Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ECOLOGY AND AGROECOSYSTEMS

Teacher (s): Snežana I. Oljača

Subject status: obligatory

ECTS: 4

Aims of the subject.

To enable students acheiving:

a) Knowledge/understanding in principles of regulation within natural and agricultural ecosystems and to demonstrate the complex interconnections between natural landscape and agricultural production; how applying ecological concepts and principles to the design and management of agroecosystems improve long-term reliability in agricultural production.

b) Skills in sampling for analysis, measuring of different climatic and soil properties, establishment and management of the sustainable agroecosystems

Learning outcomes

At the end of the subject student should show knowledge/understanding of the ecological problems in agriculture, to show ability of outlining, projecting and applicating of knowledge in area of agroecology. Student should have ability to apply new ecological technologies for the purpose of natural resources preservation in agricultural production and creation of functional agroecosystems.

At the end of the subject student should be qualified for: critical analysis, evaluation, and synthesis of the new ideas in the field of agroecology, presentation of accomplishment, to be able to give over professional knowledge and ideas to the colleagues and broader academic community, to be able to use informational techlologies in the area of applied ecology in agriculture.

Content

Lectures: Problems in sustainable use of natural resources in agriculture. Plants and environmental factors. The agroecosystems concept. Introduction to basic ecosystem functions with regard to organization of biocoenosis and metabolism. Population processes in agriculture. Species interactions in crop communities. Agroecosystem diversity and stability. The energy in agroecosystems. Elaboration of possibilities and constraints to manage and utilize agroecosystems. Description of relationships and dependencies between different ecosystems in view of land use. Achieving sustainability in agriculture.

Practicals, field work, seminars: Each theoretical subject will be covered with practical workshops. Students research work will include individual work on seminar and research papers.

Literature

Oljaca S. (2010): Ecology and agroecosystems. Ed. Faculty of Agriculture, University of Belgrade 180 pp.

Kastori, R. (1995): Agroecosystem protection. Feljton d.o.o., Novi Sad.

Selected papers from journal Agriculture, ecosystems and environment

Number of contact hours **60**			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures		Written	50
Practical work		Oral	
Coloquia			
Tests	30		
Seminars	20		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: APPLIED ECOPHYSIOLOGY

Teacher: Marina P. Mačukanović-Jocić

Subject status: obligatory

ECTS: 4

Aims of the subject.

The subject should enable students acheiving:

a) knowledge/comprehension of: characteristics of the abiotic environmental factors on habitat (temperature, water, light regime of habitat, mineral regime of soil, etc.); the mode of action of abiotic environmental factors on plants, plant responses to abiotic factors, the concept of abiotic stress factors, the phenomenon of resistance of plants to stress factors

b) Skills in: use of instruments for determination of abiotic environmental factors, description of the symptoms of the stress factors, measurements of plant responses to the ecological factors

Learning outcomes:

Upon complition of this course student should show knowledge/understanding of: the types and mode of action of abiotic ecological factors, especially stress factors on cultivated plants, and morpho-physiological adaptations of cultivated plants to stress abiotic factors

Upon complition of this course student should be qualified for: critical thinking, analysis, and identification of specific ecological adaptation of plants to changes of environmental conditions, individual use and research of literature, presenting the acquired knowledge, the use of ICT in the field of ecophysiology and e-learning methods.

Content

Lectures:

Ecological factors analisys - Abiotic ecological factotrs: definition, classification (climatic factors - water, temperature, light, air; edaphic and orographic) and mode of action on plants, Abiotic stress factors and resistance mechanisms of plants

Ecological characterization of plants: characteristics of plant groups related to abiotic ecological factors (water, temperature, light, air, edaphic and orographic); ecological characteristics of cultivated plants

Adaptations of cultivated plants to stress factors: Morpho-physiological responses of cultivated plants to abiotic stresses (drought, flooding, cold, heat and salt stress, soil and air pollution, etc)

Practical training, field work, seminars:

Measurements of abiotic ecological factors in the habitat (microclimatic parameters, soil and air analysis), measurements of cultivated plant responses to the environmental conditions (plant water status, leaf temperature, light intensity at leaf level etc.), screening of the stress symptoms.

Selected chapters will be interpreted through interactive teaching, e-learning and practical training

Students research work will include individual work on seminar papers and research papers related to the subject.

Literature:

Mačukanović-Jocić M., Pekić Quarrie, S., 2010. Primenjena ekofiziologija. Skripta. Poljoprivredni fakultet, Univerzitet u Beogradu i WUS. 110 pp.

Pekić, S. 1988. Ecophysiological basis of resistance of maize to drought, Naučna knjiga, Beograd.

Larcher, W. 1995. Physiological Plant Ecology. Springer-Verlag,.

Fitter, A H., Hay R.K.M.1993. Environmental Physiology of Plants. Academic Press. 1993.

Stevanović B., Janković, M. 2001. Plant ecology with the basics of plant physiological ecology, NNK International, Beograd.
Smith, J.A., Griffiths, H. 1993. Water deficits: plant responses from cell to community. Bios

Number of contact hours 60			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures combined with interactive teaching, e-learning (moodle), seminar paper with the presentation,, consultation , class discussion, small group work, and mentoring work with students

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 40	**Final exam**	Points: 60
Activity during lectures		Written	**60**
Practical work		Oral	
Coloquia			
Tests	**10**		
Seminars	**30**		
Other			

Type of study programme: Master studies

Subject: ECOTOXICOLOGY

Teacher (s): Dragica V. Brkić

Subject status: compulsory

ECTS: 5

Aims of the subject.

To enable students understanding of ecotoxicological effects, dose-response and concentration-response relationships, to perform identification of agricultural toxicants and their sources in the environment. To get experience and expertise in practical toxicity testing study; data interpretation and evaluation; case studies of ecotoxicological-risk characterization and critical assessment, application of toxicological data to hazard and risk assessment.

Learning outcomes

а) Knowledge/understanding of: fundamental principles of toxicology that are essential to understanding environmental toxicology; effects and risk assessment; current methods of ecotoxicological testing and their use in regulation, issues of extrapolation at different levels of biological organization;

б) Skills: gathering information on specific hazards and adverse effects; applying principles of hazard and risk assessment, high-level spoken and written communication; capability and skill for teamwork; skill for the independent acquisition of knowledge; capability for lifelong learning in an information-based society; capability for developing critical thought + *problem solving, decision making, evaluation of LO and of the teaching process*

Content: Basics of Fundamentals of Environmental Toxicology. Identification of agricultural toxicants and their sources in the environment. Lethal and sublethal effects. The dose – response and concentration – response relationships of environmental toxicants. Interaction (antagonisms and synergisms). Effects of exposure (endpoints). Quantitative methods in measuring acute and chronic toxicity (IC-50; EC-50, LC-50, NOEC). Bioaccumulation and biomagnification. Freshwater Toxicity Test procedures (short-term toxicity, long-term toxicity). Factors that modify toxicity. Variability of test results. Terrestrial toxicity: Tests with bacteria and plants, Tests with invertrebrates, Tests with birds and mammals. The "Key" to classification; Effects assessment for ecosystems (PNEC); Quantitative methods of risk characterization.

Practicals, lab work, seminars: Practical Toxicity testing study; Data interpretation and evaluation; Case studies of ecotoxicological-risk characterization and critical assessment, Application of toxicological data to hazard and risk assessment.

Literature:

1. Vitorović, Lj. S., Milošević, P.M.(2002): Osnovi toksikologije sa elementima ekotoksikologije, Treće dopunjeno izdanje, Vizartis, Beograd.
2. van Leeuwen and Hermens, J.L.M.(Eds): Risk Assessment of chemicals, An introduction, Kluwer Academic Publishers, Dordrecht/Boston/London, 2000.
3. Rand, M.G.(Ed): Fundamentals of Aquatic Toxicology, Effects, Environmental Fate, and Risk Assessment, Second Edition, Taylor&Francis, 1995.
4. Landis, G.W., Sofield, M.R., Yu, Ming-Ho: Environmental Toxicology. CRC Press, Taylor & Francis Group, 2011.

Number of contact hours 60			Other -
Lectures: 2	Practicals: 1	SIR: 1	

Методе извођења наставе

Предавања у комбинацији са интерактивном наставом, семинари, консултације и менторски рад са студентима

Evaluation of knowledge (maximum 100)

Pre-exam	Points:	**Final exam**	Points: 40
Activity during lectures	10	oral	40
Tests	30		
Seminars	20		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: MICROBIAL ECOLOGY

Teacher(s): Vera B. Raicevic

Subject status: obligatory

ECTS: 4

Aims of the subject.

To enable students examine and udnerstand the microbial divesity in ecosystems, significanse and possibilities of microorganisms application in safe food production, but also its role in bioremediation and bioconversion of agroindustrial waste. The aim of the subject includes multidisciplinary approach to the study and characterization of ecosystems and giving insight into the modern and reliable methods for detection of saprophytic and pathogenic microorganisms in the environment and for application in agriculture and in reparation of damaged ecosystems.

Learning outcomes

At the end of the subject student should describe mutual interactions between microbial populations as well as plant-microbial interactions, to understand the effect of environmental factors on microorganisms, to associate ecological problems in agriculture and soil and water contamination with possibility of practical application of microorganisms in bioremediation, biofertilization and safe food production.

At the end of the subject, student should be able to: perceive environmental problems in agriculture and analyse the role of microorganisms in ecosystems, to present possibilities да прикаже possibilities of microorganisms application in modern agriculture using examples, to present acquired knowledge individually or in group, to develop the capacity of critical thinking, evaluation of the learning process and outcomes.

Content

Lectures: Biodiversity of microbial populations, Microbial interactions, Plant-microbe interactions, Rhizosphere, Plant growth promoting bacteria, Microorganisms in bioremediation and bioconversion of agroindustrial waste, Composting, Microorganisms as contaminants of fresh fruit and vegetables.

Practicals: Methods of isolation and identification of saprophytic and pathogenic microorganisms from the environment, detection of human pathogens in the food production chain, as well as overview of advantages and disadvantages of microorganisms application in bioremediation.

Literature:

Raicevic, V., Lalevic, B., Kljujev, I., Petrovic, J. (2010) Ekoloska mikrobiologija, Faculty of Agriculture, Belgrade, ИСБН 978-86-7834-091-8

Jovicic-Petrovic J., Kljujev, I. (2012) Praktikum iz mikrobiologije zemljista sa radnim listovima, Практикум из микробиологије земљишта са радним листовима, Faculty of Agriculture, Belgrade, ИСБН 978-86-7834-204-2

Pepper, I.L., Gerba, C.P (2004): Microbiology. Laboratory manual			
Number of contact hours 60			Other:
Lectures: 2	Practicals:1	SIR: 1	
Teaching methodology			
Lectures, case study, practical, laboratory work, interactive classes, e-learning using platform of Faculty of Agriculture :http://moodle.agrif.bg.ac.rs/ amended for communication with students, organisation of team work, and announcements of activities.			
Evaluation of knowledge (maximum 100)			
Activity during lectures	Points 60	Final exam	Points 40
Practical work		written	40
Activity during lectures		oral	-
Coloquia	5		
Tests	10		
Seminars	45		

Type of study programme: Master studies

Subject: ENVIRONMENTAL MANAGEMENT IN AGRICULTURE

Teacher (s): Nataša B. Petrović

Subject status: compulsory

ECTS: 4

Aims of the subject.

Providing knowledge and systematic and critical review of the scientific basis of environmental management, and policy and regulation in the field of environmental management in agriculture with a practical understanding and adoption methodologies, strategies and practices of environmental management, sustainability, and environmental protection in agriculture.

Learning outcomes

Knowledge:

- Basic principles of natural resource management
- Environmental valuation methodology
- Environmental management systems in agriculture
- EMAS (Environmental Management and Auditing System) application in agriculture
- Waste management principles and practices in agriculture
- Energy efficiency management in agriculture

Skills:

- Environmental management systems in agriculture
- EMAS (Environmental Management and Auditing System) application in agriculture
- Cleaner Production Technologies in agriculture
- Waste management principles and practices in agriculture
- Energy efficiency management in agriculture
- Land resource management in agriculture
- Water resource management in agriculture

Generic skills: High-level spoken and written communication; capability and skill for teamwork; skill for the independent acquisition of knowledge; capability for lifelong learning in an information-based society; capability for developing critical thought, problem solving, and decision making.

Content

Human vs. Environment: Introduction in ecology and environmental crisis. Input and output environmental impacts produced by human activities. Input and output environmental crisis. Need for environmental problem solving on global level.

The history of the environmental movement and the environmental awareness development: The historical development of the environmental awareness. The historical development of the environmental movement. National

and international events concerning environmental issues. Sustainable Development: definition, concept, principles, strategies, indicators.
Environmental Management: The historical development of environmental management issues and approaches. Principles of environmental management at local, regional, and global levels. A study of global environmental management that integrates knowledge and builds on the conceptual foundation through integrative analysis, practical application, and critical thinking. Emerging issues in global environmental management. An overview of the fundamental elements of an integrated environmental management program. The economic development and environmental pollution, remediation, and conservation within a multifaceted scientific, legal, political, and global context. Case studies and an advanced management project apply principles and concepts to environmental perspectives, experiences, research issues, and new paradigms of sustainable development.
Environmental Management Systems: Formalized Environmental Management Systems (EMS). British Standard BS 7750. European Union System for Environmental Management and audit: EVRO-EMA system.
International standard ISO 14000.
Introduction of cleaner production practices. Cleaner Production Strategy, implications and impediments in Serbia.
Environmental Management in Agriculture: The scientific principles governing ecosystems, particularly as they relate to the environmental consequences of resource development and agricultural processes. Economic and social trends in farming. Pressures of agriculture on the environment. Environmental trends and services linked to agriculture.

Literature

1. Petrović N. Ekološki menadžment u poljoprivredi. FON, Beograd 2013.
2. Petrović N. Ekološki menadžment, FON, Beograd 2012.
3. Petrović N. Ekološki menadžment u poljoprivredi. Izd Poljoprivredni fakultet.2010
4. Barrow C. J Environmental Management-Principles and Practice 1999
5. Botkin D., E. Keller Environmental Science-Earth as a living planet John Wiley&Sons, Inc 2003

Number of contact hours	**60**		Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methods

This course is taught using methods such as: lecture, class discussions, case method, small team work, project creation, and electronic discussion (email and website chat room).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 60	**Final exam**	Points: 40
Activity during lectures	10	Written	
Practical work	5	Oral	40
Coloquia	10		
Tests	30		
Seminars	5		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

Teacher (s): Radmilo Pesic

Subject status: obligatory

ECTS: 4

Aims of the subject.

To enable students acheiving a profound knowledge of:
a) the sustainable development, b) the global environmental problems and the role of agriculture c) economic elements it environmental policy mix, d) climate change economics, and e) international and interregional policy institutions.

Learning outcomes

At the end of the course students should have knowledge/understanding of the theory and policy of optimal

renewable and nonrenewable resource use, policy instruments of environmental and resources protection, environmetal valuation and economic aspects of environmental impact assessment.
Students should also acquaire skils of independent and critical analysis of the current environmetal problems and policies, application of environmental valuation techniques, and the optimal use of natural resources in agribusines sector according to the international standards.

Content

Lectures: The sustainable development. Renewable resource economics. Non-renewable resource economics. Economics of pollution. Environmental macroeconomic accounting. Environmental valuation techniques. Climate change economics.
Field work: A visit to the Regional climate policy center in Belgrade.

Literature

Pešić, Radmilo (2012) Ekonomika životne sredine i prirodnih resursa. Univerzitet u Beogradu - Poljoprivredni fakultet i Zavod za udžbenike, Beograd
J.M. Alier and I Ropke (2008) "Recent Developments in Ecological Economics" Edward Elgar Publ
Perman, R. Ma, Y. and McGilvray J. (1996) "Natural Resource and Environmental Economics" Longman: London and New York.
Quentin Grafton R., Adamowicz W., Dupont, D., Nelson H., Hill, R.J., Renzetti, S. (2004) "The Economics of the Environment and Natural Resources" Blackwell Publ.

Number of contact hours **60**			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

lecturing, class discussions, field work, small group work, project creation, and electronic debate (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 30	**Final exam**	Points: 70
Activity during lectures	10	Written	70
Practical work		Oral	
Coloquia			
Tests			
Seminars	20		
Other			

Study programme: Environmental protection in agriculture
Type of study programme: Master academic studies
Subject: PLANT PROTECTION AND ENVIRONMENT
Teacher (s): Aleksa Ž. Obradovic
Subject status: elective
ECTS: 6

Aims of the subject.

To enable students achieving:
a) Knowledge/understanding of general principles of plant protection and various strategies that provide environment friendly control of pathogens and pests;
b) Development of skills facilitating team work with plant protection specialists in designing ecologically acceptable and consumer safe protection strategy with reduced risk of environmental pollution.

Learning outcomes

Knowledge and understanding of: a) role of plant protection in agriculture; b) major groups of plant pathogens and pests; plant protection principles and variety of pest control measures; consequences of inadequate plant protection; integration of different measures preventing occurrence of harmful organisms and reducing use of pesticides in order to protect environment.

Content

Lectures: Importance of plant protection in agriculture; biotic and abiotic factors affecting plant production; control of harmful organisms; Integrated pest management; Specificity of plant protection in different production systems; Effect of intensive plant protection on environment; Risk management of plant protection negative effects on

environment.
Practical work: Principles of detection and determination of plant pathogens and pests; Good plant protection practice; Plant protection safety; Plant protection waste management.

Literature

1. Мијатовић М., Обрадовић А., Ивановић М. (2007): Заштита поврћа од болести, штеточина и корова. Агро-Мивас, Смедеревска Паланка.
2. Ивановић, М., Ивановић, Д. (2005): Болести воћака и винове лозе и њихово сузбијање, Пољопривредни факултет Универзитета у Београду.
3. Бабовић, М. (2003): Основи патологије биљака. Пољопривредни факултет Универзитета у Београду.
4. Марић, А., Јевтић, Р. (2005): Атлас болести ратарских биљака. Пољопривредни факултет Нови Сад.
5. Шинжар, Б., Јањић, В. (1995): Коровске биљке. Пољокњига, Београд.
6. Јањић, В. (2005): Фитофармација. Друштво за заштиту биља Србије, Београд.
7. EPPO (2005): Good Plant Protection Practice. EPPO Standards PP2

Number of contact hours 90			Other
Lectures: 3	Practicals: 2	SIR: 1	

Методе извођења наставе

Lecturing with active participation of students, seminars, mentoring

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 70	**Final exam**	Points: 30
Activity during lectures	/	Written	/
Practical work	/	Oral	30
Coloquia	/		
Tests	40		
Seminars	30		
Other	/		

Type of study programme: Master studies

Subject: ENVIRONMENTAL PROTECTION IN FIELD CROP AND VEGETABLE PRODUCTION

Teacher (s): Dušan Dj. Kovačević

Subject status: elective

ECTS: 6

Aims of the subject.

To enable students acheiving:

Knowledge/understanding of: soil fertility, degradation, cultural measures in field and vegetable production in different farming systems (conventional, LEISA and Organic) and their effects to pollution environment, reason for modifaing cultural practices and their reflections to the enviroment.

Skills: Establishment and management of environmental friendly field and vegetable production.

Capability and skill for teamwork; capability for developing critical thought + problem solving, decision making, evaluation of LO and of the teaching process.

Learning outcomes

At the end of the subject student should show knowledge/understanding problems in agriculture and environment.. Student should have ability to apply new agricultural technologies from conventional agronomy to organic farming. The major innovations will be done in the area of some cultural practices in different farming systems. Many of them must be modified from ecological point of view.

At the end of the subject student should be qualified for: critical analysis, evaluation, and synthesis of the new ideas in the field of general principles protection field and vegetable crop production in different farming systems agroecology.

Content

Lectures:.Type of farming systems. Conventional, Conservation and organic farming systems. Their effect on enviromental protection. Changes in crop production practice. Field and vegetable crop production i Serbia. Pollution in agriculture. Tillage. Climate changes. GMO. Cultural practeces and their effects on environment in different farming systems from conventional to organic. Farming systems - challenges and future directions.

Practicals, field work: Establishment and management in field and vegetable production in different farming system.

Literature

Dusan Kovacevic (2011): Environmental protection in field and vegetable crops, Monography. Ed. Faculty of Agriculture, University of Belgrade. (in Serbian).

Kovacevic, D., Oljaca Snezana eds. (2005): Organic agriculture. Monography. Faculty of agriculture -Zemun pp 323.

Kovačević, D. (2010): General Farming. Ed. Faculty of Agriculture, University of Belgrade, Second edition, 780 pp.

*** IFOAM Training Manual on Organic Agriculture in the Tropics.

"Agriculture, ecosystems and environment" Elsevire.

Number of contact hours 90			Other
Lectures: 3	Practicals: 2	SIR: 1	

Teaching methodology

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 60	**Final exam**	Points: 40
Activity during lectures	10	Written	-
Practical work		Oral	40
Coloquia			
Tests	20		
Seminars	30		
Other	-		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL PROTECTION AND BIODIVERSITY IN LIVESTOCK PRODUCTION

Teacher (s): Vladan T. Bogdanović

Subject status: Elective

ECTS: 6

Prerequest: ---

Aims of the subject

To enable students achieving: 1) knowledge for determination of livestock production systems, 2) understanding of impacts of livestock production systems on the environment, 3) knowledge for management and sustainable utilisation of livestock biodiversity.

Learning outcomes

At the end of the subject student should show: a) knowledge/understanding of characteristics of livestock production systems and their interactions with the environment; b) knowledge/understanding of impact of livestock production systems the environment and natural resources; c) knowledge of methods for protection and utilisation of livestock biodiversity.

At the end of the subject student should be qualified for critical analysis, evaluation, and synthesis of the new ideas in the field of livestock biodiversity, presentation of accomplishment, to be able to give over professional knowledge and ideas to the colleagues and broader academic community.

Content

Livestock production, natural resources and the environment; Grazing livestock production systems and the environment; Mixed livestock production systems and the environment; Landless livestock production systems and the environment; Livestock production and livestock biodiversity; Breeding goals and breeding programs for autochthonous livestock breeds; Case studies in protection and utilisation of livestock biodiversity.

Students research work will include individual work on seminar and research papers.

Literature

Bogdanović, V. (2010). Environmental protection and biodiversity in livestock production. Austrian Development Cooperation, WUS, Austria, Faculty of Agriculture, Belgrade, 65 pp.
Gajić, I. (1994). Biološke osnove stočarstva. Faculty of Agriculture, Belgrade, 595 pp.
Hall, S. J. G. (2004). Livestock Biodiversity – Genetic Resources for the Farming of the Future. Blackwell Publishing, Oxford, UK.
Jarvis, D. I., Padoch, C., Cooper, H. D. (Eds.) (2007). Managing Biodiversity in Agricultural Ecosystems. Columbia University Press, New York, USA.
Robinson, T.P., Thornton P.K., Franceschini, G., Kruska, R.L., Chiozza, F., Notenbaert, A., Cecchi, G., Herrero, M., Epprecht, M., Fritz, S., You, L., Conchedda, G., See, L. (2011). Global livestock production systems. Rome, Food and Agriculture Organization of the United Nations (FAO) and International Livestock Research Institute (ILRI), 152 pp.
Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales, C. de Haan (2006). Livestock's long shadow - Environmental issues and options, LEAD FAO, Rome.
Secondary Guidelines for Development of National Farm Animal Genetic Resources Management Plans - Management of small populations at risk. FAO UNEP, Rome.
Selected papers from journals: Agricultural systems, Agriculture, ecosystems and environment, Animal, Livestock Science etc.

Number of contact hours: 90			Other
Lectures: 3	Practical: 2	SIR: 1	

Teaching methodology

Lecture, class discussions, small group work, project work, seminar work, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	**Points: 40**	**Final exam**	**Points: 60**
Seminar and oral discussion	40	Written	60

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL PROTECTION IN FRUIT GROWING AND VITICULTURE

Teacher (s): Branislava V. Sivčev, Milica M. Fotirić Akšić, Zorica Z. Ranković-Vasić

Subject status: elective

ECTS: 5

Aims of the subject:

To enable students to acheiving:

a) Knowledge / understanding of the agro-ecosystem of vineyards and orchards, and their environmental infrastructure, flora and fauna in the vineyard, antagonists in the vineyard, the key pests in orchards and their antagonists, the role of grass cover on slopes plantations, establishment and maintenance of ecological infrastructure in the orchard and vineyard

b) Skill strategy choices of varieties and breeding systems of control and the biological cycle of the pest, the ecological basis for the application of protective measures as a key moment in the preservation of healthy ecosystems in the vineyard and orchard.

Learning outcomes:

At the end of the course the student should demonstrate a thorough knowledge and understanding of the advantages and disadvantages of monocultures in agriculture: growing and voćarastvu, to review and approve the terms: "multufunkcionalna agriculture", "functional biodiversity", "conservation biological control and environmental infrastructure," the co-administered traditional and new procedures and coordinate security procedures in sustainable agriculture-growing and voćarastvu

At the end of the course the student should be able to: critically examine applicable information, and assessing the quality of environmental infrastructure in the vineyard and orchard, the new scientific and technical knowledge translate into usable

information and stimuli interested farmers to apply some knowledge in his vineyard and orchard.

Content

Lectures: Theoretical Studies: Consideration of orchards and vineyards as monocultures, knowledge of the causes of immune dysfunction agroecosystems, ways of reaching a healthy ecosystem, the mechanisms for improving immunity agroecosystems, measures to improve the functionality of biodiversity, measures to improve the natural number of species to reduce pest population density, cultural practices in viticulture and fruit as a measure of protection against diseases and pests and ecosystem conservation plantings and the area around the plants, the conditional distribution of the primary and secondary products in viticulture and wine and fruit production and ways of exploiting njihovor

Practical classes:

At any time, the student will be using a script filled test. It will be a way to overcome the basic material. Material from the Internet (from an appropriate minimum area) will be offered to students to further master the part pedemta. The field exercise will be organized 1-3 after completion of the field. Seminar is a required part of the exam can be a team, if there are more participants, or individual.

Literature:

1. Sivčev, B., Fotirić Akšić, M., Ranković-Vasić, Z., Sivčev, L. (2010): Zaštita zivotnr sredine u voćarstvu i vinogradarstvu. Univerzitet u Beogradu Poljoprivredni fakultet, 213 str.
2. Altieri, M. & Nicholls, C. (2005): Agroecology and Search for a Truly Sustainable Agriculture. United Nations Environmental Programme. ISBN 968-7913-35-5
3. Altieri M. (2012): Insect pest management in agro ecosystems of the future. Atti Accademia Nazionale Italiana di Entomologia Anno LX 137-144.
4. Kevan, P.G. 1999. Pollinators as bioindicators of the state of the environment: species, activity and diversity. Agriculture, Ecosystems and Environment 74:373–393.
5. Chehregani, A., Malayeri, B. E. 2007. Removal of Heavy Metals by Native Accumulator Plants. International journal of agriculture & biology 9(3): 462–465.
6. Pankhurst, C., Doube, B.M., Gupta V. V. S. R. (eds.). 1997. Biological indicators of Soil Health. CABI Publishing, Wallingford, Oxon, UK.
7. Cubison, S. 2009. Organic fruit production and viticulture, a complete guide. The Crowood Press Ltd, Ramsbury, Marlborough, UK.
8. Lind, K., Lafer, G., Schloffer, K., Innerhofer G., Meister, H. 2003. Organic fruit growing. CABI Publishing, Wallingford, Oxon, UK.

Number of contact hours 90			Other
Lecture: 3	Practicals: 2	SIR: 1	

Teaching methodology

lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website)

Evaluation of knowledge (maximum 100)

Pre-exam	Points 50	Final exam	Points 50
Activity during lectures	5	Writen	-
Practical work	5	Oral	50
Coloquia			
Tests	30		
Seminars	10		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: BIODIVERSITY AND NATURAL PLANT RESOURCES IN AGRICULTURE

Teacher (s): Zora P. Dajić Stevanović

Subject status: obligatory

ECTS: 4

Aims of the subject: Enable student to obtain: a) knowledge/comprehension of: importance of biodiversity preservation at all levels (genetic, species ecosystem), general diversity of life, especially of Balkan and Serbian flora and vegetation, factors jeopardizing the biodiversity and causes of biodiversity loss, key principles of biodiversity sustainable use and management, including strategic and legislation framework; b) skills in: collecting and analyzing of field data, determination of some important plant communities and ecosystems, quantitative and qualitative evaluation of plant resources

Learning outcomes:

Upon completion of this course, the student should be able to:

1. define biodiversity and its ground levels
2. describe principles of in situ and ex situ biodiversity conservation, as well as key factors affecting the biodiversity; understand the needs for sustainable use of biodiversity and plant natural resources;
3. critically evaluate and interpret information and scientific results related to the impact of economy and agriculture on biological diversity, emphasise the importance of plant genetic resources, and access and benefit sharing of biodiversity;
4. understand a global, regional and local needs for biodiversity conservation; understand a range of ecosystem services and related practical implementations;
6. plan, implement and interpret initial research in solving complex problems related to biodiversity and environmental protection

Content

Theoretical study: Introduction (biodiversity definitions and means, biodiversity at three levels, agrobiodiversity), Species diversity, Genetic diversity and plant genetic resources, Ecosystem diversity and Ecosystem services, Review of Serbian floristic and vegetation diversity and plant natural resources (especially related to agriculture – grasslands, medicinal plants, ornamental species, weeds, etc.), Factors endangering biodiversity (habitat loss, fragmentation and alterations, overcollecting, pollution, global disasters, invasive species, impact of industry, impact of agriculture on biodiversity), Biodiversity use and management – in situ and ex situ conservation measurements, Strategic and legislative framework – international and national, access and benefit sharing of biodiversity use

Practical training: Selected chapters will be interpreted through interactive lectures, practical trainings and case studies. Preparation of seminar papers and articles related to the subject will be organized in the form of mentoring.

Literature

1. Dajić Stevanović, Z., Bernhardt, K.G. (2010). Biodiversity and natural plant resources in agriculture. Authorized script, University of Belgrade, faculty of Agriculture, Belgrade (in Serbian and in English).
2. Group of authors (1995). Biodiversity of Yugoslavia with review of internationally important species (ed. V. Stevanovic and V. Vasic). Ekolibri and Faculty of Biology, Belgrade (in Serbian).
3. Group of authors (2005). Biodiversity on beginning of new millennia. (ed. M. Andjelkovic). Edition: Scientific meetings, Book 2, Serbian Academy of the Sciences and Arts, Belgrade (in Serbian).
4. Selected scientific papers from national and international scientific journals

Number of contact hours		**60**	Other: -
Lectures: 2	Practical: 1	SIR: 1	

Teaching methodology

Lectures combined with interactive classes, seminars, consultation and mentoring students lecture, class discussions, laboratory and field work, small group work, electronic discussion (moodle).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures		Written	50

Practical work		Oral	
Coloquia			
Tests	10		
Seminars	40		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: SOIL POLLUTION AND REMEDIATION

Teacher (s): Svetlana B. Antić-Mladenović

Subject status: obligatory

ECTS: 4

Aims of the subject.

To enable students to achive: a) knowledge/understanding of: contemporary definition of soil pollution, sources and types of pollution, behavior and fate of contaminants depending on the characteristics of the contaminant and the chemical, physical and biological properties of the soil, the effects of pollutants on soil, living organisms and the environment, theoretical basis, advantages and disadvantages of measures/solutions to reduce risk of transfer of pollutants from the soil to other components of the environment and techniques for the remediation of polluted soil. b) Skills - interpretation of the results of chemical analysis of soil and plant material in order to define the extent of soil contamination and associated risk, selection of appropriate procedures to reduce the risk of anthropogenic pollution originating from agricultural sources and creating appropriate remediation plan.

Learning outcomes

At the end of the course students should show a thorough understanding of the problems that can occur in the environment as a result of soil pollution from agricultural production as a source, receiver and/or transferring pollutants; know, understand and show an ability to choose and plan appropriate methods of soil management and soil remediation technologies in order to achieve sustainable environmental conditions. Students should be qualified for work in teams, critical analysis and presentation of the achived knowledge.

Content

Lectures: Soil as a natural resource - the composition and basic properties; Soil pollution - definition, types and sources of pollution; Pollutants - behavior in a soil, transfer to other parts of the environment, the effects on soil, living organisms and the environment; Measures for reducing/preventing environmental pollution from agricultural sources; Assessment of soil pollution and risk level; Legislation; Techniques for remediation of polluted soils - physical, chemical, biological.

Practical work: Group workshops/platforms - the practical application of theoretical knowledge in solving of specific tasks. Group presentations. Individual research work.

Literature

Antić-Mladenović, S. (2010): Soil pollution and remediation – script (in Serbian). Austrian Development Cooperation, WUS Austria. Poljoprivredni fakultet Beograd.

Mirsal, I.A. (2008): Soil Pollution: Origin, Monitoring and Remediation, 2nd edition, Springer.

Livingston, J.V. (2006): Agriculture and soil pollution: New Research. Nova Science Pub Inc.

Mackova, M., Dowling, D.N., Macek, T. (2006): Phytoremediation and Rhizoremediation. Springer.

Terry, N. and Banuelos,G. (2000): Phytoremediation of contaminated soil and water. CRC Press, Boca Raton.

De Haan, F.A.M. and Visser – Reyneveld, M.I. (1996): Soil Pollution and Soil Protection. PHLO Wageningen Agricultural University.

Yaron, B., Calvet, R., Prost, R. (1996): Soil Pollution: Processes and Dynamics. Springer.

Number of contact hours **60**			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, presentations, seminars/workshops, work in small groups and mentoring.

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 40	**Final exam**	Points: 60	
Activity during lectures		Written	60	
Practical work		Oral		

Coloquia			
Tests	20		
Presentations	20		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: AQUATIC ECOLOGY AND MONITORING

Teacher (s): Zorka P. Dulić

Subject status: obligatory

ECTS: 4

Aims of the subject.

To enable students achieving:

Knowledge/understanding basic water properties and standard water quality parameters. Aquatic organisms and their interaction with the environment. Sources of water pollution and effects of pollutants on aquatic organisms. Bioindicators and biomonitoring. Methods for wastewater treatment.

Learning outcomes

After completion of the subject student should:

1. Recognize different groups of aquatic organisms
2. Analyze the level of water pollution in a water body
3. Apply knowledge in ecology of aquatic organisms
4. Use different methods in water quality assessment using chemical parameters
5. Use bioindicators and biomonitoring in water quality assessment
6. Apply biotic indexes in water quality assessment
7. Show readiness and capability for team work, critical thinking, presentation of acquired knowledge, evaluation of learning outcomes, evaluation of the teaching process
8. Show ability for professional development and progress in spoken and written communication

Content

Lectures: Introduction to aquatic ecology: basic water characteristics, aquatic organisms, structure and functioning of aquatic ecosystems. Standard water quality parameters. Causes and problems of water pollution: Sources and effects of water pollutants on aquatic organisms. Types of pollution in agriculture. Legislation. Introduction to monitoring systems. Indicator organisms. Pollution indices (Saprobien system). Data analysis and interpretation. Methods of wastewater treatment, focusing on biological treatments.

Practicals, field work: Introduction to water sampling equipment. Water sampling and analysis of physical, chemical and biological parameters. Laboratory techniques for biological analysis of water quality and data analysis. Students research work includes individual work on seminar and research papers.

Literature

Zorka Dulić (2010): Water pollution and remediation. Script. Austrian Development Cooperation, WUS Austria, Faculty of Agriculture, Belgrade, p.101.

Mirko Cvijan (2000): Ekologija zagađenih sredina, bioindikatori i monitoring sistem. Biološki fakultet, Beograd. 122 str.

Spellerberg Ian F. (2005): Monitoring Ecological Change. Cambridge University Press. Cambridge, p. 391.

Chapman, D. (1997): Water Quality Assessment: A guide to the use od biota, sediments and water in environmental monitoring. Taylor and Fransis, p. 626.

Dulić, Z., Poleksić, V., Rašković, B., Lakić, N., Marković, Z., Živić, Stanković, M. (2009): Assessment of the water quality of aquatic resources using biological methods. Water Treatment and Desalination 11, 264-274.

Poleksić, Vesna, Dulić Zorka, Živić Ivana, Rašković, B. (2007): Zoološki priručnik. Poljoprivredni fakultet. Beograd.149 str.

Selected papers from scientific journals on water quality, bioindicators, biomonitoring and wastewater treatment.

Number of contact hours 60			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, class discussions, interactive teaching, laboratory and field work, project creation and e-learning on the faculty's moodle platform

Evaluation of knowledge (maximum 100)			
Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures	10	Written	50
Practical work		Oral	
Coloquia			
Tests	10		
Seminars	30		
Other			

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: GIS AND PRECISION AGRICULTURE

Teacher (s): Goran R. Topisirović

Subject status: Obligatory

ECTS: 4

Aims of the subject

To enable students to achieve:

a. Knowledge and understanding of: possibilities and importance of application of GIS and precision agriculture (PA) principles, GIS and PA methods and techniques, basic GIS project working procedures, spatial data infrastructure and visualization, data bases structure, functional connecting of spatial data and corresponding data bases, possibilities of the results analysis and visual presentation.

b. Skills of: GIS applications in practice, selection and collecting attributes for data base, spatial data mapping and visualization, applications of principles of precision agriculture, GIS applications as a tools for precision agriculture.

Learning outcomes

At the end of the course students should show a thorough understanding and knowledge on possibilities and importance of application of GIS and precision agriculture (PA) principles, GIS and PA methods and techniques, basic GIS project working procedures, spatial data infrastructure and visualization, data bases structure, functional connecting of spatial data and corresponding data bases, possibilities of analysis and visual presentation of the results.

Content

Lectures: Introduction, Possibilities of application in agriculture, Systems and application of visual presentations, Data bases, Data analysis and results presentation

Practical work: Exercises, Discussions, Study and research work.

Literature

1. Pierce, F.J., Clay, D. 2007. GIS Applications in Agriculture. CRC Press. Taylor and Francis Group. Boca Raton, USA.

2. Brase, A.T. 2006. Precision Agriculture. Thomson Delmar Learning, Clifton Park New York, USA.

3. Burrough, A.P., McDonnel, A.R. 2000. Principles of Geographical Information Systems. Oxford University Press Inc., New York. USA.

4. Heywood, I., Cornelius, Sarah, Carver, S. 1998. An Introduction to Geographical Information Systems. Pearson Education Limited, Essex, England.

5. Longley, A.P., Goodchild, F.M., Maguire, J.D., Rhind, W.D. 2001. Geographic Information Systems and Science. John Wiley and Sons, Ltd. Chichester, England.

6. Lojo, A., Ponjavić, M. 2004. GIS u gazdovanju prirodnim resursima. Gauss d.o.o. Tuzla. Bosna i Hercegovina.

7. Чукалиев, О., Вукелић Шутоска, Марија, Арнаудова, Жулиета, Иванов, И. 2005. Геоматски техники во земјоделството. Медиана д.о.о. Скопје. Македонија.

8. Ormsby, T., Napoleon, E., Burke, R., Groess, Carolyn, Feaster, Laura. 2001. Getting to Know ArcGIS desktop. ESRI Press. Redlands, California. Recommended Internet sites

Number of contact hours: 60			Other
Lectures: 2	Practicals: 1	Study research work: 1	

Teaching methodology			
Oral presentations with interactive lectures, video presentations and simulations, problem based discussions			
Evaluation of knowledge (maximum 100)			
Pre-exam	Points: 50	**Final exam**	Points: 50
Activity during lectures	20	Written	50
Practical work		Oral	
Coloquia			
Tests			
Seminars	30		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ECOLOGICAL FARMING OF INVERTEBRATES

Teacher (s): Vesna D. Poleksić, Bojan S. Stojnić, Zorka P. Dulić, Božidar S. Rašković

Subject status: elective

ECTS: 4

Aims of the subject

To enable students to acquire knowledge and understanding of: the biology and ecology of edible snails, earthworms and aquatic invertebrates (Cladocera, Copepoda, Rotatoria, and freshwater crayfish); basis of heliculture, lumbiculture, and culture of aquatic invertebrates, regulation related to exploitation and/or technology of ecological farming of selected species of invertebrates by the use of modern methods of teaching and modern teaching resources (literature, internet, e-learning)

Learning outcomes

At the end of the module student should be able to:

1) Analyze biology of selected species of invertebrates suitable for farming
2) Apply knowledge on ecology, feeding, enemies, and diseases of invertebrates suitable for farming
3) Perform visual examination, species and age determination, dissection and/or microscopic examination, as well as sampling for analysis of invertebrates suitable for farming.
4) Classify and explain different systems of sustainable farming and processing of invertebrates that are safe for the environment
5) Prepare a feeding plan for cultured/farmed invertebrates suitable for farming.
6) Analyze existence and combat enemies of invertebrates suitable for farming
7) Adapt farming to the requirement of legislation concerning production, processing and trade of invertebrates suitable for farming
8) Shows readiness and capability for teamwork, critical thinking, presentation of acquired knowledge, estimation of the learning outcomes, and estimation of the teaching process.

Content

Lectures

Biology and taxonomy of invertebrates suitable for farming . Body organization. Reproduction. Ecology. Feeding and behavior. Natural enemies, farming diseases and protection.

Farming of invertebrates suitable for farming: farming systems. Selection of the area and sites, facilities organization and equipment on the farm. Broodstock (initial population) and standard litter establishment. Legislation and regulation. Production, processing and placement.

Practical

Species and age category classification of of invertebrates suitable for farming. Visual examination, dissection and sampling. Establishment and management of the farm. Exploitation and usage of invertebrates suitable for farming.

Literature

- Poleksić, Vesna, Stojnić Bojan, Dulić Zorka, Rašković, Božidar (2010): Ekološko gajenje

beskičmenjaka. Skripta. Austrian Development Cooperation, WUS Austrija, Poljoprivredni fakultet. Beograd.180 str.
- Vesna Poleksic (2000): Gajenje puzeva. Nolit. Beograd. 86 p.
- Poleksić, Vesna, Dulić Zorka, Živić Ivana, Rašković, B. (2012): Zoološki priručnik. Drugo dopunjeno izdanje. Poljoprivredni fakultet. Beograd.155 str.
- M. Mitrović (1995): Gajenje glista Lumbrikultura. KIZ „Centar“ Beograd.82 str.
- N. Rajković i B. Minić (1986): Gliste – humus. Biblioteka Unosna zanimanja. „Ekonomski biro“ Beograd. 111str.
- Poleksić, Vesna. i Dulić Stojanović, Z. (2003): Integralno gajenje beskičmenjaka: rečnog raka, dafnija, glista i drugih beskičmenjaka sa ribama – oblik ekološke i ekonomične proizvodnje. Seminar “Pastrmsko i šaransko ribarstvo”, zbornik predavanja 91-98. Poljoprivredni fakultet.
- Poleksić, V., Stojnić, B., Topisirović, G. (2004): Gajenje puževa u Srbiji – koncepti i prva iskustva Biotechnology in Animal Husbandry 20 (5-6). 333-340, 2004.Marković, Z., Poleksić, Vesna, Dulić-Stojanović, Zorka, Ljubić, Biljana. 2001. Possibilities of alternative aquaculture in Serbia, Ichthyologia, Vol. 33, No. 1, 1-10, 2001.
- Poleksic, V., Stojnic, B., Dajic-Stevanovic, Z., Topisirovic, G., and Zaric, V. (2005): Edible snail farming in Serbia: present and future. Savremena Poljoprivreda. 54, 1-2, 42-46.
- Internet sites concerning research and farming of aquatic plants, invertebrates and fish

Number of contact hours **60**			Other
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures and practical teaching/learning in the laboratories of the Faculty of Agriculture and on the experimental farm at the school estate Radmilovac. interactive classes, seminars, e/learning and communication with students on the learning platform of the Faculty (http://moodle.agrif.bg.ac.rs/)

Evaluation of knowledge (maximum 100)

Pre-exam	Points:	**Final exam**	Points:
Activity during lectures		Written	*40*
Practical work		Oral	
Coloquia			
Tests			
Seminars	30		
Other	30		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ECOLOGICAL AQUACULTURE

Teacher: Zoran Z. Marković

Subject status: Elective

ECTS: 5

Aims of the subject:

To enable students to get to know and understand: ecological aquaculture

Learning outcomes

Specific outcomes:

After successfull completion of the course it is expected that student will be able to use different systems of ecological aquaculture. Moreover, it is expected that the student will acquire: following knowledge/understanding of: Biology and ecology of cultivated aquatic organisms, basic of planning and design of fish farm, basic aquaculture, pollution sources in aquaculture, types of pollutants in aquaculture, application of appropriate technology and agrotechnical measures in aquaculture to reduce pollution, purification of water used in aquaculture, ecological production in aquaculture, effects of pollution from aquaculture on recipients.

Skills: sampling of water and aquatic organisms, dissection of aquatic organisms, preparation, labeling, and transport of samples to the laboratory for analysis, measurement of physical and chemical parameters in the water, determination of risk points – sources of pollution in aquaculture, proposing appropriate measures for protection of pollutants from aquaculture.

General outcomes:

Knowledge innovation and the integration of newly acquired knowledge into existing knowledge; Response on time and resolution of existing problems. The ability of professional training; The ability of anticipation and strategic planning; Adoption and use new skills together with a high level of spoken and written communication; ability and skills for teamwork; lifelong learning in a society based on modern forms of learning and training, the ability for critical thinking

Content

Lectures:

Biology and ecology of cultivated aquatic organisms (aquatic plants, invertebrates and vertebrates); Basics of planning and design of fish farms (investigations, planning and project design concepts for fish farms); Basics of aquaculture (cultivation of aquatic plants, invertebrates and vertebrates); Sources of pollution (inlet water; stocking; feeding, disinfection, tretment, drainage water); Type of pollutants (physical, chemical and biological pollutants), The application of appropriate technology and agrotechnical mesures in aquaculture to reduce pollution (controlled inlet water, water treatment, prevention in stocking fish farms, adequate feeding, cleaning and disinfection of objects on fish farms, drainage water); Purification of used water (mechanical, chemical, biological purification); Types of ecological production in aquaculture; the effect of pollution on recipient (the effect of physical, chemical and biological contamination) ;

Practical work:

Sampling of water and aquatic organisms: dissection ofaquatic organisms; preparation, labeling, and transport of samples to the laboratory for analysis, measurement of physical and chemical parameters of the water; determination of risk points – sources of pollution in aquaculture

Literature

Marković, Z., Mitrović-Tutundžić, V. (2003) Fish farming, in Serbian. The Foundation Andrejević, Belgrade, 137 p.

Marković, Z., Mitrović-Tutundžić, V. (2003) Fishery – script

Treer T., Safner R., Aničić I., Lovrinov M. (1995). Fishery, Nakladni zavod, Globus, Zagreb, 463 p.

Spellerberg, I. (2005): Monitoring Ecological Change. 2nd Edition. Cambridge University Press. 409p

Parker R O, Parker PH D (2000): Aquaculture Science E2. Thomson Delmar Learning. 640p

Lloyd, R. (1992): Pollution and Freshwater Fish. Fishing New Books, Blackwell Scientific Publications Ltd.

Greenberg, A. et al. (1985) Standard methods for the examination of water and wastewater, American Public Health Association, Washington, D.C.

Marković, Z. (2010) Carp, growing in ponds and cages. Prof. Dr Zoran Marković,152 p.

Web site on the topic of ecological aquaculture

Number of contact hours: 60				Other
Lectures: 2	Practicals: 1	Other forms of teaching: eLearning, field reainind, seminars	SIR:1	

Teaching methodology

Lectures, practical work in laboratory and in the Centar for fishery and applied hydrobiology, seminars, e-learning

Evaluation of knowledge (maximal 100)

Pre-exam	**Points: 40**	Final exam	**Points: 60**
Activity during lectures	**10**	Written	**60**
Practical work	**10**	Oral	
		.....	
Seminars	**20**		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: WASTEWATER TREATMENT

Teacher(s): Vera B. Raičević

Subject status: elective

ECTS: 4

Aims of the subject.

To provide students with:

a) knowledge/understanding about treatment of wastewater from agriculture and food industry based on biotechnological processes, understanding of wastewater influence on recipient as well as understanding of complex interacions of microorganisms in the activated sludge
b) Skills related to monitoring and quality assessment of wastewater treatment facility and acquiring scientific knowledge in the area of agroindustrial wastewater management

Learning outcomes

At the end of the subject, student should be able to define agroindustrial wastewater types and to predict their influenc on recipients, to evaluate the quality of activated sludge, to analyze posibilities of microorganisms aplications in wastewater treatment using examples of good practice, to independently decide about the need and level of wastewater treatment, to present acquired knowledge individually or in group, to develop the ability of critical thinking, evaluation of learning process and learning outcomes.

Content

Lectures: The nature and composition of wastewaters from agriculture and food industry, autopurification of surface water, eutrofication – causes and consequences, modes of wastewater treatments, microbial communities in activated sludge, aerobic and anaerobic agroindustrial wastewater treatments, anaerobic digestion, legislation in water protection.

Practicals: sampling of wastewater and activated sludge, analysis of activated sludge, examples of good practice in the wastewater treatments.

Literature:

Number of contact hours 60			Other:
Lectures: 2	Practicals: 1	SIR: 1	

Teaching methodology

Lectures, case study, interactive classes, practicals, case study, e-learning

Evaluation of knowledge (maximum 100)

Activity during lectures	Points 60	Final exam	Points 40
Tests	20	written	40
Practicals	20	oral	
Poster/presentaion	20		

Study programme: Environmental protection in agriculture

Type of study programme: Master academic studies

Subject: ENVIRONMENTAL EPIZOOTIOLOGY

Teacher (s): Slavča V. Hristov, Branislav M. Stanković

Subject status: elective

ECTS: 4

Aims of the subject:

The subject enables students to acquire knowledge and skills in relation to sources of biological agents (pathogens), transmission routes, and modes of infection of animals within the same and different species, ways of transmission of zoonotic agents, biosecurity on farms and preventing and combating infectious and parasitic diseases.

Learning outcomes:

Upon completion of this course, the student should be able to:

1. define the terms about the sources and routes of transmission of biological agents;

2. describe the basic methodology of epidemiology and environmental protection, particularly those relating to the investigation of the influence of air, water and land pollution;
3. critically evaluate and interpret scientific results related to the impact of potential hazards to health;
4. review the role of the environment in the emerging and spreading of pathogens in populations of the same and different species of animals, as well as in the emerging and spreading of zoonoses;
5. depending on the environmental conditions and other factors, suggest measures for monitoring and control of the spread of biological agents, and to evaluate the effectiveness of the proposed measures;
6. plan, implement and interpret initial research in solving complex problems related epidemiology and environmental protection including animal health hazards of concern during natural disasters.

Content

Theoretical study:

1. a primary, secondary and the intermediate sources of the biological agents;
2. routes of transmission of the biological agents;
3. survival of the biological agents in the environment and infection of the animals within the same and different species;
4. mechanisms of action of biological agents;
5. factors of outbreaks, surveillance and control of emergence and the re-emergence of bacterial, viral, parasitic diseases of animals and zoonoses;

6 biosecurity on farms, monitoring and measures to prevent the occurrence and control of infectious and parasitic diseases including animal health hazards of concern during natural disasters.

Practical training:

For each chapter of the theoretical studies will be organized appropriate practical workshop. Preparation of seminar papers and articles related to the subject will be organized in the form of mentoring.

Literature

1. Hristov S. 2002: Zoohigijena. Poljoprivredni fakultet, Univerzitet u Beogradu. Beograd. [*Hristov S. 2002: Animal hygiene. Faculty of Agriculture, University of Belgrade, Belgrade*] 2. Seimenis A., Capacity building for zoonotic and foodborne diseases in the Mediterranean and Middle East regions (an intersectoral WHO/MZCP proposed strategy) International Journal of Antimicrobial Agents 36S (2010) S75–S79. 3. WHO. The control of neglected zoonotic diseases. A route for poverty alleviation. Report of a joint WHO/DFID-AHP meeting with the participation of FAO and OIE. Geneva: World Health Organization; 2006. WHO/SDE/FOS/2006. 4. FAO/WHO. Hazard characterization for pathogens in food and water. In: Microbiological Risk Assessment Series No. 3. Rome: Food and Agriculture Organization of the United Nations and Geneva: World Health Organization; 2003.King LJ. Emerging and re-emerging zoonotic diseases: challenges and opportunities. In: OIE 72nd General Session. 2004. 5. Blancou J., Chomel B., Belotto A., Meslin F., Emerging or re-emerging bacterial zoonoses: factors of emergence, surveillance and control. Veterinary Research, BioMed Central, 2005, 36 (3), pp.507-522. <10.1051/vetres:2005008>. <hal-00902977> 6. Noordhuizen J., Frankena K. Epidemiology and quality assurance: applications at farm level. Preventive Veterinary Medicine 39 (1999) 93-110. 7. Blaha Th. Epidemiology and quality assurance application to food safety. Preventive Veterinary Medicine 39 (1999) 81-92. 8. Armour, J., 1980. The epidemiology of helminth disease in farm animals. *Vet. Parasitol.*, 6: 7-46. 9. Noordhuizen J., Metz J. Quality control on dairy farms with emphasis on public health, food safety, animal health and welfare. Livestock Production Science 94 (2005) 51–59. 10. Pearce N., Douw J., Research at the interface between human and veterinary health. Preventive Veterinary Medicine 111 (2013) 187– 193. 11. *Alemayehu* **A.,** Review on Emerging and Re-Emerging Bacterial Zoonotic Diseases American-Eurasian Journal of Scientific Research 7 (4): 176-186, 2012. 12. Kahn, L. H., 2006. Confronting zoonoses, linking human and veterinary medicine. Emerging Infectious Diseases 12 (4), 556-561. 13. EFSA/ECDC (European Food Safety Authority/European Centre for Disease Prevention and Control), 2012. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food - borne outbreaks in 2010. EFSA Journal, 10(3):2597, 442 pp. 14. Valčić M. 1998. Opšta epizootiologija, Univerzitet u Beogradu, Fakultet Veterinarske Medicine. [*Valčić M. 1998. General epizootiology,*

University of Belgrade, Faculty of Veterinary Medicine] 15. Valčić M. 2004. Specijalna epizootiologija, Veterinarska Komora Srbije, Beograd [*Valčić M. 2004. Special epizootiology, Veterinary Chamber of Serbia, Belgrade*].

Chosen papers from journals that consider relationship between epizootiology, epidemiology and ecology.

Number of contact hours		**60**	Other: -
Lectures: 2	Practicals: 1	SIR:1	

Teaching methodology

Lectures combined with interactive classes, seminars, consultation and mentoring students lecture, class discussions, laboratory and field work, small group work, project creation, and electronic discussion (email and website).

Evaluation of knowledge (maximum 100)

Pre-exam	Points: 70	**Final exam**	Points: 30
Activity during lectures		Written	30
Practical work		Oral	
Coloquia			
Tests	30		
Seminars	40		
Other			

Study programme: Environmental protection in agriculture

Type of studies: Master studies

Practical work

ECTS: 2

Aims

Subject has to enable student achieving creativity and specific practical skills necessary for the profession. Acquitance with the function, organisation and technology of the work at the company, institution, governmental and non-governmental organisations working with envirronmental protection in agriculture.

Outcomes

Student will be able to recognise the sources of pollution in agiricultural production and to protect and improve natural resources.

Content

Practical work will be realised in the adequate institutions dealing with environmental protection in agriculture: local comunities, ministries, companies, consultative offices, etc. Students will take part in expert analysis of the measures for monitoring and prevention pollution deriving from agriculture.

Methods

Practical work will be done in an interactive way by direct communication with experts on the site. Students will be obliged to participate in the activities, run diaries, do seminars.

Evaluation of the practical work (max 100 points)

Presentation of the seminar 50 points
Diary 50 points

Study programme: Environmental protection in agriculture

Type and level of studies: Master studies, second level

ECTS: 8

Preconditions: All exams from the study programme passed

Goals of the master thesis:

The major goal of the master thesis is to provide student with competences to individully run research in any aspect of environmental pollution from agriculture, apply relevant methods of case stydy, literature and formulates conclusions with recomendations for solving the problem. Student also has to learn how to present data both in writing and oraly.

Outcomes:
After comleting master thesis student should demonstrate skills in methodologies of research, analysing and sythetising data obtained, oral and written communication with mentor and other teachers and collegues, use of IT- communication technologies and data presentation.
After defending master thesis student gets diploma degree of engeneer - master of environmental protection.

General content:
Master thesis is a research work in which student gets acquainted with the research methodology in the particular area of environmental protection in agriculture. Master thesis has the following chapters: Introduction, Literature review, methods, Results and discussion, Conclusions, Literature.

Methods:
Students will be given guidance by mentor on how to use relevant experimental methods according to the topic of the master work, as well as how to analyse and present data. Defence is organised as a public event in front of 2 members of the commision.

Mark (max. 100 points)			
Pre-examination activities	50	Defence	50
Collecting and analysing data	10	Presentation	30
Research	20	Answer to questions of the members of commision	20
Writing	20		