

Predmet: Analitika organskih in anorganskih onesnažil v ekosistemi
Course title: Analysis of organic and inorganic pollutants in ecosystems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	10	15	/	10	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Marjan Veber

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.

Graduates of uniform master programmes and 2nd cycle programmes of biomedical, biotechnical, mathematical and natural sciences

Vsebina: _____ **Content (Syllabus outline):** _____

Koncepti analitike sledov in mikroanalize značilnosti in zahteve; praktični problemi v analitiki sledov; pomen in vpliv posameznih stopenj analiznega postopka na rezultate kemijskih analiz; predkoncentriranje in izolacija analitov iz tekočih, plinastih in trdnih vzorcev.

Pregled metod atomske absorpcijske (AAS) in emisijske spektrometrije (OES) ter elementne masne spektrometrije (ICP-MS) in njihova uporaba za določevanje anorganskih onesnažil.

Osnove masne spektrometrije (MS).

Principi kromatografskih separacij, plinska kromatografija (GC) tekočinska kromatografija visoke ločljivosti (HPLC), kapilarna elektroforeza (CE). Primeri uporabe kromatografskih metod za določanje organskih onesnažil v realnih vzorcih.

Sklopljene metode v analitiki okoljskih vzorcev - speciacijska analitika.;
Primeri določitve značilnih onesnažil v zraku, vodi, zemlji in bioloških vzorcih.

Concepts in trace analysis and micro analysis; characteristics and requirements, practical problems in trace analysis, importance of different steps of analytical procedure and their impact on results of chemical analysis, preconcentration and isolation of analytes from gaseous, liquid and solid samples.

Survey of methods of atomic spectrometry (atomic absorption -AAS and emission spectrometry -OES), elemental mass spectrometry (ICP-MS) and their application for the determination of inorganic pollutants.

Principles of mass spectrometry (MS)

Principles of chromatographic separations - gas chromatography (GC), high pressure liquid chromatography (HPLC), capillary electrophoresis (CE). Examples of the application of chromatographic methods for the determination of organic pollutants in real samples.

Hyphenated techniques in analysis of environmental samples- speciation analysis. Some examples of determination of typical pollutants in air, water soil and biological samples.

Temeljni literatura in viri / Readings:

Environmental Analytical Chemistry, Ed. F.W. Fifield, P.J. Haines, Blackwell Science, 2000, Izbrana poglavja/Selected chapters: D. A. Skoog, , F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, Thomson, 2007.

članki v znanstveni in strokovni periodiki s področja analitike kemije,

papers in scientific journals related to analytical chemistry

Cilji in kompetence:

Pridobiti znanja, ki so potrebna za razumevanje analiznih metod in postopkov, ki jih uporabljamo za določevanje organskih in anorganskih onesnažil v okoljskih vzorcih.

Objectives and competences:

To obtain knowledge necessary for the understanding of analytical methods and procedures which are used for the determination of organic and inorganic pollutants in environmental samples.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:

Poznavanje in razumevanje značilnosti in lastnosti modernih analiznih pristopov za določevanje sledov anorganskih in organskih spojin v okoljskih vzorcih bo omogočilo izbiro ustreznega analiznega pristopa pri reševanju konkretnih analiznih problemov ter kritično oceno in vrednotenje analiznih rezultatov.

Knowledge and understanding:

The knowledge and understanding of characteristics of modern analytical methods for the determination of traces of inorganic and organic pollutants in environmental samples will enable selection or suggestion for the proper analytical approach for the solution of practical analytical problems and critical evaluation of analytical results.

Metode poučevanja in učenja:

Predavanja s seminarjem, priprava seminarske naloge na osnovi pregleda literature za izbrano tematiko.
Laboratorijske vaje obravnavajo praktični primer analiznega postopka.
Individualni študij s konzultacijami.

Learning and teaching methods:

Lectures with seminar, seminar thesis (selected topic based on the literature survey),
Laboratory exercise deals with an example of practical analytical procedure,
Individual study with consultation

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Vsebina in predstavitev seminarske naloge	30	Content and presentation of the seminar thesis
Ustni izpit	70	Oral exam

Reference nosilca / izvajalcev / Lecturer's references:

- ŠEBEZ, Bine, OGOREVC, Božidar, HOČEVAR, Samo B., VEBER, Marjan. Functioning of antimony film electrode in acid media under cyclic and anodic stripping voltammetry conditions. *Analytica chimica acta*, ISSN 0003-2670. [Print ed.], 2013, vol. 785, no. 1, str. 43-49, ilustr., doi: [10.1016/j.aca.2013.04.051](https://doi.org/10.1016/j.aca.2013.04.051). [COBISS.SI-ID [36731141](https://www.cobiss.si/urn:nbn:si:coi:36731141)],
- CAMILLERI, J., KRALJ, Polonca, VEBER, Marjan, SINAGRA, E. Characterization and analyses of acid-extractable and leached trace elements in dental cements. *International endodontic journal*, ISSN 0143-2885, 2012, vol. 45, no. 8, str. 737-743, doi: [10.1111/j.1365-2591.2012.02027.x](https://doi.org/10.1111/j.1365-2591.2012.02027.x). [COBISS.SI-ID [36005893](https://www.cobiss.si/urn:nbn:si:coi:36005893)]
- ARH, Gregor, KLASINC, Leo, VEBER, Marjan, POMPE, Matevž. Calibration of mass selective detector in non-target analysis of volatile organic compounds in the air. *Journal of chromatography. A*, ISSN 0021-9673, 2011, vol. 1218, issue 11, str. 1538-1543. [COBISS.SI-ID [1448796](https://www.cobiss.si/urn:nbn:si:coi:1448796)],
- KITANOVSKI, Zoran, GRGIĆ, Irena, VEBER, Marjan. Characterization of carboxylic acids in atmospheric aerosols using hydrophilic interaction liquid chromatography tandem mass

spectrometry. *Journal of chromatography. A*, ISSN 0021-9673, 2011, vol. 1218, issue 28, str. 4417-4425, doi: [10.1016/j.chroma.2011.05.020](https://doi.org/10.1016/j.chroma.2011.05.020). [COBISS.SI-ID [4657946](#)]

5. BEESTON, Michael Philip, POHAR, Andrej, ELTEREN, Johannes Teun van, PLAZL, Igor, ŠLEJKOVEC, Zdenka, VEBER, Marjan, GLASS, Hylke J. Assessment of physical leaching processes of some elements in soil upon ingestion by continuous leaching and modeling. *Environmental science & technology*, ISSN 0013-936X. [Print ed.], 2010, vol. 44, issue 16, str. 6242-6248, doi: [10.1021/es1006725](https://doi.org/10.1021/es1006725). [COBISS.SI-ID [4448538](#)],

6. ARH, Gregor, FRAS, Simona, POLAK, Tomaž, ŽLENDER, Božidar, VEBER, Marjan, POMPE, Matevž. Modification of method for the determination of organochlorine pesticides in meat samples. *Acta chimica slovenica*, ISSN 1318-0207. [Tiskana izd.], 2009, vol. 56, no. 4, str. 920-926. [COBISS.SI-ID [3736952](#)],

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Biometeorološko modeliranje
Course title:	Biometeorological modeling

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	10	10	/	15	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Lučka Kajfež Bogataj

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.

Vsebina: **Content (Syllabus outline):**

Interakcije rastilna-ekositem-atmosfera

Opredelitev pomembnih aspektov s področij mikrometeorologije, fizike tal, ekologije in biogeokemije uporabljanih v biometeorologiji. Viri podatkov, merjenja in inštrumenti v biometeoroloških študijah.

Izmenjava mase in energije v terestričnih ekosistemih. Modeliranje turbulentnih gibanj in difuzije v rastlinski odeji, prenosa gibalne količine in sevanja. Matematični modeli za opis fotosinteze, dihanja, stomatalne regulacije.

Modeli vodnega cikla. Kvantificiranje intercepcije in odtoka padavin. Metode za računanje evapotranspiracije (aerodinamične in statistične). Modeli za trajanje omočenosti lista.

Modeli razvoja in rasti poljščin. Potrebne parametrizacije rastlinske odeje. Preprosti statistični modeli v agrometeorologiji. Dinamični modeli in pogonske spremeljivke v njih. Generični modeli.

Fenološko modeliranje. Statistični modeli v agrofenoologiji. Verifikacija modelov in njihova občutljivost. Učinki podnebnih sprememb na fenološke cikle rastlin in živali.

Nehotene spremembe atmosferskega dela okolja – vloga človeka. Onesnaženje zraka, klimatske spremembe, ozonska luknja, odnos globalni-lokalni okoljski problemi. Slabšanje razmer v okolju skupaj z deforestacijo in dezertifikacijo.

Biometeorološki modeli in urbano okolje, Spremembe masnih in energijskih tokov v urbaniziranem prostoru. Klima zaprtih prostorov in povezava s počutjem ter zdravjem človeka. Vpliv klime na prostorsko planiranje in arhitekturo mest.

Plant-Ecosystem-Atmosphere Interactions

relevant aspects of micrometeorology, soil physics, physiological ecology, ecosystem ecology and biogeochemistry. Instrumentation and measurements, associated with the study of plant biometeorology.

Water and energy exchange of ecosystems. Modeling biophysical processes (e.g. turbulence and diffusion, momentum and photon transfer through vegetation, evaporation, photosynthesis, plant and soil respiration, and stomatal mechanics)

Water cycle models. Quantifying Interception of precipitation, outflows on stems and trunks. Methods for evapotranspiration calculation – aero dynamical, radiation, empirical. Modelling leaf wetness duration.

Crop models. Parameterization of plant canopy in models. Simple statistical and dynamical agro meteorological models. Meteorological driving variables and parameters.

Terrestrial phenological modeling. Statistical, causal and dynamical models. Verification, calibration, sensitivity of models. The effects of climate change on plant life cycle events.

The inadvertent modification of the atmosphere by living systems, especially human (studies of pollution, climate change impacts, changes to atmospheric amenity, and the processes of deterioration of landscape including deforestation and desertification)

Biometeorological models of the built environment The intentional modifications of natural energy and matter flows within urban areas, and indoor climate constructions. Modeling indoor climate, urban design, and architecture.

Temeljni literatura in viri / Readings:

1. Monteith J.L., Unsworth M.H. 2013. Principles of Environmental Physics: Plants, Animals, and the Atmosphere. Fourth Edition, Elsevier Ltd: Oxford, Amsterdam, Waltham. ISBN: 978-0-12-386910-4, 401 str.
2. Bonan G.B. 2008. Ecological Climatology, Concepts and Applications. Second Edition. Cambridge University Press, Cambridge. ISBN: 978-0-521-87221-8, 550 str.
3. Lutgens F.K., Tarbuck E.J. 2011. Foundations of Earth Science. Sixth Edition. Pearson Education Inc., New Jersey, ISBN: 978-0-321-71441-1, 506 str.
4. Oke T.R. Boundary layer climates. 1987. Second Edition. Methuen: London, New York, ISBN: 0-416-04432-8, 435 str.

5. Revijalni članki s področja in tekoča periodika.

Cilji in kompetence:

- Pridobitev poglobljenega znanja o vplivu vrena in klime na žive organizme na podlagi fizikalnega pristopa.
- Modeliranje procesov, ki vplivajo na rast in razvoj živih organizmov in kvantativne metode za oceno vpliva podnebja na agroekosisteme.

Objectives and competences:

- Understanding of weather and climate impact on living organisms and physical factors that influence climate.
- Knowledge of approaches to model processes that influence agroecosystems and methods to quantify vegetation-climate interactions.

Predvideni študijski rezultati:

Znanje in razumevanje
Podrobnejši vpogled v interakcije med atmosferskim delom okolja in živimi organizmi (vegetacija, fauna, človek)
Uporaba: Uporaba fizikalnih zakonov in preprostih modelov za razumevanje biometeoroloških procesov
Refleksija: Povezava interakcije med atmosfero, človeškim delovanjem s fizikalnimi zakoni.

Intended learning outcomes:

Knowledge and understanding:
Deeper understanding of the interactions between atmospheric processes and living organisms (plants, animals, and humans)..
Applicability: The use of basic physical laws and simple models to understand biometeorological processes
Reflection: Interactions between atmosphere and organisms and their description by physical laws.

Metode poučevanja in učenja:

Predavanja, vaje, seminar ob uporabi informacij o stanju klimatskega sistema iz različnih virov

Learning and teaching methods:

Lectures, tutorials, seminars using information on state of the climate from different sources

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Opravljeni seminarji iz vaj	40%	Problem-solving seminars,
predstavitev seminarja, ustni izpit iz teorije.	60%	Seminar presentation, theoretical examination.

Reference nosilca / izvajalcev / Lecturer's references:

LUČKA KAJFEŽ-BOGATAJ

- KURNIK, Blaž, LOUWAGIE, Geertrui, ERHARD, Markus, CEGLAR, Andrej, KAJFEŽ-

BOGATAJ, Lučka. Analysing seasonal differences between a soil water balance model and in situ soil moisture measurements at nine locations across Europe. *Environmental modeling & assessment*, 2014, vol. 19, 1:19-34.[COBISS.SI-ID 7623801]

- TAJNIK, Tanja, KAJFEŽ-BOGATAJ, Lučka, JURAČ, Egon, RIBARIČ-LASNIK, Cvetka, LIKAR, Jakob, DEBELAK, Brane.2013. Investigation of adsorption properties of geological materials for CO2 storage. *International journal of energy research*, ISSN 0363-907X, 2013, vol. 37, issue 8: 952-958. [COBISS.SI-ID 7007097]
- ČREPINŠEK, Zalika, ŠTAMPAR, Franci, KAJFEŽ-BOGATAJ, Lučka, SOLAR, Anita. 2012. The response of *Corylus avellana* L. phenology to rising temperature in north-eastern Slovenia. *International journal of biometeorology*, vol. 56, no. 4: 681-694,[COBISS.SI-ID 6758265]
- BERGANT, Klemen, KAJFEŽ-BOGATAJ, Lučka, TRDAN, Stanislav.2006 Uncertainties in modelling of climate change impact in future : an example of onion thrips (*Thrips tabaci* Lindeman) in Slovenia. *Ecological modelling*, vol. 194, no. 1-3: 244-255. [COBISS.SI-ID 4481913]
- ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka, BERGANT, Klemen. Modelling of weather variability effect on fitophenology. *Ecological modelling*, vol. 194, no. 1-3: 256-265. [COBISS.SI-ID 4467065]
- BERGANT, K., TRDAN, S., ŽNIDARČIČ, D., ČREPINŠEK, Zalika, KAJFEŽ-BOGATAJ, Lučka.2005. Impact of climate change on developmental dynamics of *Thrips tabaci* (Thysanoptera: Thripidae): can it be quantified?. *Environmental entomology*, vol. 34, no. 4:755-766. [COBISS.SI-ID 4286585]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Biotske interakcije v agroekosistemi in varstvo rastlin
Course title:	Biotic interactions in agroecosystems and plant protection

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	40	-	-	10	180	10

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Stanislav Trdan

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij.

General conditions for enrolment in doctoral studies.

Vsebina: _____

Content (Syllabus outline): _____

Inter- in intraspecifični odnosi v agroekosistemih. Interakcije med rastlinami, njihovimi škodljivci (žuželke, pršice, ogorčice) ali fitopatogenimi organizmi (glive, bakterije, virusi, viroidi, fitoplazme) in koristnimi organizmi v agroekosistemu. Škodljivčeva izbira gostitelja. Vpliv biotičnega stresa na izpad pridelka. Infekcijski procesi pri fitopatogenih organizmih. Vplivanje patogenov na metabolne procese gostiteljskih rastlin. Obrambne reakcije rastlin proti patogenom. Konstitutivna in inducibilna odpornost. Specifičnost odnosov med gostiteljem in parazitom. Poljsko in laboratorijsko določevanje odpornosti škodljivih organizmov. Neciljno delovanje fitofarmaceutskih sredstev in biotičnih agensov. Vmesni posevki, privabilni posevki, prekrivni posevki, antagonistične rastline, antifidanti, naravna fitofarmaceutska sredstva: koncepti in mehanizmi delovanja. Praktična uporaba biopesticidov (glive, bakterije, virusi). Laboratorijsko gojenje škodljivih in koristnih žuželk in drugih živali ter mikroorganizmov. Laboratorijsko in poljsko preizkušanje biopesticidov in biotičnih agensov (plenilske in parazitoidne žuželke, plenilske pršice, entomopatogene ogorčice).

Inter- and intraspecific relationships in agroecosystems. Interactions between plants, their pests (insects, mites, nematodes) or phytopathogenic organisms (fungi, bacteria, viruses, viroids, phytoplasmas) and beneficial organisms in agroecosystems. Host-plant selection by the pest. Influence of biotic stress on the yield loss. Infection processes in phytopathogenic organisms. Influence of pathogens on metabolic processes of the host plants. Plant defence reactions against pathogens. Constitutive and inducible resistance. Specificity of relationships between hosts and their parasites. Field and laboratory evaluation of pest organisms resistance. Non-target effect of pesticides and biological control agents. Intercrops, trap crops, cover crops, antagonistic plants, antifeedants, natural plant protection products: concepts and mechanisms. Practical use of biopesticides (fungi, bacteria, viruses). Laboratory rearing of harmful and beneficial insects and other animals and microorganisms. Laboratory and field evaluation of biopesticides and biological control agents (predatory insects, parasitoids, predatory mites, entomopathogenic nematodes) efficacy.

Temeljni literatura in viri / Readings:

Agrios, G. 2005. Selective chapters from book Plant pathology, 5th edition. Elsevier Academic Press: 922 str., ISBN 0-12-044565-4.
Dermastia, M. 2007. Pogled v rastline. Ljubljana, Nacionalni inštitut za biologijo: 237 str., ISBN 978-961-90363-7-2.
Gillings M. 2004. Plant Microbiology, BIOS Scientific Publ: 390 str.; ISBN-10: 1859962246.
Perry, R.N., Moens, M. 2006. Plant nematology. CABI Publishing, Wallingford: 447 str., ISBN 1845930568.
Peterson, R.K.D., Higley, L.G. 2000. Biotic stress and yield loss. CRC Press, Boca Raton, London, New York, Washington: 261 str., ISBN 0-8493-1145-4.
Pimentel, D. 2002. Encyclopedia od pest management. Taylor & Francis, Boca Raton, London, New York, Singapore: 929 str., ISBN 0-8247-0632-3.
Prell, H.H., Day, P.R. 2000. Plant fungal pathogen interaction – A classical and molecular view. Springer-Verlag, Berlin etc., 214 str. ISBN 3-540-66727-X.
van Lenteren, 2003. Quality control and production of biological control agents. CABI Publishing, Wallingford: 327 str., ISBN 0-85199-688-4.
in
revijalni članki s področja, tekoča periodika, druga učna gradiva...

Cilji in kompetence:

Objectives and competences:

Temeljni izobraževalni cilj je poglobitev znanja na področju inter- in intraspecifičnih odnosov med živimi organizmi v agroekosistemih ter načinov njihovega podnebnim in geografskih razmeram Slovenije prilagojenega zatiranja, s poudarkom na okolju in človeku sprejemljivejših metodah.

Fundamental objective of the course is deepening the knowledge in the fields of inter- and intraspecific relationships between living organisms in agroecosystems and the knowledge about the methods of their control, which are adapted to Slovenian climate and geographical conditions, with special emphasis on environmentally and human acceptable methods.

Predvideni študijski rezultati:

Znanje in razumevanje:

Predviden študijski rezultat je kandidatovo razumevanje odnosov med živimi organizmi (zlasti na relaciji rastline – škodljivi organizmi – koristni organizmi) v agroekosistemih.

Intended learning outcomes:

Knowledge and understanding:

Intended learning outcome is to qualify the candidate to understand the relationships between living organisms (especially in relation plants – harmful organisms – beneficial organisms) in agroecosystems.

Metode poučevanja in učenja:

Predavanja, seminarji, konzultacije, samostojno delo.

Learning and teaching methods:

Lectures, seminars, consultations, individual work.

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

- pisni izpit
- samostojno delo študenta

70 %
30 %

- written exam
- individual work of the student

Pogoja za opravljanje študijskih obveznosti – pisnega izpita:
- zagovor seminarja

Conditions for performing study obligations - written exam:
- seminar performed

Reference nosilca / Lecturer's references:

TRDAN STANISLAV

BOHINC, Tanja, **TRDAN, Stanislav**. Sowing mixtures of Brassica trap crops is recommended to reduce *Phyllotreta* beetles injury to cabbage. *Acta Agric. Scand., B Soil Plant. Sci.*, 2013, vol. 63, issue 4, str. 297-303 [COBISS.SI-ID 7346041].

BOHINC, Tanja, HRASTAR, Robert, KOŠIR, Iztok Jože, **TRDAN, Stanislav**. Association between

glucosinolate concentration and injuries caused by cabbage stink bugs *Eurydema* spp. (Heteroptera: Pentatomidae) on different Brassicas. *Acta Sci., Agron. (Impr.)*, 2013, vol. 35, no. 1, str. 1-8 [COBISS.SI-ID 7393657].

LAZNIK, Žiga, **TRDAN, Stanislav**. An investigation on the chemotactic responses of different entomopathogenic nematode strains to mechanically damaged maize root volatile compounds. *Exp. parasitol.*, 2013, vol. 134, issue 3, str. 349-355 [COBISS.SI-ID 7525241].

ŽEŽLINA, Ivan, ŠKVARČ, Andreja, BOHINC, Tanja, **TRDAN, Stanislav**. Testing the efficacy of single applications of five insecticides against *Scaphoideus titanus* on common grapevines. *Int. j. pest manag.*, 2013, vol. 59, no. 1, str. 1-9 [COBISS.SI-ID 7363705].

BOHINC, Tanja, VAYIAS, Bill J., BARTOL, Tomaž, **TRDAN, Stanislav**. Assessment of insecticidal efficacy of diatomaceous earth and powders of common lavender and field horsetail against bean weevil adults. *Neotropical entomology*, 2013, vol. 42, iss. 6, str. 642-648 [COBISS.SI-ID 7728761].

LAZNIK, Žiga, **TRDAN, Stanislav**. The influence of insecticides on the viability of entomopathogenic nematodes (Rhabditida: Steinernematidae and Heterorhabditidae) under laboratory conditions. *Pest manag. sci.*. [Print ed.], 2013, v tisku [COBISS.SI-ID 7651705].

LAZNIK, Žiga, VIDRIH, Matej, **TRDAN, Stanislav**. The effects of different fungicides on the viability of entomopathogenic nematodes *Steinernema feltiae* (Filipjev), *S. carpocapsae* Weiser, and *Heterorhabditis downesi* Stock, Griffin & Burnell (Nematoda: Rhabditida) under laboratory condition. *Chil. j. agric. res. (Print)*, 2012, vol. 72, no. 1, str. 62-67 [COBISS.SI-ID 7069049].

ROJHT, Helena, KOŠIR, Iztok Jože, **TRDAN, Stanislav**. Chemical analysis of three herbal extracts and observation of their activity against adults of *Acanthoscelides obtectus* and *Leptinotarsa decemlineata* using a video tracking system. *Journal of plant diseases and protection*. [Print ed.], 2012, vol. 119, no. 2, str. 59-67 [COBISS.SI-ID 7158649].

ROJHT, Helena, HORVAT, Aleksander, ATHANASSIOU, Christos G., VAYIAS, Bill J., TOMANOVIĆ, Željko, **TRDAN, Stanislav**. Impact of geochemical composition of diatomaceous earth on its insecticidal activity against adults of *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae). *Journal of pest science*, 2010, vol. 83, no. 4, str. 429-436 [COBISS.SI-ID 6320761].

LAZNIK, Žiga, TÓTH, Tímea, LAKATOS, Tamás, VIDRIH, Matej, **TRDAN, Stanislav**. Control of the Colorado potato beetle (*Leptinotarsa decemlineata* [Say]) on potato under field conditions: a comparison of the efficacy of foliar application of two strains of *Steinernema feltiae* (Filipjev) and spraying with thiametoxam. *Journal of plant diseases and protection*. [Print ed.], 2010, vol. 117, no. 3, str. 129-135 [COBISS.SI-ID 6308985].

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Determinacija rastlinskih škodljivcev in bolezni
Course title:	Determination of plant pests and diseases

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	25	-	-	10	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Stanislav Trdan

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Splošni pogoji za vpis na doktorski študij.	General conditions for enrolment in doctoral studies.

Vsebina: **Content (Syllabus outline):**

Detekcijske metode škodljivih organizmov. Diagnostične metode za določevanje vrstne pripadnosti fitopatogenih organizmov: tradicionalne tehnike (simptomatika, morfološko anatomske, selektivni mediji); biokemične tehnike (substratni metabolizem, profil maščobnih kislin, analiza proteinov, analiza nukleinskih kislin) tehnike, molekulska detekcija. Praktični prikaz izolacije in determinacije fitopatogenih gliv in virusov (različne tehnike) iz posameznih rastlinskih delov in substratov. Kochovi postulati v fitopatologiji – potrjevanje povzročitelja bolezni. Načini vzorčenja in hranjenja škodljivih organizmov (s poudarkom na žuželkah in ogorčicah) in mikrobov pred determinacijo (maceracija, dehidracija, koncentracija, RNA/DNA ekstrakcija...) in po njej (priprava preparatov...). Uporaba morfoloških determinacijskih ključev izbranih skupin škodljivih žuželk in fitoparazitskih ogorčic: opisni, opisno-slikovni, slikovni morfološki ključiči. Telesni deli škodljivih organizmov (glav, oprsje, zadek idr.), pomembni za morfološko determinacijo. Genetski identifikacijski ključiči škodljivih organizmov. Pravilna izbira posameznih diagnostičnih tehnik: prednosti in slabosti. Pomen detekcije in determinacije v preprečevanju širjenja karantenskih škodljivih organizmov.

Methods of detecting harmful organisms. Diagnostic methods for determining species affiliation of phytopathogenic organisms: traditional techniques (symptomatic, morphological anatomic, selective media); biochemical techniques (substrate metabolism, profiles of fatty acids, protein analysis, analysis of nucleonic acids) techniques, molecular detection. Practical demonstration of isolation and determination of phytopathogenic fungus and viruses (various techniques) from individual plant parts and substrates. Koch's postulates in phytopathology – confirming the causative agents of illness. Methods of sampling and storing harmful organisms (with a stress on insects and nematodes) and microbes prior to determination (maceration, dehydration, concentration, RNA/DNA extraction etc.) and after (preparing preparation). Using morphological identification keys of selected groups of harmful insects and phytoparasitic nematodes: descriptive, descriptive-pictorial, pictorial morphological keys. Body parts of harmful organisms (heads, chests, abdomen etc.) important for morphological identification. Genetic identification keys of harmful organisms. Correct choice of individual diagnostic techniques: advantages and weaknesses. Importance of detection and determination in preventing the spread of quarantine pests.

Temeljni literatura in viri / Readings:

Arnett, R.H. 1999. American insects: a handbook of the insects of America north of Mexico. The Sandhill Crane Press, Gainesville: 850 str., ISBN 1-877743-19-4.
 Fox, R.T.V. 1993. Principles of diagnostic techniques in plant pathology. CAB International, Wallingford, 213 str., ISBN 0-85198-740-0.
 Mound, L., Kibby, G. 1998. Thysanoptera: an identification guide. 2nd Edition. CAB International, Wallingford: 70 str., ISBN 0 85198 634 X.
 Paterson, R.R.M., Bridge, P.D. 1994. Biochemical techniques for filamentous fungi. CAB International, Wallingford, 125 str., ISBN 0-85198-899-7.
 Urek, G., Hržič, A. 1998. Ogorčice – nevidni zajedavci rastlin: fitonematologija. Ljubljana, samozaložba: 240 str., ISBN 961-6302-04-3.
 in
 revijalni članki s področja, tekoča periodika, druga učna gradiva...

Cilji in kompetence:

Objectives and competences:

Temeljni izobraževalni cilj je poglobitev znanja za samostojno delo na področju detekcije in morfološke ter molekulske determinacije izbranih skupin škodljivih žuželk, ogorčic, fitopatogenih gliv, virusov, bakterij in fitoplazem.

The basic educational aim is to deepen knowledge for independent work in the field of detection and morphological and molecular determination of selected groups of harmful insects, nematodes, phytogetic fungi, viruses, bacteria and phytoplasmas.

Predvideni študijski rezultati:

Predviden študijski rezultat je kandidata usposobiti za detekcijo in determinacijo izbrane skupine ali skupin škodljivih organizmov, z namenom uporabe omenjenih znanj v raziskovalnem ali aplikativnem delu.

Intended learning outcomes:

The intended learning outcome is to train the candidate in the detection and determination of a selected group or groups of harmful organisms, with the intention of using this knowledge in research or applied work.

Metode poučevanja in učenja:

Predavanja, seminarji, konzultacije, samostojno delo.

Learning and teaching methods:

Lectures, seminars, consultations, individual work.

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

- pisni izpit
- samostojno delo študenta

70 %
30 %

- written exam
- individual work of the student

Pogoja za opravljanje študijskih obveznosti – pisnega izpita:

Conditions for performing study obligations - written exam:

- zagovor seminarja

- seminar performed

Reference nosilca / izvajalcev / Lecturer's references:

TRDAN STANISLAV

TOMANOVIĆ, Željko, KOS, Katarina, PETROVIĆ, Andjeljko, STARÝ, Petr, KAVALLIERATOS, Nickolas, ŽIKIĆ, V., JAKŠE, Jernej, **TRDAN, Stanislav**, IVANOVIĆ, Ana. The relationship between molecular variation and variation in the wing shape of three aphid parasitoid species: *Aphidius uzbekistanicus* Luzhetzki, *Aphidius rhopalosiphi* De Stefani Perez and *Aphidius avenaphis* (Fitch) (Hymenoptera: Braconidae: Aphidiinae). *Zool. Anz.*, 2013, vol. 252, no. 1, str.

41-47. [COBISS.SI-ID 7197049].

MEHLE, Nataša, **TRDAN, Stanislav**. Traditional and modern methods for the identification of thrips (Thysanoptera) species. *Journal of pest science*, 2012, vol. 85, no. 2, str. 179-190. [COBISS.SI-ID 7029369].

KOS, Katarina, PETROVIĆ-OBRADOVIĆ, Olivera, ŽIKIĆ, Vladimir, PETROVIĆ, Andjeljko, **TRDAN, Stanislav**, TOMANOVIĆ, Željko. Review of interactions between host plants, aphids, primary parasitoids and hyperparasitoids in vegetable and cereal ecosystems in Slovenia. *Journal of the Entomological Research Society*, 2012, vol. 14, no. 3, str. 67-78 [COBISS.SI-ID 7358585].

KOS, Katarina, **TRDAN, Stanislav**, PETROVIĆ, Andjeljko, STARÝ, Petr, KAVALLIERATOS, Nickolas, PETROVIĆ-OBRADOVIĆ, Olivera, TOMANOVIĆ, Željko. Aphidiinae (Hymenoptera, Braconidae, Aphidiinae) from Slovenia, with description of a new *Aphidius* species. *Zootaxa (Print)*, 2012, no. 3456, str. 36-50 [COBISS.SI-ID 7227769].

KOS, Katarina, PETROVIĆ, Andjeljko, STARÝ, Petr, KAVALLIERATOS, Nickolas, IVANOVIĆ, Ana, TOŠEVSKI, Ivo, JAKŠE, Jernej, **TRDAN, Stanislav**, TOMANOVIĆ, Željko. On the identity of cereal aphid parasitoid wasps *Aphidius uzbekistanicus*, *Aphidius rhopalosiphi*, and *Aphidius avenaphis* (Hymenoptera: Braconidae: Aphidiinae) by examination of COI mitochondrial gene, geometric morphometrics, and morphology. *Ann. Entomol. Soc. Am.*, 2011, vol. 104, no. 6, str. 1221-1232 [COBISS.SI-ID 6928761].

LAZNIK, Žiga, TÓTH, Tímea, LAKATOS, Tamás, VIDRIH, Matej, **TRDAN, Stanislav**. First record of *Steinernema feltiae* (Filipjev) (Rhabditida: Steinernematidae) in Slovenia. *Helminthologia (Bratisl.)*, 2009, vol. 46, no. 2, str. 135-138 [COBISS.SI-ID 6013817].

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Funkcionalna ekologija rastlin in okoljske spremembe
Course title:	Functional plant ecology and environmental changes

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	20	/	/	/	95	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Franc Batič

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

splošni pogoji za vpis na doktorski študij

general conditions for enrolment in doctoral studies

Vsebina: **Content (Syllabus outline):**

Seznanitev s funkcionalno ekologijo kot znanostjo, ki se ukvarja z vlogo organizmov (rastlin) v združbah in ekosistemih. Obravnava različnih funkcionalnih lastnosti oz. znakov rastlin (anatomsko-morfoloških, fizioloških, fenoloških, razmnoževalnih, razširjevalnih, biokemijskih), ki kažejo na prilagoditve rastlinske vrste na določeno okolje. Učinki različnih funkcionalnih skupin rastlin na delovanje ekosistema (produktivnost ekosistema, biogeokemični cikli, biotska pestrost). Korelacije in izključevanja med posameznimi lastnostmi rastlin, kot osnova za funkcionalne klasifikacije rastlinskih vrst. Pregled nekaterih splošnih funkcionalnih klasifikacij rastlin (Raunkiaerjeve življenjske oblike, r-K selekcija pri rastlinah, rastlinske strategije po Grime-u). Prilagoditve rastlin na različne oblike motenj in stresa v okolju ter koncept rastlinskih funkcionalnih tipov. Uporaba teh znakov pri sledenju in predvidevanju dinamike vegetacije ob spremembah rabe tal (intenzifikaciji kmetijske pridelave, opuščanju rabe), klimatskih in drugih okoljskih spremembah. Funkcionalna pestrost v naravi, njen evolucijski razvoj in pomen pri stabilnosti ekosistemov. Indikativna vrednost rastlin za potrebe sledenja zračnih, vodnih in talnih onesnaženj. Rastline kot meliorativno sredstvo. Funkcionalne lastnosti invazivnih rastlin

Introduction to functional ecology, dealing with role of plants in ecosystems. Plant functional traits (anatomical, morphological, physiological, phenological, reproductional, biochemical) as indicators of adaptation of plant species to environment. Effects of plant functional types on ecosystem function (productivity, biogeochemical cycles, biotic diversity). Correlations and exclusions among some plant traits as a basis for plant functional classification. Overview of some plant functional classification (Raunkiaer's life forms, r-K selection in plants, Grime CSR strategies). Plant adaptations to disturbances and stress. Application of plant functional traits in monitoring and predicting of vegetation dynamics triggered by land use change (intensification of agricultural production, abandonment of land use), climate and other environmental changes. Functional diversity in nature, its evolution and significance in stability of ecosystems. Indicator value of plants in biomonitoring of environmental pollution, climate change and land use changes. Plants for environmental remediation. Functional traits of invasive plants.

Temeljni literatura in viri / Readings:

- Anonimous, 2013. Ambient air -Biomonitoring with lichens – Assessing epiphytic lichen diversity", Final version of EN 16413, CEN & Afnor, CEN/TC 264/WG 31, 28 str.
- Booth, B.D., Murphy, S.D., Swanton, C.J. 2010. Invasive plant ecology in natural and agricultural systems. 2nd edition. Cab International, ISBN-13:978 0 85199 528 1, s.214
- Dierschke, H. 1994. Pflanzensociologie, Verlag Eugen Ulmer, Stuttgart,
- Van der Marel, E., 2005. Vegetation Ecology; Blackwell Science Ltd., ISBN 0-632-05761-0, 395 s.
- Grime, J. Philip. Plant strategies, vegetation processes and ecosystem properties - 2nd ed. - Chichester [etc.] : J. Wiley & Sons, 2002, 417str.
- Markert, B. (Ed.), 1993. Plants as Biomonitors: Indicators for Heavy Metals in the Terrestrial Environment. VCH, Weinheim; New York; Basel; Cambridge; 664 str., ISBN 3-527-30001-5.
- Markert, B. A., Breure, A. M., Zechmeister, H. G. (Eds.), 2003. Bioindicators & biomonitors: principles, concepts and applications. Elsevier Science, Amsterdam, 997 str., ISBN 0-08-044177-7.
- Nimis, P. L., Scheidegger, C., Wolseley, P. (Eds.), 2002. Monitoring with Lichens – Monitoring Lichens, Kluwer Academics, Dordrecht, 403 str., ISBN 1-4020-0430-3.

Smith, T.M., Shugart, H.H. & Woodward F.I. 1997. Plant Functional Types. Cambridge University Press, Cambridge, ISBN 0-521-56643-6, 369 s.

revijalni članki s področja, tekoča periodika, druga učna gradiva...
journal papers, current periodicals, others...

Cilji in kompetence:

Cilji predmeta so študentu približati znanstveno-raziskovalno delo na področju funkcionalnih tipov rastlin ter ekosistemske ekologije ter ga seznaniti z naborom raziskovalnih metod, ki se pri tem delu uporabljajo.

Objectives and competences:

Aims of the class: to make the student familiar with scientific research work in the field of the plant functional types and ecosystem ecology and to introduce available research methods which can be used in this work.

Predvideni študijski rezultati:

Znanje in razumevanje:
Študent pozna nabor najpomembnejših metod, ki se uporabljajo pri preučevanju funkcionalnih tipov rastlin in ekologiji kopenskih ekosistemov, njihov glavni namen ter prednosti in slabosti.
Za določen namen raziskovanja zna izbrati ustrezne metode, jih ovrednotiti s stališča objektivnosti, ponovljivosti in uporabnosti. Zna jih uporabiti v raziskavah odziva rastlin in ekosistemov v eksperimentalnih ali naravnih razmerah. Sposoben je načrtovanja raziskovalnega dela ter sinteze in analize dokaj širokega spektra znanj na področju botanike, rastlinske ekologije in ekosistemske ekologije, varstva okolja ter sorodnih ved.

Intended learning outcomes:

Knowledge and understanding:
The student gets to know basic methods used in study of plant functional types and the ecology of terrestrial ecosystems; their applicability, advantages and disadvantages.
He/she is able to select appropriate methods for a given research problem/question and can critically evaluate their objectivity, repeatability and applicability. He/she is able to apply these methods when studying responses on plant or ecosystem level, both in experimental and environmental conditions. Student can plan research work, he/she is able to make synthesis and analyses of broad spectra of knowledges from the field of botany, plant ecology, ecosystem ecology, environmental conservation and related fields of science.

Metode poučevanja in učenja:

Learning and teaching methods:

Študenti se na predavanjih in laboratorijskih vajah seznanijo z osnovami metod. Te kasneje uporabijo v okviru projektnega dela, ki ga izvedejo na terenu ali v kontroliranih razmerah v laboratoriju oz. rastlinjaku. Rezultate projekta predstavijo.

With lectures and lab exercises students are introduced to basics of different methods. Later they use selected methods in their project work, which can be performed in the field or under controlled conditions (lab, greenhouse). They present the results of the project.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Izpit	50	Exam
Projektno delo	50	Project work

Reference nosilca / Lecturer's references:

FRANC BATIČ

- ROZMAN, Andrej, DIACI, Jurij, **BATIČ, Franc**. Functional analysis of vegetation on alpine treeline ecotone in the Julian and Kamnik-Savinja Alps in Slovenia. *European journal of forest research (Print)*, ISSN 1612-4669, 2013, vol. 132, iss. 4, 579-591, ilustr. <http://dx.doi.org/10.1007/s10342-013-0691-4>, doi: [10.1007/s10342-013-0691-4](https://doi.org/10.1007/s10342-013-0691-4). [COBISS.SI-ID [3706790](https://www.cobiss.si/id/3706790)], [JCR, SNIP, WoS do 30. 9. 2013: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0, Scopus do 30. 9. 2013: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0]
- LESKOVŠEK, Robert, ELER, Klemen, **BATIČ, Franc**, SIMONČIČ, Andrej. The influence of nitrogen, water and competition on the vegetative and reproductive growth of common ragweed (*Ambrosia artemisiifolia* L.). *Plant ecology*, ISSN 1385-0237, 2012, vol. 213, no. 5, str. 769-781, ilustr., doi: [10.1007/s11258-012-0040-6](https://doi.org/10.1007/s11258-012-0040-6). [COBISS.SI-ID [3833448](https://www.cobiss.si/id/3833448)], [JCR, SNIP, WoS do 5. 6. 2012: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0, Scopus do 25. 4. 2012: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0]
- FERLAN, Mitja, ALBERTI, G., ELER, Klemen, **BATIČ, Franc**, PERESSOTTI, Alessandro, MIGLIETTA, Francesco, ZALDEI, A., SIMONČIČ, Primož, VODNIK, Dominik. Comparing carbon fluxes between different stages of secondary succession of a karst grassland. *Agriculture, ecosystems & environment*, ISSN 0167-8809. [Print ed.], 2011, vol. 140, no. 1/2, str. 199-207, ilustr. <http://dx.doi.org/10.1016/j.agee.2010.12.003>, doi: [10.1016/j.agee.2010.12.003](https://doi.org/10.1016/j.agee.2010.12.003). [COBISS.SI-ID [3086246](https://www.cobiss.si/id/3086246)], [JCR, SNIP, WoS do 29. 10. 2013: št. citatov (TC): 4, čistih citatov (CI): 2, normirano št. čistih citatov (NC): 3, Scopus do 9. 10. 2013: št. citatov (TC): 5, čistih citatov (CI): 3, normirano št. čistih citatov (NC): 4]
- GRABNER, Boštjan, RIBARIČ-LASNIK, Cvetka, ROMIH, Nadja, PFEIFHOFER, Hartwig W., **BATIČ, Franc**. Bioaccumulation capacity for Pb, Cd and Zn from polluted soil in selected species of the Brassicaceae family in different vegetation types. *Phyton*, ISSN 0079-2047, 2011, vol. 50, fasc. 2, str. 287-300. [COBISS.SI-ID [6552697](https://www.cobiss.si/id/6552697)], [JCR, SNIP, WoS do 5. 5. 2011: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0, Scopus do 11. 5. 2011: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0]
- MRAK, Tanja, JERAN, Zvonka, **BATIČ, Franc**, DI TOPPI, Luigi Sanitá. Arsenic accumulation and thiol status in lichens exposed to As(V) in controlled conditions. *Biometals*, ISSN 0966-0844,

2010, vol. 23, str. 207-219. [COBISS.SI-ID [23151911](#)], [JCR, SNIP, WoS do 17. 1. 2013: št. citatov (TC): 3, čistih citatov (CI): 3, normirano št. čistih citatov (NC): 1, Scopus do 24. 10. 2012: št. citatov (TC): 3, čistih citatov (CI): 3, normirano št. čistih citatov (NC): 1]

6. ŠIRCELJ, Helena, MIKULIČ PETKOVŠEK, Maja, **BATIČ, Franc**. Antioxidants in spring leaves of *Oxalis acetosella* L. *Food chemistry*, ISSN 0308-8146. [Print ed.], 2010, vol. 123, iss. 2, str. 351-357. <http://dx.doi.org/10.1016/j.foodchem.2010.04.042>, doi: [10.1016/j.foodchem.2010.04.042](https://doi.org/10.1016/j.foodchem.2010.04.042). [COBISS.SI-ID [6283897](#)], [JCR, SNIP, WoS do 4. 6. 2013: št. citatov (TC): 2, čistih citatov (CI): 2, normirano št. čistih citatov (NC): 2, Scopus do 1. 5. 2013: št. citatov (TC)

Predmet: Funkcioniranje in zdravje tal
Course title: Soil health and functioning

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	20	20	/	/	190 ur	10

Nosilec predmeta / Lecturer: Nosilec: Domen Leštan

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij

General conditions for enrolment in doctoral studies.

Vsebina:

Pregled osnovnih kemijskih, biokemijskih, fizikalnih in bioloških parametrov in pokazateljev kakovosti zdravja tal. Tla kot habitat. Biodiverzitetna in funkcije tal. Interakcije med organizmi in procesi v tleh. Biotski indikatorji kakovosti in zdravja tal. Vpliv rabe tal in kmetijskih praks na kakovost in funkcioniranje tal. Vpliv onesnažil, fizikalnih, naravnih in antropogenih dejavnikov in procesov degradacije na kakovost in zdravje tal. Problematika urbanih tal. Zakonodaja iz

Content (Syllabus outline):

Review of the basic chemical, biochemical, physical and biological principles and indicators of soil quality and health. Soil as Habitat. Soil Biodiversity and functions. Organism interaction and soil processes. Bioindicators of soil quality and health. Effects of land use and agronomic practices on soil quality and soil health. The effect of contaminants, physical factors and natural and anthropogenic processes of soil degradation on soil quality and soil functioning. Specifics of urban soils. Regulations and

področja varovanja tal.
Remediacija onesnaženih tal in metode rehabilitacije in revitalizacije degradiranih tal.
Podrobneje bomo obravnavali poglavja: Kemije in biokemije organske snovi tal; Ravnotežja na faznih mejah;
Sorpcijo na površinske funkcionalne skupine in komplekse;
Oksidacijsko-redukcijske reakcije v tleh in potenciale;
Proteolitske reakcije Al in Fe oksidov, karbonatno ravnotežje;
Biokemijske reakcije in vloga pri procesih geneze in kroženja talnih komponent;
Kinetika kemijskih in biokemijskih reakcij in procesov v tleh;
Izbrana poglavja ekologije tal. Recikliranje hranil, puferna in samočistilna sposobnost tal, ekosistemska samo-regulacija rastlinskih bolezni in škodljivcev. Stabilnost talnega ekosistema, odpornost na motnje in prožnost mikrobne združbe.

legislation on soil protection.
Remediation of contaminated soil and methods of rehabilitation and revitalization of degraded soils.
More detailed will be discussed on:
Chemistry and biochemistry of organic soil substances,
Equilibrium at phase boundaries, sorption on surface functional groups and complexes;
Oxidation-reduction reactions in soil and potentials, Proteolytic reactions of Al and Fe oxides, carbonate balance;
Biochemical reactions: role in processes of genesis and circulation of soil components; Kinetics of chemical and biochemical reactions and processes in soils;
Selected chapters of soil ecology. Recycling of nutrients, buffering and decontamination, ecosystem self-regulation of plant diseases and pests. Stability of soil ecosystem, resistance and resilience of soil microbial community.

Temeljni literatura in viri / Readings:

Brady, N.C., Weil, R.R. 2002. The Nature and Properties of Soils, 13ed. Prentice Hall, Upper Saddle River, ISBN 0-13-016763-0
Pierzynski, G.M., Sims, T., Vance, G. 2004. Soils and Environmental Quality, 3rd. ed. CRC Press, Boca Raton. ISBN 10-8493-1616-2
Sparks, D.L. 2003. Environmental Soil Chemistry. Academic Press, San Diego. ISBN 0-12-656446-9
Wall, D.H., 2012. Soil Ecology and Ecosystem services, Oxford University Press, ISBN 978-0-19-957592-3
Bloem J., Hopkins D.W., Benedetti A., 2008. Microbiological Methods for Assessing Soil Quality. ISBN 0-85199-098-3.
- revijalni članki s področja, tekoča periodika, druga učna gradiva...

Cilji in kompetence:

Tla so osnovni substrat v kmetijstvu in bistven del okolja. Pri raziskavah prehrane rastlin, uvajanju sodobnih agronomskih praks in pri raziskavah varstva in sanacije degradiranih oziroma onesnaženih tal je nujno dobro poznavanje konceptov funkcioniranja in zdravja tal, ki se odraža v kemijskih, biokemijskih, fizikalnih in bioloških lastnostih in procesih v tleh.

Objectives and competences:

Soils are the basic substrate in agriculture and an essential part of the environment. In studying the nutrition of plants, introducing contemporary agronomic practices and in researching the protection and sanitation of degraded or polluted soils it is crucial to be well acquainted with the functioning of the soil, which is to a large extent dependent on the chemical, biochemical, physical and biological properties and processes in the soil.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:
Predmet omogoča študentom poglobljen vpogled v lastnosti talnih komponent, reakcij, procesov in interakcij, ki usmerjajo delovanje tal kot tridelnega sistema trdne, tekoče in plinaste faze ter kot specifičnega ekosistema. Hkrati jih seznanijo z metodami in instrumenti, ki se uporabljajo pri tovrstnih raziskavah.

Knowledge and understanding:
The subject enables the student an in-depth insight into the properties of soil components, reactions and processes that direct the functioning of soils as a tripartite system of solid, liquid and gaseous phases and specific ecosystem. At the same time, it acquaints them with methods and instruments used in this kind of research.

Metode poučevanja in učenja:

Predavanja, seminarji, laboratorijske vaje, samostojno delo

Learning and teaching methods:

Lectures, seminars, laboratory exercises, individual work.

Načini ocenjevanja:

- Ustni izpit iz predavanj in vaj
- Ocena seminarja v povezavi s samostojnim delom

Delež (v %) /
Weight (in %)

Assessment:

- Oral examination from lectures and exercises
- Assessment of seminar connected with the student's individual work.

Reference nosilca / Lecturer's references:

Domen Leštan:

- 1.) VOGLAR, David, LEŠTAN, Domen. Chelant soil-washing technology for metal-contaminated soil. Environmental technology, ISSN 0959-3330, 2014, vol. , no. , str. v tisku, ilustr., doi: 10.1080/09593330.2013.869265. [COBISS.SI-ID 7836025]
- 2.) FINŽGAR, Neža, JEŽ, Erika, VOGLAR, David, LEŠTAN, Domen. Spatial distribution of metal contamination before and after remediation in the Meza Valley, Slovenia. Geoderma, ISSN 0016-7061. [Print ed.], 2014, vol. 217/218, str. 135-143. <http://dx.doi.org/10.1016/j.geoderma.2013.11.011>. [COBISS.SI-ID 7831161]
- 3.) JELUŠIČ, Maša, LEŠTAN, Domen. Effect of EDTA washing of metal polluted garden soils. Part I, Toxicity hazards and impact on soil properties. Science of the total environment, ISSN 0048-9697, 2014, vol. , v tisku. <http://dx.doi.org/10.1016/j.scitotenv.2013.11.049>, doi: 10.1016/j.scitotenv.2013.11.049. [COBISS.SI-ID 7831417]
- 4.) JELUŠIČ, Maša, VODNIK, Dominik, MAČEK, Irena, LEŠTAN, Domen. Effect of EDTA washing of metal polluted garden soils. Part II, Can remediated soil be used as a plant substrate?. Science of the total environment, ISSN 0048-9697, 2014, vol. , v tisku. <http://dx.doi.org/10.1016/j.scitotenv.2013.11.111>, doi: 10.1016/j.scitotenv.2013.11.111. [COBISS.SI-ID 7831673]
- 5.) VOGLAR, David, LEŠTAN, Domen. Pilot-scale washing of Pb, Zn and Cd contaminated soil using EDTA and process water recycling. Chemosphere, ISSN 0045-6535. [Print ed.], 2013, vol. 91, str. 76-82. <http://dx.doi.org/10.1016/j.chemosphere.2012.12.016>, doi: 10.1016/j.chemosphere.2012.12.016. [COBISS.SI-ID 7447673]
- 6.) TICA, Dragana, UDOVIČ, Metka, LEŠTAN, Domen. Long-term efficiency of soil stabilization with apatite and Slovakite: The impact of two earthworm species (*Lumbricus terrestris* and *Dendrobaena veneta*) on lead bioaccessibility and soil functioning. Chemosphere, ISSN 0045-6535. [Print ed.], 2013, vol. 91, issue 1, str. 1-6. <http://dx.doi.org/10.1016/j.chemosphere.2012.11.011>, doi: 10.1016/j.chemosphere.2012.11.011.

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Interakcije med genotipi in okoljem pri kmetijskih rastlinah
Course title:	Interactions between genotypes and environment in the agricultural plants

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type

teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	25	/	/	5	85	5

Nosilec predmeta / Lecturer:

Nosilec: izr. prof. dr. Zlata Luthar

Jeziki / Languages:

Predavanja / Lectures:	slovenski / angleški Slovene / English
Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Splošni pogoji za vpis na doktorski študij

Prerequisites:

General conditions for enrollment in doctoral studies.

Vsebina:**Content (Syllabus outline):**

Elastičnost genetsko pogojenih odzivov rastlin na agrotehnične ukrepe in na druge vplive okolja. Vloga generativnega oziroma vegetativnega razmnoževanja rastlin pri evolucijskih prilagoditvah. Genetski polimorfizem in vpliv genetske strukture sort na biotsko raznovrstnost. Abiotski vplivi, ki so povzročili evolucijske adaptacije rastlin in vplivi naravnih in induciranih sevanj.

Razlike v adaptaciji pri različnih rastlinskih vrstah, ki so povezane s kmetijsko prakso. Obramba in prilagajanje rastlin na abiotske dejavnike, ki pogojujejo sintezo flavonoidov, taninov in drugih snovi, ki ščitijo rastline in njihov pomen v prehrani.

Raziskovanje reakcij rastlin na različne tehnologije pridelave kot osnova zagotavljanja kakovosti pridelkov. Alokacija asimilatov kot sestavni del poteka uravnavanja rasti in razvoja kmetijskih rastlin. Pomen interakcije genotip x patogen v koevoluciji in adaptaciji gojenih in drugih rastlin. Evolucijska adaptacija na opraševalce.

Vloga koevolucije in interakcije pri žlahtnjenju novih sort. Genetska struktura posameznih tipov sort, njihova stabilnost in vzdrževanje genetske identičnosti, principi in metode molekularskih markerjev kot pomoč pri ciljnem žlahtnjenju novih sort za specifične namene.

The adaptability of genetic responses of plants on the agro technical measures and other environmental conditions. The role of generative or vegetative propagation of plants in the evolutionary adaptations. Genetic polymorphism and the impact of genetic structure of varieties on biodiversity. Abiotic influences that have led to evolutionary adaptations of plants and the effects of natural and induced radiation. Differences in adaptation at different plant species that are connected with agricultural practices.

Defense and adaptation of plants to abiotic factors that determine the synthesis of flavonoids, tannins and other substances that protect plants and their importance in the nutrition.

Study the reactions of plants to different production technology as the base of quality assurance of the products. Allocation of assimilates as part of the growth and development balancing of agricultural plants. The importance of the interaction genotype x pathogen in co-evolution and adaptation of cultivated and other plants. Evolutionary adaptation to pollinators.

The role of co-evolution and interaction in selection of new varieties. Genetic structure of different types of varieties, their stability and the maintenance of genetic identity, principles and methods of molecular markers as an aid in targeted varietal selection of new varieties for specific purposes.

Temeljni literatura in viri / Readings:

Graham L.; Wilcox L.; Graham J. 2001. Plant Biology, Edition: 2nd, ISBN10: 0131469061, ISBN13: 9780131469068, 2006, Publisher: Benjamin Cummings, str. 14-140, 200-298, 420-490, 532-589.

Gilbert S. F. 2006. Developmental Biology, ISBN10: 087893250X, ISBN13: 9780878932504, Publisher: Sinauer Associates Inc. , str. 499-545.

Acquaah G. 2007. Principles of plant genetics and breeding. Blackwell Publ., 567 s., ISBN 9781405134477.

Reynolds M. P. 2010. Climate Change and Crop Production. Volume 1: CABI Publishing,

Wallingford in Cambridge (Ma), 292 s. ISBN 978-1-84593-633-4.

Singh P.K., Dasgupta S.K., Triphati S.K. 2005. Hybrid vegetable development.. Hawarth Press, ISBN 10: 1560221186 / 1-56022-118-6, ISBN 13: 9781560221180 441 s.

Revijalni članki s področja, tekoča periodika, druga učna gradiva
Magazine articles from the field, current periodicals, other teaching materials

Cilji in kompetence:

Seznanimi študente z interakcijami med genetskimi in ekološkimi dejavniki pri vzgoji novih genotipov s specifičnimi lastnostmi in za specifične rastne razmere (sušni/temperaturni stres, ...). Naučiti študente prepoznavati in razčlenjevati vplive na rast in razvoj kmetijskih rastlin ter različnih tipov sort. Seznaniti študente z najnovejšo literaturo na tem področju. Posredovati študentom aktualno znanje na področju koevolucije in evolucijskih adaptacij rastlin.

Objectives and competences:

To acquaint students with the interactions between genetic and environmental factors in the education of new genotypes with specific properties and for specific growing conditions (drought / temperature stress ...). To teach students to identify and analyze the impacts on the growth and development of agricultural plants as well as on the different types of varieties. To acquaint students with the recent literature on this subject. To provide students with current knowledge in the field of co-evolution and evolutionary adaptations of plants.

Predvideni študijski rezultati:

Znanje in razumevanje:
Usposobiti študente za prepoznavanje in razčlenjevanje genetskih in ekoloških vplivov na rast in razvoj genotipov ter za samostojno vzgojo novih sort kmetijskih rastlin s specifičnimi lastnostmi v povezavi z molekuskimi analizami.

Intended learning outcomes:

Knowledge and understanding:
Teach students how to recognize and analyze genetic and ecological impacts on the growth and development of genotypes and independent raising of new crop varieties with specific properties in conjunction with molecular analyzes.

Metode poučevanja in učenja:

Študij pri tem predmetu bo organiziran s predavanji, konzultacijami in seminarskim delom.

Learning and teaching methods:

Studies in this course will be organized with lectures, consultations, and seminar work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Seminarska naloga	30 %	Seminar work
Predstavitev izpit	70 %	Presentation examination

Reference nosilca / izvajalcev / Lecturer's references:

ZLATA LUTHAR

JAKŠE, Jernej, ČERENAK, Andreja, RADIŠEK, Sebastjan, SATOVIĆ, Zlatko, LUTHAR, Zlata, JAVORNIK, Branka. Identification of quantitative trait loci for resistance to Verticillium wilt and yield parameters in hop (*Humulus lupulus* L.). *Theoretical and Applied Genetics*, ISSN 0040-5752. [Print ed.], 2013, vol. 126, no. 6, str. 1431-1443, [COBISS.SI-ID [7466361](#)], [JCR, SNIP, WoS].

JAKŠE, Jernej, ŠTAJNER, Nataša, LUTHAR, Zlata, JELTSCH, Jean-Marc, JAVORNIK, Branka. Development of transcript-associated microsatellite markers for diversity and linkage mapping studies in hop (*Humulus lupulus* L.). *Molecular breeding*, ISSN 1380-3743. [Tiskana izd.], 2011, vol. 28, no. 2, str. 227-239, [COBISS.SI-ID [6353273](#)], [JCR, SNIP, WoS].

ČERENAK, Andreja, ŠATOVIĆ, Zlatko, JAKŠE, Jernej, LUTHAR, Zlata, CAROVIĆ-STANKO, Klaudija, JAVORNIK, Branka. Identification of QTLs for alpha acid content and yield in hop (*Humulus lupulus* L.). *Euphytica*, ISSN 0014-2336. [Print ed.], 2009, vol. 170, no. 1-2, str. 141-154. <http://dx.doi.org/10.1007/s10681-009-9920-9>, doi: [10.1007/s10681-009-9920-9](https://doi.org/10.1007/s10681-009-9920-9). [COBISS.SI-ID [5954681](#)], [JCR, SNIP, WoS do 11. 2. 2014: št. citatov (TC): 5, čistih citatov (CI): 1, normirano št. čistih citatov (NC): 1, Scopus do 11. 3. 2014: št. citatov (TC): 7, čistih citatov (CI): 3, normirano št. čistih citatov (NC): 3]

JAKŠE, Jernej, LUTHAR, Zlata, JAVORNIK, Branka. New polymorphic dinucleotide and trinucleotide microsatellite loci for hop *Humulus lupulus* L. *Molecular ecology resources*, ISSN 1755-098X, 2008, vol. 8, no. 4, str. 769-772, doi: [10.1111/j.1755-0998.2007.02053.x](https://doi.org/10.1111/j.1755-0998.2007.02053.x). [COBISS.SI-ID [5449081](#)], [JCR, SNIP, WoS do 17. 11. 2013: št. citatov (TC): 8, čistih citatov (CI): 2, normirano št. čistih citatov (NC): 1, Scopus do 16. 12. 2013: št. citatov (TC): 11, čistih citatov (CI): 4, normirano št. čistih citatov (NC): 2]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Iskanje informacij in priprava člankov
Course title:	Information searching and paper writing

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code: Pustite prazno

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	15	20	/	/	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Tomaž Bartol

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij	General conditions for enrolment in doctoral studies.
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Vsebina: **Content (Syllabus outline):**

ISKANJE INFORMACIJ

ISKALNE TEHNIKE: učinkovita iskalna poizvedba (sintaksa, iskalni operatorji, iskalna polja, portali).

SPECIALIZIRANE ZBIRKE: bibliografske zbirke, celotna e-besedila, zbirke doktorskih del, tehnike oddaljenega dostopa.

CITATNE ZBIRKE: Web of Science, Scopus. Napredne iskalne tehnike, analitika objav/citativ (IF/JCR - kvartili in izračunavanje faktorja vpliva, H-Index/SJR)

DRUGE ZBIRKE: standardi, intelektualna lastnina, statistične informacije (EuroStat), pravni predpisi SPLETNO ISKANJE

ZNANSTVENIH VSEBIN: učinkovite iskalne strategije, e-opozorila (Google Scholar Alerts), analitika in faktor vpliva na spletu

SICRIS/COBISS/E-KNJIŽNICE: slovenska bibliografija, evalvacija objav po tipih dokumentov, merila raziskovalne uspešnosti (SICRIS) glede na WOS ter Scopus, digitalne knjižnice Slovenije

PISANJE ČLANKOV

ZNANSTVENI JEZIK: terminološki viri (e-glosarji), pravilna raba znanstvenih okrajšav in mednarodnih tujk, slog znanstvenih besedil (poudarek na angleščini), učinkovito samopreverjanje angleščine s spletnimi orodji.

ZBIRANJE REFERENC: generiranje lastne osebne bibliografije, e-urejevalniki referenc (npr. Zotero, Mendeley), rangiranje

znanstvenih revij in izbira revije za objavo

OBLIKOVANJE BESEDIL ZA OBJAVO: standardni slog besedil, struktura sekcij in poglavij po znanstveni shemi IMRAD, pisanje strukturiranih izvlečkov po pravilih različnih založnikov, pošiljanje v objavo (manuscript submission managers), recenzentski postopki, spletno objavljanje v odprtem dostopu

NAMIGI IN TRIKI: učinkovito formatiranje in urejanje besedil, uporaba predlog/stilov

INFORMATION SEARCHING

SEARCH TECHNIQUES: efficient search query (syntax, search operators, search fields, interfaces)

SPECIALIZED DATABASES: bibliographic databases, full-text, dissertations databases, remote access techniques

CITATION DATABASES: Web of Science, Scopus. Advanced search techniques, citation analytics (IF/ JCR - quartiles and Impact Factor calculation, H-Index/SJR)

OTHER DATABASES: standards, intellectual property, statistical information (EuroStat), legislation

SCIENTIFIC INFORMATION ON WWW competent search strategies, Google Scholar alerts, Web citation analytics

SICRIS/COBISS/E-LIBRARIES: Slovenian bibliography, document types and research evaluation (SICRIS) and links to WOS and Scopus, digital libraries of Slovenia

PAPER WRITING

SCIENTIFIC LANGUAGE: terminological resources (e-glossaries), use of international scientific acronyms and abbreviations, scientific style (emphasis on English language), language self-testing with the use of Web tools.

MANAGEMENT OF REFERENCES: generation of personal bibliography, reference managers (e.g. Zotero, Mendeley), scientific journal ranking and journal selection

PREPARING TEXTS FOR PUBLISHING: standard style, IMRAD structure of paragraphs and sections, writing structured abstracts according to different international publishers, manuscript submission managers, peer-review procedures, Open Access publishing

TIPS AND TRICKS: competent text formatting and editing, using templates/styles

Temeljni literatura in viri / Readings:

Bartol T. 2014. Znanstveno informacijski praktikum. Spletni učbenik. Dostopen prek Biotehniška fakulteta: e-učenje (Moodle)

Worldwide Commonalities and Challenges in Information Literacy Research and Practice. (Kurbanoglu, S. et al., eds.). Communications in Computer and Information Science. Springer International Publishing, 2013, 397 p.

Burkhardt JM, MacDonald MC, Rathemacher AJ (2010) Teaching information literacy: 50

standards-based exercises for college students. American Library Association, Chicago, 139 p.

Revijalni članki s področja, tekoča periodika, druga učna gradiva v e-obliki

Cilji in kompetence:

Predmet je namenjen predvsem študentom, ki na prejšnjih stopnjah niso poslušali informacijskih predmetov ali želijo ta znanja utrditi. Študent spozna različne informacijske sisteme, načela citiranja, značilnosti znanstvenega jezika in strukturo besedil in s tem pridobi napredna informacijska znanja. Seznan se s terminološkimi orodji (posebno v angleščini), geslovniki in klasifikacijami. Spozna napredne iskalne tehnike ter načine oddaljenega dostopa, vsebinsko specializirane zbirke, zbirke doktorskih del, citatne zbirke ter načela vrednotenja citatov/publikacij. Spozna tehnike za bolj kompetentno odkrivanje vsebin na spletnih iskalnikih. Spozna specifiko slovenskih bibliografij ter načine vrednotenja objav. Seznan se z orodji za računalniško urejanje referenc. Seznan se s stili in strukturo pisanja na različnih ravneh prispevka in spozna specifične stile za objavljanje.

Objectives and competences:

The course is aimed at students who have previously not attended information-related courses or wish to improve respective competencies. Students get acquainted with different information systems, citation principles, characteristics of scientific language and structure of texts, and thus acquire advanced information knowledge. They get to know terminological tools (esp. English-language-related), specialized glossaries, classification systems. They study advanced search techniques and remote-access procedures, specialized databases, dissertations databases, citation databases, and principles for the evaluation of publications and citation impact. They get conversant with advanced techniques for discovery of scientific information on the Web. They explore specifics of Slovenian national bibliography and systems for research evaluation. They get familiar with citation managers. They study styles and paper composition on different levels and get familiar with publishing guidelines and styles.

Predvideni študijski rezultati:

Znanje in razumevanje:
Študent pridobi znanje za samostojno iskanje in vrednotenje informacij ter oblikovanje znanstvenih izdelkov/člankov. Zna uporabiti strokovno terminologijo in sestaviti ustrezno stavčno strukturo (prevsem v angleščini). Razume iskalno strategijo glede na svoje kriterije: iskanje predmetno-specifičnih vsebin, iskanje organizmov, iskanje/vrednotenje citatov, izbor revije za objavo članka ipd. Vire kritično ovrednoti z rabo analitičnih orodij. Interpretira podatke nacionalne bibliografije Cobiss in sistema Sicris. Usposobi se za pisanje znanstvenega izdelka. Vire uredi v osebno bibliografijo s pomočjo urejevalnikov referenc in po zahtevah mednarodnih založnikov. Citate uporabi pri svojem izdelku, ki

Intended learning outcomes:

Knowledge and understanding:
Students acquire knowledge for efficient and independent retrieval and evaluation of information along with paper writing skills. They can use specialist terminology and compose a correct sentence structure (in English). They understand search strategy, noting particular criteria: subject-specific content, organism-descriptors, citation search/evaluation, selecting a journal for the purposes of publishing, etc. They critically evaluate resources with analytical tools. They appraise data in the Slovenian national bibliography Cobiss and system for research evaluation (Sicris). They gain skills for paper composition. They are able to generate a personal bibliography according to international publishing styles using citation

ga oblikuje v skladu z uveljavljeno strukturo znanstvenih del. Spozna izbrane postopke za spletno oddajo prispevkov (manuscript submission managers).

managers. They employ citations in papers which they systematize according to typical research-paper structure. They gain some knowledge relating to the procedures of manuscript submission managers.

Metode poučevanja in učenja:

Predavanja, računalniške in praktične vaje, praktične naloge, individualne konzultacije, (sodelovanje gostujočih predavateljev po potrebi glede na vsebino), samostojno delo študentov

Learning and teaching methods:

Lectures, practicals in a computer laboratory, coursework assignments, individual consultations, (participation of guest-lecturers if applicable); individual student work

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Praktični pisni bibliografski projekti	33%	Practical bibliographic assignments
Ustni preizkus znanja	33%	Oral examination
Seminar	34%	Seminar

Reference nosilca / izvajalcev / Lecturer's references:

Bartol Tomaž

BARTOL, Tomaž, BUDIMIR, Gordana, DEKLEVA SMREKAR, Doris, PUŠNIK, Miro, JUŽNIČ, Primož. Assessment of research fields in Scopus and Web of Science in the view of national research evaluation in Slovenia. *Scientometrics*, 2014, vol. 98, iss. 2, str. 1491-1504. [COBISS.SI-ID 7744633]

Accession Number: WOS:000330622600044

WOS: computer science, interdisciplinary applications; 20/100 ; četrtina: 1; information science & library science; 7/85 ; četrtina: 1

BARTOL, Tomaž, MACKIEWICZ-TALARCZYK, Maria. Bibliometric analysis of publishing trends in fiber crops in Google Scholar, Scopus and Web of Science. *Journal of National Fibers* (sprejeto v objavo sept 2014)

WOS: materials science; 15/22 ; četrtina: 3

BARTOL, Tomaž. Assessment of indexing trends with specific and general terms for herbal medicine. *Health information and libraries journal*, 2012, vol. 29, issue 4, str. 285-295.

[COBISS.SI-ID 7283577]

Accession Number: WOS:000311410500004

WOS: information science & library science ; 37/83 ; četrtina: 2

BARTOL, Tomaž. Non-agricultural databases and thesauri : Retrieval of subject headings and

non-controlled terms in relation to agriculture. Program, 2012, vol. 46, no. 2, str. 258-276. [COBISS.SI-ID 7027577]

Accession Number: WOS:000304629800006

WOS: information science & library science; 52/83 ; četrtina: 3

Web of Science - CP Citation Index (CPCI):

BARTOL, Tomaž. Information literacy and international capacity development initiatives in life sciences: AGORA, OARE, HINARI, ARDI (Research4Life - R4L). V: KURBANOGLU, Serap (ur.), et al. Worldwide commonalities and challenges in information literacy. Communications in Computer and Information Science, 397. Cham: Springer, 2013, str. 338-344. [COBISS.SI-ID 7878265]

Accession Number: WOS: še ni vnešeno

Web of Science Categories: Computer Science, Information Systems; Computer Science, Theory & Methods

VILAR, Polona, JUŽNIČ, Primož, BARTOL, Tomaž. Slovenian researchers : what influences their information behaviour?. V: KURBANOGLU, Serap (ur.). E-science and information management. Communications in computer and information science, ISSN 1865-0929, 317. Berlin; New York: Springer, cop. 2012, str. 47-60. [COBISS.SI-ID 50012770]

Accession Number: WOS:000311976500008

Web of Science Categories: Computer Science, Information Systems; Computer Science, Theory & Methods; Information Science & Library Science

BARTOL, Tomaž. Agriculture-related concepts in non-agricultural and general thesauri. V: BARRIOCANAL, Elena (ur.). Metadata and semantic research. Communications in computer and information science, ISSN 1865-0929, vol. 240. Springer, 2011; Berlin Heidelberg; London; New York, str. 433-444. [COBISS.SI-ID 6862201]

Accession Number: WOS:000310181200043

Web of Science Categories: Computer Science, Information Systems; Computer Science, Theory & Methods

BARTOL, Tomaž. Assessment of food and nutrition related descriptors in agricultural and biomedical thesauri. V: SARTORI, Fabio (ur.). Metadata and Semantic Research. Communications in computer and information science, ISSN 1865-0929, 46, 2009). Springer-Verlag, 2009; Berlin; Heidelberg, str. 294-305. [COBISS.SI-ID 6178169]

Web of Science Categories: Computer Science, Information Systems; Computer Science, Theory & Methods

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Meritve fizikalno-kemijskih in bioloških lastnosti tal
Course title:	Measurement of physical, chemical and biological properties of soil

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	20	20	/	/	190 ur	10

Nosilec predmeta / Lecturer: Nosilec: Domen Leštan

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij

General conditions for enrolment in doctoral studies.

Vsebina: **Content (Syllabus outline):**

Seznanitev s standardi s področja meritev fizikalno-kemijskih in bioloških lastnosti tal in talne vode. Načini in-situ vzorčenja tal in talne vode v različni globinah in glede na namen raziskave. Orodja in problemi povezani z vzorčenjem (reprezentativnost, ponovljivost). Metode osnovne pedološke analize tal: pH tal, tekstura tal, struktura tal, organska snov tal, kationska izmenjalna kapaciteta tal. Fizikalne lastnosti trdne faze (lastnosti primarnih delcev, strukturne značilnosti), tekoča faza (voda, količina vode, energijsko stanje vode) in interakcije. Možne poglobljene vsebine: Dinamika tekočin v poroznem mediju (nasičen in nenasičen tok), evaporacija iz poroznega medija, infiltracija, sledila (onesnaževala) v poroznem mediju, prenos onesnaževal (konvekcijsko disperzijska enačba), gibanje multifazne tekočine, zaslanjevanje tal, toplota tal ter metode merjenja erozije. Kemijske meritve: vsebnost mikro in makro hranil ter onesnažil v tleh, sekvenčne ekstrakcije in frakcionacija kovin v tleh, testi mobilnosti onesnažil v tleh (toksično značilno izpiranje), in vitro metode določevanja biološke dostopnosti hranil in onesnažil v tleh (fiziološko pogojeni ekstrakcijski testi, ekstrakcija z ligandi). Biološke in biokemijske metode: metode določevanja mikrobne aktivnosti v tleh (respiracija, dehidrogenazna aktivnost), metode določevanja mikrobne biomase v tleh, ugotavljanje strukture mikrobnih populacij v tleh (fosfolipidi maščobnih kislin, izolacija DNK), specifične encimske aktivnosti v tleh, in vivo metode določevanja biodostopnosti hranil in onesnažil.

Acquaintance with standards in the field of measurement of physical, chemical and biological properties of soil and groundwater. Methods of in situ sampling of soil and groundwater at various depths and in relation to the purpose of the research. Tools and problems connected with sampling (representativeness, repeatability). Methods of basic pedological analysis of soil: pH of soil, soil texture, soil structure. Organic substances of soil, cation exchange capacity of soil. Physical properties of the solid phase (primary particles characteristics, structure), fluid phase (water, water quantity, energy state of water), and interactions there of are addressed. Further insight into the follow topics: fluid dynamics in porous media, evaporation from porous media, infiltration, tracer (pollutants) in porous media, pollutant transfer (convection-dispersion equation), multiphase fluid movement, soil salinization, soil thermal properties and methods of erosion measurement. Chemical measurements: content of micro and macro nutrients and pollution in the soil, sequential extraction and fractionation of metals in soil, tests of mobility of pollutants in soil (toxically characteristic leaching), in vitro methods of determining biological availability of nutrients and pollutants in soil (physiologically conditioned extraction tests, extraction with ligands). Biological and biochemical methods: methods of determining microbial activity in soil (respiration, dehydrogenation activity), methods of determining microbial biomass in soil, establishing the structure of microbial populations in soil (phospholipids of fatty acids, DNA isolation), specific enzyme activity in soil, in vivo methods of determining bioavailability of nutrients and pollutants.

Temeljni literatura in viri / Readings:

Alef K., Nannipieri P. 1995. Methods in Applied Soil Microbiology and Biochemistry. Academic Press, San Diego (izbrana poglavja / selected chapters)

Naldu R. 2008. Chemical bioavailability. Elsevier, Amsterdam (izbrana poglavja / selected chapters)

Wilson N. 1995. Soil Water and Ground Water Sampling. London, Lewis Publishers: 188 s. (izbrana poglavja / selected chapters)

Rowell. D.L. 1994. Soil Science. Methods and application. Longman Scientific & Technical,,: 350 s. (izbrana poglavja / selected chapters)

Dean, J.R. 2007. Bioavailability, bioaccessibility and mobility of environmental contaminants. John Wiley & Sons.Ltd., Chichester, (izbrana poglavja / selected chapters)

Jacob H. Dane, Clarke Topp 2002. Methods of Soil Analysis. Part 4. Physical Methods (Soil Science Society of America Book Series, Vol. 5), (izbrana poglavja / selected chapters)

William A. Jury, Robert Horton 2004. Soil Physics. Sixth Edition. (izbrana poglavja / selected chapters)

Jacob Bear 1988. Dynamics of fluids in porous media, Dover publications, Inc. New York (izbrana poglavja / selected chapters)

Cilji in kompetence:

Kakovost tal je pomemben pogoj za trajnostno (npr. kmetijsko) rabo tal ter pri raziskavah tal kot naravnega vira. Slušatelj spozna metode za določevanja tistih fizikalno-kemijskih in bioloških lastnosti tal ter talne raztopine, ki so pomembni pokazatelji procesov v tleh in funkcioniranja tal. Slušatelj pridobi praktične izkušnje z merilnimi metodami.

Objectives and competences:

Soil quality is important pre-condition for the sustainable (e.g., agricultural) use of soil as non-renewable natural resource. Students are familiarised with methods of determining physical, chemical and biological properties of soil and soil solution as important indicators of soil processes and functioning of soil. Students acquire practical measurement skills.

Predvideni študijski rezultati:

Znanje in razumevanje:
Slušatelj se nauči izbrati in pravilno uporabiti primerno metodo za merjenje in ugotavljanje lastnosti tal, procesov, funkcioniranja in indikatorjev kakovosti tal pri raziskavah trajnostne rabe tal v kmetijstvu, oceni tveganja in remediaciji onesnaženih tal, pri ekoloških, eko-toksikoloških in drugih raziskavah talnega ekosistema. Slušatelj se nauči rezultate meritev kritično vrednotiti in jih interpretirati v povezavi z drugimi pridobljenimi in danimi podatki.

Intended learning outcomes:

Knowledge and understanding:
Students are taught to select and use appropriate methods for assessing given soil properties, processes, functions and quality indicators in relation with sustainable soil use in agriculture, risk assessment and remediation of polluted soils, and in ecological, ecotoxicological and other research of soil ecosystems. They are taught to evaluate results critically and interpret results with respect and in connection with other available and obtained data.

Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja, seminarji, laboratorijske vaje, samostojno delo	Lectures, seminars, laboratory exercises, individual work.
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		Delež (v %) / Weight (in %)	Assessment:
Načini ocenjevanja:			
Ustni izpit iz predavanj in vaj		50	Oral examination from lectures and exercises
Ocena seminarja v povezavi s samostojnim delom		50	Assessment of seminar connected with the student's individual work

Reference nosilca / Lecturer's references:

Domen Leštan:

1. UDOVIČ, Metka, DROBNE, Damjana, LEŠTAN, Domen. An in vivo invertebrate bioassay of Pb, Zn and Cd stabilization in contaminated soil. *Chemosphere*, ISSN 0045-6535. [Print ed.], 2013, vol. 92, issue 9, str. 1105-1110. <http://dx.doi.org/10.1016/j.chemosphere.2013.01.054>, doi: 10.1016/j.chemosphere.2013.01.054. [COBISS.SI-ID 7458425]
2. JELUŠIČ, Maša, GRČMAN, Helena, VODNIK, Dominik, SUHADOLC, Marjetka, LEŠTAN, Domen. Functioning of metal contaminated garden soil after remediation. *Environmental pollution*, ISSN 0269-7491. [Print ed.], 2013, vol. 174, str. 63-70. <http://dx.doi.org/10.1016/j.envpol.2012.10.027>. [COBISS.SI-ID 7368313]
3. VOGLAR, Grega E., LEŠTAN, Domen. Equilibrium leaching of toxic elements from cement stabilized soil. *Journal of hazardous materials*, ISSN 0304-3894. [Print ed.], 2013, vol. 246-247, str. 18-25. <http://dx.doi.org/10.1016/j.jhazmat.2012.11.058>, doi: 10.1016/j.jhazmat.2012.11.058. [COBISS.SI-ID 7367801]
4. POCIECHA, Maja, LEŠTAN, Domen. Recycling of EDTA solution after soil washing of Pb, Yn, Cd and As contaminated soil. *Chemosphere*, ISSN 0045-6535. [Print ed.], 2012, vol. 86, issue 8, str. 843-846. <http://dx.doi.org/10.1016/j.chemosphere.2011.11.004>, doi: 10.1016/j.chemosphere.2011.11.004. [COBISS.SI-ID 6904441]
5. UDOVIČ, Metka, LEŠTAN, Domen. EDTA and HCl leaching of calcareous and acidic soils polluted with potentially toxic metals: Remediation efficiency and soil impact. *Chemosphere*, ISSN 0045-6535. [Print ed.], 2012, vol. 88, issue 6, str. 718-724. <http://dx.doi.org/10.1016/j.chemosphere.2012.04.040>, doi: 10.1016/j.chemosphere.2012.04.040. [COBISS.SI-ID 7132025]
6. POCIECHA, Maja, LEŠTAN, Domen. Novel EDTA and process water recycling method after soil washing of multi-metal contaminated soil. *Journal of hazardous materials*, ISSN 0304-3894. [Print ed.], 2012, vol. 201-202, str. 273-279, ilustr. <http://dx.doi.org/10.1016/j.jhazmat.2011.11.092>, doi: 10.1016/j.jhazmat.2011.11.092. [COBISS.SI-ID 6927993]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Metode v ekofiziologiji rastlin in ekologiji kopenskih ekosistemov
Course title:	Methods in plant ecophysiology and ecology of terrestrial ecosystems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
20	-	20	/	50	160	10

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Dominik Vodnik

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

splošni pogoji za vpis na doktorski študij

general conditions for enrolment in doctoral studies

Vsebina:
 Predmet obravnava najpomembnejše metodološke pristope v proučevanju odziva (1) posameznih rastlinskih osebkov in (2) kopenskih ekosistemov na glavne okoljske, posebej abiotske dejavnike. Predstavljene metode so ovrednotene s stališča njihove

Content (Syllabus outline):
 The subject deals with most important methodological approaches used to study the response of 1) individual plants and 2) terrestrial ecosystems to main, mainly abiotic environmental factors. The introduced methods are evaluated with respect to their objectivity,

objektivnosti, časovne in prostorske reprezentativnosti ter zahtevnosti za izvedbo.

Na ravni rastline so predstavljene metode za spremljanje fiziološkega in biokemijskega odziva rastlin na razpoložljivost svetlobe, vode in hranil, na temperaturni režim, na onesnažila v tleh, zraku in vodi, idr. Predstavljene metode na tem nivoju vrednotijo okoljske dejavnike z meritvami fotosinteze, dihanja rastline, rasti, listne površine, vodnega potenciala, vsebnosti pigmentov, antioksidantov in drugih primarnih in sekundarnih metabolitov.

Na ekosistemski ravni so predstavljene metode, ki obravnavajo tokove snovi in energije skozi kopenske ekosisteme ter dejavnike, ki na to vplivajo. Težišče je na spremljanju (1) komponent ogljikovega cikla (bruto in neto primarna produkcija in dihanje ekosistema, neto ekosistemska produkcija, dihanje tal in njegove komponente, dekompozicija), (2) vodne bilance (evaporacija in transpiracija, odtok, intercepcija, razpoložljivost vode v tleh) ter (3) bilance mineralnih hranil (depozicija iz atmosfere, izpiranje, fiksacija N₂, denitrifikacija).

Med bolj detajlno predstavljenimi metodami so: meritve fotosinteze lista z IRGA analizatorji, HPLC in spektrofotometrične analize rastlinskih vzorcev, mikrometeorološke metode (eddy covariance), meritve plinov s premičnimi komorami, stabilni izotopi (ogljik, kisik, vodik, dušik), transpiracijski tok v steblih/debljih, meritve listne površine z LAI analizatorji in fotografijo, vegetacijski indeksi in drugi biometrični postopki.

temporal and spatial representativity and applicability.

On the plant level different physiological and biochemical methods, aimed to study the response to light-, water- and nutrient-availability and to air-, soil- and water pollutants, are presented. These methods reveal the action of environmental factors on the level of photosynthesis, respiration, growth, leaf area, water potential, the content of pigments, antioxidants, and other primary and secondary metabolites.

On the ecosystemic level, methods used in the studies of fluxes of matter and energy in the ecosystems and methods aimed to study the effects of different environmental factors on these fluxes, are presented. Here, the subject focuses on evaluation of 1) different components of the carbon cycle (gross and net primary production, ecosystem respiration, net ecosystem production, soil respiration and its components, decomposition), 2) water balance (evaporation and transpiration, drain off, interception, soil water availability) and 3) the balance of mineral nutrients (atmospheric deposition, leaching N₂ fixation, denitrification).

Methods presented in detail include: gas exchange measurements based on the use of IRGAs, HPLC and spectrophotometric analyses of plant samples; micrometeorological methods (eddy covariance), chamber-techniques used to measure fluxes of gases in the field, stable isotope techniques (carbon, oxygen, hydrogen, nitrogen); sap-flow techniques, leaf area index measurements (ceptometers, hemispheric photography); vegetation indexes and other biometric procedures.

Temeljni literatura in viri / Readings:

- Reigosa Roger M. J. 2001. Handbook of Plant Ecophysiology Techniques. Kluwer Academic Publishers, Dordrecht, 452 s., ISBN 0-7923-7053-8
- von Willert D.J., Matyssek R., Herppich W. 1995. Experimentelle Pflanzenökologie – Grundlagen und Anwendungen. Geroth Thieme Verlag Stuttgart, New York, 344s., ISBN 3-13-134401-6
- Larcher, W. 2002. Physiological Plant Ecology. Ecophysiology and Stress Physiology of Functional Groups. četrta izdaja, Springer, Berlin: 506 s. ISBN 3-540-43516-6
- Flexas J., Loreto F., Medrano H. 2012. Terrestrial Photosynthesis in a Changing Environment. Cambridge University Press, Cambridge, 728 s. ISBN 978-0-521-89941-3
- Chapin III, F.S., Matson, P.A., Vitousek, P. 2012. Principles of Terrestrial Ecosystem Ecology, 2nd

ed. Springer, Berlin: 529 p. ISBN 978-1-4419-9502-5

Sala, O.E., Jackson, R.B., Mooney, H.A., Howarth, R.W. (Eds.). 2000. Methods in Ecosystem Science. Springer, New York: 421 p. ISBN: 978-0-387-98743-9

Waxmundska-Hajnos, M., Sherma, J. 2010. High performance liquid chromatography in phytochemical analyses. CRC Press, 975 s. ISBN: 978-1-4200-9260-8

revijalni članki s področja, tekoča periodika, druga učna gradiva...
journal papers, current periodicals, others...

Cilji in kompetence:

Cilji predmeta so študentu približati znanstveno-raziskovalno delo na področju ekofiziologije rastlin ter ekosistemske ekologije ter ga seznaniti z naborom raziskovalnih metod, ki se pri tem delu uporabljajo.

Objectives and competences:

Aims of the class: to make the student familiar with scientific research work in the field of the ecophysiology of plants and ecosystem ecology and to introduce available research methods which can be used in this work.

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent pozna nabor najpomembnejših metod, ki se uporabljajo v ekofiziologiji in ekologiji kopenskih ekosistemov, njihov glavni namen ter prednosti in slabosti.

Za določen namen raziskovanja zna izbrati ustrezne metode, jih ovrednotiti s stališča objektivnosti, ponovljivosti in uporabnosti. Zna jih uporabiti v raziskavah odziva rastlin in ekosistemov v eksperimentalnih ali naravnih razmerah. Sposoben je načrtovanja raziskovalnega dela ter sinteze in analize dokaj širokega spektra znanj na področju rastlinske ekofiziologije in ekosistemske ekologije ter sorodnih ved.

Intended learning outcomes:

Knowledge and understanding:

The student gets to know basic methods used in ecophysiology and the ecology of terrestrial ecosystems; their applicability, advantages and disadvantages.

He/she is able to select appropriate methods for a given research problem/question and can critically evaluate their objectivity, repeatability and applicability. He/she is able to apply these methods when studying responses on plant or ecosystem level, both in experimental and environmental conditions. Student can plan research work, he/she is able to make synthesis and analyses of broad spectra of knowldges from the field of plant ecophysiology, ecosystem ecology and related fields of science.

Metode poučevanja in učenja:

Študenti se na predavanjih in laboratorijskih vajah seznanijo z osnovami metod. Te kasneje uporabijo v okviru projektnega dela, ki ga izvedejo na terenu ali v kontroliranih razmerah v laboratoriju oz. rastlinjaku. Rezultate projekta predstavijo.

Learning and teaching methods:

With lectures and lab exercises students are introduced to basics of different methods. Later they use selected methods in their project work, which can be performed in the field or under controlled conditions (lab, greenhouse). They present the results of the project.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Izpit	50	Exam
Projektno delo	50	Project work

Reference nosilca / Lecturer's references:

DOMINIK VODNIK

- VODNIK, Dominik**, HLADNIK, Jože, VREŠAK, Martina, ELER, Klemen. Interspecific variability of plant stomatal response to step changes of [CO₂]. *Environmental and Experimental Botany*, ISSN 0098-8472. [Print ed.], 2013, vol. 88, str. 107-112.
<http://dx.doi.org/10.1016/j.envexpbot.2011.12.029>, doi: [10.1016/j.envexpbot.2011.12.029](https://doi.org/10.1016/j.envexpbot.2011.12.029). [COBISS.SI-ID [7440505](https://www.cobiss.si/record/7440505)]
- ELER, Klemen, PLESTENJAK, Gregor, FERLAN, Mitja, ČATER, Matjaž, SIMONČIČ, Primož, **VODNIK, Dominik**. Soil respiration of karst grasslands subjected to woody-plant encroachment. *European journal of soil science*, ISSN 1351-0754. [Print ed.], 2013, vol. 64, issue 2, str. 210-218, ilustr. <http://dx.doi.org/10.1111/ejss.12020>, doi: [10.1111/ejss.12020](https://doi.org/10.1111/ejss.12020). [COBISS.SI-ID [7550841](https://www.cobiss.si/record/7550841)]
- STRAJNAR, Polona, ŠIRCA, Saša, UREK, Gregor, ŠIRCELJ, Helena, ŽELEZNIK, Peter, **VODNIK, Dominik**. Effect of Meloidogyne ethiopica parasitism on water management and physiological stress in tomato. *European journal of plant pathology*, ISSN 0929-1873, 2012, vol. 132, no. 1, str. 49-57. <http://www.springerlink.com/content/nkq21m023723421v/>, doi: [10.1007/s10658-011-09847-6](https://doi.org/10.1007/s10658-011-09847-6). [COBISS.SI-ID [3642984](https://www.cobiss.si/record/3642984)]
- PLESTENJAK, Gregor, ELER, Klemen, **VODNIK, Dominik**, FERLAN, Mitja, ČATER, Matjaž, KANDUČ, Tjaša, SIMONČIČ, Primož, OGRINC, Nives. Sources of soil CO₂ in calcareous grassland with woody plant encroachment. *Journal of soils and sediments*, ISSN 1439-0108, 2012, vol. 12, no. 9, str. 1327-1338, ilustr. <http://dx.doi.org/10.1007/s11368-012-0564-3>, doi: [10.1007/s11368-012-0564-3](https://doi.org/10.1007/s11368-012-0564-3). [COBISS.SI-ID [3420838](https://www.cobiss.si/record/3420838)]
- FERLAN, Mitja, ALBERTI, G., ELER, Klemen, BATIČ, Franc, PERESSOTTI, Alessandro, MIGLIETTA, Francesco, ZALDEI, A., SIMONČIČ, Primož, **VODNIK, Dominik**. Comparing carbon fluxes between different stages of secondary succession of a karst grassland. *Agriculture, ecosystems & environment*, ISSN 0167-8809. [Print ed.], 2011, vol. 140, no. 1/2, str. 199-207, ilustr. <http://dx.doi.org/10.1016/j.agee.2010.12.003>, doi: [10.1016/j.agee.2010.12.003](https://doi.org/10.1016/j.agee.2010.12.003). [COBISS.SI-ID [3086246](https://www.cobiss.si/record/3086246)]
- VODNIK, Dominik**, STRAJNAR, Polona, JEMC, Sonja, MAČEK, Irena. Respiratory potential of maize (*Zea mays* L.) roots exposed to hypoxia. *Environmental and Experimental Botany*, ISSN 0098-8472. [Print ed.], 2009, vol. 65, iss. 1, str. 107-110.
<http://dx.doi.org/10.1016/j.envexpbot.2008.05.005>, doi: [10.1016/j.envexpbot.2008.05.005](https://doi.org/10.1016/j.envexpbot.2008.05.005). [COBISS.SI-ID [5612153](https://www.cobiss.si/record/5612153)]
- VODNIK, Dominik**, VIDEMŠEK, Urška, PINTAR, Marina, MAČEK, Irena, PFANZ, Hardy. The characteristics of soil CO₂ fluxes at a site with natural CO₂ enrichment. *Geoderma*, ISSN 0016-7061. [Print ed.], 2009, vol. 150, no. 1/2, str. 32-37.
<http://dx.doi.org/10.1016/j.geoderma.2009.01.005>, doi: [10.1006/j.geoderma.2009.01.005](https://doi.org/10.1006/j.geoderma.2009.01.005). [COBISS.SI-ID [5828217](https://www.cobiss.si/record/5828217)]
- VIDEMŠEK, Urška, HAGN, Alexandra, SUHADOLC, Marjetka, RADL, Viviane, KNICKER, Heike, SCHLOTTER, Michael, **VODNIK, Dominik**. Abundance and diversity of CO₂-fixing bacteria in grassland soils close to natural carbon dioxide springs. *Microbial ecology*, ISSN 0095-3628, 2009, issue 1, vol. 58, str. 1-9. <http://dx.doi.org/10.1007/s00248-008-9442-3>, doi: [10.1007/s00248-008-9442-3](https://doi.org/10.1007/s00248-008-9442-3). [COBISS.SI-ID [5663097](https://www.cobiss.si/record/5663097)]
- HLADNIK, Jože, ELER, Klemen, KRŽAN, Kaja, PINTAR, Marina, **VODNIK, Dominik**. Short-

term dynamics of stomatal response to sudden increase in CO₂ concentration in maize supplied with different amounts of water. *Photosynthetica*, ISSN 0300-3604, 2009, vol. 47, no. 3, str. 422-428. <http://www.springerlink.com/content/e555t1110rw48444/fulltext.pdf>. [COBISS.SI-ID [6138489](#)]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Mikrobna ekologija agroekosistemov
Course title:	Microbial ecology of agroecosystems

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	20	/	/	/	95 ur	5

Nosilec predmeta / Lecturer: Nosilec: Prof. dr. David Stopar

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij.

General conditions for enrolment in doctoral studies.

Vsebina: **Content (Syllabus outline):**

- Vloga mikroorganizmov pri kroženju elementov (C, N, S, P, Fe, Mn, O, H, Si, Ca, Hg, Cr, Pb, Zn, Cu).
- Biorazgradnja rastlinskega materiala.
- Mikrobna ekologija rizosfere in filofsere
- Simbiotske interakcije mikroorganizmov in rastlin (mikoriza, fiksacija dušika).
- Vloga mikrobnih združb v različnih agroekosistemih.

- Microorganisms and nutrient cycling (C, N, S, P, Fe, Mn, O, H, Si, Ca, Hg, Cr, Pb, Zn, Cu).
- Biodegradation of plant material.
- Microbial ecology of rhyzo and phylosphere.
- Symbiotic interactions between microbes and plants (mycorrhize, nitrogen fixation).
- Microbial communities in different agroecosystems.

Temeljni literatura in viri / Readings:

- Soil microbiology, ecology, and biochemistry / editor, Eldor A. Paul. — 3rd ed. 2007, Academic Press
- Microbial Ecology: Fundamentals and applications Atlas R.M. and Bartha R., 4th ed. 1998
- Mycorrhizal Symbiosis, S.E. Smith, D.J. Read – 3rd ed. 2008, Academic Press
- Soil Ecology and Ecosystem Services (izbrana poglavja) / editor, Wall D.H. 2012, Oxford University Press
- revijalni članki s področja

Cilji in kompetence:

Študent spozna vlogo mikroorganizmov pri delovanju različnih agroekosistemov. Mikroorganizme zna izkoriščati v proizvodne namene.

Objectives and competences:

Student understands the essential role that microorganisms play in functioning of different agroecosystems. Student is able to exploit microorganisms in agricultural production.

Predvideni študijski rezultati:

Študent razume funkcioniranje sistema rastlina-mikrob v rizosferi in filosferi. Razume vlogo mikroorganizmov pri biorazgradnji, kroženju snovi in energije v ekosistemu in pomenu le tega za prehrano rastlin. V podrobnostih razume mikorizo in biološko fiksacijo in ju zna izrabiti v praksi.

Intended learning outcomes:

Student understands functioning of plant-microbe system in rhizosphere and filosphere. Understands biogeochemical cycling of elements, biodegradation and how this influences plant nutrition. Understands in detail the processs of mycorrhizae and biological nitrogen fixation.

Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja po posameznih sklopih. Problemsko voden seminar prilagojen potrebam posameznega študenta. Seminar lahko študent v dogovoru z nosilcem opravi teoretično ali praktično v laboratoriju.

Lectures and seminar adjusted to student needs. In agreement with the lecture student may decide to do practical or theoretical seminar.

Načini ocenjevanja:

Delež (v %) /
Weight (in %)

Assessment:

Ocenjuje se izvedba problemsko orientiranega seminarja. ~~Ocena seminarja je opisna (opravi/ni opravi).~~

100

Seminar is evaluated ~~(passed/failed).~~

Reference nosilca / izvajalcev / Lecturer's references:

Prof. Dr. David Stopar

1. DANEVČIČ, Tjaša, MANDIČ-MULEC, Ines, STRES, Blaž, STOPAR, David, HACIN, Janez. Emissions of CO₂, CH₄ and N₂O from Southern European peatlands. *Soil biology & biochemistry*, ISSN 0038-0717. [Print ed.], 2010, vol. 42, str. 1437-1446, doi: [10.1016/j.soilbio.2010.05.004](https://doi.org/10.1016/j.soilbio.2010.05.004). [COBISS.SI-ID [3779192](https://www.cobiss.si/id/3779192)]

2. MAČEK, Irena, VIDEMŠEK, Urška, KASTELEC, Damijana, STOPAR, David, VODNIK, Dominik. Geological CO₂ affects microbial respiration rates in Stavešinci mofette soils = Geološki CO₂ vpliva na mikrobno dihanje v tleh na območju mofete Stavešinci. *Acta biologica slovenica*, ISSN 1408-3671. [Tiskana izd.], 2009, vol. 52, št. 2, str. 41-48. [COBISS.SI-ID [6209657](https://www.cobiss.si/id/6209657)]

3. DANEVČIČ, Tjaša, STOPAR, David. Asymmetric response of carbon metabolism at high and low salt stress in *Vibrio* sp. DSM14379. *Microbial ecology*, ISSN 0095-3628, 2011, vol. 62, str. 198-204, doi: [10.1007/s00248-011-9870-3](https://doi.org/10.1007/s00248-011-9870-3). [COBISS.SI-ID [3915640](https://www.cobiss.si/id/3915640)]

4. IVANČIČ, Tina, JAMNIK, Polona, STOPAR, David. Cold shock CspA and CspB protein production during periodic temperature cycling in *Escherichia coli*. *BMC research notes*, ISSN 1756-0500, 2013, vol. 6, article no. 248, str. 1-9. <http://www.biomedcentral.com/content/pdf/1756-0500-6-248.pdf>, doi: [10.1186/1756-0500-6-248](https://doi.org/10.1186/1756-0500-6-248). [COBISS.SI-ID [4262776](https://www.cobiss.si/id/4262776)]

5. BORIČ, Maja, DANEVČIČ, Tjaša, STOPAR, David. Prodigiosin from *Vibrio* sp. DSM 14379 : a new UV-protective pigment. *Microbial ecology*, ISSN 0095-3628, 2011, vol. 62, str. 528-536, doi: [10.1007/s00248-011-9857-0](https://doi.org/10.1007/s00248-011-9857-0). [COBISS.SI-ID [3915896](https://www.cobiss.si/id/3915896)]

6. STARIČ, Nejc, DANEVČIČ, Tjaša, STOPAR, David. *Vibrio* sp. DSM 14379 pigment production - a competitive advantage in the environment?. *Microbial ecology*, ISSN 0095-3628, 2010, vol. 60, no. 3, str. 592-598, doi: [10.1007/s00248-010-9671-0](https://doi.org/10.1007/s00248-010-9671-0). [COBISS.SI-ID [3772024](https://www.cobiss.si/id/3772024)]

7. HEMMINGA, Marcus A., VOS, Werner L., NAZAROV, Petr V., KOEHORST, Rob B. M., WOLFS, Cor J. A. M., SPRUIJT, Ruud B., STOPAR, David. Viruses : incredible nanomachines, New advances with filamentous phages. *European biophysics journal*, ISSN 0175-7571, 2010, issue 4, vol. 39, str. 541-550, doi: [10.1007/s00249-009-0523-0](https://doi.org/10.1007/s00249-009-0523-0). [COBISS.SI-ID [3659128](https://www.cobiss.si/id/3659128)]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Ocenjevanje tveganja in upravljanje s fitofarmaceutskimi sredstvi v okolju
Course title:	Pesticide risk assessment and management

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	5	15	/	5	90	5

Nosilec predmeta / Lecturer: Nosilec: doc.dr. Marjetka Suhadolc

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Diplomanti enovitih magistrskih študijskih programov in študijskih programov 2. stopnje s področja biomedicinskih, biotehniških in naravoslovno matematičnih usmeritev.

Graduates of uniform master programmes and 2nd cycle programmes of biomedical, biotechnical, mathematical and natural sciences

Vsebina: **Content (Syllabus outline):**

Fitofarmacevtska sredstva – osnovne definicije. Procesi v usodi fitofarmacevtskih sredstev in dejavniki, ki jo določajo. Porazdelitev v tleh, mehanizmi vezave, fenomen vezanih ostankov, izhlapevanje, zanašanje, površinski odtok, premeščanje v talnem profilu, izpiranje v podtalnico, sprejem v organizme, transformacije - razgradnja – mineralizacija. Remediacija tal: biostimulacija in bioaugmentacija. Vpliv FFS na neciljne organizme. Predstavitev metod preučevanja usode organskih ksenobiotikov v okolju na različnih nivojih in vrednotenja njihovih rezultatov. Uporaba dinamičnega modeliranja in metamodeliranje za ocenjevanje tveganj in upravljanje s FFS v okolju. Karte ranljivosti tal. Omilitveni ukrepi za preprečevanje točkovnega in razpršenega onesnaženja s FFS. FFS na podlagi mikroorganizmov in virusov – prednosti, omejitve in možnosti uporabe v integriranem varstvu rastlin. Zakonodaja, ki obravnava okoljska tveganja FFS v R Sloveniji in EU.

Pesticides - basic definitions. Processes in the fate of plant protection products and the influential factors. Distribution in the soil, binding mechanisms, the phenomenon of bound residues, evaporation, drift, surface runoff, movement in soil profile, leaching into groundwater, uptake by organisms, transformation - degradation - mineralization. Soil remediation: biostimulation and bioaugmentation. The impact of pesticides on non-target organisms. Methods for examining the fate of pesticide in the environment at different levels will be presented, as well as how to interpretate their results. Dynamic modeling and metamodeling approaches for pesticide risk assessment and management in the environment. Maps of soil vulnerability. Mitigation measures for the prevention of point and diffuse pollution by pesticides. Pesticides on the basis of micro-organisms and viruses (biopesticides) - the advantages, limitations and possible applications in integrated plant protection. Legislation dealing with environmental risks of pesticides in Slovenia and EU.

Temeljni literatura in viri / Readings:

Dunnivant F.M. in Anders E., 2006. A basic introduction to pollutant fate and transport. An integrated approach with chemistry, modelling, risk assessment and environmental legislation. John Wiley & Sons, Inc. New Jersey, 480 s.
Scheunert I., Parlar H., 1992. Terrestrial Behavior of Pesticides. Springer-Verlag, 144 s.
Roberts T., Hutson D., 1999. Metabolic pathways of agrochemicals (part 1 and 2), The Royal Society of Chemistry, MPG Books Ltd., Cornwall, 1475/ 849 s.
Revijalni članki s področja, tekoča periodika, druga učna gradiva.

Cilji in kompetence:

Posredovati znanja za razumevanje usode fitofarmacevtskih sredstev (FFS) v okolju. Študente seznaniti z različnimi pristopi za ugotavljanje tveganja uporabe FFS in upravljanje s FFS v okolju. Študente spodbujati k samostojnemu razmišljanju o ukrepih za zmanjševanje okoljskih tveganj uporabe FFS. Specifičnosti FFS na podlagi mikroorganizmov in virusov ter možnosti souporabe s kemičnimi FFS.

Objectives and competences:

Provide knowledge on pesticide fate in the environment. Different approaches to pesticide risk assessment and management in the environment will be introduced. Students will be encouraged to independently reflect mitigation measures for reducing environmental risks of pesticides. Specifics of biopesticides and the possibility of the joint use with chemical pesticides.

Predvideni študijski rezultati:

Znanje in razumevanje:
Kandidat bo sposoben samostojno vrednotiti podatke o lastnostih FFS, ki določajo njihovo usodo v okolju. Sposoben bo izdelati ocene

Intended learning outcomes:

Knowledge and understanding:
Students will be able to independently evaluate pesticide properties data which determine their environmental fate. Moreover, they will be able

tveganj uporabe FFS v različnih kmetijsko-okoljskih scenarijih in predlagati možne ukrepe za zmanjševanje teh tveganj na ravni kmetije, kot tudi vodozbornih območij in državni ravni.

to make pesticide risk assessments in different agro-environmental scenarios and propose possible measures to mitigate those risks at farm scale, as well as on the catchment and national level.

Metode poučevanja in učenja:

Predmet se izvaja v obliki predavanj, seminarских vaj (delo z modeli) in samostojne seminarske naloge, kjer pridobljena znanja uporabijo.

Uporabljena bodo sodobna audiovizualna sredstva in računalniška orodja (modeli FOCUS, FOOTPRINT orodja, arcGIS).

Learning and teaching methods:

The course will consist of lectures, tutorials (working with models) and a separate seminar, where acquired knowledge is used. Modern audio-visual products and computer tools will be applied (models FOCUS FOOTPRINT tools, ArcGIS).

Načini ocenjevanja:

Seminar.
Ustni izpit.

Delež (v %) /

Weight (in %)

Assessment:

Seminar.
Oral examination.

Reference nosilca / izvajalcev / Lecturer's references:

Marjetka Suhadolc

(i) **SUHADOLC, Marjetka**, SCHROLL, Reiner, HAGN, Alexandra, DÖRFLER, Ulrike, SCHLOTTER, Michael, LOBNIK, Franc. Single application of sewage sludge - Impact on the quality of an alluvial agricultural soil. Chemosphere, ISSN 0045-6535. [Print ed.], 2010, vol. 81, no. 11, str. 1536-1543, ilustr. <http://dx.doi.org/10.1016/j.chemosphere.2010.08.024>, doi: 10.1016/j.chemosphere.2010.08.024. [COBISS.SI-ID 6392185]

(ii) FOLBERTH, Christian, SCHERB, Hagen, **SUHADOLC, Marjetka**, MUNCH, Jean Charles, SCHROLL, Reiner. In situ mass distribution quotient (iMDQ) - a new factor to compare bioavailability of chemicals in soils?. Chemosphere, ISSN 0045-6535. [Print ed.], 2009, vol. 75, iss. 6, str. 707-713, ilustr. <http://dx.doi.org/10.1016/j.chemosphere.2009.01.077>, doi: 10.1016/j.chemosphere.2009.01.077. [COBISS.SI-ID 5885305]

(iii) FOLBERTH, Christian, **SUHADOLC, Marjetka**, SCHERB, Hagen, MUNCH, Jean Charles, SCHROLL, Reiner. Batch experiments versus soil pore water extraction - what makes the difference in isoproturon (bio-)availability?. Chemosphere, ISSN 0045-6535. [Print ed.], 2009, vol. 77, issue 6, str. 756-763, ilustr. <http://dx.doi.org/10.1016/j.chemosphere.2009.08.029>, doi: 10.1016/j.chemosphere.2009.08.029. [COBISS.SI-ID 6073977]

(iv) VIDEMŠEK, Urška, HAGN, Alexandra, **SUHADOLC, Marjetka**, RADL, Viviane, KNICKER, Heike, SCHLOTTER, Michael, VODNIK, Dominik. Abundance and diversity of CO₂-fixing bacteria in grassland soils close to natural carbon dioxide springs. Microbial ecology, ISSN 0095-3628, 2009, issue 1, vol. 58, str. 1-9. <http://dx.doi.org/10.1007/s00248-008-9442-3>, doi: 10.1007/s00248-008-9442-3. [COBISS.SI-ID 5663097]

(v) JELUŠIČ, Maša, GRČMAN, Helena, VODNIK, Dominik, **SUHADOLC, Marjetka**, LEŠTAN, Domen. Functioning of metal contaminated garden soil after remediation. Environmental pollution, ISSN 0269-7491. [Print ed.], 2013, vol. 174, str. 63-70. <http://dx.doi.org/10.1016/j.envpol.2012.10.027>. [COBISS.SI-ID 7368313]

(vi) WALLISCH, Stefanie, GRIL, Tjasa, DONG, Xia, WELZL, Gerd, BRUNS, Christian, HEATH, Ester, ENGEL, Marion, **SUHADOLC, Marjetka**, SCHLOTTER, Michael, Schlotter, 2014. Effects of different compost amendments on the abundance and composition of alkB harboring bacterial

communities in a soil under industrial use contaminated with hydrocarbons. *Frontiers in Microbiology*, 5:96. doi:10.3389/fmicb.2014.00096, ISSN: 1664-302X, in press.

Znanstveni članek:

ŠINKOVEC, Marjan, ŠTANGELJ, Ana, BUKOVEC, Primož, SUHADOLC, Marjetka. Primerjava modelov FOCUS PELMO in PEARL pri ocenjevanju izpiranja herbicidov v treh izbranih vrstah tal na območju Apaške doline = Comparison of PELMO and PEARL FOCUS models for assessing herbicide leaching in three selected soil types in the Apače Valley area. *Acta agriculturae Slovenica*, ISSN 1581-9175. [Tiskana izd.], 2011, vol. 97, no. 1, str. 33-38. <http://aas.bf.uni-lj.si/marec2011/05sinkovec.pdf>. [COBISS.SI-ID 6614905]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Podnebne spremembe
Course title:	Climate change

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	agronomy	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	20	/	/	15	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. Lučka Kajfež Bogataj

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

splošni pogoji za vpis na doktorski študij

General conditions for enrolment in doctoral studies.

Vsebina: _____ **Content (Syllabus outline):** _____

Klimatski sistem. Opredelitev podnebnih dejavnikov in interakcij med njimi in povratnih zank. Viri paleo klimatskih informacij. Klima različnih geoloških obdobj. Klimatske značilnosti obdobja meteoroloških merenj.

Vzroki klimatskih sprememb

(ekstraterestrični in terestrični). Človekov hoten in nehoten vpliv na vremenske spremenljivke, kopno, atmosfero, vreme in podnebje. Tanjšanje ozonskega plašča. Emisije toplogrednih plinov (TGP) in spremembe rabe tal. Ogljikov cikel – viri in ponori CO₂. Vpliv kmetijstva na podnebje.

Podnebno modeliranje. Globalni modeli splošne cirkulacije in metode interpolacije njihovih rezultatov v manjšo prostorsko skalo. Regionalni klimatski modeli. Predpostavke, interdisciplinarni pristopi, koncepti negotovosti. Napoved bodoče klime v različnih časovnih horizontih (100 do 1000 let). Poti do stabilizacije koncentracij TGP.

Posledice klimatskih sprememb. Modeli vplivov na naravne (gozd, kmetijstvo, biotska raznovrstnost) in družbene sisteme. Interakcije z drugimi globalnimi spremembami.

Blaženje podnebnih sprememb. Vzvodi za zmanjševanje emisij TGP. Mednarodna javnost in podnebne spremembe – konvencije, dogovori

Prilagajanje na podnebne spremembe. Povezave med blaženjem, prilagajanjem in trajnostnim razvojem. Pojem ranljivosti agroekosistemov in prilagoditvene sposobnosti.

Cimate system. Climatic factors and interactions. Climate sensitivity and feedback mechanisms. Paleo data and proxies. History and evolution of Earth's climate. Direct Observations of Recent Climate Change. Climate fluctuation and variability.

Drivers of Climate Change (extraterrestrial and terrestrial). Human impact on climate system and climate. Weather modification, greenhouse gas (GHG) emissions. Land use change. Ozone layer, ozone hole. Carbon cycle – sources and sinks of CO₂. Agriculture role in climate change.

Climate modeling. Global Climate models in downscaling methods. Regional Climate models and their evaluation. Projections of Future Changes in climate (100 to 1000 years). Stabilisation pathways of GHG concentrations. Uncertainty concepts: quantitative measures and qualitative statements.

Key Vulnerabilities and the Risk from Climate Change. Impacts of climate change on natural (forest, agriculture, biodiversity) and social systems.

Mitigation of climate change. Assessment of mitigation technologies and practices, options, potentials and costs. International responses to climate change.

Adaptation to Climate Risks. Relationships between adaptation and mitigation. Assessment of adaptation practices, options, constraints and capacity. Perspectives on Climate Change and Sustainability

Temeljni literatura in viri / Readings:

6. IPCC: Climate Change 2013 - The Physical Science Basis. Cambridge Univ. Press, ISBN 978-0-521-70596-7
7. Dennis L. Hartmann: Global Physical Climatology. Academic Press, 1994, 411 p., ISBN 0-12-328530-5.
8. J. Rakovec in T. Vrhovec: Osnove meteorologije za naravoslovce in tehnike, DMFA
9. Kajfež Bogataj L. 2012. Vroči novi svet. Ljubljana, Cankarjeva založba: 211 str
10. Revijalni članki s področja in tekoča periodika.

Cilji in kompetence:

Objectives and competences:

- Pridobitev poglobljenega znanja o klimatskem sistemu in planetarni klimi na podlagi fizikalnega pristopa.
- Modeliranje procesov, ki vplivajo na podnebje in kvantitativne metode za oceno vpliva podnebja na vegetacijo.

- Understanding of Earth climate system and physical factors that influence climate.
- Knowledge of approaches to model processes that influence the Earth climate, and methods to quantify vegetation-climate interactions.

Predvideni študijski rezultati:

Znanje in razumevanje
Podrobnejši vpogled v fizikalne dejavnike klime, vzroke za klimatske spremembe in njihovo modeliranje. Razumevanje posledic podnebnih sprememb
Uporaba: Uporaba fizikalnih zakonov in preprostih klimatskih modelov za razumevanje klimatskih sprememb.
Refleksija: Povezava interakcije med atmosfero, oceani, površjem, ledom ter človeškim delovanjem s fizikalnimi zakoni.

Intended learning outcomes:

Knowledge and understanding:
Deeper understanding of physical factors that influence the Earth climate, anthropogenic causes of climate change and their descriptions in the models. Understanding climate change consequences.
Applicability: The use of basic physical laws and simple climate models to understand climate change processes
Reflection: Interactions between atmosphere, oceans, land, cryosphere, biosphere and humans and their description by physical laws.

Metode poučevanja in učenja:

Predavanja, vaje, seminar ob uporabi informacij o stanju klimatskega sistema iz različnih virov

Learning and teaching methods:

Lectures, tutorials, seminars using information on state of the climate from different sources

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Opravljeni seminarji iz vaj	40%	Problem-solving seminars,
predstavitev seminarja, ustni izpit iz teorije	60%	Seminar presentation, theoretical examination

Reference nosilca / izvajalcev / Lecturer's references:

KAJFEŽ-BOGATAJ LUČKA

- BERGANT, K., KAJFEŽ-BOGATAJ, Lučka. N-PLS regression as empirical downscaling tool in climate change studies. Theor. appl. climatol., 2005, no. 1-2, vol. 81, p. 11-23
- DOHERTY, S. J., KAJFEŽ-BOGATAJ, Lučka. 2009. Lessons learned from IPCC AR4 : scientific developments needed to understand, predict, and respond to climate change. Bull. Am. Meteorol. Soc., 2009, vol. 90, no. 4: 497-513.
- DOLINAR, M., VIDRIH, B., KAJFEŽ-BOGATAJ, Lučka, MEDVED, S. 2010. Predicted changes in energy demands for heating and cooling due to climate change. Phys. chem. earth, 2010, vol. 35, no. 1-2: 100-106.
- CEGLAR, A., KAJFEŽ-BOGATAJ, Lučka. 2012 Simulation of maize yield in current and changed climatic conditions: addressing modelling uncertainties and the importance of bias

correction in climate model simulations. Eur. J. agron. 2012, vol. 37 (1): 83-95.

- DE LUIS, M., ČUFAR, K., SAZ, M. A., LONGARES, L. A., CEGLAR, A., KAJFEŽ-BOGATAJ, Lučka. 2012. Trends in seasonal precipitation and temperature in Slovenia during 1951-2007. Reg. environ. change , doi: 10.1007/s10113-012-0365-7.
- KURNIK, Blaž, KAJFEŽ-BOGATAJ, Lučka, CEGLAR, A.. 2012. Correcting mean and extremes in monthly precipitation from 8 regional climate models over Europe. *Climate of the past*, ISSN 1814-9324, 2012, vol. 8, no. 2: 953-986. [COBISS.SI-ID [7109241](#)]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Statistične metode za analizo podatkov
Course title:	Statistical methods for data analysis

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agriculture	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	/	35	/	/	80	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Katarina KOŠMELJ

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Potrebno je znanje osnovne statistike.

Knowledge of basic statistics is required.

Vsebina: **Content (Syllabus outline):**

Moderni grafični prikazi.
Analiza kontingenčnih tabel.
Analiza enega vzorca za povprečje in za delež; parametrični in neparametrični pristop.
Analiza dveh vzorcev za povprečji in za deleža: parametrični in neparametrični pristop.
Analiza variance: slučajne skupine, slučajni bloki, večfaktorske zasnove; parametrične in neparametrične alternative.

Modern graphics for data presentation.
Analysis of contingency tables.
One sample mean and proportion analysis with parametric and nonparametric tests.
Two sample means and proportions analysis with parametric and nonparametric tests.
Analysis of variance; complete random one-way design, randomized complete block design, multi-factor experiment with parametric and nonparametric tests.

Temeljni literatura in viri / Readings:

KOŠMELJ, Katarina. *Uporabna statistika*. 2. dopolnjena izd. Ljubljana: Biotehniška fakulteta, 2007. ISBN 978-961-6275-26-2. http://www.bf.uni-lj.si/fileadmin/groups/2721/Uporabna_statistika_01.pdf. [COBISS.SI-ID [235777024](https://nbn-resolving.org/urn:nbn:si:coibis-235777024)]

Košmelj K.: Interna gradiva.(pdf datoteke)

Mead R, Curnow R & Hasted A. (2002). *Statistical Methods in Agriculture and Experimental Biology*, Third Edition. Chapman & Hall/CRC Press.

R Core Team (2013). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. URL <http://www.R-project.org/>.

Cilji in kompetence:

Cilj predmeta je seznaniti študenta s koncepti, postopki in statističnimi metodami za načrtovanje poskusov in analizo podatkov v bioloških in biotehniških vedah.

Objectives and competences:

Main objective is to give students an overview of concepts and statistical methods for design and analysis of experiments in biological and biotechnical sciences.

Predvideni študijski rezultati:

Znanje in razumevanje: študent nadgradi znanje osnovne statistike z znanjem zahtevnejših statističnih metod in pristopov. Poudarek je na uporabi ustrezne metode, na interpretaciji rezultatov ter na uporabi modernih programskih orodij.

Intended learning outcomes:

Knowledge and understanding: students upgrade basic knowledge of statistics with modern statistical and computing approaches. The focus is on the choice of appropriate methods, on the interpretation of the results and of the use of modern tools for statistical computing.

Metode poučevanja in učenja:

Learning and teaching methods:

Pouk je v računalniški učilnici, pri pouku se uporablja moderna programska oprema. Domače delo.

Lectures in computer room; modern software is used. Home work.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Izpit v računalniški učilnici.	100	Exam in computer laboratory.

Reference nosilca / izvajalcev / Lecturer's references:

Katarina Košmelj

AČIMOVIČ, Jure, KOŠIR, Rok, KASTELEC, Damijana, PERŠE, Martina, MAJDIČ, Gregor, ROZMAN, Damjana, KOŠMELJ, Katarina, GOLIČNIK, Marko. Circadian rhythm of cholesterol synthesis in mouse liver : a statistical analysis of the post-squalene metabolites in wild-type and Crem-knockout mice. *Biochemical and biophysical research communications*, ISSN 0006-291X, 2011, vol. 408, issue 4, str. 635-641, graf. prikazi, doi: [10.1016/j.bbrc.2011.04.076](https://doi.org/10.1016/j.bbrc.2011.04.076). [COBISS.SI-ID [28296665](https://www.cobiss.si/COBISS.SI-ID-28296665)]

ČOP, Jure, LAVRENČIČ, Andrej, KOŠMELJ, Katarina. Morphological development and nutritive value of herbage in five temperate grass species during primary growth: analysis of time dynamics. *Grass and forage science*, ISSN 0142-5242, 2009, vol. 64, no. 2, str. 122-131. <http://dx.doi.org/10.1111/j.1365-2494.2008.00676.x>. [COBISS.SI-ID [5979769](https://www.cobiss.si/COBISS.SI-ID-5979769)]

ČRNE-HLADNIK, Helena, PEKLAJ, Cirila, KOŠMELJ, Katarina, HLADNIK, Aleš, JAVORNIK, Branka. Assessment of Slovene secondary school students' attitudes to biotechnology interns of usefulness, moral acceptability and risk perception. *Public underst. sci.*, 2009, vol. 18, no. 6, str. 747-758. <http://dx.doi.org/10.1177/0963662509336761>

KOŠMELJ, Katarina, ŽABKAR, Vesna. A methodology for identifying time-trend patterns : an application to the advertising expenditure of 28 European countries in the 1994-2004 period. *Metodološki zvezki*, ISSN 1854-0023. [Tiskana izd.], 2008, vol. 5, no. 2, str. 161-171, ilustr. <http://mrvar.fdv.uni-lj.si/pub/mz/mz5.1/kosmelj.pdf>. [COBISS.SI-ID [17992934](https://www.cobiss.si/COBISS.SI-ID-17992934)]

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	Voda kot naravni vir v kmetijstvu
Course title:	Water as a natural resource for agriculture

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Interdisciplinarni doktorski študijski program BIOZNANOSTI 3. stopnja	Agronomija	1,2	1,2,3,4
Interdisciplinary Doctoral Study Programme in BIOSCIENCES 3rd cycle	Agriculture	1,2	1,2,3,4

Vrsta predmeta / Course type teoretični predmet / theoretical course

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje work	Druge oblike študija	Samost. delo Individ. work	ECTS
10	5	/	/	15	95	5

Nosilec predmeta / Lecturer: Nosilec: prof. dr. Marina Pintar

Jeziki / Languages:	Predavanja / Lectures:	slovenski / angleški Slovene / English
	Vaje / Tutorial:	slovenski / angleški Slovene / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: **Prerequisites:**

Splošni pogoji za vpis na doktorski študij.

Common conditions for the application on the doctoral study.

Vsebina: **Content (Syllabus outline):**

Pomen vode kot naravnega vira za kmetijstvo. Zakonski okvir povezave vode in kmetijstva. Voda za hrano in ekosisteme. Omejitve kmetijstva zaradi preveč ali premalo vode. Ugodne vodne talne razmere za rast rastlin. Retenzijske površine in kmetijstvo. Osuševanje in namakanje. Odvisnost svetovnega in slovenskega kmetijstva od namakanja. Različne tehnologije namakanja in njihov vpliv na okolje. Namakanje nekmetijskih površin. Sistemi za podporo odločanja o namakanju. Kakovost vode za rabo v kmetijstvu. Vodni viri za namakanje (površinske vode, podzemne vode, voda iz čistilnih naprav). Nabira vode. Problematika vodnih zadrževalnikov. Ukrepi za zmanjšano porabo vode v rastlinski pridelavi. Vpliv kmetijstva na vodno okolje. Mehanizmi prenosa onesnažil v površinske in podzemne vode. Mehanizmi preprečevanja vnosa onesnažil v vodno okolje in mehanizmi čiščenja voda onesnažil iz kmetijstva. Računalniško modeli prenosa onesnažil v vodno okolje. Vodovarstvena območja in kmetijstvo. Celovito urejanje voda v kmetijskem okolju.

Water as a natural resource important for agriculture. Legislative framework of water and agriculture connection. Water for food and ecosystems. Water as a restriction factor for agriculture – too much or too less water. Appropriate soil water status for plant production. Water retention areas and agriculture. Drainage and irrigation. Dependency of world and Slovene plant production on irrigation. Irrigation of non agricultural land. Different irrigation technologies and their impact on the environment. Decision support systems for irrigation. Water quality for the use in agriculture. Water resources for irrigation (surface waters, groundwater, and treated waste water) Water harvesting. Water reservoirs. Measurements for water use reduction in plant production. Mechanisms of pollutants transfer to surface and ground waters. Mechanisms of pollution prevention and mechanisms of agriculture pollutants reduction. Computer models dealing with agriculture and water quality. Water protection zones and agriculture. Holistic approach to water management in agricultural environment.

Temeljni literatura in viri / Readings:

- Chin, D. A. 2006. Water-quality engineering in natural systems. John Wiley & Sons, New Jersey. 609. s, ISBN -13: 978-0-471-71830-7. Chapter 1, Chapter 6, Chapter 9.
- Lazarova, V., Bahri A. 2005. Water Reuse for Irrigation. CRC Press, Boca Raton. 408 s.; ISBN 1-56670-649-1. Chapter 1-9.
- Molden D., 2007. Water for Food, Water for Life. Earthscan, London. 645 s., ISBN: 978-1-84407-396-2. Chapter 3 in 4.:
- Revijalni članki s področja, tekoča periodika, druga učna gradiva, ipd.

Cilji in kompetence:

Spoznati pomen vode v in za kmetijstvo ter vpliv kmetijstva na kakovost in količine vode z vsemi pomembnimi procesi in potmi prenosa onesnažil iz kmetijstva v vodno okolje.

Objectives and competences:

To realize a meaning of water in and for agriculture and the impact of agriculture to water quality and quantity inclusively all important processes and paths of pollutant transport from agriculture to water media.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje:
 študent pridobi znanje o vodi kot o naravnem viru, pomembnem za kmetijstvo, na katerega kakovostno in količinsko stanje pa kmetijstvo posredno ali neposredno s svojimi dejavnostmi vpliva. Spozna, kakšni so možni ukrepi za čim manjši vpliv kmetijstva na vodno okolje in za trajnostno upravljanje z vodo v kmetijstvu.

Knowledge and understanding:
 students get knowledge about water as a natural resource important for agriculture. Agriculture activities impact water quality and quantity status. Students get knowledge on measurements to diminish the negative impact of agriculture to water environment and for sustainable management of water in agriculture.

Metode poučevanja in učenja:

Predavanja oz. konzultacije in projektno oz. seminarsko delo.

Learning and teaching methods:

Lectures or consultation and project work or seminars.

Načini ocenjevanja:

Ocena seminarja (če je mogoče v povezavi s študentovo doktorsko nalogo).

Delež (v %) /

Weight (in %)

Assessment:

Evaluation of the seminar (if possible connected with the doctoral work)

100

Reference nosilca / izvajalcev / Lecturer's references:

Pintar Marina

1. GLAVAN, Matjaž, MILIČIĆ, Vesna, **PINTAR, Marina**. Finding options to improve catchment water quality - lessons learned from historical land use situations in a Mediterranean catchment in Slovenia. *Ecological modelling*, ISSN 0304-3800. [Print ed.], 2013, vol. 261-262, str. 58-73. <http://dx.doi.org/10.1016/j.ecolmodel.2013.04.004>, doi: [10.1016/j.ecolmodel.2013.04.004](https://doi.org/10.1016/j.ecolmodel.2013.04.004). [COBISS.SI-ID [7581049](https://www.cobiss.si/id/7581049)]
2. GLAVAN, Matjaž, **PINTAR, Marina**, VOLK, Martin. Land use change in a 200-year period and its effect on blue and green water flow in two Slovenian Mediterranean catchments-lessons for the future. *Hydrological processes*, ISSN 0885-6087, 2013, vol. 27, iss. 26, str. 3694-3980, ilustr. <http://dx.doi.org/10.1002/hyp.9540>, doi: [10.1002/hyp.9540](https://doi.org/10.1002/hyp.9540). [COBISS.SI-ID [7364473](https://www.cobiss.si/id/7364473)]
3. CVEJIĆ, Rozalija, TRATNIK, Matjaž, MELJO, Jana, BIZJAK, Aleš, PREŠEREN, Tanja, KOMPARE, Karin, STEINMAN, Franci, MEZGA, Kim, URBANC, Janko, **PINTAR, Marina**. Trajno varovana kmetijska zemljišča in bližina vodnih virov, primernih za namakanje = Permanently protected agricultural land and the location of water sources suitable for irrigation. *Geodetski vestnik*, ISSN 0351-0271. [Tiskana izd.], 2012, letn. 56, št. 2, str. 308-324, ilustr. http://www.geodetski-vestnik.com/56/2/gv56-2_308-324.pdf. [COBISS.SI-ID [5856865](https://www.cobiss.si/id/5856865)]

4. KACJAN-MARŠIĆ, Nina, BURNIK ŠTURM, Martina, ZUPANC, Vesna, LOJEN, Sonja, **PINTAR, Marina**. Quality of white cabbage yield and potential risk of ground water nitrogen pollution, as affected by nitrogen fertilisation and irrigation practices. *Journal of the Science of Food and Agriculture*, ISSN 0022-5142, 2012, vol. 92, issue 1, str. 92-98, doi: [10.1002/jsfa.4546](https://doi.org/10.1002/jsfa.4546). [COBISS.SI-ID [24907303](https://www.cobiss.si/id/24907303)]
5. ZUPANC, Vesna, BURNIK ŠTURM, Martina, LOJEN, Sonja, KACJAN-MARŠIĆ, Nina, ADU-GYAMFI, Joseph, BRAČIČ-ŽELEZNIK, Branka, URBANC, Janko, **PINTAR, Marina**. Nitrate leaching under vegetable field above a shallow aquifer in Slovenia. *Agriculture, ecosystems & environment*, ISSN 0167-8809. [Print ed.], 2011, vol. 144, issue 1, str. 167-174, ilustr. <http://dx.doi.org/10.1016/j.agee.2011.08.014>, doi: [10.1016/j.agee.2011.08.014](https://doi.org/10.1016/j.agee.2011.08.014). [COBISS.SI-ID [6820217](https://www.cobiss.si/id/6820217)]
6. BURNIK ŠTURM, Martina, KACJAN-MARŠIĆ, Nina, ZUPANC, Vesna, BRAČIČ-ŽELEZNIK, Branka, LOJEN, Sonja, **PINTAR, Marina**. Effect of different fertilisation and irrigation practices on yield, nitrogen uptake and fertiliser use efficiency of white cabbage. *Scientia horticultrae*, ISSN 0304-4238. [Print ed.], 2010, vol. 125, str. 103-109. [COBISS.SI-ID [23519015](https://www.cobiss.si/id/23519015)]