UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	Bioindikacija in biomonitoring
Subject Title:	Bioindikacija in biomonitoring

Študijski program Study programme	Letnik Year	Semester Semester
Varstvo okolja in ekotehnologije	2	2 ali 3

Predavanja Lectures	Sem. vaje Tutorial	Lab. vaje Lab. work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
20		15	15	130	**6**

Nosilec predmeta / Lecturer: prof. dr. Boštjan Pokorny, doc. dr. Samar Al Sayegh Petkovšek / Boštjan Pokorny, Ph.D, Full Prof., Samar Al Sayegh Petkovšek, Ph.D., Assist. Prof.,

Jeziki / SL **Languages:**	**Predavanja / Lectures:**	20
	Vaje / Tutorial:	30

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

Osnovno znanje biologije, ekologije in kemije.

Prerequisits:

Basic knowledge on biology, ecology and chemistry.

Vsebina:

- Opredelitev in koncept bioindikacije in biomonitoringa.
  - Namen, strategija, principi, prednosti in slabosti.
  - Okoljski stres, onesnaževanje okolja in bioindikacija.
  - Pomen bioindikacije za okoljsko zakonodajo.
- Načini, metode in ravni bioindikacije/biomonitoringa.
  - Akumulacijska in odzivna (reakcijska) bioindikacija.
  - Aktivna in pasivna bioindikacija.
  - Retrospektivna (zgodovinska) bioindikacija.
- Značilnosti in možnosti uporabe različnih bioindikatorskih organizmov ter primeri dobre prakse v Sloveniji.
  - Lišaji in mahovi kot bioindikatorji onesnaženosti zraka.
  - Glive kot bioindikatorji onesnaženosti tal.
  - Višje rastline kot bioindikatorji onesnaženosti okolja.
  - Nevretenčarji kot bioindikatorji onesnaženosti okolja.
  - Vretenčarji (ptice, sesalci) kot bioindikatorji.

Content (Syllabus outline):

- *Definition and concept of bioindication/biomonitoring.*
  - *Purpose, strategy, principles, advantages and drawbacks.*
  - *Environmental stress, pollution and bioindication.*
  - *Importance of bioindication for environmental legislation.*
- *Methods and levels of bioindication/biomonitoring.*
  - *Accumulative and sensitive (reactive) bioindication.*
  - *Active and passive bioindication.*
  - *Retrospective (historical) bioindication.*
- *Characteristics and employability of different bioindicator organisms with emphasis on Slovene case studies.*
  - *Lichens and mosses as bioindicators of air pollution.*
  - *Fungi as bioindicators of soil pollution.*
  - *Higher plants as bioindicators of environmental pollution.*
  - *Invertebrates as bioindicators of environmental pollution.*
  - *Vertebrates (birds, mammals) as bioindicators.*

Temeljni literatura in viri / Textbooks:

Markert, B.A., Breure A.M., Zechmeister, H.G. (eds), 2003. Bioindicators & Biomonitors: principles, concepts and applications.- Elsevier, Amsterdam, 997 str.

Markert, B. (ed.), 1993. Plants as biomonitors: Indicators for heavy metals in the terrestrial environment.- VCH Verlagsgesellschaft, Weinheim, 642 str.

Poročila o uporabi različnih organizmov kot bioindikatorjev onesnaženosti okolja v Sloveniji (bodo dostopna na www.erico.si): (i) Pokorny, B., 2004-2007. Srnjad kot bioindikator onesnaženosti okolja. (ii) Poličnik, H., 2006-2008. Epifitski lišaji kot bioindikatorji onesnaženosti zraka. (iii) Al Sayegh Petkovšek, S., 2009. Biomonitoring gozdnega ekosistema. (iv) Al Sayegh Petkovšek, S., Pokorny, B., 2004-2008. Glive kot bioindikatorji onesnaženosti tal. (v) Poličnik, H., Levanič, T., Pokorny, B., 2009. Drevesne branike kot retrospektivni bioindikator onesnaženosti okolja s težkimi kovinami.

Cilji:

Objectives:

- Študente seznaniti z osnovami in konceptom bioindikacije/biomonitoringa ter osnovami ugotavljanja stanja/onesnaženosti kopenskih ekosistemov s pomočjo rastlin, gliv in vretenčarjev kot indikatorskih organizmov.
- Študente seznaniti s primeri dobre prakse uporabe različnih bioindikatorjev v slovenskem prostoru.
- Študente usposobiti za samostojno izvajanje nekaterih preprostih metod bioindikacije.
- Študente spodbuditi za nadaljnje razvijanje področja bioindikacije/biomonitoringa v slovenskem prostoru.

- *To acquaint students with backgrounds and concepts of bioindication/biomonitoring as well as with basis for determination of stage/pollution of terrestrial ecosystems by using plants, fungi and vertebrates as bioindicators.*
- *To acquaint students with examples of good practices of employment of different bioindicator organisms in Slovenia.*
- *To qualify students for autonomous executing of some simple bioindicative methods.*
- *To encourage students for up-following development of bioindication/biomonitoring in Slovenia.*

Predvideni študijski rezultati:

Znanje in razumevanje:

Študent bo ob zaključku tega predmeta sposoben: (i) razumeti principe in metodologijo biomonitoringa; (ii) povezovati podatke, informacije in znanja s področja biologije-bioindikacije z različnimi tehnološkimi procesi in drugimi metodami spremljanja stanja okolja ter uporabiti kompleksno znanje v različnih oblikah in situacijah; (iii) uporabiti in izbrati ustrezne metode bioindikacije za ugotavljanje antropogenih vplivov na ekosisteme; (iv) analizirati in razumeti rezultate, dobljene z uporabo izbranih bioindikacijskih metod; (v) ovrednotiti stanje okolja, pridobljeno s pomočjo različnih metod bioindikacije, in presojati vrednost ter zanesljivost zakonsko predpisanih fizikalno-kemijskih meritev v okolju.

Prenesljive/ključne spretnosti in drugi atributi:

- spretnosti uporabe domače in tuje literature;
- sposobnost zbiranja in interpretiranja podatkov;
- prepoznavanje in reševanje okoljskih problemov;
- kritična analiza in sinteza podatkov.

Intended learning outcomes:

Knowledge and Understanding:

The student will be able at the completion of this course to: (i) understand principles and methodology of biomonitoring; (ii) link data, information and knowledge from biology-bioindication with different technological processes as well as with other methods for assessment of environmental quality, and use this comprehensive knowledge in various possibilities and/or situations; (iii) apply and select adequate bioindicative methods for determination of the influence of anthropogenic activity on the environment; (iv) analyse and understand data, obtained by several bioindicative methods; (vi) evaluate the quality of the environment, obtained by usage of different bioindication methods, and thereby criticise reliability of other data, obtained by mandatory physical and chemical measurements of different environmental media.

Transferable/Key Skills and other attributes:

- *usage of Slovene and foreign literature;*
- *ability for collecting and interpretation of data;*
- *recognising and solving environmental issues;*
- *reliable analyses and syntheses of data/information..*

Metode poučevanja in učenja:

- predavanja (20 ur);
- terenske vaje (dva dneva v izbranih območjih Slovenije);
- laboratorijske vaje (spoznavanje nekaterih primerov, metod in uporabe bioindikacije v praksi);
- seminarska naloga (študent/ka izbere določeno temo, ki jo samostojno obdela in predstavi).

Learning and teaching methods:

- *lectures (20 hours);*
- *field work (two days in selected Slovene regions);*
- *lab work (insight into some of the examples, methods and principles of bioindication in practice);*
- *tutorial (each student autonomously selects, prepares and presents one topic).*

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt):		***Type (examination, oral, coursework, project):***
• opravljene terenske in laboratorijske vaje	20	• *completed field work and lab work*
• opravljena seminarska naloga	30	• *completed tutorial*
• ustni izpit	50	• *oral examination*

Materialni pogoji za izvedbo predmeta :

- Predavanja: predavalnica z multimedijsko opremo.
- Laboratorijske vaje: ustrezen biološki laboratorij.

Material conditions for subject realization:

Lectures: classroom with the multimedia equipment.
Lab work: adequate biological laboratory.

Obveznosti študentov:

(pisni, ustni izpit, naloge, projekti)

- Obvezna prisotnost na terenskih in laboratorijskih vajah ter izdelano poročilo za obe vrsti vaj.
- Izdelava in predstavitev seminarske naloge.
- Ustni izpit.

Student's commitments:

(written, oral examination, coursework, projects):

- *Obligatory presence on both field works and lab works and preparation of reports for both of them.*
- *Preparation and presentations of seminar work.*
- *Oral examination.*