Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Biodiverziteta**
Course title:	**Biodiversity**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Biologija, 1. stopnja		**3.; 3rd**	**5.; 5th**
Biology, 1st cycle			

Vrsta predmeta / Course type	Obvezni / Compulsory
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
30	**15**		**30**		**105**	**6**

Nosilec predmeta / Lecturer:	Tina KLENOVŠEK

Jeziki / Languages:	**Predavanja / Lectures:**	slovenščina / Slovene
	Vaje / Tutorial:	slovenščina / Slovene

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

Vsebina:	Content (Syllabus outline):
Biodiverziteta (biotska raznovrstnost): • definicije, razvoj pojma, nivoji (genetski, vrstni in ekosistemski) • Konvencija o biološki raznovrstnosti (CBD, UNEP, 1992): nastanek (vloga OZN), vsebina (s Kartegenskim in Nagoyskim protokolom), vpliv na države podpisnice in zakonodajo • Pomen biodiverzitete in ekosistemske storitve (po MEA) • Ocene globalnega stanja biodiverzitete: Living Planet Index (LPI) in Poročila o stanju planeta (WWF), Rdeči seznam ogroženih vrst (IUCN), Rdeči seznam ekosistemov (IUCN), Global Biodiversity Outlook (GBO), Biodiversity Indicators Partnership (BIP)	Biodiversity (biotic diversity): • Definition and development of the concept, levels of biodiversity (genetic, species, and ecosystem) • Convention on Biological Diversity (CBD, UNEP, 1992): formation (role of UN), content (with Cartagena and Nagoya protocols), impact on parties and legislation • Importance of biodiversity and Ecosystem services (after Millenium Ecosystem Assessment) • Assessments of global biodiversity: Living Planet Index (LPI) and Living Planet Reports (WWF), IUCN Red List of Threatened Species, IUCN Red List of Ecosystems, Global Biodiversity Outlook (GBO), Biodiversity Indicators Partnership (BIP)

- Vrstna pestrost: osebki, populacije, vrste, ocene števila vrst, zgodovinski pregled odkrivanja in klasifikacije organizmov, klasifikacija eukariotov na šest superskupin
- Merjenje vrstne pestrosti: indeksi številčnosti (S, R1, R2), poravnanosti (E) in pestrosti (H', λ); nivoji prostorske pestrosti (α, β in γ)
- Genetska pestrost na nivoju osebkov, populacij in vrst; pomen in merjenje genetske pestrosti (H), heterozigotnosti, divergence med populacijami; genetski pretok, efektivna velikost populacij, problematika učinka osnovatelja, ozkega grla, parjenja v ožjem sorodstvu, homogenizacije populacij, genetskega drsa
- Nastanek in pomen domestificiranih vrst
- Vzorci biodiverzitete v odnosu do velikosti površine ozemlja (»aarea-adjusted species richness«) in vrstno-površinske krivulje na lokalnem, regionalnem, kontinentalnem nivoju in otočjih
- Vzorci razporeditve globalne biodiverzitete v odvisnosti od geografskih gradientov (geografske širine (LGD, iLDG) in nadmorske višine) - ekološki in evolucijski dejavniki

Upadanje biodiverzitete ter vpliv človeka na izumiranje vrst (dejavniki HIPPO):
- nastanek novih vrst, naravno izumiranje vrst, aktualno šesto množično izumiranje
- zgodovina razvoja človeške družbe in eksponentna rast človeške populacije (demografija)
- industrijska revolucija, socialno-ekonomski in Zemeljsko-sistemski trendi razvoja družbe od 1750-2000 leta (veliko pospeševanje, Great Acceleration), meje zmogljivosti planeta (Planetary Boundaries)
- problematika stalne gospodarske rasti (BDP) in potrošništva
- ocene vpliva človeka na naravno okolje (HANPP, IPAT, ekološki odtis), razlike med regijami in državami
- problematika in vplivi degradacije, fragmentacije in izgube habitatov (deforestacija, poljedelstvo, paša, izsuševanje mokrišč, gradnja jezov, infrastrukture, urbanizacija, rudniki, turizem itd.) s primeri na lokalnem in globalnem nivoju
- problematika in vplivi tujerodnih invazivnih vrst (kompeticija, predacija, hibridizacija, infekcije) s primeri
- problematika in posledice netrajnostne rabe populacij (goloseki, prelov, globalna trgovina s prostoživečimi organizmi in njihovimi deli (CITES) itd.)
- onesnaževanje prsti, vodotokov, zraka (viri: industrija, kmetijstvo, energetika, rudarjenje, transport itd.) in primeri posledic
- klimatske spremembe (fosilna goriva, toplogredni plini in efekt tople grede, posledice dviga temperature)

Strategije in ukrepi ohranjanja biodiverzitete:

- Species (organismal) diversity: individuals, populations, species, species number assessments, research and classification of organisms: an overview of the history, classification of eucaryotes to six supergroups
- Meassurements of species diversity: indices of species richness (S, R1, R2), evenness (E) and diversity (H', λ); spatial scales of biodiversity (α, β and γ)
- Genetic diversity at levels of specimens, populations and species; importance and meassurements of genetic diversity (H), heterozygosity, population divergences; gene flow, efective population size, founder effect problems, bottle-neck effect, inbreeding, population genetic homogenisation, genetic drift
- Species domestification – origin and importance
- Biodiversity patterns in relation to surface area size (area-adjusted species richness) and species-area curves on local, regional, continental levels and islands
- Global biodiversity patterns in relation to geographical gradients (Latitudinal Gradient of Biodiversity (LGD), inversed LGD, and altitudinal gradients) – ecological and evolutionary drivers

Loss of biodiversity and human influence on species extinction (HIPPO):
- origins of new species, natural species extinction rates, the sixth mass extinction
- history of human civilisations and exponential growth of human population (demography)
- industrial revolution, socio-economic and Earth System trends from years 1750-2000 known as Great Acceleration, concept of Planetary Boundaries
- problems of constant economic growth (GDP) and consumption
- estimations of human impact on natural environments (HANPP, IPAT, ecological footprint), differences among regions and countries
- problems and impacts of habiltat degradation, fragmentation and loss (deforestation, agriculture, grazing, wetland drying, river damming, infrastructure building, urbanisation, mining, turism etc.) with examples on local and global scales
- problems and impacts of allochtone invasive species (competition, predation, hybridisation, infections) with examples
- problems and consequences of overexploitation or unsustainable use of populations (deforestation, overhunting, global trade with free-living organisms and their parts (CITES))
- pullution of soil, water, air (from industry, farming, energy sector, mining, transport etc) and examples of consequences
- climate change (burning of fossil fuels, greenhouse gases and effect, consequences of temperature rise)

• Zakonodaja, strategije in ukrepi ohranjanja biodiverzitete od podpisa CBD naprej na nivoju OZN, EU in Slovenije: - analize stanj (GBO), konference CBD, strateški načrti CBD in Aichi cilji, mednarodno leto in desetletje biodiverzitete - Strategija EU za biotsko raznovrstnost in akcijski načrti, Direktiva o pticah, Direktiva o habitatih, Natura 2000 - pregled stanja in strategija ohranjanja biodiverzitete (SOBR) v Sloveniji ter analiza doseganja ciljev, Zakon o ohranjanju narave (ZON), Nacionalni program varstva narave (NPVO) • nekatere mednarodne konvencije, vladne in nevladne organizacije, ki se ukvarjajo z biodiverziteto (npr. CBD, WWF, IUCN, CITES, ZRSVN, ARSO, BirdLife Int., društva) • drugi pomembni dogovori in cilji: trajnostni razvoj in Agenda 2030, UNFCCC, Kyotski protokol, Pariški podnebni sporazum, podnebne konference (COP), Zeleni dogovor EU Poglobljene študije primerov v obliki seminarjev, ki se navezujejo na vsebino predmeta. Laboratorijske vaje se navezujejo na vsebino predavanj in so namenjene numeričnim in statističnim postopkom za vrednotenje in predstavljanje biodivezitetnih vzorcev in procesov: - rekonstrukcije filogenije na podlagi morfologije, morfometrije, celične organizacije in nukleotidnih zaporedij - vzorčenje vrstne diverzitete in vrstna diverziteta v prostoru - vrednotenje povezave med biodiverziteto in abiotskimi dejavniki okolja (nadmorsko višino, geografsko širino in klimo) - izračuni in uporaba biodiverzitetnih indeksov	Strategies and action plans of biodiversity protection: • Legislations,strategies and action plans after CBD on levels of United Nations, European Union and Slovenia: - Global Biodiversity Outlook (GBO), strategic plans of CBD, Aichi Goals, International Year of Biodiversity, International Decade of Biodiversity - EU Biodiversity Strategy for 2030 and an associated Action Plans, The Birds Directive, The Habitats Directive, Natura 2000 - Biological and Landscape Diversity in Slovenia, Biodiversity Conservation Strategy of Slovenia, Zakon o ohranjanju narave (ZON), Nacionalni program varstva narave (NPVO) • some international conventions, non- and governmental organisation dealing with biodiversity (eg. CBD, WWF, IUCN, CITES, ZRSVN, ARSO, BirdLife Int., associations) • other important agreements and goals: sustainable development and Agenda 2030, UNFCCC, Kyoto protocol, Paris agreement, Conferences of Parties (COP), EU Green Deal Detailed studies of cases in the form of seminars that are related to the course content. Laboratory exercises are related to the content of lectures and focus on numerical and statistical procedures for assessments of biodiversity patterns and processes: - reconstructions of phylogenies based on morphology, morphometry, cellular organisation, and nucleotide sequences - sampling of species diversity and spatial scales of species diversity - assessement of relationships between biodiversity and abiotic environmental factors (altitude, latitude, and climatic factors) - calculation and use of biodiversity indices

Temeljni literatura in viri / Readings:

- Konvencija o biološki raznovrstnosti (UL L 309, 13.12.1993, str. 3–20).
- Kryštufek, B. 1999 Osnove varstvene biologije. Tehniška založba Slovenije, Ljubljana.
- Levin, S. A. 2001 Encyclopedia of biodiversity. Academic Press, cop. San Diego.
- Sodhi N.S., P.R. Ehrlich 2010 Conservation Biology for All. Oxford University Press.
- Rosenzweig, M.L., (različne izdaje) Species Diversity in Space and Time. Cambridge University Press, New York
- Pontarp M. in sod. 2019 The Latitudinal Diversity Gradient: Novel Understanding through Mechanistic Eco-evolutionary Models. Trends in Ecology & Evolution 34(3), str. 211-223.
- Skoberne P.: Pregled mednarodnih organizacij in predpisov s področja varstva narave 2004 - Priročnik, Ministrstvo za okolje, prostor in energijo – Agencija RS za okolje Ljubljana.
- Skoberne P: Varstvo narave v Sloveniji, Ljubljana, 2015

Cilji in kompetence:	Objectives and competences:
Študentje bodo pridobili znanje o in razumevanje: • osnovnih pojmov in konceptov povezanih z biodiverziteto • naravnih dejavnikih biodiverzitete in antropogenih grožnjah biodiverziteti • organizacij, konvencij, zakonodaje, strategij in ukrepov povezanih z ohranjanjem biodiverzitete • ocenah in kazalnikih biodiverzitete in biogeografskih porazdelitvah biodiverzitete • pomena poznavanja in ohranjanja biodiverzitete Študentje bodo pridobili praktične sposobnosti iskanja, prepoznavanja in razumevanja relevantne domače in tuje znanstvene ter strokovne literature s področja biodiverzitete. Študentje bodo pridobili praktične veščine študija primerov, obdelave numeričnih podatkov, ocene biodiverzitete in predstavitve rezultatov ter ugotovitev dobljenih z raziskavami biodiverzitete.	Students will gain knowledge and understanding of: • basic issues and concepts connected to biodiversity • natural drivers of biodiversity and anthropogenic threats to biodiversity • organisations, conventions, legislation, stategies and action plans connected to biodiversity conservation • assessments and indices of biodiversity and biogeographic distribution of biodiversity • importance of knowledge about biodiversity and biodiversity conservation Students will acquire practical skills in search, identification and understanding of relevant scientific and professional local and foreign literature in the field of biodiversity. Students will acquire practical skills in case studies, numerical data processing, biodiversity assessments, and presentations of results and findings obtained from biodiversity research.

Predvideni študijski rezultati:	Intended learning outcomes:
Po opravljenem kurzu naj bi bili študentje sposobni: • navesti in pojasniti osnovne koncepte povezane z biodiverziteto • navesti in pojasniti naravne dejavnike biodiverzitete in antropogene grožnje biodiverziteti • našteti organizacije, konvencije, zakone, strategije in ukrepe povezane z ohranjanjem biodiverzitete na nacionalni, evropski in svetovni ravni • navesti in razložiti različne kazalnike biodiverzitete ter biogeografsko porazdelitev biodiverzitete • pojasniti pomen različnih nivojev biodiverzitete, ekosistemskih storitev in razlogov za ohranjanje • poiskati in prepoznati relevantno literaturo, izvesti teoretično študijo primera, obdelati numerične podatke in podati oceno biodiverzitete ter predstaviti rezultate in ugotovitve dobljene z raziskavami biodiverzitete.	After the accomplished course the students should be able to: • identify and explain the basic concepts related to biodiversity • indicate and explain the natural drivers of biodiversity and anthropogenic threats to biodiversity • list organizations, conventions, legislations, strategies and action plans related to biodiversity conservation at the national, European and global level • identify and explain different biodiversity indices and biogeographic distribution of biodiversity • explain the importance of different levels of biodiversity, ecosystem services and reasons for conservation • find and identify relevant literature, to carry out a theoretical case study, to process numerical data, asses biodiversity and present results and findings obtained from biodiversity research.

Metode poučevanja in učenja:	Learning and teaching methods:
• Predavanja • Seminarji • Laboratorijske vaje	• Lectures • Seminars • Laboratory excersises

Delež (v %) /

Načini ocenjevanja:	Weight (in %)	**Assessment:**
Vaje in poročilo iz laboratorijskih vaj se ovrednoti z opravil/ni opravil.		Laboratory exercises and a report from laboratory exercises is evaluated with pass/fail grading.
• Seminarska naloga in predstavitev • Pisni izpit	50 50	• Seminar essay and presentation • Written exam
Pogoji za pristop k izpitu so: - opravljene laboratorijske vaje in poročila - seminarska naloga in predstavitev		Prerequisites for the exam are: - passed laboratory exercises and reports - seminar essay and presentation

Reference nosilca / Lecturer's references:

KRYŠTUFEK, Boris, SHENBROT, Georgy I., KLENOVŠEK, Tina, JANŽEKOVIČ, Franc. Geometric morphometrics of mandibular shape in the dwarf fat-tailed jerboa : relevancy for trinomial taxonomy. Zoological journal of the Linnean Society. Aug. 2021, vol. 192, iss. 4, str. 1363-1372.

JANŽEKOVIČ, Franc, KLENOVŠEK, Tina. The biogeography of diet diversity of barn owls on Mediterranean islands. Journal of biogeography. 2020, vol. 47, iss. 11, str. 2353-2361.

KLENOVŠEK, Tina. Modularity of the dorsal and lateral view of the skull in the European ground squirrel = Modularnost dorzalne in lateralne strani lobanje evropske tekunice. Acta biologica slovenica : ABS. [Tiskana izd.]. 2020, vol. 63, no. 1, str. 17-23.

KRYŠTUFEK B, JANŽEKOVIČ F, HUTTERER R, KLENOVŠEK T. 2017 Morphological evolution of the skull in closely related bandicoot rats : a comparative study using geometric morphometrics. *Hystrix : the italian journal of mammalogy*, 27 (2): 1-7.

JAKŠIĆ, Predrag N., JANŽEKOVIČ, Franc, KLENOVŠEK, Tina. Monitoring butterfly biodiversity on prime butterfly area Avala Mt. (Serbia) by the transect method (Pollard Walks) in the year 2017. The University thought : publication in natural sciences, ISSN 2560-3094, 2017, vol. 7, no. 2, str. 28-35.