VNIVERSITAT DE VALÈNCIA

Course Guide
33108 Indicators and environmental monitoring

COURSE DATA

Data Subject	
Code	33108
Name	Indicators and environmental monitoring
Cycle	Grade
ECTS Credits	4.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	176 - Environmental indicators and monitoring	Optional

Coordination

Name	Department
ANDREU SANCHEZ, OSCAR ENRIQUE	25 - Plant Biology
GARCIA ROGER, EDUARDO MOISES	275 - Microbiology and Ecology

SUMMARY

This course will provide theoretical and practical introduction to the use of indicators of environmental and ecological status, as well as planning and conducting follow-up (monitoring) environment. Indicators are measures of a component or material environmental phenomenon, used to estimate or evaluate conditions or environmental changes or to establish environmental goals. Therefore, knowledge of the indicators is essential in ecological research and environmental management, for its versatility and synthetic capacity in the evaluation of the state of the habitat and ecosystem. Here we will therefore both descriptive indicators (ecological) and standards (indicators for environmental management), either abiotic or biological indicators. Be detailed use, selection and applications, and interpretation. Environmental monitoring involves obtaining environmental data over time to observe or detect changes in key variables. This monitoring is usually focused on environmental management objectives, or to evaluate possible harmful effects of human impacts on biodiversity or investigate ecological processes over time. This course aims to clarify the needs and planning strategies for environmental monitoring, and practical aspects to carry out quality monitoring. regular monitoring networks will be introduced, but also what methods and techniques can be implemented in the field for data and indexes in a standardized

and quality for proper environmental monitoring and further analysis to draw conclusions with statistical soundness.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Consolidated knowledge of Ecology and Soil Science.
Working knowledge of spreadsheet programs and internet search tools.

OUTCOMES

1104 - Degree in Environmental Sciences

- Capacidad para seleccionar y aplicar sistemas de indicadores ambientales en el medio natural.
- Capacidad para diseñar sistemas de monitorización ambiental y realizar planes de vigilancia en distintos sistemas naturales.

LEARNING OUTCOMES

Practical work involving problem solving, data analysis and critical interpretation.
Using bibliographic databases in electronic form, access to magazines and other printed and electronic format, and use of at least one presentation software.
Solving problems involving making qualitative and quantitative data in the laboratory or field, the analysis of these data and their interpretation in a theoretical context.
Knowledge and application of environmental indicator systems in the natural environment.
Knowledge of the main types of indicators and their particular use.
Practice and use of ecological indicators in the field and interpreting their meaning in the assessment of ecological status.
Development of environmental monitoring systems and implementation of environmental monitoring plans.
Implementation issues and case owners of different sampling techniques in environmental and ecological data.
Planning and analysis of data resulting from the environmental monitoring.

DESCRIPTION OF CONTENTS

1. Characteristics and basic properties of environmental indicators

1.1 Introduction to environmental indicators.
1.2 Characteristics to meet the indicators.
1.3 Main types of indicators.
1.4 Indicators and temporal and spatial variability of the natural environment.

2. Design and selection of indicators

2.1 Selection of indicators.
2.2. Models of indiacators.

3. Abiotic indicators of the use and state of natural resources

3.1. Indicators of the edaphic environment and geo-indicators
3.2. Indicators of the aquatic and marine environment
3.3. Indicators of anthropogenic pressure in natural areas

4. Environmental monitoring networks and systems

4.1. Design of networks for environmental data collection
4.2. Water quality monitoring networks
4.3. Polluted soil monitoring networks and systems
4.4. Air monitoring networks

5. Biological indicators of ecological status and biodiversity

5.1. Criteria for the selection of ecological status indicators.
5.2. Classification of ecological status indicators.
5.3. Indices based on indicator species.
5.3.1. Concept of ecological niche.
5.3.2. Stenoic indicator species.
5.3.3. Endemic and protected species.
5.3.4. Alien and invasive species.
5.4. Indices based on ecological strategies.
5.5. Indices based on diversity measures.
5.6. Indices based on measures of biomass and abundance.
5.7. Integral and holistic indices.
5.8. Indicators in paleoecology, environmental reconstruction and ecological restoration.

6. Indicators and indices of ecological status in surface water bodiesFramework Directive.

6.1. Evaluation of ecological status in surface water bodies in the context of the Water Framework Directive
6.2. Criterios de selección de sitios de referencia y definición de condiciones de referencia
6.3. Indices for ecological status studies in lotic systems
6.3.1. Organisms used
6.3.2. Unimetric indices
6.3.3. Multimetric indices
6.4. EQR values and establishment of quality classes calidad
6.5. Indices for the study of ecological status in lentic systems
6.5.1. Organisms used
6.5.2. Indices

7. Indicators for the study of the ecological status of marine ecosystems

7.1. Introduction.
7.2. Types of indicators.
7.2.1. Environmental and habitat indicators.
7.2.2. Indicators based on key species.
7.2.3. Indicators based on size.
7.2.4. Trophodynamic indicators.
7.3. Network analysis.
7.4. Application cases including fisheries maintenance.

8. Use of ecological state indices in terrestrial ecosystems. Application of thermodynamic indices in agroecosystems

8.1. Energy and entropy balance in a terrestrial ecosystem: agroecosystem.
8.2. Entropy surplus as an index of ecosystem degradation.
8.3. Criteria and reference conditions.
8.4. Examples

9. Sampling designs for environmental monitoring

9.1. Environmental monitoring in populations and biological communities
9.1.1. Status and trend studies
9.1.2. Cause and effect studies
9.1.3. Design for species inventories. Multivariate data analysis of communities and multiple indicators
9.2. Sampling designs in environmental monitoring plans
9.2.1. Randomized design
9.2.2. Systematic design
9.2.3. Stratified design
9.2.4. Multilevel design
9.2.5. Quantitative criteria for the choice of sampling design and optimum effort

10. Informatics practices

10.1. Exploratory examination of survey data on heavy metal contamination (statistics and geostatistics)
10.2. Evaluation of soil contamination. Statistical treatment of results. Generation of contamination indexes

11. Laboratory Practice

11.1. Analysis and evaluation of water quality indicator parameters.
11.2. Analysis and evaluation of indicator parameters of soil properties.

12. Field Practice

Obtaining biological indices and taking samples to calculate environmental indicators. Sampling techniques will be used to monitor organisms and habitat. The field trip will be carried out jointly with other subjects to a site with areas with little impact and others more disturbed by man.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	27,00	100
Laboratory practices	12,00	100
Computer classroom practice	4,00	100
Tutorials	2,00	100
Attendance at events and external activities	4,00	0
Development of group work	10,00	0
Development of individual work	10,00	0
Readings supplementary material	3,50	0
Preparation of evaluation activities	15,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	10,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The hours of classroom theory will be taught primarily through lecture methodology, with the support of board and presentations, which will first be made available to the students in the virtual classroom. Also, you can also use participatory methods of problem solving or case studies, and discussion of scientific texts, guided by the teacher.
The hours of computing be taught in groups of approximately 32 students working in pairs. In these sessions students, supervised by a teacher, do exercises using data processing software such as spreadsheets or statistical.
Hands-on activities will include field sessions (7h) and laboratory (5h). In field and laboratory sessions are groups of approximately 16 students and work in pairs or in groups of 4. Under the supervision of a teacher, do practical work related to the themes developed in the theory sessions. In the field work to obtain biological indices and sampling for calculation of environmental indicators and sampling techniques used for monitoring organisms and habitat. The field trip will take place with other subjects in a place with little impacted areas and more disturbed by man.
The tutorials are performed in subgroups of 16 students or so. In them, the teacher monitors the work and progress of students and addresses the concerns raised.

EVALUATION

The evaluation of the acquired knowledge will be carried out by means of a written test (exam) composed of questions that may be open and/or multiple choice. The questions may include any aspect that has been presented, worked or discussed in the theoretical classes, tutorials, seminars and practices, regardless of whether it has been in computer classroom, laboratory or in the field. The exam will compute 70% of the final grade. In order to pass the course, it is necessary to (1) pass each of the parts of the theory exam (part of abiotic indicators, taught by the Soil Science Teaching Unit, and part of biotic indicators, taught by the Ecology Teaching Unit) with at least 2 points out of 5, and (2) obtain a grade higher than 5 out of 10 in the total computation of the theory exam.

In the part of the course taught by the Soil Science Teaching Unit, the reports and/or activities carried out in the practicals will count for 15%. In the part of the course taught by the Teaching Unit of Ecology, the report of the field trip will compute 15% of the final grade. Attendance to tutorials and computer, laboratory and field practices is compulsory. Incidents regarding attendance will be resolved by agreement of the teaching team. The grades obtained in these activities will be retained until the second call for the exam only in the case of having passed in the first call.

In order to request the advance of this subject, the student must take into account that he/she must have completed the compulsory activities indicated in the teaching guide of the subject.

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