



COURSE DATA

DATA SUBJECT

Code: 47084
Name: Effects of Pollution
Cycle: Master's Degree
ECTS Credits: 7
Academic year: 2025-26

STUDY (S)

| Degree | Center | Acad. year | Period |
|---|----------------------------------|------------|---------------|
| 2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología | Facultat de Ciències Biològiques | 1 | First quarter |

SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|--------------------------------------|------------|
| 2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología | Procesos contaminantes y sus efectos | COMPULSORY |

COORDINATION

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SUMMARY

This course offers a multidisciplinary approach to the effects of environmental pollution on living organisms and ecosystems, combining specialized knowledge from various fields. It is structured into five thematic blocks.

The **first block** focuses on the effects of pollution on animals, from the subcellular to the physiological level. It examines responses to toxic or stressful agents (such as chemicals or temperature), as well as toxicokinetics, which is key to understanding the interaction between pollutants and organisms.

The **second block** addresses soil pollution, emphasizing the influence of human activities. It covers assessment methods and highlights the importance of soil as a natural filter for contaminants and its role in mitigating climate change.

The **third block** analyzes how pollutants affect plants, highlighting their physiological defense and detoxification mechanisms. This knowledge has biotechnological applications for environmental bioremediation.



The **fourth block** examines pollution in aquatic ecosystems, describing the main types, methods for ecological risk assessment, and the responses of aquatic organisms to contaminants.

The **fifth block** explores the impacts of pollution on human health, recognizing the close relationship between environmental conditions and human well-being, which underscores the importance of ongoing monitoring and research.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

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

COMPETENCES / LEARNING OUTCOMES

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Collaborate effectively in work teams, taking on responsibilities and leadership roles and contributing to collective improvement and development.

Demonstrate critical and self-critical reasoning in the field of the degree, considering aspects such as professional ethics, moral value and the social implications of the different activities carried out.

Design specific indicators for a particular environmental risk.

Develop and implement programmes and projects to prevent, control and mitigate environmental pollution.

Develop the ability to work in multidisciplinary teams and to cooperate effectively.

Develop the capacity for analysis, synthesis and critical thinking in applying the scientific method.

Diagnose environmental problems.

Evaluate and assess the impact of human activities on pollution in the atmosphere, inland waters, marine waters and soils.

Evaluate the behaviour of pollutants and their interactions in different environmental compartments.

Evaluate the quality of water and soil.

Know and understand, within the area of the degree, inequalities based on sex and gender in society; integrate different needs and preferences based on sex and gender into the design of solutions and problem-solving.



Know the animal models used for studying human diseases in relation to environmental pollution.

Know the biochemical parameters of clinical interest in human samples.

Know the mechanisms developed by living organisms to resist environmental pollution.

Learn how to write scientific articles in the fields of environmental pollution and ecotoxicology.

Understand and interpret the processes of atmospheric, aquatic and soil pollution and their effects.

Understand the mechanisms of pollutant toxicity.

Understand the natural world as a product of evolution and its vulnerability to human influence.

Understand the nature of different environmental matrices, their components and aspects related to their degradation, resilience and health.

Use different bibliographic sources and biological databases.

Use indicators of environmental risks and health-related damage.

DESCRIPTION OF CONTENTS

Block 1. Effects on Animals

Animal responses to changes in environmental physico-chemical conditions. Acclimation and adaptation. General stress response. Toxicokinetics of organic and inorganic pollutants in animals. Cellular and molecular mechanisms of toxicity. Effects of pollution on animal physiology. *Adverse Outcome Pathway* (AOP): concept and applications.

Block 2. Effects on Soil

Impacts of human activities on soil pollution and environmental implications. Methods and techniques for assessing soil contamination and its effects. Environmental consequences of soil pollutants. Perspectives on soil health in the Anthropocene.

Block 3. Effects on Plants

Types of pollutants in air, water, and soil that affect plants. Effects and responses in plants caused by these pollutants.

**Block 4. Effects on the Aquatic Environment**

Basic concepts. Main types of pollution in aquatic ecosystems. Pollution indicators and guideline levels. Methods for characterizing exposure and effects in aquatic ecosystems. Risk assessment methods for aquatic environments. Case studies and practical exercises.

Block 5. Effects on Human Health

Epidemiological research techniques for environmental risk factors affecting human health. Epidemiological surveillance of environmental risks.

WORKLOAD**PRESENCIAL ACTIVITIES**

| Activity | Hours |
|--------------------|--------------|
| Theory | 52,00 |
| Laboratory | 18,00 |
| Total hours | 70,00 |

NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---------------------------------------|---------------|
| Attendance at other activities | 0,00 |
| Individual or group project | 20,00 |
| Independent study and work | 43,00 |
| Preparation of lessons | 10,00 |
| Preparation for assessment activities | 30,00 |
| Resolution of case studies | 2,00 |
| Total hours | 105,00 |

TEACHING METHODOLOGY

The course is structured as follows:

- **Theoretical classes:** participatory lectures delivered sequentially throughout the semester.
- **Laboratory practical sessions**
- **Seminars**

EVALUATION



Continuous assessment: 2.5 points

Assessment of non-attendance activities: 1 point

Written exam: 6 points (a minimum of 2.75 out of 6 points is required to pass the course)

Evaluation of activities related to transversal competences: 0.5 points

REFERENCES

Block 1

- Klaassen CD, ed. Casarett and Doull's Toxicology, The basic science of poisons, 9th. edition. New York: McGraw-Hill, (2023)
- Randall, D. Burggren, W. y French, K. (2002). Eckert Animal Physiology: Mechanisms and Adaptations. 5a Edición. W.H. Freeman and Company, New York
- Willmer, T., Stone, G.N. y Johnston, I.A. (2004). Environmental Physiology of Animals. Blackwell Science, Oxford, U.K.

- Withers, P.C (1992). Comparative Animal Physiology. Saunders College Publishing.

Block 2

- Essington, M.E. (2015). Soil and Water Chemistry: An Integrative Approach. CRC Press. Taylor & Francis Group. Boca Raton Fl. 640 pp.
- Mirsal, I.A. (2008). Soil Pollution. Origin, monitoring and remediation. Springer. Berlín. 312 pp.
- Porta, J.; López-Acevedo, M. y Roquero, C., (2003). Edafología para la agricultura y el medio ambiente. Mundi-Prensa. Madrid.
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- Duarte, AC, Cachada, A, Rocha-Santos TAP. 2017. Soil Pollution: From Monitoring to Remediation. Academic Press. 312 pp.
- Raymond, W, Nyle B. 2016. The Nature and Properties of Soils. Pearson Education. 1104 pp.

Block 3



- Calatayud, V., Sanz, M.J., Calvo, E., Cerveró, J., Ansel, W., Klumpp, A. Ozone biomonitoring with Bel-W3 tobacco plants in the city of Valencia (Spain). *Water, Air & Soil Pollution*, 183: 283-291, 2007 (DOI10.1007/s11270-007-9376-2)
- Ferretti, M., Bussotti, F., Calatayud, V., Schaub, M., Kräuchi, N., Petriccione, B., Sanchez-Peña, G., Sanz, M.J., Ulrich, E. Ozone and forests in south-western Europe Introduction. *Environmental Pollution* 145: 617-619, 2007
- Klumpp, A., Ansel, W., Klumpp, G., Calatayud, V., Garrec, J.P., He, S., Peñuelas, J., Ribas, A., Ro-Poulsen, H., Rasmussen, S., Sanz, M.J. & Vergne, P. Ozone pollution and ozone biomonitoring in European cities. Part I. Ozone concentrations and cumulative exposure indices at urban and suburban sites. *Atmospheric Environment* 40: 79637974, 2006
- Dharmendra K. Gupta, Francisco J. Corpas, José M. Palma (2013) *Heavy Metal Stress in Plants*. Springer. <https://doi.org/10.1007/978-3-642-38469-1>
- Tariq Aftab (2023) *Emerging Contaminants and Plants. Interactions, Adaptations and Remediation Techno* Sumira Jan, Javid Ahmad Parray (2016) *Approaches to Heavy Metal Tolerance in Plants*. Springer. <https://doi.org/10.1007/978-981-10-1693-6>

Block 4

- Efectos sobre los ecosistema acuáticos -Orozco Barrenetxea, Carmen, 2002. *Contaminación ambiental: una visión desde la química*. Ed. Paraninfo.
- Orozco Barrenetxea, Carmen, 2003. *Problemas resueltos de contaminación ambiental: cuestiones y problemas resueltos*. Ed. Paraninfo. -Kalff, J. 2002. *Limnology*. Prentice Hall. 592 pp.
- Maitland P.S. & N.C. Morgan 1997. *Conservation and management of freshwater habitats: lakes, rivers and wetlands*. Chapman & Hall-Kluwer. New York.
- Mason, C. 2001. *Biology of Freshwater Pollution*. Prentice Hall
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- Vighi, M. (2024). *General Principles of Ecological Risk Assessment: Protecting Ecosystems in the Third Millennium*. Cambridge Scholars Publishing.
- van Leeuwen C.J., Vermeire, T.G. (2007). *Risk Assessment of Chemicals: An Introduction*. Springer

Block 5

- Klaasen CD, ed. Casarett and Doull's *Toxicology, The basic science of poisons*, 9th. edition. New York: McGraw-Hill, (2023)
- <https://echa.europa.eu/es/information-on-chemicals>
- https://www.who.int/health-topics/climate-change#tab=tab_1
- <https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/health-impacts>