet u Sarajevu, 343 str. 4. Richards, J. A. (2013): Remote Sensing Digital Image Analysis, An introduction. Springer-Verlag Berlin Heidelberg. 494 str.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Dario Baričević, PhD.	1.7. Number of ECTS credits	2
1.2. Course title	Application of phytocenology in forestry practice	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225925	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The aim of the course is to acquaint students through real examples from practice with the application of phytocenological knowledge in the management, governance and protection of forest ecosystems. And in that way to be able for independent phytocenological recording, processing and		



	<p>interpretation of phytocenological data, as well as creation of vegetation maps and interpretation of the same. In doing so, they will be able to use classical methods, but also the latest knowledge, methods and tools, and apply them when making and interpreting the basics of management, management plans, ecological studies and spatial plans.</p>
<p>2.2. Enrolment requirements and/or entry competences required for the course</p>	<p>-</p>
<p>2.3. Learning outcomes at the level of the programme to which the course contributes</p>	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways A3. apply simpler methods of operation research B9. prepare ecological studies and forestry parts of spatial plans B14. manage forest, human resource, and technical potential during performance of forest works B15. develop current technologies as well as implement new technologies D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry D2. conduct courses in professional secondary and other similar schools D4. professionally and scientifically upgrade through different educational ways and postgraduate study D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper.</p>
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Interpret the application of vegetation research (synecological and vegetation research and their interpretation - identification and description of forest communities, systematic position, change in floral composition and surface, stability of phytocoenoses). Valorize the floral composition as an indicator of the disturbance of forest ecosystems (phytocenological recording, biodiversity index, creating an eco-diagram, analysis of the obtained results and making detailed conclusions). Present the mapping of forest vegetation (mapping, technical preparation, field work, processing of collected data, creation of a vegetation map). Interpret forest vegetation maps and apply them in practice. Explain the application of phytocenological research and knowledge in the making and interpretation of management bases, management plans, ecological studies and spatial plans.</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures 1. Sinmorfology; definition, importance. Biogeocenosis; definitions, factors, relationships, biological equilibrium. Natural and near-natural ecosystems. 2. Natural stands as an integral part of the plant community. Forest communities; struggle for survival, properties, structure and relationships within the community. Examples. 3. Preparation and collection of data; phytocoenological recording - general data, layering, floral composition, abundance and coverage, sociability. Examples of use in practice. 4. Classical analysis of phytocenological records; characteristic and distinguish species, process of synthetic classification. Examples of use in practice.</p>



	<p>5. Computer processing of phytocenological records. Computer software in forest phytocenology - types, ways of use, advantages. Turboveg database. Examples of use in practice.</p> <p>6. Computer programs for data analysis in ecology and systematics. Syntax 2000 programming package, Juice programming package; description, possibilities, advantages. Examples of use in practice.</p> <p>7. Numerical multivariate analysis of phytocenological records; definitions, species, importance, advantages over the classical analysis of phytocenological records. Examples of use in practice.</p> <p>8. Hierarchical clustering methods. Agglomerative methods (single linkage, complete linkage, average linkage method, etc.). Multidimensional scaling. Original and artificial variables. Principal coordinates analysis (PcoA) and other methods. Dendrograms. Examples of use in practice.</p> <p>9. The eco-indicator value of some plant species and the possibility of ecological characterization and comparison of forest habitats based on the indicative value of floral composition. Examples of use in practice.</p> <p>10. Floral composition as an indicator of the state of forest ecosystems. Examples from practice.</p> <p>11. Mapping vegetation; in general, the meaning of vegetation maps, types and scale of maps, map making by classical methods. Examples of use in practice.</p> <p>12. Modern methods of vegetation research and mapping and their application. Terrestrial and remote exploration of vegetation. Advantages and disadvantages compared to classical methods. Examples of use in practice.</p> <p>13. Use of satellite images in the research of types of forest vegetation; in general, types, ways of use, advantages and disadvantages. Examples of use in practice.</p> <p>14. Getting to know the basics of GIS technology. Digitized vegetation maps - importance and advantages in relation to classic vegetation maps. Application in the preparation of the management bases, management plans, ecological studies and similar.</p> <p>15. Application of phytocenological research and knowledge in the making and interpretation of management bases, management plans, ecological studies and spatial plans. Examples of use in practice.</p>										
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:				
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES			
	Experimental		NO	Report		NO	(other)				



	Work							
	Essay		NO	Seminar Paper		NO	(other)	
	Preliminary exam		NO	Practical Work		NO	(other)	
	Project		NO	Written exam	YES		ECTS credits (total)	2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures. Making seminar work. Taking exam.							
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media	
	Vukelić, J., Đ. Rauš, 1998: Šumarska fitocenologija i šumske zajednice u Hrvatskoj. Udžbenik, Sveučilište u Zagrebu, Šumarski fakultet, Zagreb, 310 str.				YES			
	Vukelić, J., Mikac, S., Baričević, D., Bakšić, D., R. Rosavec, 2008: Šumska staništa i šumske zajednice u Hrvatskoj Nacionalna ekološka mreža. Državni zavod za zaštitu prirode, 263 str.				YES		Web, Merlin	
	PP presentations with examples of application of forest phytocenology in practice						Web, Merlin	
2.12. Optional literature	<ol style="list-style-type: none"> Podani, J., 1994: Multivariate data analysis in Ecology and Systematics. SPB Academic Publishing bv. Den Haag. Digby, P.G.N., R.A. Kempton, 1987: Multivariate Analysis of Ecological communities. Chapman and Hall Ltd. Ellenberg, H., 1979: Zeigerwerte der Gefässpflanzen Mitteleuropas. Verlag E. Goltze KG, Göttingen. Glavač, V., 1996: Vegetationsökologie - Grundfragen, Aufgaben, Methoden. Gustav Fischer, Jena, Stuttgart, 385 str. Kachigan, S.K., 1991: Multivariate Statistical Analysis. Radius Press, New York. Oberdorfer, E., 1983: Pflanzensoziologische Exkursions flora. Verlag Eugen Ulmer Stuttgart, 1051 str. 							



7. Šegulja, N. & V. Hršak, 1988: Priručnik za fitocenološka i ekološka istraživanja vegetacije. Mala ekološka biblioteka, knjiga 1, HED, 91 str.

8. Baričević, D., 1998: Ecological-vegetational properties of forest "Žutica". Glas. šum. pokuse 35: 1–91.

9. Baričević, D., 1999: Ekološko-vegetacijske promjene u šumama hrasta lužnjaka na području G.J. "Žutica". Šum. list 123(1–2): 17–28.

10. Vukelić, J., D. Baričević, S. Mikac, M. Rukavina & D. Tomljanović, 2006: Karta šumske vegetacije sjevernoga Velebita. Glas. šum. pokuse, posebno izdanje 5: 139-149.

11. Baričević, D., 2006: Promjene flornoga sastava šumskih zajednica na lokalitetima naftnih akciditeta u šumi Žutica. Naftaplin, knjiga 20/06: 107-125.

12. Baričević, D., N. Pernar, J. Vukelić, S. Mikac & D. Bakšić, 2009: Floristic composition as an indicator of destabilisation of lowland forest ecosystems in Posavina. Periodicum Biologorum 111(4): 443-451.

13. Šapić, I., Vukelić, J., Mikac, S., Baričević, D., 2015: Mapping of forest vegetation of Plitvice Lakes National Park using SPOT satellite images. Poster. U. 36th Meeting of Eastern Alpine and Dinaric Society for Vegetation Ecology - Book of Abstracts. Škvorc, Ž., Franjić, J., Krstonošić, D. (ur.). - Zagreb : Croatian Botanical Society: 49-49.

14. Zenković, D., 2015: Promjene flornoga sastava na lokalitetima narušenosti u šumi Žutica, diplomski rad, Šumarski fakultet Sveučilišta u Zagrebu.

15. Vukelić, J. i suradnici, 2005: Studija uređenja područja Bundeka. Gradski ured za poljoprivredu i šumarstvo i Šumarski fakultet.

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Asst. prof. Marko Vucelja, PhD	1.7. Number of ECTS credits	2
1.2. Course title	Zoonoses in forest ecosystems	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73819	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian



1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students acquire knowledge about the zoonoses in Croatian forest ecosystems which should be helpful in reduction of the the future infection risks among forestry workers. Defining the importance of zoonotic agents in forest ecosystems is a contribution to better understanding of natural forest stability and preservation		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A2. explain position and trends of urban forestry, nature conservation and environmental protection in the country and worldwide B9. organise and manage integrated protection of plants and trees in urban areas and protected natural areas B14. develop current technologies as well as implement new technologies C2. perform and manage works in horticultural and communal services D1. conduct buisnesses of scientific and professional associate in scientific-research institutions in the field of forestry		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<ol style="list-style-type: none"> 1. Comprehend the definition of zoonoses, reservoirs and disease vectors, list the causes of zoonoses and link them to specific zoonoses 2. Interpret and explain the way of spreading zoonoses, identify and describe the importance of protected forest ecosystems (National Parks, Nature Parks) as natural habitats of zoonotic agents, considering the risk factors for forest workers 3. Comment on the horizontal and vertical distribution of the Dobrava and Puumala viruses in the protected forests of Croatia, name their reservoirs and spatial distribution according to the latest scientific knowledge. 4. Identify the occurrence of leptospirosis, Lyme borreliosis, tularemia, salmonellosis, lymphocytic choriomeningitis, West Nile fever in protected forests of Croatia, with particular reference to the flood forest of Lonjsko polje and forests of the Plitvice Lakes and Risnjak National Parks, Medvednica, Papuk and Žumberak-Samobor. 5. Comment on the horizontal and vertical distribution of certain serological variants of Leptospira (floodplain forests of Lonjsko polje Nature Park, forests of the Plitvice Lakes and Risnjak National Parks, Medvednica, Papuk and Žumberak-Samobor. 		
2.5. Course content (syllabus)			
			2.7. Comments:



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Writing seminar. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Turk, N., Margaletić, J., Markotić, A., 2009: Forest ecosystems and zoonoses. Wildlife: Destruction, Conservation and Biodiversity / Harris, D. John ; Brown, L. Paul (ur.). Hauppauge, NY, USA : Nova Science Publishers, Inc., Str. 1-45			NO		Yes, e-learning platform "Merlin"			
	Shakespeare, M., 2002: Zoonoses. Pharmaceutical Press, 285 str			NO		Yes, e-learning platform "Merlin"			



	<p>Casil, .M., 2005: Hantavirus. The Rosen Publishing Group, 64 str</p>	<p>NO</p>	<p>Yes, e-learning platform "Merlin"</p>
	<p>Lacey, E.A., Patton, J.L., Cameron, G.N., 2000: Life underground the biology of subterranean rodents. The University of Chicago Press, Chicago and London, 449 pp</p>	<p>NO</p>	<p>Yes, e-learning platform "Merlin"</p>
<p>2.12. Optional literature</p>	<p>Cvetnić, Ž., Margaletić, J., Đikić, M., Glavaš, M., Đikić, D., Špičić, S., Jurić, I., Salajpal, K., 2002: Glodavci kao mogući rezervoari leptospiroze u otvorenim sustavima držanja svinja. U: Đikić, M., Jurić, I., Kos, F. (ur.), Turopoljska svinja, 165–172.</p> <p>Margaletić, J., Glavaš, M., Turk, N., Milas, Z., Starešina, V., 2002: Small rodents reservoirs of leptospiroses in the forests of Posavina in Croatia. Glas. šum. pokuse 39: 43–65.</p> <p>Cvetnić, Ž., Margaletić, J., Đikić, M., Glavaš, M., Djikić, D., Špičić, S., Jurić, I., Salajpal, K., 2002: Rodents as possible reservoirs of leptospirosis in extensive swine breeding systems. Acta Agraria Kaposváriensis, 6(2): 77–82.</p> <p>Milas, Z., Turk, N., Starešina, V., Margaletić, J., Slavica, A., Živković, D., Modrić, Z., 2002: The role of myomorphous mammals as reservoirs of leptospira in the pedunculate oak forests of Croatia. Veterinarski arhiv, 72(3):119–129.</p> <p>Turk, N., Milas, Z., Margaletic, J., Staresina, V., Slavica, A., Riquelme-Sertour, N., Bellenger, E., Baranton, G., Postic, D., 2003: Molecular characterization of Leptospira spp. isolated from small rodents in Croatia. Epidemiol. Infect., 130(1):159–166.</p> <p>Margaletić, J., 2003: Sitni glodavci šumskih ekosustava kao rezervoari zaraznih bolesti. Acta Medica Croatica, 57: 421–426.</p> <p>Margaletić, J., 2003: Small rodents in the forest ecosystem as infectious disease reservoirs. Acta medica Croatica : casopis Hrvatske akademije medicinskih znanosti, 57(5): 421-426.</p> <p>Cvetnic, Z., Margaletic, J., Tonicic, J., Turk, N., Milas, Z., Spicic, S., Lojkić, M., Terzic, S., Jemersic, L., Humski, A., Mitak, M., Habrun, B., Krt, B., 2003: A serological survey and isolation of leptospires from small rodents and wild boars in the Republic of Croatia. Vet. Med.-Czech 48(11): 321–329.</p> <p>Cvetko L., Markotić A., Plyusnina A., Margaletić J., Miletić-Medved M., Turk N., Milas Z., Avšič-Županc T., Plyusnin A., 2005: Puumala virus in Croatia in the 2002 HFRS Outbreak. Journal of Medical Virology, 77: 290–294.</p> <p>Cvetko L., Turk N., Markotić A., Milas Z., Margaletić J., Miletić-Medved M., Plyusnin A., Baranton, G., Postic, D., Avšič-Županc T., 2006: Dual infection with Puumala virus and Leptospira interrogans in bank vole (Clethrionomys glareolus). American Journal of Tropical Medicine and Hygiene, 74(4): 612–614.</p> <p>Margaletić, J., 2006: Sitni glodavci kao rezervoari zoonoza u šumama Hrvatske. Rad.-Šumar. inst. Jastrebar., 41(1-2): 133–140.</p> <p>Konjević, D., Špakulová, M., Beck, R., Goldová, M., Severin, K., Margaletić, J., Pintur, K., Keros, T., Perić, S., 2007: First evidence of</p>		



- Paraheligmonina gracilis and Hymenolepis sulcata among fat dormice (*Glis glis* L.) from Croatia. *Helminthologia*, 44(1): 34–36.
- Margaletić, J., Grubešić, M., Pernar, R., 2007: Sitni glodavci šumskih ekosustava kao rezervoari zoonoza. *Zbornik radova, knjiga 37/08*, 33-42.
- Margaletić, J., 2008: Sitni glodavci izvori zaraznih bolesti u šumama. *Priroda*, 3: 35–39.
- Markotić, A., Cvetko-Krajinović, L., Margaletić, J., Turk, N., Miletić-Medved, M., Žmak, Lj., Janković, M., Kurolt, I.C., Šoprek, S., Đaković-Rode, O., Milas, Z., Puljiz, I., Ledina, D., Hukić, M., Kuzman, I., 2008: Zoonoses and vector-borne diseases in Croatia - a multidisciplinary approach. *Veterinaria Italiana*, 45(1): 55-66.
- Turk, N., Milas, Z., Margaletić, J., Turk, R., Barbić, Lj., Konjević, D., Perić, S., Štritof, Z., Starešina, V., 2008: The role of fat dormouse (*Glis glis* L.) as reservoir host for spirochete *Borrelia burgdorferi sensu lato* in the region of Gorski Kotar, Croatia. *Eur. J. Wildl. Res.*, 54(1): 117–121.
- Habuš, J., Cvetnić, Ž., Milas, Z., Štritof, Z., Balen-Topić, M., Margaletić, J., Turk, N., 2009: Seroepidemiološko i seroepizootiološko istraživanje leptospiroze u Hrvatskoj tijekom 2007. *Infektološki glasnik*, 28(4): 183-188.
- Beck, R., Vojta, L., Čurković, S., Mrljak, V., Margaletić, J., Habrun, B., 2011: Molecular survey of *Babesia microti* in wild rodents in central Croatia. *Vector-Borne and Zoonotic Diseases*, 11(1): 81-83.
- Plyusnina A., Krajinović, L.C., Margaletić J., Niemimaa, J., Lundkvist, A., Markotić A., Miletić-Medved M., Avšič-Županc T., Henttonen, H., Plyusnina A., 2011: Genetic evidence for the presence of two distinct hantaviruses associated with *Apodemus* mice in Croatia and analysis of local strains. *Journal of Medical Virology*, 83(1): 108–114.
- Tadin, A., Turk, N., Korva, M., Margaletić, J., Beck, R., Vucelja, M., Habuš, J., Svoboda, P., Avšič Županc, T., Henttonen, H., Markotić, A., 2012: Multiple Co-infections of Rodents with Hantaviruses, *Leptospira* and *Babesia* in Croatia. *Vector-Borne and Zoonotic Diseases*, 12(5): 388–392.
- Štritof Majetić, Z., Galloway, R., Ružić Sabljčić, E., Milas, Z., Mojčec Perko, V., Habuš, J., Margaletić, J., Pernar, R., Turk, N., 2014: Epizootiological survey of mouse-like rodents as *Leptospira* spp. reservoirs in Eastern Croatia. *Acta Tropica*, 131: 111-116.
- Margaletić, Josip; Markotić, Alemka; Vucelja, Marko; Bjedov, Linda; Svoboda, Petra; Pisačić, Marija, 2016: Sitni glodavci kao rezervoari virusa Puumala i Dobrava. *Zbornik radova seminara "DDD i ZUPP – jučer, danas, sutra"*, 281–292.
- Jelena Prpić, Tomislav Keros, Marko Vucelja, Oktavija Đaković Rode, Josip Margaletić, Boris Habrun, Lorena Jemeršić, 2019: Full title: First evidence of hepatitis E virus infection in a small mammal (yellow-necked mouse) from Croatia. *PLoS ONE* 14(11):e0225583



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assoc. Prof. Martina Temunović, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	Methods of plant taxonomy	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73820	1.9. Expected enrolment in the course	5-10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	In this course students gain an understanding of the basic principles, key concepts and available methods in plant taxonomy. This allows them to define and interpret taxonomic problems correctly as well as to collect and process required plant material. They get acquainted with the latest methodologies and tools for the analyses of various types of taxonomic data, including molecular tools which are becoming widely accessible due to rapid development of science and technology.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>B9. prepare ecological studies and forestry parts of spatial plans</p> <p>D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry</p> <p>D2. conduct courses in professional secondary and other similar schools</p> <p>D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper.</p>		



<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>To explain basic principles and terminology in plant taxonomy (phylogeny, plant nomenclature, understanding of the taxon concept, evolution, speciation) To use plant identification keys, floristic handbooks, herbarium collections and herbarium material for plant identification. To define taxonomic problems and to recommend appropriate methods of collecting and processing suitable types of taxonomic data (morphology, anatomy, cytology and biochemistry, phytogeography, paleobotany, molecular taxonomy). To analyse taxonomic data and to interpret the obtained results.</p>								
<p>2.5. Course content (syllabus)</p>	<p>Lectures: 1. Taxonomy – definition, basic principles and terminology. Phylogeny. (1h) 2. Plant nomenclature. Taxon definition, understanding of the taxon concept, taxonomic ranks. (1h) 3. Evolution and Microevolutionary processes. (1h) 4. Species definitions. Speciation. (1h) 5. Developing and using plant identification keys, floristic handbooks. (1h) 6. Herbarium and herbarium collections. (1h) 7. Plant identification. (1h) 8. Methods of collecting and processing taxonomic data – morphology. (1h) 9. Methods of collecting and processing taxonomic data – anatomy, cytology and biochemistry. (1h) 10. Methods of collecting and processing taxonomic data – phytogeography and paleobotany. (1h) 11. Methods of collecting and processing taxonomic data – molecular taxonomy. (2h) 12. Methods of collecting and processing taxonomic data – molecular taxonomy. (1h) 13. Statistical analysis of taxonomic data. (1h) 14. Seminar presentations. (1h)</p>								
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			<p>2.7. Comments:</p>		
<p>2.8. Monitoring student work</p>	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar	YES		(other)		



			paper					
	Preliminary Exam	NO	Practical work		NO	(other)		
	Project	NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities								
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library		Availability via other media				
	Vidaković, M., J. Franjić, 2004: Golosjemenjače. Sveučilište u Zagrebu-Šumarski fakultet. Zagreb	YES						
	Franjić, J., Ž. Škvorc, 2010: Šumsko drveće i grmlje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 432 str. Zagreb	YES						
	Franjić, J., Ž. Škvorc, 2014: Šumsko zeljasto bilje Hrvatske. Sveučilište u Zagrebu – Šumarski fakultet, 626 str. Zagreb	YES						
	Stuessy, T. F. 2009: Plant taxonomy: The systematic evaluation of comparative data. 2nd edition. Columbia University Press, New York.	NO		YES. As PDF from the professor				
	Judd, W. S., C. S. Campbell, E. A. Kellogg, P. F. Stevens 2007: Plant Systematics. A Phylogenetic Approach. 3rd edition. Sinauer Associates. Sunderland.	NO						
2.12. Optional literature	1. Nikolić, T., 1996: Herbarijski priručnik, 1-167. Zagreb. 2. Nikolić, T., 2013: Sistematska botanika - Raznolikost i evolucija biljnog svijeta. Alfa d.d., 882 str. Zagreb. 3. Nikolić, T., 2019: Flora Croatica 4 - Vaskularna flora Republike Hrvatske, Alfa d.d., 664 str. Zagreb. 4. Domac, R., 1994: Flora Hrvatske, priručnik za određivanje bilja. Školska knjiga, Zagreb.							



	<p>5. Singh, G. 2016: Plant Systematics, 3rd edition: An Integrated Approach. CRC Press.</p> <p>6. Besse, P. (ur.) 2014: Molecular plant taxonomy: methods and protocols. Humana Press.</p> <p>7. Winston, J.E. 1999: Describing Species, Practical Taxonomic Procedure for Biologist. Columbia University Press, New York</p> <p>8. Clive, S., 2005: Plant taxonomy and biosystematics-does DNA provide all the answers? Taxon 54: 999-1007.</p> <p>9. Relevant scientific papers</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	doc.dr.sc. Kristijan Tomljanović	1.7. Number of ECTS credits	2
1.2. Course title	Bird ecology	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73821	1.9. Expected enrolment in the course	25-30
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Through the topics students are familiarized with the most important features of bird fauna. The basic ecological characteristics of birds are treated, with an emphasis on indigenous species. The course concludes with a review of current legislation, directives and threat lists.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish		



<p>the level of the programme to which the course contributes</p>	<p>possibilities of different interpretation of the same problem analysed in different ways B2. establish forest management programs and wildlife management programs B3. implement forest management programs B10. apply knowledge related to forest machines, techniques and standard technologies used in forestry D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry</p>								
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Definition of ornithophore research methods. technique and technology used in bird research. The definition requires certain groups of birds, anatomy, mating, nesting, intrageneric and interspecific predation. Presentation of individual groups (taxonomic categories) with important common features, requirements and specifics of importance to management.</p>								
<p>2.5. Course content (syllabus)</p>	<p>Through fifteen thematic units, students are introduced to the basics of ecology, anatomical material, demography, within peers and among peers. LECTURES 1. Introduction to ornithology 2. Introduction to bird ecology 3. Digestive system and metabolism 4. Mating 5. Nesting 6. Feathers and moulting 7. Nutrition 8. Flight of birds 9. Relocation and migration 10. Demography 11. Birds and climate change 12. Bird communities I 13. Bird communities II 14. Research methods 15. Legislation, directives and red books</p>								
<p>2.6. Format of instruction</p>	<input type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)	<p>2.7. Comments:</p>						
<p>2.8. Monitoring student work</p>	<p>Class attendance</p>	<p>YES</p>		<p>Research</p>	<p>YES</p>		<p>Oral exam</p>	<p>YES</p>	



	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Examination.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Chandler, D., Couzens, D., Malin, R., Moss, S. 2008: The complete illustrated Encyclopedia of British & European Birds				YES				
	Ptice Hrvatske i Europe, priručnik 2018				YES				
2.12. Optional literature	Gill, F. 2000: Ornithology. W. H. Freeman and Company, New York. Dolenec, Z. 2009: Ptice tu oko nas. Školska knjiga, Zagreb. Sterry, P. 2004: Birds of Mediterrean. C. Helm, London								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	doc. Marko Vucelja, PhD	1.7. Number of ECTS credits	2
1.2. Course title	Behavioural ecology	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73822	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	English
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	This course should familiarize the students with central features in behavioural ecology and animal behaviour in an evolutionary perspective. Obtained knowledge should also provide the forestry students with a link between the importance of behavioural ecology and conservation of free living animals.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B2. establish forest management programs and wildlife management programs		
2.4. Expected learning	1. Identify the main scientists and their research that set the foundations of ethological research. 2. Identify the difference between the ultimate and proximal causes of animal behavior.		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<ol style="list-style-type: none"> 3. List the types of innate and learned behaviors. 4. Identify the mechanisms responsible for the innate and learned behavior. 5. Identify examples of natural and sexual selection and the impact of both on the development and behavior of animal species. 7. Identify in nature different types of behavior and appearance of animals due to natural and sexual selection. 8. Classify different reproductive strategies of animals with an emphasis on monogamy and polygamy. 9. Identify various mechanisms in females and males responsible for brood care. 10. Identify sexual dimorphism and identify intrasexual and intersexual selection. 								
<p>2.5. Course content (syllabus)</p>	<ol style="list-style-type: none"> 1. Introduction to behavioural ecology: history background with emphasis on work of Tinbergen, Lorenz and Darwin. Explanation of basic terms and definitions needed for understanding the behavioural and ecological studies. 2. Introducing different types of behaviour; different analysis and interpretations of behaviour. 3. Proximate and ultimate mechanisms of behaviour 4. Evolution of behaviour: Understanding behaviour through mechanisms of sexual and natural selection. 5. Intra- and inter- specific interactions 6. Foraging theory 7. Learning in animals: operant and classical conditioning, non-associative learning, imprinting 8. Selection types: balancing, directional, disruptive, stabilizing, r-strategy and k-strategy 9. Aggressive and territorial behaviour 10. Hormones and behaviour 11. Social behaviour in animals and humans 12. Conservation biology 1 13. Conservation biology 2 14. Importance of behavioural in comparison of different field of study (ecology, neurobiology, sociology and psychology) 15. Short summary of lectures 1-12; consultation for students with questions concerning the lectures 								
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)	<p>2.7. Comments:</p>						
<p>2.8. Monitoring student work</p>	<p>Class attendance</p>	<p>YES</p>		<p>Research</p>		<p>NO</p>	<p>Oral exam</p>		<p>NO</p>



	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Alcock J. Animal Behavior: An Evolutionary Approach. Seventh Edition. Sunderland (MA): Sinauer Publishers, 2001.				NO		Yes, e-learning platform „Merlin“		
	Pavičić, Željko Opća etologija Zagreb: Veterinarski fakultet Sveučilišta u Zagrebu, 2006., 62 str.				NO		Yes, e-learning platform „Merlin“		
Pavičić, Ž., Ostović, M., Aladrović, J., Opća etologija, poglavlje u knjizi Dobrobit životinja, Urednik/ci Pavičić, Željko ; Ostović, Mario 2019, raspon stranica 1-22				NO		Yes, e-learning platform „Merlin“			
2.12. Optional literature	1.Eibel-Eibesfeldt, I. Grundriss der vergleichenden Verhaltensforschung. München : Verlag Piper, 1969. 2. Pullin, A. S. Conservation Biology. Cambridge University Press, 2002.								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	assist. prof. Marko Vucelja, PhD	1.7. Number of ECTS credits	2
1.2. Course title	Monitoring of animal populations	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73823	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The aim of the course is to teach students about the structure of animal populations. Students will learn about spatial distribution and different monitoring methods. Defining the importance of animals is a contribution to better knowledge of natural relationships as a guarantee of forest stability and ecosystem preservation.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways B2. establish forest management programs and wildlife management programs B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B9. prepare ecological studies and forestry parts of spatial plans		
2.4. Expected learning	List and describe the characteristics of the animal population. Express the structure of animal populations, its biotic potential and dynamics. Describe the spatial distribution of animal species. Identify different methods for determining the density of animal populations.		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Choose and combine different methods for determining the density of animal populations depending on the target animal species and the accessibility of its habitat. Anticipate barriers that may arise when estimating animal population density. List and classify the types of relations between animal populations. Identify different methods of animal control with emphasis on biological methods. Design, plan and recommend measures to control the abundance of animal species in commercial forests.</p>								
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Structure of animal populations 2. Biological potential. Calamities 3. Population dynamics (oscillations and fluctuation types, spatial aspect). 4. Impact of ecological factors on the number of animal populations 5. Habitus and genetic constitution of the animal population (birth rate and mortality, age structure). 6. Population theories. 7. Methods for determining animal populations 8. Intraspecies and interspecies relationships of animal species 9. Microdistribution and macrodistribution of animal populations. 10. The importance of animal senses in daily and periodic migrations 11. Horizontal and vertical distribution 12. The search for food 13. Dominance 14. Fluctuations of animal populations in Croatian forests. 15. Methods of animal control and regulation 								
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work				<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		<p>2.7. Comments:</p>		
<p>2.8. Monitoring student work</p>	Class attendance	YES		Research	YES		Oral exam		NO
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper	YES		(other)		



	Preliminary Exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Zabel, C.J., Anthony, R.G., 2003: Mammal Community Dynamics. Cambridge university press, 709 str.				NO		Yes, e-learning platform "Merlin"		
	Manning, A., Dawkins, M.S., 1998: Animal behaviour. Cambridge university press, 450 str.				NO		Yes, e-learning platform "Merlin"		
	Lacey, E.A., Patton, J.L., Cameron, G.N., 2000: Life underground the biology of subterranean rodents. The University of Chicago Press, 449 str.				NO		Yes, e-learning platform "Merlin"		
2.12. Optional literature	<p>Delany, M.J., 1974: The ecology of small mammals. Studies in biology, 51 Edward Arnold, London, 60 str.</p> <p>Flowerdew, J.R. & Gardner, G., 1978: Small rodent populations and food supply in a Derbyshire ashwood. J. Anim. Ecol., 47: 725-740.</p> <p>Alibhai, S.K., Gipps, J.H.W., 1985: The population dynamics of bank voles. Symposia of the zoological Society of London, 55: 277–313.</p> <p>Bujalska, G., 1981: Formation of sex structure in populations of bank vole (<i>Clethrionomys glareolus</i> Schreber 1780). Wlad. Ecol., 27: 37–48.</p> <p>Flowerdew, J.R., 1985: The population dynamics of wood mice and yellow-necked mice. Symposia of the zoological Society of London, 55: 315–338.</p> <p>Margaletic, J., Glavas, M., Bäumler, W., 2002: The development of mice and voles in an oak forest with a surplus acorns. Anzeiger für Schädlingkunde / Journal of Pest Science, 75(4): 95–98.</p> <p>Margaletić, J., Glavaš, M., Pavić, K., 2003: Brojnost glodavaca i njihova štetnost u GJ "Južna Krndija I (Kutjevačka)" i u rasadniku "Hajderovac". Šumarski list, 127(3–4): 99-107.</p> <p>Margaletić, J., 2003: Promjene u sastavu šumskih populacija sitnih glodavaca nakon mehaničkih zahvata u staništu. Zbornik radova seminara "DDD i ZUPP – stručnost prije svega", 117–122.</p>								



	<p>Margaletić, J., 2004: Dinamika populacija miševa i voluharica u šumskim ekosustavima Hrvatske u razdoblju od 1999. do 2003. godine. Zbornik radova seminara "DDD i ZUPP – Da li smo spremni za Europu?", 181–195.</p> <p>Grubešić, M., Margaletić, J., Krapinec, K., Trupčević, M., 2006: Dynamics and courses of beaver (<i>Castor fiber L.</i>) expansion in Croatia. <i>Nafta</i>, 57(3): 101–106.</p> <p>Margaletić, J., Vucelja, Marko, 2009: Dinamika populacije šumskih glodavaca. Zbornik radova seminara "DDD i ZUPP – slijedimo li svjetski razvoj", 341–353.</p> <p>Grubešić, M., Margaletić, J., Čirović, D., Vucelja, M., Bjedov, L., Burazerović, J., Tomljanović, K., 2015: Analiza mortaliteta dabrova (<i>Castor fiber L.</i>) u Hrvatskoj i Srbiji. <i>Šumarski list</i>, 139(3-4): 137-143.</p> <p>Bjedov, L., Svoboda, P., Tadin, A., Habuš, J., Štritof, Z., Labaš, N., Vucelja, M., Markotić, A., Turk, N., Margaletić, J., 2016: Utjecaj uroda sjemena obične bukve (<i>Fagus sylvatica L.</i>) na populacije sitnih glodavaca i pojavnosti hantavirusa u šumama Nacionalnog parka „Plitvička jezera“ i Parka prirode „Medvednica“. <i>Šumarski list</i>, 140(9-10): 455-464.</p> <p>Mujezinović, O., Margaletić, J., Treštić, T., Dautbašić, M., 2013: Utjecaj staništa na prisutnost šumske voluharice (<i>Myodes glareolus</i>) i žutogrlog šumskog miša (<i>Apodemus flavicollis</i>) na području Bosne. <i>Šumarski list</i>, 137(9-10): 487-494.</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Asst. prof. Marko Vucelja, PhD	1.7. Number of ECTS credits	2
1.2. Course title	Zoocology in forest ecosystems	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	73826	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	



2. COURSE DESCRIPTION	
2.1. Course objectives	The course is designed on the principles of modern forestry science and proceeds from the basis of permanent and ecological management of forest ecosystems in which the zoobiotic component is one of the important components of the complex forest ecosystem. Students are introduced to the basic ecological factors that lead to mass occurrence of certain animal species that can cause significant damage to forest ecosystems. The acquired knowledge will enable participants to focus on the permanent preservation of the stability and biodiversity of Croatian ecological systems.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	B2. establish forest management programs and wildlife management programs B3. implement forest management programs B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B9. prepare ecological studies and forestry parts of spatial plans C2. organise and manage works on organization of hunting areas D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of urban forestry, nature conservation and environmental protection D2. conduct courses in professional secondary and other similar schools
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	Interpret homotypic and heterotypic relationships within animal populations. Describe primary, secondary and tertiary methods for monitoring the number of animal populations. Break down the spatial (microdistribution and macrodistribution) distribution of animal populations in managed forests Give examples from the animal world for accidental, accessory and constant species. Connect the birth rate and mortality, age structure and reproductive potential with the population size of a certain animal species. List, draw and interpret the main elements of the animal population curve Analyze the spatial (horizontal and vertical) aspect of population dynamics. Link the impact of animal species on the ecological succession of managed forests. Break down the periodicity (change of weather, daily, lunar, seasonal, annual) and it's influence on the stability of animal populations in managed forest ecosystems. Present and critically judge the anthropogenic impact on animal ecosystems.
2.5. Course content (syllabus)	Lectures: 1. Zoocology as a science. Animal communities (zoocenoses). Types and dynamics of zoocenoses. 2. Abiotic factors 3. Wildlife feeding and nutrition, quantity and quality of food, foraging 4. Homotypic and heterotypic relationships



	5. Stress and animal care 6. Communication and the evolution of signaling 7. Mimicry, deception and honesty 8. Selection 9. Periodicity of diet 10. Life in communities 11. Migratory movements 12. Territoriality 13. Survival 14. Behavioral changes 15. Human impact on animal populations								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Writing seminar. Taking exam.								



2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Flowerdew, J. R., Gurnell, J., Gipps, J. H. W., 1985: The Ecology Woodland Rodents Bank Voles and Wood Mice. The Zoological Society of London, Clarendon Press, Oxford 409 pp.	NO	YES, Merlin
	Bonnie J. Mills, 1996: Laboratory animal management. National Academy Press, Washington, 167 pp	NO	YES, Merlin
	Zabel C. J., Anthony R. G., 2003: Mammal Community Dynamics, Cambridge University Press, London, 709 pp.	NO	YES, Merlin
2.12. Optional literature	<p>Elton, C, 1968: Animal Ecology, Methuen & Co. LTD and Science Paperbacks, London, 207 pp.</p> <p>Stoddart, D. M., 1979: Ecology of small mammals, Chapman and Hall Ltd, London, 279 pp.NO</p> <p>Lacey, E.A., Patton, J.L., Cameron, G.N., 2000: Life underground the biology of subterranean rodents. The University of Chicago Press, Chicago and London, 449 pp</p> <p>Glavaš, M., Margaletić, J., 2001: Relativna brojnost sitnih glodavaca i njihovo suzbijanje u GJ "Požeška gora". 4. znanstveno stručni skup iz DDD-a s međunarodnim sudjelovanjem "Zdravo očuvati zdravim u novom tisućljeću", 253–267.</p> <p>Margaletić, J., Glavaš, M, 2001: Istraživanje dinamike populacija sitnih glodavaca metodom minimalnoga kvadrata u Gospodarskoj jedinici "Slatinske nizinske šume". U: Matić, S., Krpan A.P.B. & Gračan, J. (ur.), Znanost u potrajnom gospodarenju hrvatskim šumama, Šumarski fakultet Sveučilišta u Zagrebu, Šumarski institut Jastrebarsko i "Hrvatske šume" p.o. Zagreb, 317–326.</p> <p>Margaletic, J., Glavas, M., Bäumlner, W., 2002: The development of mice and voles in an oak forest with a surplus acorns. Anzeiger für Schädlingkunde / Journal of Pest Science, 75(4): 95–98.</p> <p>Margaletić, J., Glavaš, M., Pavić, K., 2003: Brojnost glodavaca i njihova štetnost u GJ "Južna Krndija I (Kutjevačka)" i u rasadniku "Hajderovac". Šumarski list, 127(3–4): 99-107.</p> <p>Margaletić, J., 2004: Dinamika populacija šumskih glodavaca u Hrvatskoj. Šumarski list (11–12): 599–607.</p> <p>Margaletić, J., Božić M., Grubešić, M., Glavaš, M., Bäumlner, W., 2005: Distribution and abundance of small rodents in Croatian forests. Anzeiger für Schädlingkunde / Journal of Pest Science, 78(2): 99–103.</p> <p>Grubešić, M., Margaletić, J., Krapinec, K., Trupčević, M., 2006: Dynamics and courses of beaver (Castor fiber L.) expansion in Croatia. Nafta, 57(3): 101–106.</p> <p>Margaletić, J., Grubešić, M., Krapinec, K., Kauzlarić, K., Krajter, S., 2006: Dynamics and structure of fat dormouse (Glis glis L.) population in Croatian</p>		



	<p>forests in the period from 2002 to 2004. Glas. šum. pokuse, posebno izdanje 5: 377–386.</p> <p>Margaletić, J., Grubešić, M., Vudrag, V., 2006: Utjecaj onečišćenja šumskih staništa naftom na dinamiku populacije sitnih glodavaca na lokalitetu «Žutica». Naftaplin 20: 59–72.</p> <p>Grubešić, M., Margaletić, J., Glavaš, M., 2007: Dynamika a štruktúra lovu plcha sivého (Glis glis L.) in beech woods and fir woods of Croatia. Folia venatoria, 36-37: 173-181.</p> <p>Margaletić, J., Kauzlarić, Ž., Moro, M., Vucelja, M., Bjedov, L., Videc, G., 2011: Morfološki parametri sivog puha (Glis glis L.) uzorkovanog u šumama Gorskog kotara. Coatian journal of Forest Engineering, 32(1): 239–249.</p> <p>Maljković, Z., 2014: Zagonetna priroda. Leo Paper, Hong Kong, 320 pp</p> <p>Bjedov, L., Svoboda, P., Tadin, A., Habuš, J., Štritof, Z., Labaš, N., Vucelja, M., Markotić, A., Turk, N., Margaletić, J., 2016: Utjecaj uroda sjemena obične bukve (Fagus sylvatica L.) na populacije sitnih glodavaca i pojavnosti hantavirusa u šumama Nacionalnog parka „Plitvička jezera“ i Parka prirode „Medvednica“. Šumarski list, 140(9-10): 455-464.</p>

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Vibor Roje, Ph.D., Associate professor	1.7. Number of ECTS credits	2
1.2. Course title	Informatology and documentation in scientific research	1.8. Number of hours in semester (L+E+F+e-learning)	0+1+0
1.3. Course code	225926	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The main objectives of the course are to acquaint students with the phases of scientific research, making them aware of the role of scientific information, to train students for searching of scientific information and their critical use		



	and to provide guidelines for preparation of professional or scientific communication.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>The course will contribute to:</p> <p>a) the general engineering competencies – to collect data independently, statistically process them, to analyze and present the collected data, discuss and draw conclusions based on the analyzed data</p> <p>b) the focused engineering competencies – to apply methods of preparation and planning of works in forestry</p> <p>c) the other engineering competencies – to perform the duties of a scientific and professional associate in scientific research institutions in the field of forestry and hunting – to teach courses in vocational secondary and related schools – to collect, process and interpret sources of literature and prepare simpler written professional or scientific work.</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>After attending this course, the student will be able:</p> <ol style="list-style-type: none"> 1.) to distinguish the phases of scientific research work 2.) to recognize different types of scientific publications (primary, secondary, tertiary) 3.) to search scientific databases 4.) to prepare and perform a methodically shaped oral presentation.
2.5. Course content (syllabus)	<p>Classes will be held in the form of a workshop; student engagement in teaching will be combined with the teacher's mini-lecture method. Part of the classes will be held in a computer classroom or library/reading room using a computer.</p> <p>By weeks:</p> <ol style="list-style-type: none"> 1. What is science, types of scientific research, stages of scientific research? 2. Methods and techniques of scientific work. 3. What is information? Information sciences. Scientific information. 4. Dissemination of scientific knowledge. Primary, secondary and tertiary publications. Scientific and professional publications. 5. Presentations at professional and scientific gatherings (conferences, congresses). 6. Scientific databases, citation databases. Web of Science, Current Contents, Google Scholar, Scopus. 7. Evaluating the quality of journals according to their indexation and ranking in scientific databases. 8. Evaluating the scientific performance of an individual scientist. Citation bases. 9. Approach to the preparation of a primary scientific publication. Qualification works. Scandinavian model of doctoral thesis. 10. Approach to the preparation of a review (scientific or professional) paper.



		<p>11. How to prepare a successful oral presentation, .ppt-presentation. 12. How to hold a successful oral presentation? Attitude, speech, relationship with listeners, use of technical aids (.ppt-presentation). 13th, 14th, and 15th terms. Students will present their short (approx. 10 min) oral presentations on pre-selected topics in the field of forestry, ecology, etc. After each presentation, there will be a discussion of its methodological quality.</p>							
2.6. Format of instruction	<input type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:				
	<p>It was intended to hold classes in the form of a workshop, which means greater involvement of students in the class itself. Because of that: a) A more appropriate hourly rate for this and such a subject would be 0+1+0 (and even 1+1+0), than 1+0+0. b) In the section 2.6. only 'seminars and workshops' are marked, and a marking of 'lectures' has been avoided, because it is not the intention that lectures are dominant form of teaching of this subject.</p>								
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper	YES		(other)		
	Preliminary Exam		NO	Practical Work	YES		(other)		
	Project		NO	Written Exam		NO	ECTS credits (total)	2	



2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.		
2.10. Student responsibilities	Class attendance, preparation of a presentation and a seminar paper.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	M. Gačić, Writing in Science and Profession (in Croatian), Narodne novine, Zagreb, 2017.	YES	
	V. Silobrčić, How to prepare, publish and evaluate a scientific paper (in Croatian), 6th updated edition, Medicinska naklada, Zagreb, 2008.	YES	
2.12. Optional literature	Đ. Težak, Searching for information on the Internet (in Croatian), Hrvatska sveučilišna naklada, Zagreb, 2002. Đ. Težak i sur., Profesor Božo Težak – a Visionary in Science (in Croatian), Hrvatska sveučilišna naklada, Zagreb, 2007. R. Zelenika, Science About Science (in Croatian), Ekonomski fakultet u Rijeci, Rijeka, 2004.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Igor Anić, Ph.D. Assistant Prof. Stjepan Mikac, Ph.D	1.7. Number of ECTS credits	5
1.2. Course title	Silviculture II	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+56
1.3. Course code	33889	1.9. Expected enrolment in the course	30
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.



1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>This course is established in the science and practice of close-to-nature silviculture, which has been here developed under the name of “Zagreb school of silviculture”. It is conceived as the forest silviculture that directs the stand development by the principles of primary forest development, but based on the criteria emerging from management targets. The course trains students for independent silvicultural stand analysis, silvicultural procedures in all types of forest stands, and independent solution of silvicultural problems with making decisions on the implementation of the silvicultural procedures in all types of forest management. By taking this course, a student learns to answer the question, what and how to do in a forest stand, in order to fulfil the aim of management. The student is trained in classical silviculture and is taught about the polyvalent silviculture. The tuition is organised through lectures, exercises and fieldwork, using modern teaching devices. The lectures encompass thematic units, which are reinforced during exercises. The fieldwork includes special units and silvicultural issues in accordance with the curriculum.</p>		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B4. manage and make independent professional (business) decisions for the field of silviculture and management planning with wildlife management B5. organise and manage professional works on establishing, caring for, and renewing forest stands</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>1. Present silvicultural forming of the forest stands (structure of the virgin forest stands and managed forest stands, principles and methods of silvicultural forming of the forest stand). 2. Identify the genesis of forest stands and the choice of regeneration methods (physiological, habitat, orographic and biotic preconditions for generative and vegetative natural regeneration, features of artificial regeneration of forest stands). 3. Present regeneration of the forests on small surfaces and combined regeneration methods (irregular shelterwood systems). 4. Present the silvicultural aspects of special forest management and conversion methods (forests with protective function, forests of special purpose, cases of drying and decay of trees and stands of different tree species, conversion of degradation forms of forests).</p>		



	<p>5. Formulate silvicultural planning (sustainable forest management and multipurpose progressive sustainable management concept).</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures (30 hours):</p> <ol style="list-style-type: none"> 1. Silviculture and forest naturalness: The concept of natural forest. Criteria for determining natural forest. Forests according to the degree of naturalness. The impact of silviculture on the establishment and preservation of forest naturalness. 2. Virgin forest dynamics and application in forestry: The concept of silvodynamics. Pioneer forest. Transitional forest. The final forest. Definition and importance of virgin forest. Distribution of virgin forests in the world, Europe and Croatia. Approach to virgin forest research. Developmental stages. Silvodynamics and texture. Virgin forest biodiversity. Virgin forest stability. Application in silviculture. 3. Growth control, formation and maintenance of stand structure: Formation of horizontal and vertical stand structure. The importance of the undergrowth. Historical development of forest thinning methods. An overview of thinning methods. Comparison and evaluation of forest thinning methods. 4. Effects and rationalization of forest tending: Effects of cleaning on tree and stand morphology, and mixture. Influence of thinning method on stand structure, volume production and value of wood stock. Influence of forest tending on ecological conditions in the stand. New approaches to forest tending. Rationalization of forest tending. 5. Characteristics and conditions of natural forest regeneration: Characteristics of generative regeneration. Features of vegetative regeneration. Ecology of forest regeneration: physiological, climatic, climatic-edaphic, edaphic, orographic and biotic preconditions for regeneration. 6. Artificial regeneration according to the principles of the natural: Concept. Types, quality and selection of forest reproductive material for artificial regeneration. Methods of artificial regeneration. Number of plants and quantity of seeds for artificial regeneration in different stand and habitat conditions. Evaluation of artificial regeneration methods. Selection of forest regeneration method with regard to the method and type of reproductive material. 7. Stand regeneration using small scale shelterwood method: The concept of small regeneration area. Regeneration period. Regeneration gaps. Comparison of gaps in managed forests and in virgin forests. The shape of small scale regeneration area. Application in practice. Comparison with classic methods of regeneration. Creating of uneven-aged stand structure. 8. Other silvicultural systems: Additive methods, Irregular Bavarian method, Irregular Swiss method. Substitution methods, Wagner felling, Eberhard felling, Phillip-Kurtz felling. An overview of combined methods. Some special methods: Free style silviculture. Mosaic forests. 9. Forest conversion: Concept, goals and methods of conversion. Conversion of mixture. Conversion of silvicultural forms. Conversion of even-aged structure into uneven-aged structure and selection structure. Conversion of forest degradation forms. 10. Silviculture and nature protection: Development of the principle of sustainability in the context of the human relationship with the forest. Multipurpose silviculture. Silviculture and special nature protection conditions. Adaptation of silviculture to changes in the environment. Silvicultural practices after forest damage.



	<p>11. Silvicultural analysis and silvicultural planning: Principles of silvicultural analysis. The concept, and creation of a silvicultural plan. Principles of silvicultural planning in different stand structural and ecological conditions.</p> <p>12. Silviculture in lowland belt: Willow and poplar stands. Black alder stands. Narrow leaved ash stands. Pedunculate oak and narrow leaved ash stands. Pedunculate oak and hornbeam stands. Silvicultural procedures in conditions of dieback of trees and stands.</p> <p>13. Silviculture in low hills belt: Sessile oak stands. Stands of sessile oak and hornbeam. Chestnut stands. Silver birch stands. Silvicultural procedures in degraded stands of hilly vegetation belt. Silviculture in high hills belt: Beech stands. Stands of linden and yew. Silvicultural procedures in degradation stages of mountain forests.</p> <p>14. Silviculture in mountain belt: Fir-beech stands. Stands of great maple and common ash. Fir-spruce stands. Black pine stands. Scots pine stands. Silvicultural procedures and dieback of trees and stands of pre-Alpine belt. Silviculture in pre-alpine belt: Spruce stands. Stands of beech and mugo pine.</p> <p>15. Silviculture in the Mediterranean-littoral and Mediterranean-Mountain belts: Silvicultural characteristics of Mediterranean forests. Silvodynamics of Mediterranean forests and importance for silviculture. Aleppo pine stands. Black pine stands. Holm oak stands. Pubescent oak stands. Silvicultural procedures in the degradation stages of Mediterranean forests. Other types of stands of the Mediterranean area.</p> <p>Exercises (15 hours):</p> <ol style="list-style-type: none"> 1. Structure and texture of virgin forest stand 2. Comparison of virgin forest stand and managed forest stand 3. Tending of young pure stands and young mixture stands 4. Thinning of pure stands and mixture stands 5. Regeneration using shelterwood method over small areas (irregular shelterwood methods) 6. Forest conversion – case studies 7. Conversion of even-aged structure into selection structure 8. Silvicultural procedures after forest damages 9. Silvicultural procedures and dieback of forest trees and stands in floodplain forests 10. Silvicultural procedures in degraded forests of the low hills belt 11. Silvicultural procedures in degraded forests of the high hills belt 12. Silvicultural procedures and dieback of trees and stands of mountain belt 13. Silvicultural procedures and dieback of trees and stands of pre-alpine belt 14. Conversion of forests of the Mediterranean-littoral zone 15. Conversion of forests of the Mediterranean-mountain zone <p>Field work (56 hours):</p> <ol style="list-style-type: none"> 1. Silvicultural planning and dieback of trees and stands 2. Silvicultural planning in selection management 3. Silviculture in Central European countries 		
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops	<input type="checkbox"/> independent assignments	2.7. Comments:



	<input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work		<input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam	YES		Practical work	YES		(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		5
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in all forms of teaching. Preparation of reports from exercises and fieldwork. Taking preliminary exam. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Anić, I., 2020: Uzgajanje šuma II (predavanja). Interna skripta, Šumarski fakultet Sveučilišta u Zagrebu.			NO		YES, Merlin			
	Anić, I., S. Mikac, 2020: Uzgajanje šuma II (vježbe i terenska nastava). Interna skripta, Šumarski fakultet Sveučilišta u Zagrebu.			NO		YES, Merlin			
2.12. Optional literature	Anić, I., S. Matić, M. Oršanić, Ž. Majer, 2005: Pomlađivanje i njega šuma poplavnih područja. U: J. Vukelić (gl. ur.), Poplavne šume u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str. 263 – 276.								



	<p>Anić, I. (gl. ur.), 2020: Zbornik radova sa znanstvenog skupa Gospodarenje šumama u uvjetima klimatskih promjena i prirodnih nepogoda, Hrvatska akademija znanosti i umjetnosti, Zagreb, str. 161-181.</p> <p>Matić, S., I. Anić, B. Prpić, M. Oršanić, 2001: Uzgojni postupci u jelovim šumama oštećenima propadanjem. U: B. Prpić (ur.), Obična jela (<i>Abies alba</i> Mill.) u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str. 461 – 478.</p> <p>Matić, S., M. Oršanić, I. Anić, 2003: Uzgojni postupci u niskim i degradiranim bukovim sastojinama. U: S. Matić (ur.), Obična bukva (<i>Fagus sylvatica</i> L.) u Hrvatskoj, Akademija šumarskih znanosti, Zagreb, str. 393 – 405.</p> <p>Matić, S., I. Anić, M. Oršanić, S. Mikac, 2011: Njega i obnova šuma hrvatskoga Sredozemlja. U: S. Matić (ur.), Šume hrvatskog Sredozemlja, Akademija šumarskih znanosti, Zagreb, str. 375 – 386.</p> <p>Roehrig, E., N. Barthsch, B. v Luepke, 2006: Waldbau auf oekologischer grundlage. Ulmer verlag, Stuttgart, 479 p.</p> <p>Schuetz, Ph. J., 2002: Waldbau I – IV, Skript zur Vorlesung Waldbau, ETH-Zentrum, Zuerich.</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Dario Baričević, Ph.D. Assistant professor Irena Šapić, Ph.D	1.7. Number of ECTS credits	5
1.2. Course title	Forest vegetation	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	225918	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			



<p>2.1. Course objectives</p>	<p>The objectives of the course are to introduce students with the vegetation of the Republic of Croatia, i.e. the basic patterns of vegetation distribution, synecological factors crucial for their arrival, floral composition, and its importance and value. Students will be introduced to forest vegetation from the lowland to the subalpine belt of the Mediterranean and Euro-Siberian-North American vegetation regions. The student will be able to apply all the achieved knowledge in the management of forest ecosystems, on the principles of naturalness, sustainable forest management, ecological balance and biodiversity.</p>
<p>2.2. Enrolment requirements and/or entry competences required for the course</p>	<p>-</p>
<p>2.3. Learning outcomes at the level of the programme to which the course contributes</p>	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways B3. implement forest management programs B9. prepare ecological studies and forestry parts of spatial plans D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry D2. conduct courses in professional secondary and other similar schools D4. professionally and scientifically upgrade through different educational ways and postgraduate study D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper.</p>
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Present the forest vegetation of Croatia from the ecological, flora-genetic, syntaxonomic and biogeographic point of view (synecological conditions for the development of different forest communities in Croatia, horizontal and vertical classification, phytogeographic features, syntaxonomy of forest communities). Present occasionally floody and humid forest communities (planar belt of the continental region, floodplain and wetland forest communities and bushy communities, moist lowland communities). Classify the oak-hornbeam forests and the thermophilic acid forest communities of the coline-submontane belt (synecological conditions of arrival, forest communities, similarities and differences). Compare central European beech forests and Illyrian beech forests in Croatia (development in the Holocene, central European beech forests, beech forests of the Illyrian floral province, beech forests in Croatia, syntaxonomic classification, bio-geographic features). Classify the thermophilic forests and coppice of pubescent oak, hungarian oak and turkey oak (areal and ecological conditions, the most important forest communities, syntaxonomic classification). Present dry, basophilic pine forests on dolomites (historical and ecological factors for the development of the forest, the most important forest communities, syntaxonomic classification, endemic species and relics). Present the boreal coniferous forest (areal and ecological characteristics of the boreal zone in Europe, forest communities in Croatia).</p>



	<p>Classify forest vegetation of the coastal zone of the Mediterranean region (horizontal and vertical classification, synecological conditions, forest communities, degradation stages).</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Introduction - geographic position and synecological conditions for the development of vegetation in Croatia. Horizontal and vertical classification of forest vegetation of Croatia. 2. Mediterranean region - classification, synecological conditions of certain zones, most important community, syntaxonomic review. 3. Euro-Siberian-North American vegetation region - classification into zones, synecological conditions of certain zones, most important community, syntaxonomic review. 4. Description of the forest communities of the classes <i>Salicetea purpureae</i> and <i>Alnetea glutinosae</i>. 5. Description of the forest communities of the alliance <i>Alnion incanae</i>. 6. Description of the forest communities of the alliance <i>Carpinion betuli</i>. 7. Description of central European acidophilic and neutrophilic beech forest communities. 8. Description of Illyrian beech forest communities. 9. Description and comparison of Pannonian and Dinaric beech-fir forests. Description pre-mountain beech forests. 10. Description of thermophilic beech and fir forest communities. Description of forest vegetation of noble deciduous trees. 11. Description of the forest communities of the order <i>Quercetalia roboris-petraeae</i>. 12. Description of the forest communities of the order <i>Quercetalia pubescentis</i>. 13. Description of the forest communities of the class <i>Erico-Pinetea</i>. Description of the forest community of silver fir. 14. Description of boreal forests of the <i>Vaccinio-Piceetea</i> class. 15. Description of mediterranean forest communities of the class <i>Quercetea ilicis</i>. <p>Exercises:</p> <ol style="list-style-type: none"> 1. Factors of horizontal and vertical classification of vegetation of R. Croatia. Characteristic and distinctive species for individual vegetation zones and their morphological characteristics. 2. Altitudinal belts and zones of the Mediterranean region, typical and distinctive species for certain parts of the Mediterranean area and their morphological characteristics, degradation forms, ubiquitous. Xerophilous species. 3. Characteristic and distinctive species for individual altitude zones of the Euro-Siberian-North American region - planar, choline, montan, altimontan and subalpine vegetation belt. 4. Floral composition of lowland, flooded forest communities. Hydrophilic and hygrophilous species. Characteristic and distinctive species for individual vegetation units of lowland forests and their morphological characteristics. Wetland sedges. 5. Floral composition of occasionally flooded forest communities of narrow-leaved ash, black alder and pedunculate oak. Morphological and ecological characteristics of diagnostic species. Relationships of flood and non-flood forest ecosystems. 6. Floral composition of mesophilic and neutrophilic forest communities of lowland and hilly belt. Morphological and ecological characteristics of diagnostic species of pedunculate oak and sessile oak forests.



	<p>7. Floral composition of central European beech forests. Morphological characteristics of representative species.</p> <p>8. Floral composition of Illyrian beech forests. Illyrian floral geoelement - morphological and ecological characterization.</p> <p>9. Floral composition and morphological characteristics of characteristic and distinctive species of Pannonian and Dinaric beech-fir forests. Morphological and ecological characteristics of diagnostic species.</p> <p>10. Floral composition and morphological characteristics of characteristic and distinctive species of thermophilic beech and fir forest communities. Floral composition and morphological characteristics of characteristic and distinctive species of forest vegetation of noble leaves.</p> <p>11. Floral composition of acidophilic communities of sessile oak. Morphological characteristics of representative species.</p> <p>12. Floral composition and morphological characteristics of characteristic and distinctive species of the order Quercetalia pubescentis. Species that are indicators of thermophilic and basophilic conditions.</p> <p>13. Floral composition and morphological characteristics of characteristic and distinctive species of the class Erico-Pinetea. Diagnostic plant species of dolomite geological substrate.</p> <p>14. Floral composition of spruce communities. Characteristic and distinctive species of altimontan and subalpine communities of common spruce and their morphological characteristics. Floral composition of frost vegetation and upper forest vegetation boundaries.</p> <p>15. Floral composition and morphological characteristics of characteristic and distinctive species of mediterranean forest communities of the class Quercetea ilicis. Characteristic species of the Mediterranean region.</p> <p>Practice mode - practical, herbal collection, terrain.</p> <p>Field work (two days):</p> <p>1. Introduction to the functioning (synecology, syndinamic, characteristic plant species), systematics and importance of continental forest ecosystems.</p> <p>2. Introduction to the functioning (synecology, syndinamic, characteristic plant species), systematics and importance of mediterranean forest ecosystems.</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental		NO	Report		NO	(other)		



	Work							
	Essay		NO	Seminar Paper		NO	(other)	
	Preliminary Exam	YES		Practical Work		NO	(other)	
	Project		NO	Written exam	YES		ECTS credits (total)	5
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures, exercises and field teaching. Passing the partial exams, final exams.							
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library			Availability via other media			
	Vukelić, J., 2012: Šumska vegetacija Hrvatske. Sveučilište u Zagrebu Šumarski fakultet i DZZP, 403 str.	YES						
2.12. Optional literature	1. Vukelić, J., Mikac, S., Baričević, D., Bakšić, D., R. Rosavec, 2008: Šumska staništa i šumske zajednice u Hrvatskoj Nacionalna ekološka mreža. Državni zavod za zaštitu prirode, 263 str. 2. Topić, J., Vukelić, J., 2009: Priručnik za određivanje kopnenih staništa u Hrvatskoj prema Direktivi o staništima EU. Državni zavod za zaštitu prirode, 376 str.							



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Boris Hrašovec, Professor Danko Diminić, Assistant Prof. Marko Vucelja, Ph.D, Assistant professor Milivoj Franjević Valentina Lovrić, mag. ing. silv. Linda Bjedov, Ph.D.	1.7. Number of ECTS credits	6
1.2. Course title	Integrated forest protection	1.8. Number of hours in semester (L+E+F+e-learning)	30+30+16
1.3. Course code	33898	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	To solve protection problems it is necessary to include all the components which affect certain plants and a forest as a whole. Best solutions are obtained by their integration in time and space. It is also necessary to know all the technical means for carrying out specific protection measures. Good results are obtained by proper connection of all the factors which endanger plants and habitats in order to take safe protection measures.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at	B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests		



<p>the level of the programme to which the course contributes</p>	<p>C6. perform jobs of manager/supervisor in protected natural areas</p>
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>1. To counteract harmful biotic and abiotic factors -determination, diagnosis of health status and planning of control strategy (importance and role, preventive and curative measures of active protection, identification of most common plant diseases, identification of fungal fungi, symptoms of attack pests and symptoms of damage caused by abiotic factors and other zoobytic harmful factors).</p> <p>2. Present an assessment of the intensity of attack of harmful biotic factors and Quantifying the density of their populations and implementing repressive protection measures - aviomethods in forest protection (methods of determining the number and density of the population (abundance) of individual pests and plant diseases, technologies used recently in the protection of forests from the air).</p> <p>3. Valorize integrated protection in lowland regular oak forests, forests of common beech and oak trees, and forts of forests beans and fir (valorization of the role of somewell-known harmful biotic factors as well as those most recently discovered, as well as climatic conditions and anthropogenic interventions, on the basis of a comprehensive analysis, consider options and opportunities to undertake preventive and repressive measures of integrated protection).</p> <p>4. Present integrated protection in Mediterranean forests and their degradation stages (the greatest attention is paid to the analysis of appearance, dynamics of spread, detrimental effects and fire prevention capabilities open space, also considers the importance of some specific organisms that occasionally appear in this area as a dominant detrimental factor for forest stands)</p> <p>5. To propose integrated protection in nurseries, forest cultures and intensive plantations of special purpose (there are considered increased risks and actual danger of increased occurrence of numerous harmful factors of biotic and abiotic nature, as well as protection measures - mechanical, physical, chemical, biotechnical,biological).</p> <p>6. Connect invasive pests and the consequences of their entry to implementation. Integrated forest protection measure (pest control system, plant protection quarantine and plant control system and the most efficient methods prevention and curative (monitoring, early eradication, dissolution slowdown) in context of known measures and procedures of integrated forest protection).</p> <p>7. Predict the organization and monitoring system of biotic and abiotic harmful factors - reporting forecasting jobs in integrated forest protection (the most commonly used monitoring methods, their advantages and disadvantages are compared).</p> <p>8. Present insects as molest ants and causes allergic reactions to the forest and urban space. Analyze invasive quarantine insect species and their correlation with urban space.</p>
<p>2.5. Course content (syllabus)</p>	<p>LECTURES:</p> <ol style="list-style-type: none"> 1. History, importance and role of integrated forest protection (2 hr.) 2. Interdisciplinary and interdependent character of forest protection (2 hr.)



	<ol style="list-style-type: none"> 3. Importance of forest edges in preventive role of sturdiness against high winds (2 hr.) 4. Damaging effect and measures against high temperatures in forest stands (2 hr.) 5. Wind damages and subsequent insect outbreaks (2 hr.) 6. Heavy rain, flood and snow damages and prevention (2 hr.) 7. Weeds and their control in forest and forest nurseries (2 hr.) 8. Forest pest population dynamics (2 hr.) 9. Methods and approaches in forest pest control (2 hr.) 10. Methods and approaches in control of phytopathogenic fungi (2 hr.) 11. Game control and their impact on forest stands (2 hr.) 12. Forest rodent control and population density dynamics and assessment (2 hr.) 13. Forest nurseries and plantations (2 hr.) 14. Special measures and approaches in lowland, selective and Mediterranean forests (2 hr.) 15. Forest fires (2 hr.) <p>LAB</p> <ol style="list-style-type: none"> 1. Forest fires (2 hr.) 2. Population density assessment of the most important forest pests (2 hr.) 3. Forest rodent population control assessment (2 hr.) 4. Silvicultural measures, environment and forest protection (2 hr.) 5. Legislative measures in forest protection (2 hr.) 6. Multitude of preventive and suppressive methods in integrated forest protection (2 hr.) 7. Pesticides and their categorization (2 hr.) 8. Insecticides, rodenticides, repellents (2 hr.) 9. Fungicides (2 hr.) 10. Herbicides (2 hr.) 11. Biopesticides (2 hr.) 12. Pheromones in forest protection and monitoring (2 hr.) 13. Other means of protection (2 hr.) 14. Mechanical and biological means of protection (2 hr.) 15. Methods of forest fire risk assessment (2 hr.) <p>FIELD EXCURSION (2 days)</p> <p>Getting familiar with the typical issue in forest protection, assessment of pest population size and trend and defining the best option in suppressive measures in situ.</p>			
2.6. Format of instruction	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning </td> <td style="width: 50%; vertical-align: top;"> <input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory </td> </tr> </table>	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory	2.7. Comments:
<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory			



	<input checked="" type="checkbox"/> field work			<input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	6	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Entomološki kompleks obične jele. U: Prpić B., J. Vukelić, J. Gračan, J. Dundović (ur.), Obična jela (<i>Abies alba</i> Mill.) u Hrvatskoj. Akademija šumarskih znanosti i "Hrvatske šume", 895 str., Zagreb 2001, 579-589.				YES				
	Entomološki kompleks obične bukve. U: Matić, S., B. Prpić, J. Gračan, I. Anić, J. Dundović (ur.), Obična bukva (<i>Fagus sylvatica</i> L.) u Hrvatskoj. Akademija šumarskih znanosti, 855 str., Zagreb 2003, 537-548.				YES				
	Entomofauna poplavnih šuma. U: Vukelić, J. (ur.), Poplavne šume u Hrvatskoj. Akademija šumarskih				YES				



	znanosti, 456 str., Zagreb 2005, 379-389.		
	Entomološki kompleks Sredozemnih šuma. U: Matić, S. (ur.), Šume hrvatskog Sredozemlja. Akademija šumarskih znanosti, 740 str., Zagreb 2011, 556-572.	YES	
	Sušenje i zaštita šuma hrasta lužnjaka. U: Klepac, D., Dundović, J., Gračan, J. (ur.), Hrast lužnjak u Hrvatskoj, Zagreb 1996, 559 str.	YES	
	Bjedov. L., Vucelja, M., Margaletić, J., 2016: Priručnik o glodavcima šuma Hrvatske, 54 str.	YES	web
2.12. Optional literature	Most recent professional and scientific articles via web databases (eg. ResearchGate)		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Marijan Grubešić, Ph.D. Prof. Krešimir Krapinec, Ph.D. Assistant Prof. Kristijan Tomljanović, Ph.D.	1.7. Number of ECTS credits	4
1.2. Course title	Hunting management I	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	235890	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian



1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students will get to know the technology of game breeding in open hunting grounds and enclosed areas. The focus is on technical and economic elements of game breeding. Through teaching, exercises and teaching in the field, duties of a technologist in game breeding and protection will be presented.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>A3. apply simpler methods of operation research</p> <p>B2 .establish forest management programs and wildlife management programs</p> <p>C2. organise and manage works on organization of hunting areasa</p> <p>D1. conduct buisnesses of scientific and professional associate in scientific-research institutions in the field of forestry</p> <p>D2. conduct courses in professional secondary and other similar schools</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Define wildlife habitat, hunting ground, and hunting grounds for certain game species (determining hunting productive areas, habitat quality for large and small game, determining the hunting capacity for each species of game).</p> <p>Presenting game management (optimum sex and age structure of game in the population, growth and recharge, dump, waste, development of large and small game stocks, planning the required amount of game food).</p> <p>Comply with the technical arrangement of hunting grounds (hunting grounds - feeding tanks, dormitories, eating areas, food storage, dummies, observatories and checkers, ...).</p> <p>Establish protected species (protection and revitalization plans of endangered species, wildlife conservation programs, action plans, management plans).</p>		
2.5. Course content (syllabus)	<p>In addition to economic species of wildlife, students are also introduced to protected animal species, plans for their protection and revitalization of endangered species. The aim of this course is to educate students for future makers, implementers and supervisors of hunting management basics, breeding programs and game protection programs. To prepare students for future obligations of integrated habitat and fauna management, with the application of techniques and technology of optimal use of space and fauna with measures for protection and preservation of habitats and animal species. Through exercises and fieldwork, students will be directly acquainted with open hunting grounds, the implementation of management planning acts, as well as measures for the protection of habitats and animal</p>		



	<p>species in open hunting grounds, based on the example of our national parks and nature parks.</p> <p>Lectures:</p> <ol style="list-style-type: none"> 1. Introduction. Course content. Literature. Legislative framework 2. Hunting ground. Division of hunting grounds 3. Criteria that hunting grounds must meet legally and for certain species of game. 4. Formation of hunting grounds 5. Establishment of hunting grounds and granting of hunting rights. 6. Analysis of hunting grounds in the Republic of Croatia. The content of the hunting economic base 7. Hunting cadastre 8. Calculation of hunting productive areas 9. Determining the creditworthiness and capacity of hunting grounds 10. Breeding, increment, excretion of game from the population 11. Development of large game fund, sex and age structure 12. Development of small game fund. Feeding and feeding of game 13. Technical arrangement of hunting grounds 14. Implementation of the hunting management basis 15. Administrative tasks in hunting ground management. Hunting economics and marketing <p>Exercises:</p> <ol style="list-style-type: none"> 1. Introduction to exercises 2. Hunting management forms (LGO, PUD, PZD) 3. Calculation of surface structure - I 4. Calculation of surface structure - II 5. Calculation of hunting productive areas for large game 6. Calculation of hunting productive areas for small game 7. Determining creditworthiness 8. Calculation of the parent fund, increment and hunting management capacity - I 9. Calculation of the parent fund, increment and hunting management capacity - II 10. Calculation of supplementation and nutrition 11. Hunting management and hunting technical facilities 12. Hunting patterns, records 13. Implementation of hunting management studies 14. Revision of the hunting management plan 15. Laws, regulations, orders and directives 		
<p>2.6. Format of instruction</p>	<p><input checked="" type="checkbox"/> lectures</p> <p><input type="checkbox"/> seminars and workshops</p> <p><input checked="" type="checkbox"/> exercises</p> <p><input type="checkbox"/> <i>online in entirety</i></p> <p><input checked="" type="checkbox"/> partial e-learning</p> <p><input checked="" type="checkbox"/> field work</p>	<p><input type="checkbox"/> independent assignments</p> <p><input type="checkbox"/> multimedia and the Internet</p> <p><input type="checkbox"/> laboratory</p> <p><input type="checkbox"/> work with mentor</p> <p><input type="checkbox"/> (other)</p>	<p>2.7. Comments:</p>



2.8. Monitoring student work	Class attendance	YES		Research	YES		Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		4
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises. Examination.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str				YES				
	Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str.				YES				
	Tucak, Z., Florijančić, T., Grubešić, M., Topić, J., Brna, J., Dragičević, P., Tušek, T., Vukušić, K., 2002: Lovstvo. Drugo prošireno izdanje. Uđbenik, Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet Osijek, 405 str.				YES				
	Durantel, P., 2007: Lovstvo				YES				
Durantel, P. 2007: Praktična enciklopedija lovstva				YES					



2.12. Optional literature	Büchel, K., 2011: Lovstvo ilustrirana enciklopedija Grupa autora: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str. www.propisi.hr
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Nikola Pernar, Ph.D. Prof. Darko Bakšić, Ph.D. Assistant Prof. Ivan Perković, Ph.D.	1.7. Number of ECTS credits	4
1.2. Course title	Soil management of forest ecosystems	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+8
1.3. Course code	225919	1.9. Expected enrolment in the course	30
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The aim is to provide a student the complete picture of soil functions in the forest ecosystem, about characteristics of different soil types, on a sources and possibilities of soil degradation and on a methods of prevention of soil degradation processes.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways		



<p>the level of the programme to which the course contributes</p>	<p>A2. explain position and trends of forestry profession in the country and worldwide B2. establish forest management programs and wildlife management programs B3. implement forest management programs B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region B9. prepare ecological studies and forestry parts of spatial plans B13. apply knowledge related to the methods for preparing and planning technical works in forestry C5. manage tasks of county and national institutions competent for forestry; inspection services D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry</p>
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>1. Analyze soil functions. Critically evaluate the functions of soil. Identify the importance of soil in forestry. 2. Soil classification system. Comparative the soil to the national and WRB classification system. Comparative the properties of different type of soils. Evaluate the soil properties essential to the fertility. Evaluate the soil properties crucial for the sensitivity to harmful influences. 3. Soil mapping. Application of soil mapping in forestry. Evaluate the nature of soil relationships in forestry ecosystem in Croatia. Compare examples of land map using. 4. Explain the specificity of the soil in forest ecosystem management in relation to the management of other terrestrial ecosystems. 5. Evaluate a different soil type within the soil quality system. Evaluate the nature and relationship of a different soil type in forest ecosystems in Croatia. 6. Compare the geogenic and limit of harmful values in the soil. Valorization of soil considering with his degradation. Review harmful effects on soil in forest ecosystems (managment influenes, influence of forest fire on the soil, multipurpose uses of forest land, conversion of forest land) and present measures for its protection. 7. Organize soil monitoring of forest ecosystems. Compare the state of soil protection at a global, regional and national level. The implementation and regulations on the soil protection.</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <p>1. The role and importance of soil in the terrestrial, especially in the forest ecosystems. 2. Soil classification system. History of development and principles of soil classification. Soil classification in Croatia. American Soil Classification. WRB soil classification. 3. Automorphic soil. Physiographic and ecological-management characteristic of undeveloped and humus-accumulation soils. 4. Physiographic and ecological-management characteristic of cambic, eluvial-illuvial, anthropogenic and technogenic soils. 5. Hydromorphic soils; Physiographic and ecological- management characteristics of pseudogley, fluvial, fluvial-humus and gley soils. 6. Physiographic and ecological- management characteristics of peats and anthropogenic hydromorphic soils. Physiographic and ecological-management characteristics of halomorphic and subaquatic soils.</p>



	<p>7. Soil geography. Pedon and elementary soil areal. Soil mapping. Pedogeographic features of Croatia. Pedogeographic units of Croatian forest ecosystems. Soil zonation on Earth.</p> <p>8. Soil in terrestrial ecosystems management. Soil in spatial planning. Forest soil management - especially in relation to the soil of other terrestrial ecosystems.</p> <p>9. The productivity of forest soils and land. The rating of forest soils and land.</p> <p>10. Increasing land productivity - optimization of natural soil fertility and the possibility meliorating of physical soil properties in forestry.</p> <p>11. Increasing land productivity - meliorating of chemical soil properties in forestry.</p> <p>12. Soil degradation and protection measures - Anthropogenic soil erosion - introduction.</p> <p>13. Soil degradation and protection measures - Gravitational erosion, erosion by water and aeolian soil erosion.</p> <p>14. Soil degradation and protection measures - Degradation of chemical soil properties.</p> <p>15. Soil degradation and protection measures - Soil compaction. Fire influencet on soil. Soil protection and regulations. Soil monitoring.</p> <p>Laboratory exercises:</p> <ol style="list-style-type: none"> 1. Determination of the particle size distribution in mineral soil material (according to ISO 11277) 2. Determination of stability of soil micro-aggregates (according to Škorić, 1982) 3. Determination of liquid limit, plastic limit and plasticity index of soil (according to ASTM D4318-10, 2010) 4. Determination of organic and total carbon (according to ISO 10694, 1995) and total nitrogen (according to ISO 13878, 1998) by dry combustion 5. Determination of effective cation exchange capacity and base saturation level using barium chloride solution (according to ISO 11260) 6. Extraction of trace elements soluble in aqua regia (according to ISO 11466, 1995) 7. Determination of macro- and micronutrients in soil by Mehlich-3 method. 8. Determination of the water-retention characteristic (according to ISO 11274, 1998) 9. Determination of the water permeability <p>Field work:</p> <ol style="list-style-type: none"> 1. Characteristic soil associations and their features in integrated area management (eg forest administrations, management units, catchment area, etc.) 		
<p>2.6. Format of instruction</p>	<p><input checked="" type="checkbox"/> lectures</p> <p><input type="checkbox"/> seminars and workshops</p> <p><input checked="" type="checkbox"/> exercises</p> <p><input type="checkbox"/> <i>online in entirety</i></p>	<p><input type="checkbox"/> independent assignments</p> <p><input type="checkbox"/> multimedia and the internet</p>	<p>2.7. Comments:</p>



	<input type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work		<input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report	YES		(other)		
	Essay		NO	Seminar Paper		NO	(other)		
	Preliminary exam	YES		Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)		4
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation on lectures, exercises and field courses; preparation of exercises report and preparation and presentation of seminar work (possibly). Partial and/or full examination.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Pernar, N., 2017: Tlo; nastanak, značajke, gospodarenje. Sveučilište u Zagrebu, Šumarski fakultet, 799 p.			YES					
	Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska istraživanja tla. Sveučilište u Zagrebu, Šumarski fakultet, 192 p.			YES					
2.12. Optional literature	1. Mesić, H., D. Bakšić, F. Bašić, A. Čidić, G. Durn, S. Husnjak, I. Kisić, D. Klaić, B. Komesarović, M. Mesić et al., 2008: 2. Program trajnog motrenja tala Hrvatske (priručnik). Agencija za zaštitu okoliša, Zagreb, 135 p.								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Asst. Prof. Ida Katičić Bogdan Ph.D Prof Saša Bogdan Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Biotechnology in Forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225927	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>Students are introduced to the following contents: a) techniques of plant cell and tissue cultures (in vitro), cell cultures in suspension, protoplast cultures, vegetative propagation in vitro, commercial application of propagation, meristem cultures, embryo and megagametophyte cultures, somatic embryogenesis, storing the plant genetic resources in vitro and with somaclonal variability; assessments of somaclonal variability (phenotypic, biochemical, cytological, molecular); b) application of biochemical and molecular genetic research in forest trees, biochemical and DNA markers, structure and genetic variability in forest trees, genetic mapping, genomics and transcriptomics, genetic engineering and application of transgenic plants in forestry and urban forestry, traits of genetic resistance to pests and pathogens, resistance to extreme environmental factors, reproductive capacity, modification of lignin content; biotechnology and biosafety); c) storage of seeds, pollen and plant tissue, in vitro storage, storage over a medium period (3 to 4 years) and over a longer period (cryopreservation), the process of cryopreservation (ultra-low temperatures - 80 oC to -196 oC), thawing and cell culture , introduction to plant growth substances (auxins, gibberellins, cytokinins, ethylene, abscisic acid, etc.), seed savings banks and seed banks, and legislation related to forest reproductive material.</p>		
2.2. Enrolment requirements and/or entry competences	-		



required for the course	
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B5. organize and carry out professional field work on the establishment, care and restoration of forest stands</p> <p>B13. methods of preparation and planning of works in forestry</p> <p>B15. improve existing technologies as well as introduce new technologies</p> <p>D1. perform the duties of scientific and professional associate in scientific research institutions in the field of forestry and game management</p> <p>D2. lead teaching courses in vocational secondary and related schools</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<ol style="list-style-type: none"> 1. Describe the possibilities of applying biotechnology in the field of forestry 2. Describe the application of molecular markers in research and conservation of forest genetic resources, distinguish the applications of different molecular markers in accordance with research needs 3. Present the basics of application of the most advanced methods of biotechnology in forestry (genomics, transcriptomics, associative and comparative genomics) 4. Describe the application of biotechnological methods in EX SITU conservation of genetic resources 5. Describe tissue culture methods and their differences, support with examples 6. Understand the application of genetically modified organisms in forestry and discuss biosafety issues.
2.5. Course content (syllabus)	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Introductory - the need for the application of biotechnology in various aspects of forestry <p>Application of biotechnology methods in research and characterization of diversity and conservation of forest genetic resources (natural forests)</p> <ol style="list-style-type: none"> 2. Molecular markers Part I. 3. Molecular markers II. part 4. Genomics, associative genetics, transcriptomics, comparative genomics 5. Spatial analysis of genetic diversity for the purpose of conservation of forest genetic resources 6. Application of biotechnology methods in EX SIT conservation of genetic resources <p>Application of biotechnology methods in the propagation of forest reproductive material</p> <ol style="list-style-type: none"> 7. In vitro cultures and selection 8. Basic steps in micropropagation 9. Different methods of micropropagation 10. Application of micropropagation methods in exemplary species (Prunus avium, Populus sp.) <p>Cryopreservation</p> <ol style="list-style-type: none"> 11. Cryopreservation methods <p>Application of biotechnology methods in forest tree breeding and artificial plantations and plantations</p> <ol style="list-style-type: none"> 12. Selection assisted by molecular markers 13. Mass propagation by biotechnology methods 14. Genetic modification of organisms, biosafety



	15. Legislation on forest reproductive material								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Sonnino, Andrea. (2016). Current and potential application of biotechnology in forestry: A critical review. Asian Biotechnology and Development Review. 18. 41-85.			NO		YES			



	Bogdan, S. i I. Katičić Bogdan, 2016. Genetika s oplemenjivanjem drveća i grmlja. Interna recenzirana skripta. 224. str. (odabrana poglavlja)	NO	YES, Merlin
2.12. Optional literature	Kajba, D., Ballian, D.: ŠUMARSKA GENETIKA, Zagreb-Sarajevo 2007, 283 str. Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, str. 1-398. Marić, V. i sur., 1991: BIOKEMIJSKO INŽENJERSTVO, Interna skripta, PBF, Zagreb. Bajrović, K. i sur., 2005: UVOD U GENETIČKO INŽENJERSTVO I BIOTEHNOLOGIJU, Institut za genetičko inženjerstvo i tehnologiju, Sarajevo, 32 Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Ivica Tikvić, Ph.D. Associate Professor Damir Ugarković, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Ecological Monitoring	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33922	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Hrvatski
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Get acquainted with the methods of monitoring the condition of forest ecosystems, monitoring the condition of forest trees and other organisms, monitoring the condition of ecological factors, natural disasters and forest habitats. Learn how to monitor the vitality, damage and intensity of extinction		



	of forest trees, monitor phenophases, monitor the components of living and dead aboveground wood biomass. Get acquainted with national, European and world programs for monitoring the state of forest ecosystems and with ecological equipment and regulations in the field of ecological monitoring.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B1. organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical</p> <p>B3. implement forest management programs</p> <p>B4. manage and make independent professional (business) decisions from the field of silviculture and management planning with wildlife management</p> <p>B5. organise and manage professional works on establishing, caring for, and renewing forest stands</p> <p>B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>1. Carry out monitoring of the condition of trees and the condition of ecological factors in forests</p> <p>2. Organize monitoring of the condition of endangered organisms in forest ecosystems in protected areas of nature</p> <p>3. Design monitoring of the condition of protected NATURA 2000 forest habitats</p>
2.5. Course content (syllabus)	<p>Lectures</p> <ol style="list-style-type: none"> 1. Introduction to environmental monitoring 2. Monitoring the condition of forests and forest ecosystems 3. Monitoring the state of organisms and ecological factors in forest ecosystems 4. Excess phenomena in forest ecosystems 5. Water, air and soil pollution in forests 6. Monitoring of weather characteristics and climate 7. Monitoring the dynamics of hydrological conditions in forests 8. Assessment of vitality of forest tree trees based on morphological indicators 9. Assessment of the state of mycorrhiza on forest trees 10. Monitoring of phenophases of forest trees 11. Monitoring of components of living and extinct aboveground biomass in forest ecosystems 12. International Forest Monitoring Program ICP Forests 13. Other international forest monitoring programs 14. Equipment for ecological and biological monitoring of forest ecosystems 15. National and European regulations and programs related to ecological monitoring in forest ecosystems
	2.7. Comments:



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Laying the exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Katalog informacijskih sustava zaštite okoliša i prirode 2017.					Website of the Ministry of Economy and Sustainable Development			
	Nacionalne mogućnosti skupljanja podataka o okolišu 2001.					Website of the Ministry of Economy and			



			Sustainable Development
	Izvešće o stanju okoliša u RH 2014.		Website of the Ministry of Economy and Sustainable Development
	Oštećenost šumskih ekosustava RH – izvješće za 2019. godinu		Website of the Ministry of Economy and Sustainable Development
	Branimir Prpić – Ekologija šuma i šumarstvo		Website of the Croatian Forestry Society
2.12. Optional literature	The European environment – state and outlook 2020 Knowledge for transition to a sustainable Europe, European Environment Agency, 2019. Ferretti, M., R. Fischer (editors), 2013: Forest Monitoring. Elsevier, Oxford, UK, str. 507		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof Krešimir Krapinec	1.7. Number of ECTS credits	2
1.2. Course title	Game and Shooting Crops	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33924	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			



2.1. Course objectives	To build up inductive ability for trophic and shelter conditions of habitats. Making decision for their enhancement with reference to making a choice about kind of crop.	
2.2. Enrolment requirements and/or entry competences required for the course	-	
2.3. Learning outcomes at the level of the programme to which the course contributes	-	
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of urban forestry, nature conservation and environmental protection D2. conduct courses in professional secondary and other similar schools D3. conduct businesses and tasks in publicist writing and media connected with urban forestry, nature conservation and environmental protection D4. professionally and scientifically upgrade through different educational ways and postgraduate study D5. gather, process and interpret reference sources and prepare simple written professional or scientific paper	
2.5. Course content (syllabus)	<ol style="list-style-type: none"> 1. General overview of game and wildlife feeding demands. Physiological backgrounds of feeding, methodology of wild animals feeding researching (2 hours) 2. Importance and planning of game and shooting crops (2 hours) 3. Game and wildlife annual arables, techniques for their establishing. Fodder plants – cereals, legumes and clovers (3 hours) 4. Fodder plants – crucifers, arable crops and grasses. Fodder plants – other fodder plants, feeding and shelter values of particular fodder plant. (2 hours) 5. Arable mixtures for big game. Arable mixtures for small game, universal arable mixtures. Arable mixtures for shelter, crop rotation, phenology, pest and weed protection. (2 hours) 6. Perennial crops (remises), feeding value, fodder production, plant demands for nutrients. Establishing of perennial remises (selection of woody species, operations and costs). (4 hours) 	
		2.7. Comments:



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES	
	Experimental work		NO	Report	NO	(other)		
	Essay		NO	Seminar Paper	NO	(other)		
	Preliminary Exam		NO	Practical work	NO	(other)		
	Project		NO	Written Exam	NO	ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regularity at teaching and active participation teaching. Passing the exam.							
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media		
	Wieß, G. B., 1997: Anlage und Pflege von Wildäsungsflächen. Nimrod – Verlag, Suderburg, 320 pp					Departement for Forest Protection and Wildlife Management		
	Manojlović, L., 2017: Hranidba krupne divljači. Veleučilište u Karlovcu, Karlovac, 211 pp.					Departement for Forest Protection and		



	<p>GWCT, 1994: Game and shooting crops. Game conservancy Ltd, Fordingbridge, Hampshire, 97 pp.</p> <p>McCall, 1988: Woodlands for Pheasants. The Game conservancy Ltd, Fordingbridge, Hampshire, 99 pp.</p>		<p>Wildlife Management</p> <p>Departement for Forest Protection and Wildlife Management</p> <p>Departement for Forest Protection and Wildlife Management</p>
<p>2.12. Optional literature</p>	<ol style="list-style-type: none"> 1. Ferris, R.; Carter, C., 2000: Managing Rides, Roadsides and Edge Habitats in Lowland Forests. Bulletin 123. Forestry Commission, Edinburgh, 78 pp. 2. Maclean, M., 2006: Hedges and Hedgelaying: A Guide to Planting, Management and Conservation. Crowood Press, Ramsbury, Marlborough, Wiltshire, 192 pp. 3. Claußen, G., 1998: Feldreviere gestalten: Praxisbuch für Jäger und Naturschützer. Landsbuch Verlag, Hannove, 213 pp. 4. Hespeler, B., 1997: Handbuch Reviergestaltung: Lebensräume schaffen und erhalten. BLV Verlagsgesellschaft mbH, München Wien, Zürich, 259 pp. 5. Robertson, P. A., 1992: Woodland Management for Pheasants. Forestry Comission Bulletin 106. The Game conservancy Ltd, Fordingbridge, Hampshire, 18 pp 		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assistant Prof. Ernest Goršić, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Forest area measurement	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33927	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The same with introduction of new instruments parallel to technological progress.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>B2. establish forest management programs and wildlife management programs</p> <p>B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management</p> <p>B9. prepare ecological studies and forestry parts of spatial plans</p> <p>D2. conduct courses in professional secondary and other similar schools</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning	<p>Comparing types of inventories in forestry.</p> <p>Interpret the meaning of national forest inventories and methods of data collection during inventory conduction.</p> <p>Critically judge differences between results from national forest inventory and general management plan for different spatial levels.</p>		



outcomes)											
2.5. Course content (syllabus)	<p>CLASSES</p> <ol style="list-style-type: none"> 1. Introduction. Definition of basic terminology. Types of inventory. 2. Stand and management unit inventory level (Forest management inventory) 3. National forest inventory – inventory of large forest areas 4. Design of sample grid in national forest inventory. 5. Sample plots for assessment and forest resource measurement. 6. Classification of forest types and land use. 7. Determination of border line between land and forest. 8. Fieldwork in measurement data collection. 9. Estimation on the tract surface level. 10. Estimation on the interpretation plot and measurement plots. 11. Measurement and attribute estimation of individual tree and stump. 12. Assessment of reforestation condition and structure. 13. Field estimation and measurement control. 14. Data processing and national forest inventory results display. 15. Results of national forest inventory. 										
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)	2.7. Comments:								
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES			
	Experimental Work		NO	Report		NO	(other)				
	Essay		NO	Seminar		NO	(other)				



			Paper					
	Preliminary Exam	NO	Practical Work		NO	(other)		
	Project	NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Continuous attending and active engagement in lectures. Passing the exam.							
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library		Availability via other media				
	Pranjić, A., Lukić, N., 1997: Izmjera šuma. Šumarski fakultet Sveučilišta u zagrebu, 410 str, Zagreb	YES						
	Čavlović, J., Božić, M., 2008: Nacionalna inventura šuma u Hrvatskoj – Metode terenskog prikupljanja podataka. Šumarski fakultet Sveučilišta u Zagrebu. 146 str. Zagreb	YES						
	Čavlović, J., 2010: PRVA NACIONALNA INVENTURA ŠUMA REPUBLIKE HRVATSKE, Ministarstvo regionalnog razvoja, šumarstva i vodnog gospodarstva. 296 str. Zagreb.	YES						
	Presentations and notes from classes.			Merlin				
2.12. Optional literature	Van Laar, A., Akça, A., 2007: Forest Mensuration. Springer, 383 str.							



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Saša Bogdan, Ph.D Asst. Prof. Ida Katičić Bogdan, Ph. D	1.7. Number of ECTS credits	2
1.2. Course title	Clonal forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33931	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students gain knowledge on methods of vegetative reproduction (cloning) of forest trees, usage of cloned material in forestry and conservation of genetic resources. They are introduced to breeding and nurturing of clonal cultures and orchards, clonal seed orchards, clone archives, identification of material, short rotation cultures for biomass production and phytoremediation, all with the purpose of better understanding of the importance of clone material production of forest trees.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B5. organize and carry out professional field work on the establishment, care and restoration of forest stands B13. methods of preparation and planning of works in forestry B15. improve existing technologies as well as introduce new technologies D1. perform the duties of scientific and professional associate in scientific research institutions in the field of forestry and game management D2. lead teaching courses in vocational secondary and related schools		



<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<ol style="list-style-type: none"> 1. Propose the applicable vegetative propagation method for a particular tree species. 2. Propose heterovegetative propagation techniques in the establishment of clonal seed orchards. 3. Formulate a genetic variant of clones and transfer genetic covariantes. 4. Evaluate juvenile-adult correlation and clonal aging 5. Classify clonal material in genetic and physiological research. 6. Predict the genetic parameters in clonal tests. 7. Choose the culture of soft and noble leaflets, mixed cultures, and / or clonal archives. 8. Analyze the existence of clone × site interaction (GEI) and perform clonal selection for general and specific adaptation and determine phenotype stability of clones. 9. Evaluate the existence of clone interactions and plant spacing, the influence of biotic and abiotic factors on the production of wood stock 10. Integrate the use of clonal material as forest reproductive material with legislation and legal regulation 		
<p>2.5. Course content (syllabus)</p>	<p>Lectures</p> <ol style="list-style-type: none"> 1. Generative propagation of forest trees and biology of species suitable for short rotation 2. Autovegetative propagation, micropropagation of forest trees and somaclonal variability 3. Heterovegetative propagation and rejuvencization 4. Monoclonal and multiclonal cultures of forest trees 5. Optimal number of clones and arrangement of clones in cultures 6. Clone x Habitat Interaction (GEI) 7. Selection of clones for general and specific combination ability and ideal genotype 8. Clone seed plantations, improved clone seed plantations and second generation clone seed plantations 9. Preservation of gene pool and clone archives, 10. Energy potential of wood biomass, biomass production in short rotation crops (SRC), poplar and willow breeding. 11. Identification of clones and clone field experiments, development of favorable clone mixtures for individual habitats and mosaic arrangements 12. Estimation of genetic gain in clone tests depending on the intensity of selection. 13. Forest crops, mixed crops, bioenergy plantations, agroforestry 14. Plantations in the protection of watercourses (vegetation filters), remediation of polluted areas (phytoremediation), sequestration of atmospheric carbon, use of wastewater and sludge for replenishment of SRC. 15. Legislation and legal regulations for the use of clonal material, advantages and disadvantages of clonal forestry 		
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the	<p>2.7. Comments:</p>



	<input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work		internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.								
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library			Availability via other media				
	***BIOEN:program korištenja energije biomase, Energetski institut "Hrvoje Požar", 1998, str. 1-179.								
	*** BIOEN:program korištenja energije biomase i otpada, Energetski institut "Hrvoje Požar", 2001, str. 1-144.								
	Jelaska, S.: KULTURA BILJNIH STANICA I TKIVA, Školska knjiga, 1994, str. 1-398								
	Međedović, S. i Dž. Ferhatović: KLONSKA PROIZVODNJA								



	SADNICA DRVEĆA I GRMLJA. Sarajevo, 2003, 216 str.		
2.12. Optional literature	1. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, str. 277. 2. Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, str. 240. 3. Dickmann, D.I., Isebrands, J.G., Eckenwalder, J.E., Richardson, J.: POPLAR CULTURE IN NORTH AMERICA, NRC Research Press, Ottawa, 2001, str. 1-397. 4. El Bassam: ENERGY PLANT SPECIES, 1998, str. 1-356. 5. Falconer, D.S. & T.F.C. Mackay: INTRODUCTION TO QUANTITATIVE GENETICS. Longman Group Ltd, 1998, str. 1-459. 6. Stettler, R. F., Bradshaw, Jr., H. D., Heilman, P. E., Hinckley, T. M.: BIOLOGY OF POPULUS AND ITS IMPLICATIONS FOR MANAGEMENT AND CONSERVATION, NRC Research Press, Ottawa, 1996, str. 1-597. 7. Tamarin, R.H.: PRINCIPLES OF GENETICS. WCB Publishers, 1993, str. 1-674.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Azra Tafro, PhD, Assistant Professor	1.7. Number of ECTS credits	2
1.2. Course title	Quantitative methods for planning in Forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33928	1.9. Expected enrolment in the course	5
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students are introduced to basic concepts in linear algebra and discrete mathematics, with an overview of selected methods in operations research. The objective of the course is to demonstrate the application of mathematical objects to objects in the real world, and to describe their interactions through		



	mathematical operations, using examples from forestry. Choice of topics in the course is variable and subject to students' interests.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	A3. apply simpler methods of operation research B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B13. apply knowledge related to the methods for preparing and planning technical works in forestry B14. manage forest, human resource, and technical potential during performance of forest works C1. plan, organize and works of organization of production in forestry C2. organize and manage works on organization of hunting areas C4. manage the most complex tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<ol style="list-style-type: none"> 1. Analyzing and solving mathematical problems based on learned mathematical concepts and modeling situations outside a mathematical context. 2. Connecting quantitative methods with engineering practice. 3. Using linear algebra to calculate the matrix inverse. 4. Solving a system of m linear equations with n unknowns. 5. Solving a constrained maximization or minimization problem 6. Solving the transport problem. 7. Recommending a multiple-criteria method when making decisions in forestry 8. Constructing a decision tree for a given problem. 9. Recognizing situation types when making decisions.
2.5. Course content (syllabus)	<ol style="list-style-type: none"> 1. Development of operations research. 2. Mathematical modeling. 3. Basic linear algebra. Systems of linear equations. 4. Matrix inverse. 5. Elementary linear programming. 6. Sensitivity analysis. 7. Transportation methods. 8. Integer linear programming. 9. Investment problems. 10. Multiple-criteria decision analysis. 11. Introduction to graph theory. Shortest path. 12. Critical path method. 13. Decision theory.



	14. Decision trees. 15. Basic econometrics.								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work				<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:	
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in class. Practical seminar work. Taking exams.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Kalpić, D., Mornar, V.: Operacijska istraživanja, DRIP, Zagreb, 1996.				YES				
2.12. Optional literature	1. Elezović, N.: Linearna algebra, Element, Zagreb, 2003. 2. Bronson, R., Govindasami N.: Schaum's Outline of Theory and Problems of Operations Research. New York: McGraw-Hill, 1997.								



	3. Slack N.: Operations Management, Prentice Hall, 2001.
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Marijan Grubešić, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Hunting cinology	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33925	1.9. Expected enrolment in the course	20
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Detailed preparation for the use of the knowledge in practice for selection, training, use and evaluation of hunting dogs.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways C4. manage the most complex tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship D1. conduct buisnesses of scientific and professional associate in scientific-research institutions in the field of forestry D2. conduct courses in professional secondary and other similar schools		
2.4. Expected learning	Present hunting kinology - historical development and organization (development of kinology -organization of the World Kinologist Organization - FCI and Croatian Kinesiological Association -		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>HKS) Identify anatomy and morphology of hunting dogs (Anatomy, disadvantages of body and teeth appearance, breeding of dogs, dog diseases, procurement, keeping and schooling of dogs) Present groups and standards, and tests of hunting dogs (groups of dogs by the standards of the FCI - Pointers, retrievers, dachshunds, ect.)</p>								
<p>2.5. Course content (syllabus)</p>	<p>Lecture: 1. Introduction. Cynology. Hunting cynology 2. Historical development of dogs and their role in human development 3. Anatomy and physiology of dogs 4. Development of cynology and cynological organizations (FCI, HKS, HLS). 5. Breeding, registration (Pedigree) and training of dogs 6. Legislation in hunting related to hunting cynology 7. Division of hunting dogs, standards, errors, 8. Exterior ratings, exhibitions, IPOs, working matches. 9. Presentation of groups and breeds of hunting dogs 10. Jamari 11. Hounds 12. Bloodlines 13. Birds 14. Šunjkavci 15. Aporters and marriage dachshunds</p>								
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work	<input type="checkbox"/> independent assignments <input checked="" type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)	<p>2.7. Comments:</p>						
<p>2.8. Monitoring student work</p>	<p>Class attendance</p>	<p>YES</p>	<p></p>	<p>Research</p>	<p>NO</p>	<p>Oral exam</p>	<p>YES</p>	<p></p>	<p></p>
	<p>Experimental work</p>	<p></p>	<p>NO</p>	<p>Report</p>	<p>YES</p>	<p>(other)</p>	<p></p>	<p></p>	<p></p>
	<p>Essay</p>	<p></p>	<p>NO</p>	<p>Seminar paper</p>	<p>YES</p>	<p>(other)</p>	<p></p>	<p></p>	<p></p>
	<p>Preliminary exam</p>	<p></p>	<p>NO</p>	<p>Practical work</p>	<p></p>	<p>NO</p>	<p>(other)</p>	<p></p>	<p></p>
	<p>Project</p>	<p></p>	<p>NO</p>	<p>Written</p>	<p></p>	<p>NO</p>	<p>ECTS credits</p>	<p>2</p>	<p></p>



				exam			(total)	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises. Examination.							
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library		Availability via other media				
	Richter, I., 1986: Lovački psi uzgoj i školovanje. Nakladni zavod znanje, Zagreb	NO						
	Udovičić, A. 2016: Izvorne autohtone Hrvatske lovne pasmine pasa.	YES						
	Balać, J., Polak, M.D.: Lov, lovački psi i oružje. Alfa Zagreb 1991., Zagreb.	NO						
	Selimović, I., Reicher, D. 2001: Ptičari	YES						
2.12. Optional literature	1 Čeović, I.: Lovstvo. Lovačka knjiga Zagreb, Zagreb, 1953. 2. Grupa autora: Velika ilustrovana enciklopedija lovstva Građevinska knjiga, Beograd, 1987							

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assist. Prof. Zdravko Pandur, PhD	1.7. Number of ECTS credits	2
1.2. Course title	Mechanization in Forest Silviculture	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33926	1.9. Expected enrolment in the course	10



1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students learn about the significant features of special silvicultural machines and the methods of adjustment of machines from big series originally intended for other branches of industry.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B10. apply knowledge related to forest machines, techniques and standard technologies used in forestry		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Compare agricultural tractors in mechanized silvicultural works (technical features of tractors, classification, transmission, construction features, requirements of ISO and OECD standards for agricultural tractors). Analyze mechanized works in forest seed processing and nursery production of forest seedlings (machines for seed extraction and dewinging, machines and tools in nursery production of forest seedlings). Present mechanized works of habitat preparation, afforestation, tending of stands, forest cultures and plantations, short rotation coppice (machinery and tools in habitat preparation, machinery and devices in forest tending, machinery and devices for establishing and tending of forest cultures and plantations, specialized machinery and tools for short rotation coppice harvesting and storage of wood biomass).</p>		
2.5. Course content (syllabus)	<p>Lectures</p> <ol style="list-style-type: none"> 1. Agricultural tractors - basic features 2. Silviculture adapted agricultural tractors 3. Tractor three-joint drawbar 4. PTO shaft 5. Mechanized works in forest seed processing 6. Machines and tools in nursery production 7. Sprayers and sprinklers 8. Irrigation systems 9. Mechanized work in habitat preparation 10. Machines for planting forest seedlings 11. Machines and devices for cleaning young stands 		



	12. Machines for setting protective fence 13. Machines and tools for cultivation forest crops and plantations 14. Machines and tools for tending forest crops and plantations 15. Mechanized technology of work in forests of short rotation								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the Internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper	YES		(other)		
	Preliminary exam		NO	Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Laying the exam, exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library			Availability via other media		
	Pandur, Z, 2020: Prezentacije predavanja i vježbi iz kolegija Mehanizacija u uzgajanju šuma			NO			YES, Merlin		
	Bokulić, A., i dr., 2015: Priručnik za sigurno rukovanje i primjenu			NO			YES, web		



	sredstava za zaštitu bilja. Ministarstvo poljoprivrede RH i Hrvatski centar za poljoprivredu, hranu i selo – Zavod za zaštitu bilja, s. 170-212.		
	Zimmer, R., i dr., 2014: Integralna tehnika obrade tla i sjetve. Sveučilište J.J. Strossmayer u Osijeku, Poljoprivredni fakultet, s. 1-94.		YES, web
2.12. Optional literature	<ol style="list-style-type: none"> 1. Prankl, H., i dr. 2011: Multi-Functional PTO Generator for Mobile Electric Power Supply of Agricultural Machinery. VDI-Berichte Nr. 2124, s. 7. 2. Piechocki, J., i dr.: Development in Energy Generation Technologies and Alternative Fuels for Agriculture, Advances in Agricultural Machinery and Technologies. CRC Press Taylor & Francis Group, s. 89-110. 		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Jura Čavlović, Ph.D Assistant prof. Krunoslav Teslak, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Legislative and regulative for forest management planning	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225928	1.9. Expected enrolment in the course	5
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			



<p>2.1. Course objectives</p>	<p>How regulations for forest management planning have changed over time (history) in line with the development of the profession and the forest management planning science and the relation of man towards the forest. The aim of this course is acquiring of knowledge about the development of regulations for forest management planning, the existing regulations for forest management planning, and the interpretation and manner of application of the regulations in the procedures for preparing and approval of management plans</p>	
<p>2.2. Enrolment requirements and/or entry competences required for the course</p>	<p>-</p>	
<p>2.3. Learning outcomes at the level of the programme to which the course contributes</p>	<p>B2.establish forest management programs and wildlife management programs</p>	
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>To analyse, to present and to identify historic review of regulations for forest management planning (content characteristics of regulations, relevant determinations of historic regulations, development of regulations for forest management planning). To analyse, to assess and to present importance of the regulations and its role on forest management planning (mutual differences between two regulations, influence of several determination on change of forest management planning system, procedures of approval of elaborated forest management plan).</p>	
<p>2.5. Course content (syllabus)</p>	<p>Lectures</p> <ol style="list-style-type: none"> 1. Introduction, review of contents and literature. Defining of importance and role of legislative and regulative in forest management planning. 2. Historic development of regulations for forest management planning: Law statute of forestry from 1769 3. Historic development of regulations for forest management planning: Advisory for inventory, assessment and forest regulation of property municipality in Croatian-Slavonia province (1881). 4. Historic development of regulations for forest management planning: Advisory for elaborations of forest management plan and programme (1903) 5. Historic development of regulations for forest management planning: Advisory for forest regulation and planning of State forests (1931) 6. Historic development of regulations for forest management planning: Advisory for selection of tree to cut and prescribing of cut in selection forests (1937) 	



	7. Historic development of regulations for forest management planning: Provisional and general advisory for inventory and forest regulation and planning (1946/48) 8. Historic development of regulations for forest management planning: "New system" of forest regulation in selection forests (1962) 9. Changes of Regulations for forest management planning from 1968 up to 1990 in circumstances of forestry reorganisations and changes of Forestry Laws 10. Regulations for forest management planning from 1994 and 1997. 11. Changes and supplements of Regulations. Analyses of determinations of Regulation and needs for its changes in consideration to requirements for forest management planning 12. Procedures of validation and approval of elaborated forest management plan 13. Presentation and discussion of seminar themes 14. Presentation and discussion of seminar themes 15. Presentation and discussion of seminar themes								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:				
J2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper	YES		(other)		
	Preliminary exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	2	



2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.		
2.10. Student responsibilities	Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Excerpts from published Regulations in the Official Gazette (NN)	YES	
	Meštrović, Š., Fabijanić, G., 1994: Forest Management Planning Manual	YES	
	.Meštrović, Š., 1978: The Regulation on Preparing of Forest Management Plans and Programs in the Light of Forestry Science. Šum. list 102 (8-10), 352 - 364.	YES	
2.12. Optional literature			

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Ivan Martinić, Ph.D. Assist. Prof. Matija Landekić, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Communication and certification processes in forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225929	1.9. Expected enrolment in the course	20
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.



1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>The aim of the course is for students to acquire knowledge on topics that are crucial for a positive perception of forestry in the public and develop the skill of successful communication to different target groups and the public / media on the importance of forestry in global challenges, but also on current topics / issues at national and local level. Especially important is gaining knowledge and handling of the facts that are important for the presentation of contributions to forestry and forestry profession sustainable development, reducing climate change and biodiversity conservation. The emphasis is on the adoption of the correct orientation of students towards participatory processes (public hearings, consultations ...) in the adoption of forest management plans, multidisciplinary in the management of forest resources and in cross-sectoral cooperation. Through selected topics, students get acquainted with the elements of the communication platform (purpose, goals, topics, communication channels, tools and tactics, etc.) with emphasis on the role of forestry, and related to the ecological network Natura 2000, RED I. directive, FLEGT action plan, climate change and the concept of a 'green' economy, forest certification systems including ecological certification of products. The aim is to develop students' abilities and skills to take on different roles (e.g. reporting, lobbying, advocacy, negotiation, interpretation) in communicating key subject topics.</p>		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways A2. explain position and trends of forestry profession in the country and worldwide D3. conduct businesses and tasks in publicist writing and media connected with forestry D5. collect, process and interpret sources of literature and prepare simpler written professional or scientific work</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning	<p>Present forestry activities and improve public relations through positive messages (preservation of Natura 2000, contribution to rural development, reduction of the impact of climate change, etc.) Factually analyze current topics and argue the attitudes of the forestry profession towards target groups and the public Present to a third party the role and importance of forestry in global processes related to the bioeconomy, the 'green' economy, green jobs, the RED I Directive and the FLEGT action plan</p>		



outcomes)	Present the idea and concept, direct and indirect benefits of forest certification and ecological certification of product								
2.5. Course content (syllabus)	<p>(L1) Successful communication is an important part of professional competencies; why is good communication important?</p> <p>(L2) Introduction to forestry communication; what is communication; what it means to communicate; what is the purpose of communication?</p> <p>(L3) Characteristics of today's forestry communication: key messages to target audiences; establishing quality relationships and two-way communication.</p> <p>(L4) Global programs and processes as forestry communication topics: sustainability, Natura 2000, Climate change</p> <p>(L5) Current topics as an imposed framework of communication: forest fires, illegal logging, safety during forest work</p> <p>(L6) A new look at the role and perspective of forestry: networking - multidisciplinary - partnership - participation - publicity and transparency - socially responsible business</p> <p>(L7) Elements of the communication platform: topics and messages, communication goal, outcomes!</p> <p>(L8) Target groups and types of target public to which one communicates</p> <p>(L9) Time, organization, material and technical conditions of communication</p> <p>(L10) Communication channels: ways and conditions of communication</p> <p>(L11) Communication of strategic forestry objectives: Forestry in the EU development strategy. EU forestry guidelines and measures. Green Plan - elements, financing models</p> <p>(L12) FLEGT action plan and RED I. directive as a topic of communication.</p> <p>(L13) Biodiversity conservation as a topic of communication: Natura 2000 - concept, scope and obligations of the forestry sector</p> <p>(P14) Climate change (CC) communication in relation to forestry: the role and contributions of forestry, forestry adaptation to CC</p> <p>(P15) Concepts of forestry improvement: The role and importance of forest certification and ecological certification of products</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)				2.7. Comments:	
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		



	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam	YES		Practical Work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Taking partial exam and final exam.								
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library			Availability via other media				
	Martinić, I. : Biodiversity in private forests - what is it and how to preserve it?, Krapina-Zagorje County, Krapina, 2011, 2013, 2014.	YES			YES, online				
	Martinić, I. : The management of protected areas - planning, development and sustainability, Zagreb 2010.	YES			NO				
	Martinić, I., Landekić, M., 2020: : Forestry politics and legislation (internal collection of presentations for the current academic year)	NO			YES, Merlin				
	Bakarić, M., Martinić, I., Landekić, M., Pandur, Z., Orlović, A., 2015: Forest certification as a mechanism for improving the management of forest resources. Nova mehanizacija šumarstva. 36 (1); 63-76	NO			YES, Hrčak				
2.12. Optional literature	Šutalo, V., 2017: Public Relations (electronic script), Zagreb Business School with Public Law, Zagreb, 2017. Martinić, I., 2018: How to communicate forest, forestry and forestry profession? (Presentation for the Agency for Vocational Education and Training) Zagreb, 2018.								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Ernest Goršić PhD	1.7. Number of ECTS credits	2
1.2. Course title	Dendrochronology	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225930	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Basic goal of the subject is to give students insight into tree ring formation under different biotical and abiotical factors through increment core sampling procedures and data analyses. Through lectures students will undergo all phases of selection and increment analyses using modern methods. They will acquire the ability to analyze, interpret and implement obtained data in making conclusions and planning.		
2.2. Enrolment requirements and/or entry competences required for the course	Completed lectures in Growth and increment subject		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. Independent data collecting, statistical analyzing and displaying gathered data. Discussion and conclusion making based on these data with ability to differ various possibilities of interpretation of the same problem analyzed on different ways. B9. Creating ecological studies and spatial plans in forestry D4. Expert and scientific improvement through various educational forms and post graduate studies. D5. To collect, process and interpret literature and prepare simpler expert or scientific papers		
2.4. Expected learning	<ol style="list-style-type: none"> 1. To acquire knowledge of good sampling plot location selection and correct increment core extraction 2. To learn correct increment core preparation. 3. To identify, measure and analyse tree rings. 		



outcomes at the level of the course (3 to 10 learning outcomes)	4. To construct reference tree ring chronology. 5. To create a report.								
2.5. Course content (syllabus)	1. Introduction. History and origins of Dendrochronology with application in the world. 2. Anatomical basis of tree ring and its formation dynamics. 3. Influence of habitat on tree ring formation at various tree species. 4. Species suitable for dendrochronological analysis. 5. Sampling plot location selection and correct increment core extraction. 6. Sampling of wet and dry archaeological material. 7. Preservation and preparation of samples for analysis 8. Software TSAPWin and Win Dendro for tree ring measurement. 9. Data entry and increment core measurement in TSAPWin and Lintab. 10. Crossdating in TSAPWin with statistical dating parameters. 11. Construction of reference tree ring chronology. 12. Standardization and sample comparison in COFECHA and Arstan. 13. Basic of analysis and graphical display in program R. 14. Application of dendrochronology series in Dendroarchaeology 15. Application of dendrochronology series in Dendroclimatology								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the Internet <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental		NO	Report		NO	(other)		



	Work							
	Essay		NO	Seminar paper		NO	(other)	
	Preliminary Exam		NO	Practical work		NO	(other)	
	Project		NO	Written exam	YES		ECTS credits (total)	2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Continuous attending and active engagement in lectures. Passing the exams.							
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library			Availability via other media			
	Cook, E.R., Kairiukstis, L., 1990: Methods of Dendrochronology - Applications in the Environmental Sciences. Dordrecht, Netherlands: Springer Netherlands.	YES						
	Vaganov, E. A., Hughes, M. K., Shashkin, A. V., 2005: Growth Dynamics of Conifer Tree Rings: Images of Past and Future Environments, Springer, 358pp	YES						
	Fritts, H.C., 1976: Tree Rings and Climate. The Blackburn Press, Caldwell, New Jersey. 567pp	YES						
	Stokes, M. A., Smiley, T. L., 1996: An Introduction to Tree-Ring Dating, University of Arizona Press, Tucson, 73pp	YES						
2.12. Optional literature	R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.							



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	prof. Igor Anić, Ph. D. Ass. prof. Stjepan Mikac, Ph. D.	1.7. Number of ECTS credits	2
1.2. Course title	European forestry	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+40+0
1.3. Course code	225931	1.9. Expected enrolment in the course	20
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	1.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The objectives of the course are to introduce students to: 1) silvigeographic, structural, ecological and silvicultural characteristics of European forests; 2) historical aspects of forestry development in Europe with regard to the use of forest land; 3) trends and adjustments of silviculture in the conditions of climate change, natural disasters and nature protection requirements; 4) different methods of forest management on the examples of European countries.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A2. explain position and trends of forestry profession in the country and worldwide		
2.4. Expected learning	Present the silvigeographic features of European forests. Present the main methods of forest management in Europe. Link the history of land use with		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>forest management methods. Valorize adaptations of silviculture in the conditions of climate change and natural disasters. Valorize the role of close to nature forestry and nature protection requirements. Evaluate the economic and public interest of European forests.</p>		
<p>2.5. Course content (syllabus)</p>	<p><u>Lectures (15 hours):</u></p> <ol style="list-style-type: none"> 1. Silvigeography of Europe, part one: overview and general characteristics of forest areas. 2. Silvigeography of Europe, second part: structure of European forests (area, growing stock and increment by ownership, tree species, management methods, in general and on the examples of some countries). 3. Silvigeography of Europe, third part: forest habitats, forest types and silvicultural characteristics of the main tree species. 4. History of European forestry: the impact of land use on the development of forests and forestry. 5. Forestry in different areas of Europe: history, legislation, organization. 6. Characteristic methods of silviculture, case studies (2 hours). 7. Influence of different forest management methods on forest dynamics, sustainability and forest products. 8. Forest management and climate change: trends and adaptations. 9. Forest management and natural disasters: silvicultural procedures, case studies. 10. Forest management and nature protection requirements: trends, principles of multifunctional silviculture. 11. The concept of close to nature silviculture. Pro Silva Europa, principles, application. 12. Presentation of student seminar papers, discussion (3 hours). <p><u>Fieldwork (40 hours):</u></p> <p>Forest management of Central European countries</p>		
<p>2.6. Format of instruction</p>	<p><input checked="" type="checkbox"/> lectures</p> <p><input checked="" type="checkbox"/> seminars and workshops</p> <p><input type="checkbox"/> exercises</p> <p><input type="checkbox"/> <i>online in entirety</i></p> <p><input type="checkbox"/> partial e-learning</p>	<p><input type="checkbox"/> independent assignments</p> <p><input type="checkbox"/> multimedia and the internet</p> <p><input type="checkbox"/> laboratory</p>	<p>2.7. Comments:</p> <p>The course contains international excursion.</p>



	<input checked="" type="checkbox"/> field work			<input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities									
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Anić, I., S. Mikac, 2021: European forestry. PP presentations, University of Zagreb, Faculty of Forestry, Zagreb.				NO		YES, Merlin		
2.12. Optional literature	<p>Ellenberg, H., 2009: Vegetation Ecology of Central Europe. Cambridge University Press, English translation, 4th edition, 731 p.</p> <p>FOREST EUROPE, UNECE and FAO 2011: State of Europe's Forests 2011. Status and Trends in Sustainable Forest Management in Europe (https://www.unece.org/fileadmin/DAM/publications/timber/Forest_Europe_report_2011_web.pdf).</p> <p>McGrath, M. J., S. Luyssaert, P. Meyfroidt, J. O. Kaplan, M. Bürgi, Y. Chen, K. Erb, U. Gimmi, D. McInerney, K. Naudts, J. Otto, F. Pasztor, J. Ryder, M.-J. Schelhaas, A. Valade, 2015: Reconstructing European forest</p>								



	<p>management from 1600 to 2010. <i>Biogeosciences</i>, 12: 4291–4316 (www.biogeosciences.net/12/4291/2015/).</p> <p>Nature-based forestry in Central Europe. University of Ljubljana, Biotechnical faculty, Ljubljana, 167 p.</p> <p>Pro Silva, 2012: Pro Silva principles. 67 p. (https://www.prosilva.org/fileadmin/prosilva/3_Close_to_Nature_Forestry/01_ProSilva_Principles/Pro_Silva_Principles_2012.pdf)</p> <p>Turbé, A., U. Jana, A. de Toni, S. Woodward, A. Schopf, S. Netherer, P. Angelstam, S. Mudgal, P. Sonigo, 2012: Disturbances of EU forests caused by biotic agents. European Commission (https://ec.europa.eu/environment/forests/pdf/FBD_report_2012.pdf)</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Milan Oršanić, Ph.D. Assistant Prof. Damir Drvodelić, Ph.D. Assistant Prof. Vinko Paulić, Ph.D	1.7. Number of ECTS credits	5
1.2. Course title	Growing trees outside forests	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	225920	1.9. Expected enrolment in the course	25
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	During lectures and practical teachings, students will acquire basic knowledge on the main types of forests that are not managed exclusively for economic reasons. Students are taught to recognize main types of special purpose forests and types of activities in such forests. Besides, students are		



	familiarized with sustainable management and close-to-nature management.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	A2. explain position and trends of forestry profession in the country and worldwide B4. manage and make independent professional (business) decisions from the field of silviculture and management planning with wildlife management B5. organise and manage professional works on establishing, caring for, and renewing forest stands B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests B11. apply knowledge related to forest main and secondary forest products B15. develop current technologies as well as implement new technologies
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	Specifically forested forests, urban forests and arboriculture (raising forests of special purpose, restoration of special purpose forests, urban forestry functions, differences between urban forestry and arboriculture). Compare the assessment of dangerous trees using different methods (identifying dangerous trees (basics of static trees, fracture profiles of different tree species) and protection measures. Present the production of trees and large tree trunks (biological-ecological requirements of species, problems of large trees, extraction and packaging) Establish the establishment and care of a tree (choice of species, appearance, care). Analyze the establishment and breeding of plantations in degraded habitats (establishment of plantations in arid and semiarid areas, selection of planting species in the Mediterranean area). Present the establishment and cultivation of special forestry plants (short-term plantations for the production of forest biomass, windshield belts, agro-forestry, Christmas trees).
2.5. Course content (syllabus)	The course deals with the issue of growing trees outside forests and forest areas, for example in urban areas, as part of an arboretum, in field protection and windbreaks, for decorative purposes, for the production of wood (plantation) and non-wood forest products (forest fruit trees), as well as other similar forms of either natural or artificial origin not cultivated by classical forestry. Lectures: 1. Introduction to growing trees outside forest areas 2. Selection of trees for the establishment of tree lines, alleys and protective barriers (wind, noise, small floating particles) 3. The quality of the transplanting trees in the nursery according to E.N.A. standard 4. Planting trees for special purposes (shelter, protection, shade)



	<p>5. Care and maintenance of trees for special purposes (anchoring, mulching, basics of fertilization, basics of irrigation, basics of pruning, basics of securing the canopy, installation of lightning rods for trees)</p> <p>6. Establishment and care of forest cultures and plantations for wood forest products</p> <p>7. Paulownia plantation cultivation</p> <p>8. Establishment and care of short-rotation forest cultures (SRFC)</p> <p>9. Establishment and care of forest cultures and plantations for non-timber forest products</p> <p>10. Forest fruit trees</p> <p>11. Establishment and care of Christmas tree plantations</p> <p>12. Agroforestry</p> <p>Exercises:</p> <p>1. Application of E.N.A. standards in the selection of trees in the nursery</p> <p>2. How to plant transplanting trees properly?</p> <p>3. Application of mycorrhiza and soil bioenhancers when planting trees outside forest areas</p> <p>4. Tree care works after planting</p> <p>5. Seed production and nursery production of paulownia seedlings</p> <p>6. Selection of species for the establishment of short-rotation forest cultures (SRFC)</p> <p>7. Use and importance of wood forest products from forest cultures and plantations</p> <p>8. Use and importance of non-wood forest products from forest cultures and plantations</p> <p>9. Seed production and nursery production of forest fruit trees</p> <p>10. Seed production and nursery production of seedlings for Christmas trees</p> <p>11. Selection of species for the establishment of Christmas tree plantations</p> <p>12. Good examples from agroforestry</p> <p>Field work:</p> <p>1. Establishment of new tree lines in urban areas</p> <p>2. Plantation cultivation of paulownia</p>		
<p>2.6. Format of instruction</p>	<p><input checked="" type="checkbox"/> lectures</p> <p><input type="checkbox"/> seminars and workshops</p> <p><input checked="" type="checkbox"/> exercises</p> <p><input type="checkbox"/> <i>online in entirety</i></p> <p><input type="checkbox"/> partial e-learning</p> <p><input checked="" type="checkbox"/> field work</p>	<p><input type="checkbox"/> independent assignments</p> <p><input type="checkbox"/> multimedia and the internet</p> <p><input type="checkbox"/> laboratory</p> <p><input type="checkbox"/> work with mentor</p> <p><input type="checkbox"/> (other)</p>	<p>2.7. Comments:</p> <p>The exercises are partially performed as a practicum in the nursery 'Šumski vrt i Arboretum'. Two days of fieldwork</p>



2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper	YES		(other)		
	Preliminary Exam	YES		Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)		5
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures, exercises and field classes. Absence with a maximum of 20% of lectures and 10% of exercises is allowed. Making and submitting exercises within the given deadline. Preparation of papers from fieldwork. Taking colloquia, exams								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	1. Drvodelić, D., 2020: presentations of lectures and exercises (Merlin)								
	2. Anić, I., 2004: Uzgajanje šuma I. Skripta za internu uporabu. Šumarski fakultet, Zagreb								
2.12. Optional literature	1. Grey, G.W. The Urban Forestry: Comprehensive Management. New York. 1996 2. Miller, RW. Urban forestry: Planing and Managing Urban Green Spaces, 2nd ed. Upper Saddle River, NJ: Prentice Hill. 1997. 3. Kelly, M., J., Larson., C., B., 1992: The Ecology and Silviculture of Mixed-Species Forests. Kluwer academic Publishers. 4. Mayer, H., Ott, E: 1991: Gebirgswaldbau Schutzwaldpflege. Gustav Fischer Verlag								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assoc. Prof. Stjepan Posavec, PhD. Assist. Prof. Karlo Beljan, PhD.	1.7. Number of ECTS credits	5
1.2. Course title	Economics of Forest Company	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+8
1.3. Course code	33895	1.9. Expected enrolment in the course	20
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	When starting the production process, ie undertaking a business venture, it is necessary to gain the knowledge necessary for the production of goods or services, which will be advantageous in the market. The course analyzes the basic concepts of microeconomics and the role of the forest company. Students get acquainted with the elements and method of making a business report in forestry. Introduction with the characteristics and analysis of investments in forestry.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B1. organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical C1. plan, organise and works of organization of production in forestry C3. organise and manage work safety in forestry C4. plan and calculate production, calculate basic indicators of successful business, compose basic financial reports, recognise and analyse types of costs		



<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>To analyse capital and investments in forestry (meaning of the capital in forestry, fixed property and working capital in forestry, categories and importance of investments in forestry).</p> <p>To present costs, calculation and cost management in forestry (costs in production processes, types and methods of calculation, price structure in creation of specific calculation for characteristic productions and forest products).</p> <p>To compare economic analyse of business performance in forest company and business indicators (balance sheet, profit and loss account, cash flow, debt ratio, liquidity, activity, profitability, investment and market value).</p> <p>To estimate specifics of planning processes and business plan (economic statements, influence of forest management planning on business results, functioning of investments and business plans in forest management, goals, contents and shape of the business plan).</p> <p>To compare economic policy instruments and processes of strategic planning (monetary system, fiscal system, overseas relations and income policy, environment analyses, added value chain analyse, controlling instruments).</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Definition and subject of economics 2. Historical development of the economy 3. The meaning of the forest as capital 4. Capital and investments in forestry 5. Depreciation of assets in forestry 6. Costs and cost management 7. Cost break even point 8. Cost calculations in forestry 9. Product price structure 10. Contribution margin 11. Business analysis of the company, financial reports 12. Business performance indicators 13. Specifics of planning in forestry 14. Business plan of the forestry company, strategic planning, controlling 15. Economic policy instruments, macroeconomic indicators <p>Exercises:</p> <ol style="list-style-type: none"> 1. Types and ways of using a compounding interest rate and net present value 2. Calculation of depreciation in forestry, 3. Calculation of the rate of return on investment (ROI), the rate of return on capital (ROE) in forestry 4. Analysis of fixed, variable and total costs 5. Calculation of break even point 6. Cost calculation methods in forestry 7. Calculation using an equivalent number 8. Analysis of the business performance of the forestry company 9. Economic indicators of the forestry company 10. Business plan for forestry investments 11. Analysis of the portfolio of business activities in forestry 12. Accounting standards, financial reports 13. Application of cost management in business process 14. Justification of investment projects in forestry 15. Examples of budgeting and controlling in forestry



	Field work: 1. Review of the connection between the forestry and wood processing sectors. Business plan and justification of investment on the example of forestry company and wood processing company in practice.								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	4	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Ordinary participation and active participation in classes, exercises and field trip. Individual preparation and exercise submission. Examination.								
2.11. Required literature (available in the library)	Title				Availability in the library		Availability via other media		
	Figurić, M.: UVOD U EKONOMIKU ŠUMSKIH RESURSA, Šumarski fakultet, Zagreb, 1998								



and/or via other media)	Figurić, M.: MENADŽMENT TROŠKOVA U DRVNOTEHNOLOŠKIM PROCESIMA, chosen fields, Šumarski fakultet, Zagreb, 2003.		
	Posavec, S.; Kajba, D.; Beljan, K.; Boric, D.: Economic analysis of short rotation coppice investment: Croatian case study, AUSTRIAN JOURNAL OF FOREST SCIENCE, 2017, volume 134, 163-176		
	Kajanus, M.; Leban, V.; Glavonjic, P.; Krc, J.; Nedeljkovic, J.; Nonic, D.; Nybakk, E.; Posavec, S.; Riedl, M.; Teder, M.; Wilhelmsson, E.; Zalite, Z.; Eskelinen, T.: What can we learn from business models in the European forest sector: Exploring the key elements of new business model designs. FOREST POLICY AND ECONOMICS, 2019. volume 99, 145-156		
	Posavec, S., Avdibegović, M., Bećirović, DŽ., Petrović, N., Stojanovska, M., Marčeta, D., Pezdevšek Malovrh, Š. 2016: Private forest owners willingness to supply woody biomass in selected South-Eastern European countries, Biomass & bioenergy, 81, 144-153.		
2.12. Optional literature	Samuelson, P., Nordhaus, W.: EKONOMIKA, Mate, Zagreb, 1992, str. 1-800. KLEMPERER, W.D.: FOREST RESOURCE ECONOMICS AND FINANCE, McGraw-Hill Book Comp., New York		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Marijan Grubešić, Ph.D. Prof. Krešimir Krapinec, Ph.D. Assistant Prof. Kristijan Tomljanović, Ph.D	1.7. Number of ECTS credits	5
1.2. Course title	Hunting management II	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+8
1.3. Course code	225921	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students get acquainted with the techniques and technologies of intensive game breeding, ie game breeding in the fence. In addition to technologies, knowledge is acquired in the field of production planning as well as the preparation of feasibility studies (projects) for intensive game breeding. Through teaching, exercises and fieldwork, a synergy of theoretical and practical knowledge about intensive game breeding is established.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways B2. establish forest management programs and wildlife management programs C2. organise and manage works on organization of hunting areas D2. conduct courses in professional secondary and other similar schools		



<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Present game breeding in a fenced area (reasons, advantages and lack of intensive game breeding, facilities and equipment in wildlife farms).areas, habitat quality for large and small game, determining the hunting capacity for each species of game).</p> <p>Identify the breeding technology of a certain species of game in a fenced area.</p> <p>Organize hygiene and health care in the breeding grounds (preventive, curative and remedial measures of health care, equipment, handling of game meat).</p> <p>Review the economics and marketing of wild game breeding in a fenced area (economic justification, calculation of income and expenditure of game farms, marketing of farms, products and services).</p> <p>To predict the entry of wild game from breeding into open hunting grounds (procedure for entry of game from game farms into open hunting grounds - drift, preparation of habitat, reception site, discharge procedure, release time).</p>
<p>2.5. Course content (syllabus)</p>	<p>Classes will be held with the use of modern aids and materials recorded and prepared by domestic and foreign hunting grounds and game farms. Through fieldwork, students will be directly introduced to large and small game farms.</p> <p>Lectures:</p> <ol style="list-style-type: none"> 1. Introduction. History of game breeding in a fenced area 2. Fences, types of fences and fence materials 3. Technical elements of fenced hunting grounds and farms such as fencing, fencing facilities and fenced facilities intended for game and hunters. 4. Technology of breeding certain types of game. 5. Game breeding in an enclosed space. 6. Intensive breeding of bivalves 7. Intensive breeding of wild boars 8. Rabbit cage breeding technology 9. Technology of poultry breeding in artificial breeding centers (pheasants) 10. Cycle of game breeding 11. Release and savagery of farmed game 12. Wildlife protection. 13. Damage caused by game as well as damage prevention measures. 14. Health care and hygiene in game farms 15. Economic elements of game breeding, game products and marketing presentation of game and hunting management. <p>Exercises:</p> <ol style="list-style-type: none"> 1. Intensive breeding of large game - farms, breeding farms 2. Development of fencing cost estimates 3. Calculation of farm capacity - large game 4. Intensive rabbit breeding - cost estimates and capacities 5. Intensive pheasant breeding - cost estimate and capacities 6. Calculation of necessary nutrition and nutrition, facilities 7. Obtaining and hygiene of game meat in intensive breeding 8. Procedures with game after shooting - manipulation, objects 9. Game meat, quality, nutritional value, use 10. Diseases of wild animals - distribution of diseases, sources of infection, hygiene 11. Infectious diseases, bacterial and viral diseases 12. Parasitic diseases, poisoning and other risks



	13. Game breeding program, patterns, production and implementation 14. Game protection program, patterns, development and implementation 15. Legislation								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work	YES		(other)		
	Project		NO	Written exam	YES		ECTS credits (total)		5
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises. Examination.								
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media		
	Andrašić, D., 1984: Zoologija divljači i lovna tehnologija. Skripta, Sveučilište u Zagrebu Šumarski fakultet, Zagreb, 294 str				YES				



	Mustapić, Z., i suradnici., 2004: LOVSTVO priručnik. Hrvatski lovački savez Zagreb, 597 str.	YES	
2.12. Optional literature	Grupa autora: 1967: Lovački priručnik, Lovačka knjiga Zagreb, 704 str. Grupa autora, 1987: Velika ilustrovan enciklopedija lovstva Beograd I i II		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Marijan Šušnjar, Ph.D. Assistant Prof. Hrvoje Nevečerel, Ph.D. Assistant Prof. Dinko Vusić, Ph.D. Assistant Prof. Kruno Lepoglavec, Ph.D. Assistant Prof. Zdravko Pandur, Ph.D.	1.7. Number of ECTS credits	5
1.2. Course title	Forestry Techniques and Technologies	1.8. Number of hours in semester (L+E+F+e-learning)	30+30+24
1.3. Course code	33897	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students acquire knowledge about the application of the latest technologies in timber extraction, opening of forests to primary and secondary forest roads and technical and operational characteristics of machines and devices used in timber extraction and construction of forest roads.		



2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	B10. apply knowledge related to forest machines, techniques and standard technologies used in forestry
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Recommend machines for tree felling and processing and timber transport (chainsaw, harvester, skidder, adapted farming tractor, forwarder, forest trucks for timber transport, cableways). Present timber harvesting works, development of standardization and rationalization of timber harvesting (timber harvesting systems and subsystems, works required for the production of a particular forest product, standardization of forest products by processing methods, skidding or forwarding technology, new technical and technological method of timber harvesting, standardizing of harvesting works by applying work and time studies, rationalization of works). Investigate the construction and maintenance of forest roads in the lowland area and on sloping terrains (the procedures for establishing an optimal network of forest roads in the field are considered through the issues of construction and maintenance in the lowland area and on sloping terrain, the analysis of the existing primary and secondary forest traffic infrastructure network). Present a modern approach to optimizing the network of forest roads - revitalization of land (justifiability of return on land, land revitalization, so-called reforestation, existing techniques and technologies for land revitalization).</p>
2.5. Course content (syllabus)	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Standards of wood forest products by purpose (HRN) and by quality (HRN EN). Classification of wood forest products. (2 h) 2. Development of standardization and rationalization of wood extraction works. Experiential, statistical, technical and computer standards for timber extraction works. (2 h) 3. Partially mechanized timber extraction systems. System development. Influencing factors. (2 h) 4. Mechanized timber extraction systems. Laws of mechanization (2 h) 5. Energy wood extraction systems. Quality of solid wood biofuels. (2 h) 6. Felling and processing machines development - chainsaws, harvesters (2 h) 7. Battery tools for care and cleaning of forest stands (2 h) 8. Machines for wood extraction (skidders, forwarders, tractor assemblies) and application of forest winches on mechanized means (2 h) 9. Application of mechanized means in damaged forest stands (2 h)



10. Remote monitoring of forest machines – FMS (2 h)
11. Construction and maintenance of forest roads on sloping terrains and in lowland areas – (6 h)
12. Procedures for stabilization of the lower machine and slope of the embankment and excavation of the forest road - (2 h)
13. Modern approach in the optimization of the forest road network - land revitalization - (2 h)

Exercises:

1. Wood defects and characteristics of wood - recognition and measurement.
2. Efficiency calculations based on influencing factors. Appropriate methods for making direct cost calculations.
3. Optimization of a partially mechanized system of wood extraction; productivity adjustment - time norm method; time subsystem overlap.
4. Optimization of the mechanized system of wood extraction; a turning point in productivity.
5. Optimizing the wood chip supply system - choice of time, place and means of chipping.
6. Preparation for measuring exercise „Noise and vibrations of chainsaw“
7. Measuring exercise „Noise and vibrations of chainsaw“
8. Calculation exercise - Calculation of forest winch characteristics
9. Preparation for measuring exercise „Wheel numeric“
10. Measuring exercise „Wheel numeric“
11. Analysis of the existing network of primary and secondary forest transport infrastructure of the Republic of Croatia by relief areas. Planning of primary and secondary forest roads for certain relief areas.
12. Determining the existing classical openness and determining guidelines for improving the existing situation. (2 h)
13. Cost analysis of construction and maintenance. Analysis of the needs for future construction of primary forest roads and analysis of the costs of maintaining the entire network of forest roads - (2 h)
14. Cost calculation that takes into account the stabilization for the proposed material - geocomposite. The cost analysis includes all forest roads that need to be built in the lowland area, and refers to the cost of preparation, supply and installation of the specified stabilizing agent. The comparison is made on the basis of calculations if only mechanical stabilization is used. (2 h)
15. Costs of leaving and closing the forest road and restoring (revitalizing) to its original state. (2 h)

Field work

1. Mechanized felling and processing of trees and technology of opening, construction and maintenance of forest roads in the mountain area
2. Ground based timber extraction systems and technologies for opening, construction and maintenance of forest roads in mountainous areas
3. Timber extraction systems by forwarding and technologies for opening, construction and maintenance of forest roads in the lowland area. Wood chip extraction systems.



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:			
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES	
	Experimental work		NO	Report	NO	(other)		
	Essay		NO	Seminar paper	NO	(other)		
	Preliminary exam	YES		Practical work	NO	(other)		
	Project		NO	Written exam	YES	ECTS credits (total)	5	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures, exercises and field teaching. Laying the exam, exam.							
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library		Availability via other media				
	1. Zečić, Šušnjar, Nevečerel: Presentations of lectures and exercises for course „Forestry Techniques and Technologies“	NO		YES, web				
	2. Zečić, Ž., Vusić, D., 2020: Katalog drvnih šumskih proizvoda.	YES		YES, web				



	Sveučilište u Zagrebu Šumarski fakultet, 1–217.		
	3. Pičman, D., 2007: Šumske prometnice. Šumarski fakultet Sveučilišta u Zagrebu, 1–460.	YES	
	4. Papa I., 2014: Modeli održavanja šumskih cesta na različitim reljefnim područjima. Disertacija, Šumarski fakultet, Zagreb, 1-284. (Odabrana poglavlja)	YES	
	5. Halilović, V., 2017: Karakteristike i upotreba motornih pila u šumarstvu. Šumarski fakultet Univerzitet u Sarajevu. 1-154	NO	YES, Merlin
	6. Längin, D., Ackerman, P., Krieg, B., Immelmann, A., Potgieter, C., van Rooyen, J., Upfold, S., 2010: South African Ground Based Harvesting Handbook. Forest Engineering Southern Africa and Institute for Commercial Forestry Research, Scottsville, South Africa, 1–182. (Odabrana poglavlja)	NO	YES, web
2.12. Optional literature	<p>Lepoglavec K., 2014: Optimizacija primarne i sekundarne šumske prometne infrastrukture nagnutih terena. Disertacija, Šumarski fakultet, Zagreb, 1-341</p> <p>Sundberg, U., Silversides, C.R., 1988: Operational Efficiency in Forestry – Volume 1: Analysis. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 219.</p> <p>Silversides, C.R., Sundberg, U., 1989: Operational Efficiency in Forestry – Volume 2: Practice. Kluwer Academic Publishers – Forest Sciences, Dodrechts/Boston/Lancaster, 1 – 169.</p> <p>Lindroos, O., La Hera, P., Häggström, C., 2017: Drivers of Advances in Mechanized Timber Harvesting – a Selective Review of Technological Innovation. Croatian journal of forest engineering 38(2017) 2, 243-258.</p> <p>Spinelli, R.; Magagnotti, N. The effects of introducing modern technology on the financial, labour and energy performance of forest operations in the Italian Alps. For. Pol. Econ. 2011, 13, 520–524.</p> <p>Zorić, M., Pandur, Z., Šantek, Ž., Šušnjar, M., 2011: Ocjena indeksa kotača kao pokazatelja okolišne pogodnosti forvardera. Nova mehanizacija šumarstva. 32 (2011); 5-13.</p> <p>Gužvinec, H. Zorić, M., Šušnjar, M., Horvat, D. Pandur, Z., 2012: Utjecaj načina sidrenja na vrijednosti horizontalne sastavnice vučne sile i faktor</p>		



	<p>prijanjanja prilikom privitlavanja drva skiderom i adaptiranim poljoprivrednim traktorom. Nova mehanizacija šumarstva, 33 (2012) ; 23-33.</p> <p>Anon. 2002: Forest Road Engineering Guidebook, British Columbia, Ministry of Forests, p. 1-208.</p> <p>FAO 1998: Manual for the planning, design and construction of forest roads in steep terrain, Food and Agriculture Organisation of the United Nations, Rome, p. 1-188.</p> <p>Lepoglavec, K., Potočnik, I., Pentek, T., Tomašić, Ž., Poje, A., Mihelič, M., 2011: Programski paket za projektiranje šumskih prometnica RoadEng. Nova mehanizacija šumarstva, 32 (1): 39–51.</p> <p>Stampfer, K., 2011: Road network planning, timber harvesting and forest road construction in Austria. Predavanje na Šumarskom Fakultetu, Zagreb, 1–33.</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Željko Španjol, Ph.D. Associate Professor Damir Barčić, Ph.D. Assistant Professor Roman Rosavec, Ph.D.	1.7. Number of ECTS credits	5
1.2. Course title	Forest Karst Meliorations	1.8. Number of hours in semester (L+E+F+e-learning)	30+15+16
1.3. Course code	225922	1.9. Expected enrolment in the course	35
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			



2.1. Course objectives	Interpretation of Forest Management Issues. Management models in specific mediterranean and continental karst conditions. Analyse renewal methods of degraded and fire-affected areas.												
2.2. Enrolment requirements and/or entry competences required for the course	-												
2.3. Learning outcomes at the level of the programme to which the course contributes	B5. organise and manage professional works on establishing, caring for, and renewing forest stands B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region												
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	Assess the role and meaning of the karst ecosystem (melioration works, ecological requirements and silvicultural treatment characteristics of the pioneer species). Present the problem of erosion and torrents on karst, and degraded amelioration forest terrain (causes and consequences of erosion processes and torrents, ways reconstruction, raising of wind and rain protection belts at karst, meliorative factors of forest vegetation on karst). Predict the renewal of forest vegetation after open space fire (issues of open space fire and impact on forest vegetation, protection measures).												
2.5. Course content (syllabus)	<p>Lectures</p> <table border="1"> <tr> <td>1.</td> <td>Explanation of the concept of karst, distribution and borders in our country and the world. The role and importance of the karst ecosystem.</td> </tr> <tr> <td>2.</td> <td>General features of the karst ecosystem; geology, geomorphology, climate, karst soils and vegetation.</td> </tr> <tr> <td>3.</td> <td>Presentation of the causes and consequences of vegetation devastation and soil degradation in the karst area with the history of today's karst. History of karst forest management, and the beginnings and development of reclamation of devastated and degraded Stojbin factors (vegetation and soil).</td> </tr> <tr> <td>4.</td> <td>Biological reclamation works, afforestation of devastated and degraded areas artificially (planting plants, sowing seeds), naturally (natural succession), selection of species, planting time.</td> </tr> <tr> <td>5.</td> <td>Technical reclamation works, habitat preparation; terrain fencing, undermining, planting pits, construction of roads, construction of cities, terraces, consolidation barriers.</td> </tr> <tr> <td>6.</td> <td>Reasons for reclamation of degraded forest terrains in Croatia and the world. Ecological-biological, technical and sociological social.</td> </tr> </table>	1.	Explanation of the concept of karst, distribution and borders in our country and the world. The role and importance of the karst ecosystem.	2.	General features of the karst ecosystem; geology, geomorphology, climate, karst soils and vegetation.	3.	Presentation of the causes and consequences of vegetation devastation and soil degradation in the karst area with the history of today's karst. History of karst forest management, and the beginnings and development of reclamation of devastated and degraded Stojbin factors (vegetation and soil).	4.	Biological reclamation works, afforestation of devastated and degraded areas artificially (planting plants, sowing seeds), naturally (natural succession), selection of species, planting time.	5.	Technical reclamation works, habitat preparation; terrain fencing, undermining, planting pits, construction of roads, construction of cities, terraces, consolidation barriers.	6.	Reasons for reclamation of degraded forest terrains in Croatia and the world. Ecological-biological, technical and sociological social.
1.	Explanation of the concept of karst, distribution and borders in our country and the world. The role and importance of the karst ecosystem.												
2.	General features of the karst ecosystem; geology, geomorphology, climate, karst soils and vegetation.												
3.	Presentation of the causes and consequences of vegetation devastation and soil degradation in the karst area with the history of today's karst. History of karst forest management, and the beginnings and development of reclamation of devastated and degraded Stojbin factors (vegetation and soil).												
4.	Biological reclamation works, afforestation of devastated and degraded areas artificially (planting plants, sowing seeds), naturally (natural succession), selection of species, planting time.												
5.	Technical reclamation works, habitat preparation; terrain fencing, undermining, planting pits, construction of roads, construction of cities, terraces, consolidation barriers.												
6.	Reasons for reclamation of degraded forest terrains in Croatia and the world. Ecological-biological, technical and sociological social.												



	7.	Biological properties and ecological requirements of forest woody species important for karst reclamation (indigenous and non - indigenous species).	
	8.	The problem of karst grazing: a historical overview, socio-social and economic point of view. Today's models of an integrated approach while respecting the sociological and economic interests of users.	
	9.	The problem of erosion and torrents on karst (geological-pedological, vegetation, economic, and their control and remediation).	
	10.	Problems of forest fires. Measures for the protection of pine crops, indigenous and non-indigenous vegetation and restoration of burned areas.	
	11.	Podizanje vjetrobranih šumskih pojaseva i nasada (poljozaštitnih, snjegozaštitnih i dr.) utjecaj vjetrobranih šumskih pojaseva na mikroklimu okoliša (strujanje vjetra, brzina vjetra, temperatura zraka, temperatura tla i vlažnost zraka, vlažnost tla, eolska erozija), te druge koristi (sociološko-pejzažne, stanište životinja, dobivanje biomase, vodni režim u tlu i dr.).	
	12.	The reclamation role of individual species in improving the physico-chemical and mechanical characteristics of the soil, and the reclamation impact of raised forest crops on the improvement of breeding conditions and the return of indigenous vegetation.	
	13.	Mediterranean forests, and their role and purpose in forest management in the karst area of Croatia. Problems of karst forest crops. Advantages and disadvantages in the choice of species, determining the purpose of forest crops.	
	14.	Agroforestry as a whole of technological systems in forestry and agriculture in order to create higher productivity, economic justification, environmental acceptability and sustainable land use. Introduction to the basic systems of forestry (agrosilviculture, raising forest crops for livestock purposes, agrosilviculture with livestock).	
	15.	Ecological evaluation of karst areas in Croatia and their role in biological and landscape diversity. Economic and sociological value of the Mediterranean and continental karst area.	
	Exercises		
	1.	Practicum - classroom exercises. Introduction to the exercises, review of the literature related to forest karst reclamation.	
	2.	Practicum - classroom exercises. Basic presentation of vegetation, phytocenological and pedological characteristics of karst.	
	3.	Practicum - classroom exercises. The concept of land reclamation in forestry and application on degraded forest habitat and forest land. The main features and characteristics of karst in Croatia are covered.	



	4.	Practicum - classroom exercises. Biological reclamation works. Works on planting, sowing, natural and artificial grassing, and resurgent felling.		
	5.	Practicum - classroom exercises. Continuation of the previous exercise.		
	6.	Practicum - classroom exercises. Technical reclamation works. Ways and methods, advantages and disadvantages in the construction of cities, contour trenches, terraces, consolidation barriers, contour walls.		
	7.	Practicum - classroom exercises. Continuation of the previous exercise.		
	8.	Practicum - classroom exercises. Afforestation of the Mediterranean and continental karst area. Selection of species and reasons for establishing forest crops.		
	9.	Practicum - classroom exercises. Overview of habitat conditions and the method of afforestation in the field. The role and purpose of forested areas and a comparison with similar issues in the world.		
	10.	Practicum - classroom exercises. Raising wind protection and anti-erosion forest belts on the karst of Croatia.		
	11.	Practicum - classroom exercises. Presentation of the causes and consequences of erosion processes and torrents, ways of reconstruction of such terrains.		
	12.	Practicum - classroom exercises. Reclamation factors of forest vegetation on karst, quantity and chemistry of forest cover, mineralization and humification processes.		
	13.	Practicum - classroom exercises. Forest mat as a combustible material in stands, and as a factor important for reclamation effect. Differences due to different vegetation and risk assessments for forest fires.		
	14.	Practicum - classroom exercises. Valuation of forests and forest land on karst, the relationship between economic and generally useful roles. Possibilities of quality connection of forestry and agriculture, forestry agricultural programs.		
	15.	Practicum - classroom exercises. Preparation for fieldwork of students.		
	Field work in the area of forest meliorations			
	2.6. Format of instruction	<input checked="" type="checkbox"/> lectures	<input type="checkbox"/> independent assignments	2.7. Comments:
		<input type="checkbox"/> seminars and workshops	<input type="checkbox"/> multimedia and the Internet	
	<input checked="" type="checkbox"/> exercises			



	<input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work		<input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES	
	Experimental Work		NO	Report	NO	(other)		
	Essay		NO	Seminar paper	NO	(other)		
	Preliminary Exam	YES		Practical work	NO	(other)		
	Project		NO	Written exam	YES	ECTS credits (total)		5
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the partial exam and final exam.							
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media		
	Španjol, Ž., Barčić, D., 2020: Šumske melioracije krša (interna skripta), Faculty of Forestry, Zagreb.			NO		YES, Merlin		
2.12. Optional literature	Balen, J., 1931: Naš goli krš, pp. 311, Zagreb Bakšić, N., 2017: Vlažnost mrtvog šumskog goriva kao čimbenik nastanka požara. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb. Barčić, D., 2003: Meliorativne značajke borovih kultura u stanišnim prilikama otoka Raba, Magistarski rad, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb. Barčić, D., 2007: Odnosi stanišnih čimbenika u sastojinama crnoga bora (Pinus nigra J.F.Arnold) u Hrvatskom primorju i u Istri, Doktorski rad, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb. Drew, D., Hotzl, H. 1999: Karst Hydrogeology and Human Activities A.A.Balkema/Rotterdam/Bookfield 1999.							



	<p>Rosavec, R., 2010: Odnos čimbenika klime i zapaljivosti nekih mediteranskih vrsta kod šumskih požara. Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.</p> <p>Španjol, Ž., 1996: Biološko-ekološke i vegetacijske posljedice požara u borovim sastojinama i obnova, Disertacija, Šumarski fakultet Sveučilišta u Zagrebu, Zagreb.</p> <p>Tomašević, A., 1990: Podrivanje kao prva faza pripreme tla za pošumljavanje. Glas.šum. pokuse 26: 393-404. Zagreb.</p> <p>Tomašević, A., 1995: Višegodišnji rezultati istraživanja uspjeha pošumljavanja na kršu alepskim borom (<i>Pinus halepensis</i> Mill.), crnim borom (<i>Pinus nigra</i> Arn.), i primorskim borom (<i>Pinus pinaster</i> Ait.) kod tri različite metode pripreme tla za pošumljavanje. Šum. list CXIX, (7-8): 227-238, Zagreb.</p>
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Renata Pernar, Ph.D. Assoc. Prof. Ante Seletković, PhD.	1.7. Number of ECTS credits	2
1.2. Course title	Spatio-temporal analysis in GIS	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225932	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Introducing students to the types and models of spatial data, sources and methods of data collection for spatial and temporal analysis and valorization of space, and the basic procedures and possibilities of application of spatial - temporal analysis and valorization of space.		
2.2. Enrolment requirements and/or	-		



entry competences required for the course	
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>B2. establish forest management programs and wildlife management programs</p> <p>B9. prepare ecological studies and forestry parts of spatial plans</p> <p>B15. develop current technologies as well as implement new technologies</p> <p>D4. professionally and scientifically upgrade through different educational ways and postgraduate study</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Pronounce the definition of spatial data. Distinguish ordinary from spatial information. Describe models and sources of spatial data. Comment on the types and form of spatial data</p> <p>Pronounce the definition of digital relief model and digital orthophoto. Describe and explain ways of making and editing data at creating DRM. Present the creation of a DRM and explain its significance in forestry. Compare ways of DRM visualization.</p> <p>Compare and describe the analysis of vector and raster data.</p> <p>Analyze isolated polygons with aim of determining the homogeneity and / or heterogeneity of the studied area from the aspect of silviculture, forest management, forest protection, ...</p> <p>Analyze quantification of spatial elements of land use, land cover and habitat. Explain the significance of spatial analysis and valorization of spatial elements.</p>
2.5. Course content (syllabus)	<p>Predavanja:</p> <ol style="list-style-type: none"> 1. Introduction to spatio - temporal analysis and geomatics 2. Spatial data and spatial data models 3. Sources, formats and possibilities of exchange of geodata with other systems 4. Thematic, geometric data, importance of thematic data and concepts of their storage 5. Establish, use, maintain and update databases 6. Ways of interpolation of thematic variables and their spatial distribution 7. Generating variables for the conduction of fragmentary statistics (area and perimeter of polygons, distance of line objects, number of polygons per unit of surface, number of linear elements in an area, ect.) 8. Spatial analysis (vector, raster), data selection, analysis of selected data 9. Zoning, search, thematic overlapping, extracting content, autocorrelation, merging surfaces and content 10. Operations on location / distance, networks analysis, thematic mapping 11. Layer analysis with the aim of determining the homogeneity and/or heterogeneity of the studied area from the aspect of silviculture, management, forest protection, ... 12. Data sources for DRM creation, data editing, creation methods and and visualization of DRM 13. Generating new variables based on DRM 14. Introduction of RS products in layered analysis, digital orthophoto



	15. Significance of spatio – temporal analysis and valorization of space in forestry											
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work					<input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)					2.7. Comments:	
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES				
	Experimental work		NO	Report		NO	(other)					
	Essay		NO	Seminar paper		NO	(other)					
	Preliminary exam		NO	Practical work		NO	(other)					
	Project		NO	Written exam		NO	ECTS credits (total)	2				
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.											
2.10. Student responsibilities	Regular attendance and active participation in lectures, production and presentation of seminar work. Taking exam.											
2.11. Required literature (available in the library and/or via other media)	Title					Availability in the library		Availability via other media				
	Lang, S. & T. Blaschke, (2010): Analiza krajolika pomoću GIS-a					YES						
	Skidmore A. (2003): Environmental Modelling with GIS and Remote Sensing. Taylor & Francis, London, 268 str.							YES				



	Andričević R., H. Gotovac, I. Ljubenkov, (2007): GEOSTATISTIKA: umijeće prostorne analize, Udžbenik	YES	
	Pernar R. Seletković, A. (2019): Prezentacije s predavanja		YES
	Ključanin, S., Poslončec-Petrić, V., Bačić, Ž. (2018): Osnove infrastrukture prostornih podataka, Sarajevo: Dobra knjiga. 166 str.		YES
2.12. Optional literature	1. Maguire, D. J., Batty, M. (ur.) (2005): GIS, Spatial Analysis, and Modeling. ESRI Press, USA. 480 str. 2. Haines-Yonng, R., Green D, Cousinss (1993): Landscape ecology and GIS, Teylor & Francis, London, 288 str. 3. Lane, S. N., Richards, K. S., Chandler, J. H. (ur.) (1998): Landform Monitoring, Modelling and Analysis. John Wiley & and sons Ltd. Baffin Lane, Chichester, West Sussex, England. 466 str.		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Saša Bogdan, Ph.D. Asst. Prof. Ida Katičić Bogdan Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Bioenergy plantations and phytoremediation	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33940	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			



2.1. Course objectives	Students are introduced to woody biomass production in short rotations, use of bioenergy cultures in phytoremediation, energy potential of biomass as well as its benefits for environmental protection.
2.2. Enrolment requirements and/or entry competences required for the course	-
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B5. organize and carry out professional field work on the establishment, care and restoration of forest stands</p> <p>B13. methods of preparation and planning of works in forestry</p> <p>B15. improve existing technologies as well as introduce new technologies</p> <p>D1. perform the duties of scientific and professional associate in scientific research institutions in the field of forestry and game management</p> <p>D2. lead teaching courses in vocational secondary and related schools</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<ol style="list-style-type: none"> 1. Describe the role of biomass in obtaining energy from renewable sources 2. Propose the optimal number of clones and their arrangement in bioenergy crops (short rotation crops SRC). 3. Assess the ecological and physiological aspects of short rotation forestry (SRF). 4. Evaluate biomass production and genetic parameters in short rotation clone tests. 5. Review the results of demonstration surfaces and clone tests. 6. Classify and suggest one of the phytoremediation techniques. 7. Plan the principle of forming a buffer zone, coastal corridor, marsh protection zone, soil stabilization or flood reduction. 8. Predict the economic viability of phytoremediation. 9. Plan the establishment and use of poplar and willow crops in phytoremediation. Assess improvement of physical properties, soil, carbon sequestration, first rotation and further cultivation. 10. Connect the legislation and legal regulations for the use of clonal material in bioenergy crops and phytoremediation
2.5. Course content (syllabus)	<p>Lectures:</p> <ol style="list-style-type: none"> 1. The role of biomass in renewable energy sources and climate change mitigation 2. Types of forest trees suitable for short rotation crops, with energy potential and production of wood biomass in short rotation crops (SRC). 3. Clone / semi-relative interaction and planting spacing, and influence of habitat, biotic and abiotic factors. 4. optimal number of clones and arrangement of clones in bioenergy cultures, 5. Interaction of clones and different habitat types 6. Ecological and physiological aspects of SRC (competition, growth dynamics, regeneration, physiological stress, supplementation, etc.),



	<ol style="list-style-type: none"> 7. Crops and plantations of forest trees, mixed crops, bioenergy plantations 8. Plantations in the protection of watercourses, vegetation filters 9. Remediation of contaminated surfaces (phytoremediation). Processes in phytoremediation - Phytoextraction, rhizofiltration, phytostabilization, phytodegradation, rhizodegradation, phytovolatilization). 10. Carbon sequestration, use of wastewater and sludge for recharge in SRC. 11. Biodiversity and contribution to environmental protection in the cultivation of crops in short rotation and phytoremediation (greenhouse gases, energy balance, conversion of biomass into energy) 12. Use of SRC in the reduction of pollutants 13. Characteristics of biomass as a fuel 14. Socio-economic position of SRC 15. Legislative environment for biomass production and phytoremediation 								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the Internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	ExperNimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar Paper		NO	(other)		
	Preliminary Exam		NO	Practical Work		NO	(other)		
	Project		NO	Written Exam	YES		ECTS credits (total)	2	
2.9. Assessment methods	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								



and criteria			
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, making and delivering exercises within the given time frame. Laying the exam, exam.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Domac, J. et al.: BIOEN - program korištenja energije biomase, Energetski institut "Hrvoje Požar", 1998, p. 1-179.		
	Domac, J. et al.: BIOEN - program korištenja energije biomase i otpada, Energetski institut "Hrvoje Požar", 2001, p. 1-144.		
	BIOMASS & BIOENERGY, Pergamon, Elsevier Science Ltd.		
	FOREST MANAGEMENT FOR BIOENERGY, The Finnish Forest Research Institute, 1997, str. 1-127		
	EI Bassam: ENERGY PLANT SPECIES, 1998, pp. 1-356.		
	Journal of Phytoremediation http://www.rtdf.org/phytobib.htm		
2.12. Optional literature	<p>Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY I - GENETICS AND BIOTECHNOLOGY, Springer Verlag, 1993, pp. 277.</p> <p>Ahuja, M. R., Libby, W. J.: CLONAL FORESTRY II – CONSERVATION AND APPLICATION Springer Verlag, 1993, pp. 240.</p> <p>Dickmann, D.I., Isebrands, J.G., Eckenwalder, J.E., Richardson, J.: POPLAR CULTURE IN NORTH AMERICA, NRC Research Press, Ottawa, 2001, pp. 1-397.</p> <p>Stettler, R. F., Bradshaw, Jr., H. D., Heilman, P. E., Hinckley, T. M.: BIOLOGY OF POPULUS AND ITS IMPLICATIONS FOR MANAGEMENT AND CONSERVATION, NRC Research Press, Ottawa, 1996, pp. 1-597.</p>		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Ivica Tikvić, Ph.D. Associate Prof. Damir Ugarković, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Ecology of Forest Tree Species	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33935	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Introduction to the main forest tree species in Croatia and Europe. Defining the main ecological characteristics of forest tree species. Introduction to the natural distribution of forest tree species and distribution outside the natural range. Description of the relationship between the main economic deciduous and evergreen tree species and ecological factors (light, heat, water, climate, soil and relief). An overview of the most important adverse factors for certain indigenous and non-indigenous forest tree species.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B1. organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management B7. organise and manage professional works on inventorying forests C1. plan, organise and works of organization of production in forestry		
2.4. Expected learning	1. Describe the natural habitat characteristics of a particular indigenous or non-indigenous forest tree species		



outcomes at the level of the course (3 to 10 learning outcomes)	<p>2. Select the most favorable tree species for natural and artificial regeneration based on habitat status and ecological relationships of tree species</p> <p>3. Define the main ecological and biological problems of economically important forest tree species in Croatia</p>								
2.5. Course content (syllabus)	<p>Lectures</p> <ol style="list-style-type: none"> 1. Fundamentals of ecology and biology of forest trees and shrubs 2. Ecological and biological characteristics of common beech 3. Ecological and biological characteristics of pedunculate oak and sessile oak 4. Ecological and biological characteristics of field ash and black alder 5. Ecological and biological characteristics of willows and poplars 6. Ecological and biological characteristics of silver fir and norway spruce 7. Ecological and biological characteristics of Aleppo pine, black pine and common cypress 8. Ecological and biological characteristics of European larch and Scots pine 9. Ecological and biological characteristics of sycamore, hackberry, arborvitae and false-cypress 10. Ecological and biological characteristics of pubescent oak and holm oak 11. Ecological and biological characteristics of chestnut, linden, elm and maple. 12. Ecological and biological characteristics of Douglas fir and eastern white pine 13. Ecological and biological characteristics of maritime pine and atlas cedar 14. Ecological and biological characteristics of black locust and paulownia 15. Ecological and biological characteristics of wild chestnut and forest fruit trees 								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary	YES		Practical		NO	(other)		



	Exam			work				
	Project		NO	Written exam	YES		ECTS credits (total)	2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures. Laying the exam.							
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media		
	Tikvić, Ugarković, Ecology of forest trees, script, Faculty of Forestry, University of Zagreb.					Merlin		
	Forests of the Croatian Mediterranean, Academy of Forestry Sciences, 2011 (selected chapters - related to the ecology of forest tree species).			YES				
	Silver Fir in Croatia, Academy of Forestry Sciences, Hrvatske šume d.o.o. Zagreb, 2001, (selected chapters related to the ecology of forest tree species).			YES				
	Common beech in Croatia, Academy of Forestry Sciences, Hrvatske šume d.o.o. Zagreb, City of Zagreb, City Office for Agriculture and Forestry 2003, (selected chapters related to the ecology of forest tree species).			YES				
	Pedunculate oak in Croatia, HAZU Center for Scientific Research Vinkovci, «Hrvatske šume» Zagreb, 1996, (selected chapters - related to the ecology of forest tree species).			YES				
	European Atlas of Forest Tree Species					YES		
	Floodplain forests in Croatia, 2005, Academy of Forestry Sciences (selected chapters related to the ecology of forest tree species).			YES				



	Toljan, I., J. Leko, J. Perić, 2015. Greenery of urban areas City of Zagreb. Zagrebački holding d.o.o. Zrinjevac Branch, p. 206.		
2.12. Optional literature	Bruns Pflanzen – Catalogue of trees and shrubs 2018/2019 Forestry Compendium, CD, Cab Abstracts Lakušić, R., 1989: Ekologija biljaka. Zavod za udžbenike i nastavna sredstva, Sarajevo, str. 248		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Boris Hrašovec, Ph.D. Assistant Prof. Milivoj Franjević, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	Population outbreaks and monitoring of forest insects	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33937	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Students acquire special skills and knowledge needed in dynamics of forest pests, relations between insects and their environment. They widen their knowledge of forest entomology in general and build better foundation for the higher graduate course of "Integrated forest protection". Also, they gain specific set of skills in the field of pest prognostic programmes and monitoring systems in the field of forest protection.		
2.2. Enrolment requirements and/or entry competences	-		



required for the course	
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management</p> <p>B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests</p> <p>C6. perform jobs of manager/supervisor in protected natural areas</p>
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Identify the dynamic processes that rule in the insect populations, identify the dominant mechanisms that govern and interpret the circumstances that lead to overburdening and collapsing populations on the other side.</p> <p>Differentiate and classify different population gradation types according to their grading properties and predict the grading process on the basis of recognized patterns.</p> <p>To explain concrete historical examples of forest insect gradation based on the circumstances that led to them.</p> <p>Link recent and potential future gradations with biotic and abiotic factors that are crucial to their emergence.</p> <p>Calculate the actual and relative density of a specific forest insect population using the data collected through the monitoring system.</p> <p>To know and evaluate the risks of the outbreak of the most important forest insect pests on the basis of the analyzed input parameters and patterns that define the population dynamics of the analyzed pests.</p>
2.5. Course content (syllabus)	<p>LECTURES</p> <ol style="list-style-type: none"> 1. Population dynamics of forest insects and the occurrence of gradations. Principles, types and classification of gradation types. Positive and negative "feedback" mechanisms and their impact on the fluctuation of insect populations, natural enemies of forest insects and their relationship to fluctuations of forest pest populations, stable populations, eruptive populations, examples from European forestry practice (2 hr.) 2. Assessment of the risk of gradation outbreaks, habitat factors and their impact on risk. Soil, relief, climate, vegetation cover, and structure and their effect on the occurrence and dynamics of gradation. Dependence of gradation on the food type of forest pest (primary-secondary). Mechanisms of resistance of forest trees to defoliator and xylophage attack at the individual level and in the forest context. Mathematical and graphical models in gradation risk assessment (2 hr.) 3. Basic principles of forest insect population monitoring, monitoring organization, methods and procedures, extensive procedures, intensive procedures, indirect methods, terrestrial methods, aero-methods, damage classification, modern methods of remote sensing, direct methods of collecting or catching individual developmental stages. Making maps of spatial distribution and population density of pests based on processed samples, GIS analysis of the obtained data. Use of pheromone traps for the purpose of monitoring and prevention of intake of dangerous forest pests (4 hr.)



	<p>4. Outbreaks of defoliating pests in Croatia and surrounding countries and their respective population traits: <i>Lymantria dispar</i>, <i>Euproctis chrysorrhoea</i>, <i>Malacosoma neustria</i>, <i>Tortrix viridana</i>, <i>Thaumetopoea processionea</i>, <i>Thaumetopoea pityocampa</i>, <i>Argyresthia fundella</i>, <i>Zeiraphera rufimitrana</i>, <i>Apethymus abdominalis</i>, <i>Neodiprion sertifer</i>, <i>Caliroa annulipes</i>. Introduced alien pests and status of their populations in Croatia (3 hr.)</p> <p>5. Mass occurrences of bark beetles and other xylophages in Croatia and the surrounding area with their most important features: <i>Ips typographus</i>, <i>Ips sexdentatus</i>, <i>Pytiokteines</i> spp., <i>Tomicus</i> spp., <i>Scolytus</i> spp., <i>Xyloterus</i> spp., <i>Agrilus</i> spp., <i>Coraeus florentinus</i>, <i>Saperda</i> spp. Analysis of the reasons for the occurrence of mass attacks in certain species and the possibility of avoiding such calamities (3 hr.)</p> <p>6. Synthesis of the results of monitoring the condition of the forest pest population and risk assessment with the planning of control measures on two specific examples from the history of outbreaks and mass occurrences of pests (one defoliator and one bark beetle). Success analysis of implemented measures with critical review (1 hr.)</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work				<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input checked="" type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research	NO		Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work	YES		(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	2	



2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.		
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises, preparation and presentation of seminar work. Laying the exam, exam.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Hrašovec, B. & M. Harapin, 1999: Dijagnozno-prognozne metode i gradacije značajnijih štetnih kukaca u šumama Hrvatske. Šumarski list 5–6: 183–193.	NO	YES, Merlin
	Godišnja izvješća Izvještajno prognozne službe (IPP) Hrvatskog šumarskog instituta (2006 -)	NO	YES, web
2.12. Optional literature	1. Berryman, A.A., 1986: Forest Insects – Principles and Practice of Population Management. Plenum Press, New York and London, 273 str. 2. Berryman, A.A., 1988: Dynamics of Forest Insect Populations – Patterns, Causes, Implications. Plenum Press, New York and London, 603 str. 3. Schowalter, T.D., 2000: Insect Ecology – An Ecosystem Approach. Academic Press, USA, 483 str. 4. Speight, M.R., M.D. Hunter & A.D. Watt, 1999: Ecology of Insects – Concepts and Applications. Blackwell Science Ltd., 350 str		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Željko Španjol, Ph.D. Associate Professor Damir Barčić, Ph.D. Assistant Professor Roman Rosavec, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	Fire Management and Restoration	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225933	1.9. Expected enrolment in the course	15



1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Knowledge: Factors causing fires (soil, climate, vegetation), differentiating fire types; Skill: recovery methods and measures, determining recovery priorities		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B6. organise and manage professional works in the melioration and management of forest areas in the Mediterranean region B8. conduct protection of forests from abiotic and biotic factors, especially fires and organise procedures and means in protection of forests		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	Identify the basic features and characteristics of the fire. Identifying areas where fires occur more frequently. Grading of forest fuel. Understanding fire-fighting activities. Analyzing the ways and forms of risk assessment. Evaluation of the model for assessing the vulnerability Understanding qualitative and quantitative forms of damage. Analyze types suitable for reconstruction. Evaluation of the restoration methods.		
2.5. Course content (syllabus)	<ol style="list-style-type: none"> 1. Forest fires (definition, meaning, types) 2. Recognition of synecological features of areas in which fires occur for the area of eumediterranean, sub-Mediterranean and continental (high) karst. (pedological, relief, climatic and vegetation characteristics of the area) 3. Understanding of qualitative and quantitative forms of damage (economic value, common value), 4. Factors for assessing the priorities of remediation and restoration of burned areas. (pedological, relief, climatic, vegetation, sociological, economic and costs of rehabilitation and reconstruction) 5. Methods of remediation and restoration of burned areas 6. Post fire restoration and regeneration of burned forest habitat and natural pine stands 7. Post fire restoration of pine cultures 8. Restoration of degraded and devastated stands of holm oak (maquis and garrigue). 		



	<p>9. Restoration of pubescent oak stand (shrubs and bushes). 10. Works on rehabilitation and conversion of coppice forests. 11. Morphological, biological-ecological and breeding properties of species for regeneration of burned forests and forest land in the eumediterranean. 12. Morphological, biological-ecological and breeding properties of species for regeneration of burned forests and forest soil in the sub-Mediterranean. 13. Morphological, biological-ecological and breeding properties of species for regeneration of burned forests and forest land in the area of the so-called high (continental) karst. 14. Forest and forest land endangerment assessments through the meteorological index of forest fire danger. 15. Modeling the spread and behavior of forest fires</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Laying the partial exam and final exam.								



2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	1. Bertović, S. i dr., 1987: Osnove zaštite šuma od požara, Zagreb.	YES	NO
	2. Španjol, Ž. 2020: Šumski požari. Šumarski fakultet, Zagreb. (interna skripta)	NO	YES, Merlin
2.12. Optional literature	<ol style="list-style-type: none"> 1. Španjol, Ž. (1997): Amelioration of the burnt aleppo pine (<i>Pinus halepensis</i> Mill.) forest area in the Makarska coastline region. Glasnik za šumske pokuse 34: 67-93, Zagreb. 2. Trinajstić, I. (1993): Problem sukcesije vegetacije na požarištima alepskog bora (<i>Pinus halepensis</i> Mill.) u Hrvatskom primorju. Šumarski list CXVII (3-5): 131-137, Zagreb 3. Barčić, D., Španjol, Ž. (2001): Sukcesija vegetacije na požarištima kultura alepskog bora (<i>Pinus halepensis</i> Mill.) u Šumariji Pula. Znanost u potrajnom gospodarenju hrvatskim šumama, Znanstvena knjiga, 19-29, ŠF, ŠIJ, HŠ p.o., Zagreb. 4. Španjol, Ž, Barčić, D. (2001): Biološka sanacija šumskih požara u sastojinama crnog bora (<i>Pinus nigra</i> Arnold) . Znanost u potrajnom gospodarenju hrvatskim šumama, Znanstvena knjiga, 2001; 141-151, ŠF, ŠIJ, HŠ p.o. Zagreb. 5. Vučetić, M, Španjol, Ž. & Barčić, D. 2002: Prirodna obilježja i potencijalna opasnost od šumskih požara., 169-183. Zbornik radova s međunarodnog, znanstvenog i stručnog savjetovanja „Sigurnost u okolišu i graditeljstvu“ (s međunarodnim sudjelovanjem). Šibenik. 6. Rosavavec, R., Španjol, Ž., Barčić, D. (2006): Sanacija opožarenih površina alepskog bora (<i>Pinus halepensis</i> Mill) na području šumarije Dubrovnik. Glasnik za šumske pokuse, posebno izdanje 5, 167-178, Zagreb. 7. Španjol, Ž., Barčić, D., Rosavec, R., Mandić, A., Vučetić, M (2006): Procjena ugroženosti mediteranskih šuma od požara uporabom tehnologije GIS. Glasnik za šumske pokuse, posebno izdanje 5, 179-189, Zagreb. 8. Španjol, Ž., Biljaković, K., Rosavec, R., Dominko, D., Barčić, D., Starešinić, D. (2008): Šumski požari i fizikalni modeli. Šumarski list, 132 (5-6): 259-267. 		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof Krešimir Krapinec	1.7. Number of ECTS credits	2
1.2. Course title	Preparation and measurement of Hunting Trophies	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33933	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	To build up inductive ability for trophic and shelter conditions of habitats. Making decision for their enhancement with reference to making a choice about kind of crop.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B11. apply knowledge related to marketing of forest main and secondary forest product		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning	D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of urban forestry, nature conservation and environmental protection D2. conduct courses in professional secondary and other similar schools D3. conduct businesses and tasks in publicist writing and media connected with urban forestry, nature conservation and environmental protection D4. professionally and scientifically upgrade through different educational ways and postgraduate study		



outcomes)	D5. gather, process and interpret reference sources and prepare simple written professional or scientific paper							
2.5. Course content (syllabus)	<ol style="list-style-type: none"> 1. Definition of hunting trophies, historical overview of hunting trophoeistic. Hunting exhibitions. Development of trophy measurement proposition, legislative and administration – 4 hours 2. Practical training (antlers – red deer, fallow deer, chital, roe deer) – 6 hours 3. Practical training (horns – European mouflon, chamois, other bovids) – 3 hours 4. Practical training – tusks, skulls and pelts. – 2 hours 							
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work				<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:	
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES	
	Experimental Work		NO	Report	NO	(other)		
	Essay		NO	Seminar paper	NO	(other)		
	Preliminary Exam		NO	Practical work	NO	(other)		
	Project		NO	Written exam	YES	ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regularity at teaching and active participation teaching. Passing the exam.							



2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Varićak, V., 1997: Ocjenjivanje lovačkih trofeja; Euroteam d.o.o.; Zagreb; 176 pp		Departement for Forest Protection and Wildlife Management
	Frković, A., 1989: Lovačke trofeje, obrada, ocjenjivanje i vrednovanje – europska divljač; Lovački savez Hrvatske za uzgoj, zaštitu i lov divljači, Zagreb; 239 pp.		Departement for Forest Protection and Wildlife Management
	Hromas, J., J. Feuereisel, K. Maierhofer, 2008: Trophäenbewertung der europäischen Wildarten (aktualisierte Bewertungskriterien). CIC-Kommission „Ausstellungen und Trophäen“ – Herausgegeben für den Trophäenbewertungskurs der Internationalen Kommission für Trophäenbewertung in Nasswald vom 30. Mai bis 1. Juni 2008, 135 pp.		
	Krapinec, K., Grubešić, M., Tomljanović, K., Kovač, I., 2009: Uloga lovačkih izložbi te njihov značaj u valorizaciji stupnja razvijenosti lovstva pojedine zemlje s posebnih osvrtom na Hrvatsku. Ekonomska i ekohistorija: časopis za gospodarsku povijest i povijest okoliša, 5; 5-43.		
2.12. Optional literature	http://www.rowlandward.com www.boone-crockett.org www.safariclub.org		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Igor Anić, Ph.D. Assistant Prof. Stjepan Mikac, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	Floodplain forests	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33939	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>The tasks of this subject is to inform the students on the floodplain forest ecosystems in terms of their distribution today and in the past, their structure and morphology, the impacts exerted upon them, management methods, and spatial and time dynamics.</p> <p>Considering the significance of floodplain forest ecosystems and their proportion in the Republic of Croatia, a special attention has been paid to the methods of stand management of the floodplain region, for the purpose of conserving their biodiversity, stability and productivity. The methodology of revitalisation of the endangered stands will be analysed in case studies, particularly in the instances of water regime changes caused by infrastructural developments in the floodplain forest environment.</p> <p>The obtained knowledge will qualify the future forestry experts for acting in all situations during their work in the region of floodplain forests both in Croatia and abroad.</p> <p>The tuition is organised through lectures, using modern teaching devices and the analyses of real cases in the practice of floodplain forest management of the European forest ecosystems.</p>		
2.2. Enrolment requirements and/or entry competences required for the course	-		



<p>2.3. Learning outcomes at the level of the programme to which the course contributes</p>	<p>B5. organise and manage professional works on establishing, caring for, and renewing forest stands</p>		
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Present the geomorphology of floodplain and habitat for floodplain forest (lowland forests, floodplain forest, riparian forest, floodplain area, floodplain site, floodplain geomorphology and fluvial processes). Define geography, morphology and dynamics of floodplain forests (distribution, types, biodiversity and flood forest dynamics). Recommend the management of floodplain forests (production, economic, ecological and social values, silvicultural procedures). Present threats and revitalization of flood forest (impact of intervention in environment for floodplain forest, conservation and revitalization of floodplain forests).</p>		
<p>2.5. Course content (syllabus)</p>	<ol style="list-style-type: none"> 1. Tasks and concept of the subject. Introductory terms: lowland forest, floodplain forest, riparian forest, floodplain area, floodplain site. 2. Geomorphology of alluvial region and the fluvial processes. Significance of nanoreliefs and microreliefs for the occurrence and development of floodplain forests 3. A review of soils. Climate of floodplains and floodplain forests. 4. Water in a floodplain forest. Flood and groundwater dynamics. The impact of changes in flood and groundwater dynamics on the functioning of floodplain forests. 5. Distribution of floodplain forests in the world, Europe and Croatia. Types of floodplain forests of the boreal, temperate and Mediterranean area of Europe. Some special types of floodplain forests. 6. A review of floodplain vegetation. Flood forest biodiversity. 7. Floodplain forest production. Economic and utility value of floodplain forests. The importance of floodplain forests in the environment. 8. Silvicultural properties of floodplain forest tree species. 9. Silvicultural properties of floodplain forest stands. 10. Floodplain forest dynamics. Adaptation of silvicultural procedures to the dynamics of floodplain forests. 11. History of floodplain forest management in some European countries and in Croatia. 12. Soft deciduous floodplain forest management: status and perspective. 13. Hardwood floodplain forest management: status and perspective. 14. Impact of climate change and environmental interventions on floodplain forests: an analysis of case studies. 15. Revitalization of floodplain forests: an analysis of case studies. 		
<p>2.6. Format of instruction</p>	<p><input checked="" type="checkbox"/> lectures</p> <p><input type="checkbox"/> seminars and workshops</p> <p><input type="checkbox"/> exercises</p>	<p><input type="checkbox"/> independent assignments</p> <p><input checked="" type="checkbox"/> multimedia and the internet</p>	<p>2.7. Comments:</p>



	<input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)						
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary Exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Preparation of a seminar paper. Taking exam.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media			
	Anić, I., 2020: Poplavne šume. PP prezentacije predavanja, Sveučilište u Zagrebu, Šumarski fakultet.			NO		YES, Merlin			
	Vukelić, J. (gl. ur.), 2005: Poplavne šume u Hrvatskoj. Akademija šumarskih znanosti, Zagreb, 455 str.			YES		NO			
2.12. Optional literature	Klepac, D. (gl. ur.), 1996: Hrast lužnjak (<i>Quercus robur</i> L.) u Hrvatskoj. Hrvatska akademija znanosti i umjetnosti i Hrvatske šume p.o. Zagreb, Zagreb – Vinkovci, 559 str. Klimo, E., H. Hager (editors), 2001: The floodplain forests in Europe – current situation and perspectives. European Forest Institute, 267 p. Klimo, E., H. Hager, S. Matić, I. Anić, J. Kulhavyi (editors), 2008: Floodplain forests of temperate zone of Europe. Lesnicka prace, 623 p.								



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Assistant Prof. Damir Drvodelić, Ph.D. prof. Dario Baričević, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Management by selection system and subalpine forest ecosystems	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	33936	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The objectives of the course are to students gain basic knowledge on the functioning and natural regeneration of subalpine communities. Further topics of a detailed study will be management by selection system as one way of natural regeneration. Vegetation and floristic features of subalpine communities will also be the subject matter of detailed study.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B1. organise and perform tasks of greater complexity in forestry, from forest office and forest management unit as the lowest forestry structural units along the vertical B2. establish forest management programs and wildlife management programs B3. implement forest management programs B15. develop current technologies as well as implement new technologies		
2.4. Expected learning	Explain the division of the subalpine ecosystem and the forest community. Conduct the renovation of subalpine forest communities. Apply knowledge of ecology and stability of subalpine forest communities.		



<p>outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>Apply knowledge of selection system management methods, especially in subalpine forest ecosystems. To perfect the existing and introduce new techniques of selection system management. Apply knowledge of selection system management of beech stands and other types of trees.</p>								
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Phytocenoses of Norway spruce (<i>Picea abies</i> Karst.) and silver fir (<i>Abies alba</i> Mill.) in the altimontan belt of Croatia and their role and importance – 2 hours 2. Phytocenoses of Norway spruce (<i>Picea abies</i> Karst.) in the subalpine belt of Croatia and their role and importance – 2 hours 3. Forest vegetation on the upper border of the arrival - stands of Mountain pine and pre-mountain shrubs - 1 hour 4. Syndynamics of subalpine belt forest vegetation, anthropogenic influences, peculiarities, values and protection – 2 hours 5. Climate in uneven-aged and subalpine forest ecosystems – 2 hours 6. Stand structure in uneven-aged and subalpine forest communities – 1 hours 7. Ecological requirements and biological properties of main tree types of uneven-aged and subalpine forest ecosystems - 2 hours 8. Growing properties of main types of trees of uneven-aged and subalpine forest ecosystems – 1 hours 9. Forestation in the belt of uneven-aged and subalpine forest ecosystems – 2 hours 								
<p>2.6. Format of instruction</p>	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work	<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)	<p>2.7. Comments:</p>						
<p>2.8. Monitoring student work</p>	<p>Class attendance</p>	<p>YES</p>		<p>Research</p>	<p>NO</p>	<p>Oral exam</p>			<p>NO</p>
	<p>Experimental Work</p>		<p>NO</p>	<p>Report</p>	<p>NO</p>	<p>(other)</p>			
	<p>Essay</p>		<p>NO</p>	<p>Seminar paper</p>	<p>NO</p>	<p>(other)</p>			
	<p>Preliminary Exam</p>		<p>NO</p>	<p>Practical work</p>	<p>NO</p>	<p>(other)</p>			



	Project		NO	Written exam	YES		ECTS credits (total)	2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures. Laying the final exam.							
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media		
	1. Drvodelić, D., 2021: presentations of lectures					YES, Merlin		
	2. Baričević, D., 2021: Presentations of lectures.					YES, Merlin		
2.12. Optional literature	1. Vukelić, J., 2012: Šumska vegetacija Hrvatske. Sveučilište u Zagrebu Šumarski fakultet i DZZP, 403 str. 2. Vukelić, J., Alegro, A., Baričević, D., Šegota, V., Šapić, I., 2011: Fitocenozе obične smreke (<i>Picea abies</i> Karst.) u altimontanskom i subalpskom pojasu Hrvatske. Glasnik za šumske pokuse 44: 19-29. 3. Vukelić, J., Mikac, S., Baričević, D., Šapić, I., Bakšić, D., 2011: Vegetacijsko-strukturna obilježja sastojina obične smreke (<i>Picea abies</i> Karst.) u prašumi Smrčeve doline na sjevernom Velebitu. Croatian Journal of Forest Engineering, 32 (1): 73-86. 4. Vukelić, J., Alegro, A., Šegota, V., Šapić, I., 2010: Nomenklaturno-fitocenološka revizija asocijacije <i>Calamagrostio variaie-Piceetum dinaricum</i> Bertović 1975 nom. illeg. u Hrvatskoj. Šumarski list 135 (11-12): 559-568. 5. Vukelić, J., Alegro, A., Šegota, V., 2010: Altimontanska-subalpska smrekova šuma s obrubljenim gladcem (<i>Laserpitio krapfii-Piceetum abietis</i> ass. nova) na sjevernom Velebitu (Hrvatska). Šumarski list 135 (5-6): 211-228. 6. Vukelić, J. (ured.), 2005: Šume i šumarstvo sjevernoga Velebita. Hrvatske šume, Hrvatsko šumarsko društvo, 219 str.							



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Nikola Pernar, Ph.D. Prof. Igor Anić, Ph.D. Prof. Goran Durn, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	Remediation of degraded land	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225934	1.9. Expected enrolment in the course	10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>The goal is to provide a student the basic knowledge and skills in the of area that suffered the reduction of ecological functions or utilization opportunities caused by natural or anthropogenic factors.</p> <p>Furthermore, the goal is for students to acquire a basic knowledge needed for an interdisciplinary approach in the design of a remediation project and the implementation of remediation procedures.</p> <p>Finally, the goal is to refer the students in the optimization of remediation procedures in routine managment measures where degradation changes cannot be avoided (soil compaction by transport, open pit mines).</p>		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course	<p>A2. explain position and trends of forestry proffesion in the country and worldwide</p> <p>B4. manage and make independent professional (business) decisions form the field of silviculture and management planning with wildlife management</p> <p>B7. organise and manage professional works on inventorying forests</p>		



contributes	
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<ol style="list-style-type: none"> 1. Identify the most important forms of lands degradation. Present the most suitable remediation methods for a specific case. 2. To predict the development of erosion processes. Recommend appropriate preventative anti-erosion measures. Establish measures for remediation of eroded lands. 3. Select and apply the corresponding recovery methods for acidity or alkalinity soils. 4. Analyze the specifics of surface mining for the apply of remediation measures. Select corresponding soil remediation method. 5. Determine a degradation processes as a result of petroleum mining. Preventive measures for the progression of degradation. 6. The landfill classification. Recommend the optimal method for remediation a landfill. 7. Select plant species for a degraded land remediation project. 8. Assess the nature of forest habitat degradation. Biological remediation of fire site. 9. Evaluate the causes of individual or massive drying of trees in the stand. Appropriate technical and biological measures of land remediation.
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Introduction. Soil and land degradation. Soil and land remediation. 2. Soil remediation methods and procedures. Soil compaction. Soil coverage. 3. Soil in remediation by erosion of degraded lands Soil and soil erosion. Remediation of eroded soil. 4. Soil remediation in slope of the construction work. Surface mining and soil degradation. Soil in surface mine reclamation. Soil acidity and acidification. Remediation of acid soil. Alkalinity and alkaline soil remediation. 5. Remediation of contaminated soil. Sampling and analysis of contaminated soil. Physical remediation processes. 6. Remediation of contaminated soil. Physico-chemical remediation processes. Chemical remediation processes. 7. Remediation of contaminated soil. Biological methods of remediation. Contraindications in the remediation of contaminated soil. Soil remediation planning. 8. Environmental impacts of mining and their remediation. 9. Surface mines remediation. 10. Remediation of oil drilling waste. 11. Remediation of landfill waste. 12. Introduction to the biological aspect of soil remediation: definition, purpose, goals, possibilities, duration, physiological processes. Silvicultural principles for soil conservation. 13. Selection of plant species for biological remediation: criteria, biological properties, ecological requirements, reproductive material. Planning, implementation and control of biological remediation. 14. Biological remediation of eroded soil, surface mines, landslides, landfills, fires site, contaminated soil and weedy soil. 15. Silvicultural process in conditions of individual and mass dying trees in the stand. Elimination of invasive neophytes.



2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work		<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)		2.7. Comments:			
2.8. Monitoring student work	Class attendance	YES		Research	NO	Oral exam	YES	
	Experimental Work		NO	Report	NO	(other)		
	Essay		NO	Seminar paper	NO	(other)		
	Preliminary Exam		NO	Practical work	NO	(other)		
	Project		NO	Written exam	YES	ECTS credits (total)		2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation on lectures. Full examination.							
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library		Availability via other media		
	Pernar, N., D. Bakšić & I. Perković, 2020: Sanacija degradiranog tla. Sveučilište u Zagrebu, Šumarski fakultet, 156 p.			YES				
	Pernar, N., D. Bakšić & I. Perković, 2013: Terenska i laboratorijska			YES				



	istraživanja tla. Šumarski fakultet, Zagreb, 192 p.		
2.12. Optional literature			

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Anamarija Jazbec, Ph.D	1.7. Number of ECTS credits	2
1.2. Course title	Statistical methods and models	1.8. Number of hours in semester (L+E+F+e-learning)	15+15+0
1.3. Course code	33938	1.9. Expected enrolment in the course	5
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	3.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The objective of the course is to introduce students to several selected statistical methods commonly used in forestry. To introduce students to the possibility of various interpretations of the same problem analysed in different ways.		
2.2. Enrolment requirements and/or entry competences required for the course	Passed basic subject from biometrics or statistics.		
2.3. Learning outcomes at the level of the programme	A2.explain position and trends of forestry profession in the country and worldwide		



to which the course contributes									
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	1. Create, analyze and interpret the contingency table - ch2 test. 2. Calculate and test the statistical significance of correlation (Pearson correlation) with the help of computer support. 3. Identify and compare more than two population means (ANOVA) with the help of computer support. 4. Perform and interpret univariate linear regression with the help of computer support. 5. Perform analysis and interpret the results of multivariate linear regression with the help of computer support								
2.5. Course content (syllabus)	1-2 Comparing the equality of frequency distribution of two categorical variables-x2 test 3-4 Correlation analysis (define the correlation of the basic set and the correlation coefficient, test the statistical significance of the estimated correlation coefficient on a random sample) 5-8 Analysis of variance (comparison of more than two expectations, parametric (ANOVA) and nonparametric (Kruskal - Wallis test), Post-hoc tests. 9-12 Regression analysis (univariate and multivariate): define and classify regression analysis, methods of building a regression model, forward, backward and stepwise), quantifiers and tests for testing the adequacy of the developed model (ANOVA, coefficient of determination, MSE), testing the statistical significance of the estimated model parameters. 13-15 Some nonlinear regression models. Growth models.								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam		NO
	Experimental Work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary		NO	Practical	YES		(other)		



	exam			work				
	Project		NO	Written exam		NO	ECTS credits (total)	2
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Regular attendance and active participation in lectures and exercises. Self-solving and prepering exercises for presentation outside regular classes.							
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media	
	Jazbec A . (2010) Applied statistics. Internal script.				NO		Available on the Merlin platform	
2.12. Optional literature	Davis CS (2002) Statistical Methods for the Analysis of Repeated Measurements, Springer Verlag, New York. Sparks T (2000) Statistics in Ecotoxicology, Wiley & Sons, New York Sokal RR, Rohlf FJ (1995) Biometry, Freeman and Company, New York Jongman RHG, Braak CJF, van Tongeren (2002) Dana Analysis in Community and Landscape Ecology, Cambridge University Press.							

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Professor Dario Baričević, Ph.D.	1.7. Number of ECTS credits	2
1.2. Course title	European forest types	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225935	1.9. Expected enrolment in the course	15
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.



1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	<p>The aim of the course is to acquaint students with different types of forests in Europe, their areas, distribution, synecological conditions of arrival, historical development and current state, and biodiversity, endangerment and protection.</p> <p>With the help of this knowledge, they will be able to independently determine different habitat types according to phytocenological criteria, as well as according to existing national and European classifications. All the acquired knowledge, students will be able to apply for management and works in forest ecosystems and their protection and conservation, through the implementation of monitoring and providing relevant reports to domestic and foreign institutions and organizations.</p>		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	<p>A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways</p> <p>A3. apply simpler methods of operation research</p> <p>B3. implement forest management programs</p> <p>B9. prepare ecological studies and forestry parts of spatial plans</p> <p>B14. manage forest, human resource, and technical potential during performance of forest works</p> <p>D1. conduct businesses of scientific and professional associate in scientific-research institutions in the field of forestry</p> <p>D2. conduct courses in professional secondary and other similar schools</p> <p>D4. professionally and scientifically upgrade through different educational ways and postgraduate study</p> <p>D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper.</p>		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	<p>Present and interpret the forest vegetation of Europe through 14 categories of forest types.</p> <p>Classify forest vegetation of Croatia into European forest types.</p> <p>Valorize the forest vegetation of Croatia in relation to the forest vegetation of Europe.</p> <p>Implement forest ecosystem management and monitoring programs.</p>		
2.5. Course content (syllabus)	Lectures		



1. Forest vegetation of Europe - areas, distribution, synecological conditions of arrival, historical development and current state, biodiversity, endangerment and protection.
2. Boreal forests - arrival conditions, distribution, spruce forests, Scots pine forests, mixed spruce-birch and pine-birch boreal forest.
3. Hemiboreal coniferous and mixed broadleavedconiferous forests - arrival conditions, distribution, spruce forests, Scots pine forests, Black pine forests, mixed Scots pine and birch forests, mixed Scots pine and pedunculate oak forests, Atlantic maritime pine forests, silver fir forests, natural and anthropogenic influences.
4. Alpine coniferous forest - arrival conditions, distribution, subalpine larch-arolla pine forests, subalpine and mountainous spruce and mountainous mixed spruce-silver fir forests, Alpine Scots pine and Black pine forests, dwarf pine forests, mountainous birch forests.
5. Acidophilous oakwoods and mixed oak-birch forests - arrival conditions, distribution, lowland to submountainous forests dominated by acidophilous oaks *Quercus petraea* and *Q. robur*, pedunculate oak-birch forests.
6. Mesophytic deciduous forests - arrival conditions, distribution, oak-hornbeam forests (pedunculate oak-hornbeam forest, sessile oak-hornbeam forest); ashwood and oak-ash forests; eastern European broadleaved forests - maple-oak forests, lime-oak forests, maple-lime forests, lime forests; ravine and slope forests.
7. Beech forests - arrival conditions, distribution, lowland beech forests of southern Scandinavia and north central Europe, atlantic and subatlantic lowland beech forests, subatlantic to Atlanto-Mediterranean submountainous beech forests, central European submountainous beech forest, Carpathian submountainous beech forests, Illyrian submountainous beech forests, Moesian submountainous beech forests.
8. Mountainous beech forests - arrival conditions, distribution, south-western European mountainous beech forests, central European mountainous beech forests, Apennine-Corsican mountainous beech forests, Illyrian mountainous beech forest, Carpathian mountainous beech forests, Moesian mountainous beech forests, Crimean beech forests, oriental beech and hornbeam-oriental beech forests.
9. Thermophilous deciduous forests - arrival conditions, distribution, downy oak forests, Turkey oak, Hungarian oak and Sessile oak forests, Pyrenean oak forests, Iberian oak forests, Valonia oak forests, Macedonian oak forests, chestnut forests, other thermophilous deciduous forests.
10. Broadleaved evergreen forests - arrival conditions, distribution, mediterranean evergreen oak forests, olive-carob forests, palm groves, Macaronesian laurisilva, other sclerophyllous forests.
11. Coniferous forests of the Mediterranean, Anatolian and Macaronesian regions - arrival conditions, distribution, thermophilous pine forests, Mediterranean and Anatolian black pine forests, Canarian pine forests, Mediterranean and Anatolian Scots pine forests, Alti-Mediterranean pine forests, Mediterranean and Anatolian fir forests, Juniper forests, Cypress sempervirens forests, Cedar forests, Mediterranean yew stands.
12. Mire and swamp forests - arrival conditions, distribution, conifer dominated or mixed mire forests, alder swamp forests, birch swamp forests, pedunculate oak swamp forests, aspen swamp forests.
13. Floodplain forests - arrival conditions, distribution, riparian forests, fluvial forests, Mediterranean and Macaronesian riparian forests.



	<p>14. Non-riverine alder, birch or aspen forests - arrival conditions, distribution, alder forests, Italian alder forests, mountain birch forests, other birch forests, aspen forests.</p> <p>15. Anthropogenically formed forests - cultures and plantations of autochthonous and non-autochthonous species, changes in natural areas, anthropogenic impact throughout history and today.</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input checked="" type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental work		NO	Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam		NO	Practical work		NO	(other)		
	Project		NO	Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Regular attendance and active participation in lectures. Making seminar work. Taking exam.								
2.11. Required literature (available in the library)	Title			Availability in the library			Availability via other media		
	European Environment Agency, 2007: European forest types Categories and types for sustainable						web		



and/or via other media)	forest management reporting and policy. Copenhagen, 111 p.p.		
2.12. Optional literature	<ol style="list-style-type: none"> 1. European Commission, DG Enviroment, 2013: Interpretation Manual of European Union Habitats. EUR 28. 2. Barbati, A., Corona, P., Marchetti, M., 2010: New European Forest Types, Annex to Enquiry State of Forests and Sustainable Forest Management in Europe 2011, FOREST EUROPE /UNECE/FAO. 3. Ahti T., Hämet-Ahti L., Jalas J., 2006. Vegetation zones and their sections in north-western Europe. Ann. Bot. Fennici 5:169–211. 4. Bohn U., Gollub G., Hettwer C., 2000. Map of the natural vegetation of Europe. Bonn: Federal Agency for Nature Conservation. 5. Dierschke H., 2006. Syntaxonomical survey of European beech forests: some general conclusions. Annali di Botanica LV:17–26. 6. Ellenberg H., 1996. Vegetation Mitteleuropas mit den Alpen in ökologischer, dynamischer und historischer Sicht. 5 ed. Stuttgart: Ulmer. 7. Esseen P-A, Ehnström.B., Ericson L, Sjöberg K. 1997. Boreal forests. Ecol. Bull. 46:16–47. 8. García Herrera J.J., 2002. Mediterranean woodlands. In: Reyero J.M., editor. The Nature of Spain. Spain: Ministerio de Medio Ambiente; pp. 70–85. 9. Horvat I., Glavac V., Ellenberg H., 1974. Vegetation Südosteuropas. Stuttgart: Gustav Fischer. 10. Jahn G., 1991. Temperate deciduous forests. In: Röhrig E, Ulrich B, editors. Temperate deciduous forests. Amsterdam: Elsevier; pp. 377–502. 11. Mayer H., 1984. Wälder Europas. Stuttgart-New York: Gustav Fischer. 12. Ozenda P., 1988. Die Vegetation der Alpen im Europäischen Gebirgsraum. Stuttgart-New York: Gustav Fischer. 13. Polunin O., Walters M., 1985. A guide to the vegetation of Britain and Europe. Oxford: Oxford University Press. 14. Rodwell J., Schaminée J., Mucina L., Pignatti S., Dring J., Moss D., 2002. The diversity of European vegetation. An overview of phytosociological alliances and their relationships to EUNIS habitat. Wageningen: Landbouw, Naturbeheer en visserij/European Environment Agency. 15. Smirnova O.V., 2004. East European Forests. Holocene History and Modern State. Moscow: Nauka Publ. 16. Tüxen R., 1981. Querco-Fagetea. Bibliografia Phytosociologica syntaxonomica 35:1–1118. 17. Willner W., 2002. Syntaxonomical revision of the beech forests of southern Central Europe. Phytocoenologia 32:337–453. 18. Madera, P., Vukelić, J., Buček A., Baričević, D., 2008: Floodplain forest plant communities. Monografija Floodplain forests of the temperate zone of Europe (ur. E. Klimo, H. Hager, S. Matić, I. Anić, J. Kulhavy), Lesnicka prace, s.r.o. Kostelec nad Černými lesy, 102-159. 		



COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Krunoslav Teslak Ph.D., Assistant professor Jura Čavlović Ph.D., Full Professor	1.7. Number of ECTS credits	2
1.2. Course title	Small scale forest management planning	1.8. Number of hours in semester (L+E+F+e-learning)	15+0+0
1.3. Course code	225936	1.9. Expected enrolment in the course	5-10
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.
1.5. Course type	Elective	1.11. Language of instruction	Croatian
1.6. Year of the study	2	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	1. to habilitate students with the specifics of planning and management of small scale, private forest estates 2. to train students to manage their own forest estate (forest owners students) 3. to train students for forest management of associated forest owners (association of small scale forest owners) 4. additionally train students to compose of specific forest management programs for small-scale private forests		
2.2. Enrolment requirements and/or entry competences required for the course	completed undergraduate study of Forestry, Urban Forestry or related programme of biotechnical undergraduate studies		
2.3. Learning outcomes at the level of the programme to which the course	A1, A2, B2, B3, B7, B11, B13, C4, C5, D2, D4, D5 A1— independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways		



<p>contributes</p>	<p>A2 - explain position and trends of forestry profession in the country and worldwide B2 - establish forest management programs and wildlife management programs B3 - implement forest management programs B7 - organise and manage professional works on inventorying forests B11 - apply knowledge related to marketing of forest main and secondary forest products B13 - manage forest, human resource, and technical potential during performance of forest works C4 - manage tasks of county and national institutions competent for forestry; inspection services C5 - perform jobs of manager/supervisor in protected natural areas D2 - conduct courses in professional secondary and other similar schools D4 - professionally and scientifically upgrade through different educational ways and postgraduate study D5 - gather, process and interpret reference</p>
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<ol style="list-style-type: none"> 1. Define existing shortcomings in the current management of small scale private forests, 2. Analyze the existing regulations governing the management of small scale private forests 3. Show and compare the specifics of small scale forest management 4. Recognize and interpret the needs to adapt forest inventory methods for private forests 5. Analyze and adopt skills of drafting regulations based on uneven age management models 6. Plan the implementation of the forest owner's participation in creating the management plans for their forests. 7. Plan and compile guidelines for forest land consolidation within the management unit 8. Evaluate and analyze the adopted management guidelines and estimate degree of the expected implementation
<p>2.5. Course content (syllabus)</p>	<p>Lectures:</p> <ol style="list-style-type: none"> 1. Introduction, Small scale private forests structure (area share, growing stock, structural deficiencies) 2. Ownership status - comparison status in Croatia and the world 3. Overview of the organizational structure of private forest management in Croatia 4. Existing legislation and the possibility of improvement 5. Small scale spatial planning (internal, strategic) 6. Special features of private forest inventory and management programs 7. Uneven age forest management-a necessity for small private forest estates 8. Land consolidation and joint management 9. Compensation for management restrictions (nature 2000) 10. Guidelines for future management for private forests- amount of cutting 11. Guidelines for future management for private forests-silvicultural works 12. Tolerances in the implementation of private forest guidelines



	13. Non-wood products and public functions of forest as opportunities for small scale private forests 14. Establishing management examples of private forest estates 15. Overview and discussion, presentation of student experiences								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input type="checkbox"/> field work			<input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work	YES		Report		NO	(other)		
	Essay		NO	Seminar paper	YES		(other)		
	Preliminary exam	YES		Practical work		NO	(other)		
	Project	YES		Written exam	YES		ECTS credits (total)	2	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities									
2.11. Required literature (available in the library)	Title			Availability in the library			Availability via other media		
	Žunić, M, 2018: Modeli gospodarenja privatnim šumama u Republici Hrvatskoj s obzirom na stavove šumoposjednika i obilježja			YES					



and/or via other media)	šumoposjeda, doktorska disertacija, Šumarski fakultet, Zagreb, 149 str. (mentor Teslak)		
	Harrison, S.R., Herbohn, J.L. Herbohn, K.F. 2000: Sustainable Small-scale Forestry, 247 str.		YES
	Teslak, K.; Žunić, M.; Beljan, K.; Čavlović, J.: 2018: Stanje i izazovi gospodarenja privatnim šumama u Hrvatskoj u postojećim ekološkim i sociološkim okolnostima // Šumarski list, 142 (2018), 9/10; 459-471 doi:10.31298/sl.142.9-10.1		YES
	Pravilnici o uređivanju šuma		YES
	Zakon o šumama		YES
2.12. Optional literature	<ol style="list-style-type: none"> 1. Čavlović, J., Božić, M., 2011: Istraživanje i izrada modela uređivanja i izmjere šuma u šumama šumoposjednika, Model gospodarenja sitnim privatnim šumama , Završno izvješće projekta, Zagreb, 223 str. 2. Bettinger, P. Boston, K., Siry P.J., Grebner, L.D. 2009: Forest management and Planning, Elsevier inc., 327 pp. 3. Čavlović, J: Osnove uređivanja šuma Sveučilište u Zagrebu, Šumarski fakultet. 322 pp. (udžbenik) 		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	Prof. Jura Čavlović, Ph.D. Assist. Prof. Krunoslav Teslak, Ph.D.	1.7. Number of ECTS credits	6
1.2. Course title	Forest management planning	1.8. Number of hours in semester (L+E+F+e-learning)	30+45+32
1.3. Course code	33899	1.9. Expected enrolment in the course	25



1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	1.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Based on the results of compiling and surveying, processing and analysis of spatial data for a concrete forest and the management, as well as the synthesis of all forestry disciplines by means of lectures, laboratory work and field work, in the framework of this course students will take active part in a complete and rounded preparation procedure of management plans for a concrete forest (management unit). In this way students will be able to acquire knowledge on all individual integral parts of the management plan, as well as planning skills for management procedures at the level of stand and the level of forest.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	B2.establish forest management programs and wildlife management programs B7.organise and manage professional works on inventorying forests C4.manage the most complex tasks in all forms of forest organizations, forest and hunting advisory service; forest entrepreneurship C5.manage tasks of county and national institutions competent for forestry; inspection services		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	1.To analyse and to explain process planning and decisions (model structure of planning process, decision making model in forestry planning). 2.To analyse and to present past management and development of forest resources (impact of natural and anthropogenic factors, usage of relevant data source, impact of management on ageclass/diameter-class development, review of realized cut and management activities). 3.To assess, to measure, to calculate and to present actual state of forest resources (social-economic/technological factors, elements of site and stand structure, stand border and area, derived structure elements, age-class and diameter-class forest structure, relation between actual and theoretical age-class/diameter class structure). 4.To explain, to project and to valuate elements of prognosis and planning of future forest resources management (types of prognosis and simulation methods of future development, defining of forest management objectives, tending and regeneration influence on forest development, projection of stand selection structure and influence of changes of ageclass distribution)		



	<p>5.To calculate and to plan amount and structure of cut and other management activities (thinning cut on stand and forest level, regeneration cut on stand and forest level, selection cut on stand and forest level).</p> <p>6.To plan main approaches of other activities of direct forest management (relations between herbal and animal components of forest, forest openings by roads, appropriate technology of wood extraction).</p> <p>7.To analyze and to explain content, phases and approaches of adaptive forest management.</p>
<p>2.5. Course content (syllabus)</p>	<p>Lectures</p> <ol style="list-style-type: none"> 16. Introduction, general, review of course content and literature. Defining of basic terms and topics of forest management planning. 17. Planning process (content and analyses on phases). Model for decision making in forest management planning 18. Analyses of past management and development of forest. Purpose and importance. Specifics of analyses of past forest development. 19. Analyses of social-economic trends and processes. Review of past management in management plans and plan proceeding. 20. Assessment of actual (present) state of forest resource. Type of information and information extraction of forest state and management. State of social and economic-technological factors. 21. State of nature factors and comparison with past (area, land use, forest trees within agricultural land, forest sites, forest stands, growing volume, volume increment). 22. State of nature factors and comparison with past – II. part (defining and description of management classes, age class structure of forest, diameter class structure of forest, health status of forest). 23. Planning of future forest resource management – introduce (importance of developmental analysis, methods of exploring of future development). 24. Defining of forest management objectives and aims. Forest management objectives: types, spatial levels, approaches, dynamics and rules of defining. 25. Planning of strategy, guidelines and approaches of forest management. Starting points, basic techniques of planning. Planning of forest development. Strategy of forest regeneration, tending and protection. Basic planning on management class level. Silvicultural aims and management guidelines. Detail planning of forest development. 26. Planning of available cut. General starting points and elements. Prescribing of cut – even-aged management system: O-2, O-6 and O-7. 27. Prescribing of cut in selection forest management: general, stand level – O-3, forest level – O-8. 28. Analysis of past and projection of future management of selection forest – management unit case study. 29. Planning of other management activities: silvicultural treatments and approaches of forest protection, game management, forest roads and openings, methods of wood extraction. 30. Adaptive forest management. Evaluation of forest management plans. <p>Exercises</p> <ol style="list-style-type: none"> 1. Forest management plan elaboration – planning end performance of field works



2. Preparation and processing of assessed and measured elements of site and of stand structure
3. Area review of forests and forest land – assessment of stand areas
4. Stand delineation, elements of site characteristics and stand structure in even-aged and selection stands – site and stand description
5. Elements of site characteristics and stand structure in even-aged and selection stands – construction of height curves and volume tables(models)
6. Elements of site characteristics and stand structure in even-aged and selection stands – calculation of quantitative structure elements
7. Assessment of site quality, defining of management classes, theoretic models and management aims
8. Tables of age class distribution of the even-aged forest – comparison between actual and theoretical structure.
9. Tables of diameter class distribution of the selection forest – comparison between actual and theoretical structure.
10. Analysis of past development of age-class/diameter-class structure, and prescribed vs. realised cut amount.
11. Prescription of future management, allowed cut on stand and forest level for even-aged forest management system.
12. Prescription of future management, allowed cut on stand and forest level for selection forest management system.
13. Prescriptions of silviculture treatments and measures of forest protection.
14. Approach of forest management plan evaluation. Computer programs for forest management planning.
15. Computational revision of forest management plan. Method of tree crossing.

Field work

1. First day. In management unit of even-aged management based on previously processed data of basic stand structure elements per ha (tree number, basal area, and growing volume) on the level of individual sample plot, blank map without showed borders of stands and coordinates of plots (cca 40 plots in compartment), individual student groups (3-5 students) within compartment find of each sample plot center where perform detail description and assessment of site and stand structural elements according to categories defined by Regulations for forest management planning, and sketch all spatial information important for stand delineation. Objective of first day of field work is to connect processed data with site and stand structural characteristics directly described and assessed in field, as basis for next approach, delineation of stands.
2. Second day. Based on the processed and assessed data of site and stand characteristics, and acquired experience of spatial characteristics within 35-ha compartment, students on field perform dividing of the compartment on potential stands (sub-compartments), and record border between stands in compartment, to assess area of each stand and to group (join) belonging sample plots to each stand, followed with processing of measured and assessed qualitative and quantitative data on the stand level.
3. Third day. After left side (actual state of stand) of form O-2 filled (Exercises), students on field on appropriate samples assess elements needed for prescription of future management related on



	<p>stand regeneration and stand tending and thinning. Approach is based on data in O-2 and relevant equations – and on the field is perform check of prescriptions (possibility of realization), aimed to get feed-back information to correct eventually wrong prescribed cut amount.</p> <p>4. Fourth day. Similarly, students in selection stands of silver fir end beech perform assessment of elements needed for defining an appropriate prescriptions of future management related to problems of selection stand regeneration and tending, and achieving of balanced diameter structure. Based on data from form O-3 and different methods (equations) of quantifying of selection cut students check of possibility of cut realization to get information for correction of preliminary prescribed amount of selection cut.</p>								
2.6. Format of instruction	<input checked="" type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input checked="" type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input checked="" type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work			<input type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input type="checkbox"/> work with mentor <input type="checkbox"/> (other)			2.7. Comments:		
2.8. Monitoring student work	Class attendance	YES		Research		NO	Oral exam	YES	
	Experimental Work		NO	Report	YES		(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary Exam	YES		Practical work		NO	(other)		
	Project		NO	Written exam		NO	ECTS credits (total)	6	
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								



2.10. Student responsibilities	Attendance and active participation on lectures, exercises and field work; preparing and presentation of exercises and reports in defined deadline; passing of partial and final exams.		
2.11. Required literature (available in the library and/or via other media)	Title	Availability in the library	Availability via other media
	Čavlović, J., 2005: Šumsko gospodarsko planiranje, Prezentacija, 207 slids	NO	Merlin
	Čavlović, J., 2020: Šumsko gospodarsko planiranje, Interna skripta, 203 str.	NO	Merlin
	Čavlović, J., 2013: Osnove uređivanja šuma. Šumarski fakultet Sveučilišta u Zagrebu, Zagreb, 322 str.	YES	
	Klepac, D., 1965: Uređivanje šuma, Znanje, Zagreb	YES	
2.12. Optional literature	Bettinger, P., Boston, K., Siry, J., Grebner, D., 2008: Forest Management and Planning. Academic Press, eBook ISBN: 9780080921587, 360 str. Davis, L.S. & Johnson, K.N. 1987: Forest Management. Mc Graw-Hill Book Company, New York, 1987. Osnove gospodarenja gospodarskim jedinicama		

COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	-	1.7. Number of ECTS credits	20
1.2. Course title	Master thesis	1.8. Number of hours in semester (L+E+F+e-learning)	
1.3. Course code	255924	1.9. Expected enrolment in the course	25
1.4. Study programme	Graduate	1.10. Level of application of e-learning (level 1, 2, 3)	2.



1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	Master thesis is a comprehensive and highly independent task in which the student must demonstrate knowledge of the basics of the profession and scientific research work in defining hypotheses and research goals, research planning, data collection and processing and writing a scientific paper. It includes expanding and deepening knowledge from the content of the curriculum, individual engagement on problem topics, gaining experience in writing professional papers, ability to apply scientific methods and tools in problem processing and writing, ability to independently use relevant domestic and foreign literature published in the cited sources.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at the level of the programme to which the course contributes	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper		
2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)	1. apply previous knowledge to define the scientific-professional problem when choosing the topic of the paper 2. create a term work plan in accordance with the given deadlines for the preparation of the master thesis in stages 3. independently design the methodology of research work 4. apply the methodology of writing a professional and scientific work 5. present the work in written and oral form, using the skills of concise interpretation of results and conclusions, and provide guidelines for future development of the topic of the paper		
2.5. Course content (syllabus)	Master thesis is an individual written work based on own research that is written in scientific form and involves the time load of students with research work that is equivalent to the value of 20 ECTS. As a rule, the diploma thesis is prepared during the 4th semester of the graduate study, and ends with an oral defense (presentation and answering questions).		
2.6. Format of instruction	<input type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops	<input checked="" type="checkbox"/> independent assignments	2.7. Comments:



	<input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input checked="" type="checkbox"/> field work			<input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input checked="" type="checkbox"/> work with mentor <input type="checkbox"/> (other)					
2.8. Monitoring student work	Class attendance		NO	Research	YES		Oral exam	YES	
	Experimental work	YES		Report		NO	(other)		
	Essay		NO	Seminar paper		NO	(other)		
	Preliminary exam		NO	Practical work	YES		(other)		
	Project		NO	Written exam		NO	ECTS credits (total)		20
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.								
2.10. Student responsibilities	Apply for the topic of the thesis, conduct research and prepare the paper in accordance with the Instructions for the design of the thesis. Attend consultations and present the progress in conducting research and drafting the paper. Respect and follow the instructions of the mentor. Adhere to the principles of ethical approach in writing the thesis. Prepare a presentation and defend the thesis before the appointed committee.								
2.11. Required literature (available in the library and/or via other media)	Title			Availability in the library			Availability via other media		
	Ordinance on the preparation and defense of the master thesis at the graduate studies of the University of Zagreb, Faculty of Forestry and Wood Technology			NO			YES, web		
	Instructions for the preparation of the bachelor and master thesis			NO			YES, web		



2.12. Optional literature	
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COURSE DESCRIPTION

1. GENERAL INFORMATION			
1.1. Course lecturer(s)	-	1.7. Number of ECTS credits	4
1.2. Course title	Professional practice	1.8. Number of hours in semester (L+E+F+e-learning)	15 days
1.3. Course code	225923	1.9. Expected enrolment in the course	25
1.4. Study programme	graduate study Forestry; Programme: Silviculture and Forest Management with Wildlife Management	1.10. Level of application of e-learning (level 1, 2, 3)	N.A.
1.5. Course type	Compulsory	1.11. Language of instruction	Croatian
1.6. Year of the study	2.	1.12. Possibility of instruction in English	
2. COURSE DESCRIPTION			
2.1. Course objectives	The aim of the course is to gain experience and insight into the activities of companies that employ masters of forestry engineering in jobs that require the specified profile of experts. Within the course, students will connect the previous knowledge acquired during their studies with the performance of specific work tasks related to the part of the profession in which the company is engaged, and learn the importance of developing business responsibility, communication skills and teamwork.		
2.2. Enrolment requirements and/or entry competences required for the course	-		
2.3. Learning outcomes at	A1. independently gather data, statistically process, present and analyse data, discuss and conclude based on analysed data and distinguish possibilities of different interpretation of the same problem analysed in different ways		



<p>the level of the programme to which the course contributes</p>	<p>B2. implement forest management programs B13. manage forest, human resource, and technical potential during performance of forest works C1. plan, organise and works of organization of production in forestry D5. gather, process and interpret reference sources and prepare simpler written professional or scientific paper</p>									
<p>2.4. Expected learning outcomes at the level of the course (3 to 10 learning outcomes)</p>	<p>1. independently and responsibly perform entrusted professional tasks in forestry 2. apply in practice the knowledge and skills necessary for the implementation of the entrusted tasks 3. apply in practice legal regulations from the forestry sector 4. present professional issues in writing</p>									
<p>2.5. Course content (syllabus)</p>	<p>During the implementation of the professional practice, the student will, on the basis of a previously defined task, and according to the instructions and under the supervision of a mentor in the company, perform professional forestry work for which he is in charge. When performing professional work, the student will, in accordance with the instructions and in agreement with the mentor in the company, independently study the relevant professional literature, business documentation and legislation in the forestry sector. The results of the completed professional practice will be presented by the student to the mentor at the faculty in the form of a written report.</p>									
<p>2.6. Format of instruction</p>	<p><input type="checkbox"/> lectures <input type="checkbox"/> seminars and workshops <input type="checkbox"/> exercises <input type="checkbox"/> <i>online in entirety</i> <input type="checkbox"/> partial e-learning <input type="checkbox"/> field work</p>				<p><input checked="" type="checkbox"/> independent assignments <input type="checkbox"/> multimedia and the internet <input type="checkbox"/> laboratory <input checked="" type="checkbox"/> work with mentor <input type="checkbox"/> (other)</p>		<p>2.7. Comments:</p>			
<p>2.8. Monitoring student work</p>	Class attendance	YES		Research		NO	Oral exam		NO	
	Experimental work		NO	Report		NO	Pisani izvještaj	YES		
	Essay		NO	Seminar paper		NO	(other)			
	Preliminary exam		NO	Practical work	YES		(other)			



	Project		NO	Written exam		NO	ECTS credits (total)	4
2.9. Assessment methods and criteria	Assessment is conducted in accordance with Assessment methods and criteria for the current academic year.							
2.10. Student responsibilities	Perform entrusted professional tasks during the implementation of professional practice. Upon completion of the professional practice, prepare a written report.							
2.11. Required literature (available in the library and/or via other media)	Title				Availability in the library		Availability via other media	
	Professional practice handbook						YES	
2.12. Optional literature								