



## IDENTIFYING DATA

### Pollution

Subject	Pollution			
Code	V02G031V01402			
Study programme	Grado en Biología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	4th	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Fernández Covelo, Emma			
Lecturers	Fernández Covelo, Emma Gomez Brandon, Maria González Rodríguez, Luis Mariño Callejo, María Fuencisla			
E-mail	emmaf@uvigo.es			
Web				
General description	Know of form updated the distinct sources and types of contaminants that affect to the half and to the biota Know the dynamics of the *contaminantes in the compartments of the ecosystem Know the processes of reuse of waste and biorremediación for recovery of environments contaminated <a href="http://bioloxia.uvigo.es/docs/docencia/horarios/hor_4grado_1sem1718.pdf">http://bioloxia.uvigo.es/docs/docencia/horarios/hor_4grado_1sem1718.pdf</a>			

## Training and Learning Results

Code			
A3	Students should prove ability for information-gathering and interpret important data (usually within their study field) to judge relevant social, scientific or ethical topics.		
B2	Manage scientific-technical information using diverse and reliable sources. Analyze data and documents and interpret them critically and rigorously, including considerations on their social relevance and in the professional field of Biology.		
B4	Draft and write reports, documents and projects related to Biology. Proceed to their presentation and debate in the teaching and specialized areas, highlighting the competences of the degree.		
B5	Develop capacities for creativity, innovation and entrepreneurship, in academic and social relevant fields as well as in interaction with the productive sector.		
C1	Solve problems by applying the scientific method, the concepts and terminology specific to biology, mathematical models and statistical and computer tools.		
C7	Sampling, characterising, cataloguing and managing natural and biological resources (populations, communities and ecosystems).		
C8	Describe, assess and plan the physical environment, use bio-indicators and identify environmental problems. Provide solutions for the control, monitoring and restoration of ecosystems.		
C10	Identify biological and biotechnological processes and their potential applications, in particular in health, agri-food and environmental fields.		
C12	Writing reports and technical dossiers, as well as directing and executing projects on topics related to biology and its applications.		
D3	Commitment to sustainability and the environment. Equal, sensible and efficient use of resources.		
D4	Collaborate and work in teams or multidisciplinary groups, promote negotiation skills and the ability to reach agreements.		
D5	Communicate effectively and appropriately, including the use of computer tools and English.		

## Expected results from this subject

Expected results from this subject	Training and Learning Results		
To know the main sources, the different types and, above all, the dynamics of the most important pollutants and their relationship with biology.	A3	C1 C10	D3
To understand the concept of environmental pollution and its effects on organisms. To understand the processes of treatment and bioremediation of pollution.	A3 B2	C1 C8 C10	D3

To be aware of the different types of waste, their treatment and their use in recovery processes in degraded environments.	A3	B2 B5	C1 C8 C10	D3
To get an introductory overview of environmental toxicology, agro-food and toxicology in living beings.	A3	B2	C1 C8	D3
To know and understand the situations in which the legislation and the regulations must be applied.	A3	B2 B4 B5	C12	D3
Applying knowledge and techniques related to contamination in different processes related to environmental management.	A3	B2 B5	C1 C7	D3
Applying knowledge and technology related to Contamination in aspects related to the production, exploitation, analysis and diagnosis of biological processes and resources.	A3	B2	C1 C8 C10	D3
To obtain information, develop experiments and interpret results.	A3	B4 B5	C7 C12	D4 D5
To understand the social projection of pollution and its repercussions on professional practice.	A3	B5	C1 C8	D3
To know and use the concepts, terminology and scientific-technical instrumentation related to Contamination.	A3	B2 B5	C8	D3

## Contents

### Topic

1. INTRODUCCION To THE CONTAMINATION	<ul style="list-style-type: none"> <li>- Definition. Basic concepts. Types and categories of contaminants.</li> <li>- Sources and roads of entrance to the environment and biota.</li> <li>- Dynamic of contaminants: distribution and flow.</li> <li>- Bioindicators, biomonitors.</li> <li>- Legislation and normative</li> </ul>
2. BIODEGRADABLE WASTE	<ul style="list-style-type: none"> <li>-Organic matter</li> <li>-Oil and derivative</li> </ul>
3. ORGANIC POLLUTANTS	-PAHs, Hydrocarbons halogenados, PCBs
4. SOLID WASTE AND DISSIPATE	<ul style="list-style-type: none"> <li>- Plastic and other solid waste</li> <li>- heat</li> </ul>
4. INORGANIC POLLUTANTS	<ul style="list-style-type: none"> <li>-Acidity</li> <li>-Elements potentially toxic</li> </ul>
5. MICROBIAL POLLUTION	<ul style="list-style-type: none"> <li>-Concept and sources of pollution of microbial origin</li> <li>-Microorganisms indicators of pollution</li> <li>-Dynamic of microbial pollution in atmosphere, floor and water</li> <li>-residual Waters and treatment. Treatment anoxic of lick.</li> <li>-Impact of the pollution in environment.</li> <li>-Legislation and normative on microbiological pollution</li> </ul>
6. TREATMENT OF WASTE And PROCESSES OF RECOVERY	<ul style="list-style-type: none"> <li>- Biorremediation.</li> <li>- Composting.</li> <li>- Reuse of waste through the system am used to-plant</li> <li>- Recovery of floors contaminated</li> </ul>
7. BIOLOGICAL EFFECTS OF The CONTAMINANTS	<ul style="list-style-type: none"> <li>-Exhibition of alive organisms the contaminants. Routes of entrance. Toxicocinética. Bioaccumulation, Biotransformation.</li> <li>-Effects of the contaminants to physiological level.</li> <li>-Molecular and cellular mechanisms of action of the contaminants.</li> <li>-Essays of toxicity.</li> <li>-Effects of the contaminants to populational level and of communities of organisms.</li> <li>-Evolution of resistance.</li> </ul>

## Planning

	Class hours	Hours outside the classroom	Total hours
Laboratory practical	20	10	30
Seminars	8	8	16
Mentored work	1	63	64
Lecturing	20	10	30
Objective questions exam	2	2	4
Report of practices, practicum and external practices 1		2	3
Problem and/or exercise solving	1	2	3

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Laboratory practical	Effect of a contaminant in the soil: it will study the total content and the availability. Effects on germination, growth and other physiological parameters of plants. Effect in the reproduction of oligoquetos and integrity of the lysosomal membrane and microbiological analysis of the solution of the floor. Detection of microbiological indicators of pollution. The assistance to practices will be compulsory to be able to surpass the matter
Seminars	It will complement the theoretical part tackling appearances that in the remained clear what was necessary to complement. Resolution of doubts, etc. At the end of the explanation of each subject, will deliver to the students a questionnaire of questions referred to the same and that they will have to deliver in the term that was fixed conveniently. In the part of Microbiology, the students will cover a test in the classroom when finishing the explanation of each one of the ones of the subjects.
Mentored work	The students will have the help of the professors of the matter for the preparation of the work of practices
Lecturing	Theoretical development-practical, presentation of objectives and conceptual frame of each subject, presenting specific bibliography and examples related

### Personalized assistance

Methodologies	Description
Lecturing	
Laboratory practical	
Seminars	

### Assessment

	Description	Qualification	Training and Learning Results
Objective questions exam	Final control of the matter by means of a questionnaire of short answers and/or test. The evaluation of this control will suppose 30% of the total qualification of the matter. It is precise to reach a 5 to do average with the practical note.	30	A3 B2 C10 D3 B5
Report of practices, practicum and external practices	The integrated report of the practices of edaphology, zoology, vegetal physiology and microbiology will be realised in the format of scientific article according to the norms of the Environmental Pollution. At the beginning of course and in each one of the practices of the matter will realise indications of the requirements of them. It will be necessary to approve this part to surpass the matter	40	A3 B2 C1 D4 B4 C7 D5 C12
Problem and/or exercise solving	Evaluation of the participation of the student in the seminars, assistance to theoretical classes, etc. The professors will be able to request the delivery of questionnaires or test of each subject (a questionnaire, or test, of each one of the subjects that appear in the apartade of contents.).	30	A3 B2 C8 D3 B5 C10 D4

### Other comments on the Evaluation

For the announcement of July, will conserve the parts approved, since it presupposes that the competitions, aptitudes and knowledges purchased do not lose .

[http://bioloxia.uvigo.es/docs/docencia/examenes/exames\\_grado\\_2017-18.pdf](http://bioloxia.uvigo.es/docs/docencia/examenes/exames_grado_2017-18.pdf)

### Sources of information

#### Basic Bibliography

#### Complementary Bibliography

- Capó Martí, M., **Principios de Ecotoxicología**, Tébar,
- Mason, C.F., **Biology of Freshwater Pollution**, Longman, 3ª ed.,
- Clark, R.B., **Marine Pollution**, Oxford University, 5ª ed.,
- Walker, C.H., Hopkin, S.P., Sibly, R.M., Peakall, D.B., **Principles of Toxicology**, Taylor & Francis, 3ª ed.,
- Seoáñez Calvo, M., **Tratado de la Contaminación atmosférica**, Mundi Prensa,
- Hurst, C.J., Knudsen, G.R., McInern, M.J.ey, L.D. Stetzenbach, M.V. Walter (eds.), **Manual of Environmental Microbiology**, 3ª ed., American Society for Microbiology,
- Rice, E.W., Baird, R.B., Eaton, A.D., Clesceri L.S. (eds), **Standard Methods for the Examination of Water and Wastewater**. 23 th., A.P.H.A., A.W.W.A. and W.E.F. Washington.,
- Lagadic, L., Caquet, T., Amiard, J-C, Ramade, F., **Use of biomarkers for Environmental Quality Assessment**, Balkema,
- DeCaprio, A.P. (ed.), **Toxicologic Biomarkers**, Ed. Taylor & Francis,
- Mirshal, I., **Soil Pollution: Origin, Monitoring & Remediation.**, Springer Verlag,

Sparks, D.L., **Environmental Soil Chemistry**, Academic Press,

Tan, K., **Environmental Soil Science**, Marcel Dekker. New York,

McCutcheon S.C. , Schnoor J.L., **Phytoremediation: Transformation and Control of Contaminants.**, Wiley and Sons, Inc.,

Singh, A., Ward, O.P., **Applied Bioremediation and Phytoremediation.**, Springer-Verlag,

Benlloch, M., Sancho, E., Tena, M. (eds.), **Fitorremediación de suelos contaminados del área de Aznalcóllar**, Universidad de Córdoba,

Schmidt, T.M., Schaechter, M., **Topics in Ecological and Environmental Microbiology**, Academic Press,

Bertrand, J.C., P. Caumette, P. Lebaron, R. Matheron, P. Normand, T. Sime-Ngando, **Environmental Microbiology: Fundamentals and Applications: Microbial Ecology.**, Springer.,

Pepper, I.L., C.P. Gerba, T.J. Gentry., **Environmental Microbiology. 3ª ed.**, Academic Press,

H.B. Bradl, **Heavy Metals in the Environment: Origin, Interaction and Remediation**, Elsevier,

Alina Kabata Pendias, **Trace Elements in Soils and Plants**, CRC Press,

Yates, M.V., J.M., C.H. Nakatu, R.V. Miller., **Manual of Environmental Microbiology. 4ª ed.**, ASM Press.,

Barton, L.L., McLean, R.JC., **Environmental Microbiology and Microbial Ecology.**, Wiley-Blackwel,

Beiras, R., **Marine Pollution: sources, fate and effects of pollutants in coastal ecosystems.**, Ed. Elsevier. UK., 2018

Lipp, W.C., E. B. Braun-Howland, T.E. Baxter (eds)., **Standard Methods for the Examination of Water and Wastewater. 24 th., A.P.H.A., A.W.W.A. and W.E.F. Washington.**, 2023

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## **Recommendations**

### **Subjects that continue the syllabus**

Environmental analysis and diagnosis/V02G031V01413

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### **Subjects that it is recommended to have taken before**

Biology: Soil, aquatic environment and climate/V02G031V01106

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