Teaching Guide					
Identifying Data					2020/21
Subject (*)	Soil Quality			Code	610500009
Study programme	Mestrado Universitario en Ciencias, Tecnoloxías e Xestión Ambiental (plan 2012)				
Descriptors					
Cycle	Period	Year		Type	Credits
Official Master's Degree	1st four-month period	First		Optional	3
Language	SpanishGalicianEnglish				
Teaching method	Face-to-face				
Prerequisites					
Department	Física e Ciencias da Terra				
Coordinador	Taboada Castro, Maria Teresa		E-mail	teresa.taboada@udc.es	
Lecturers	Lado Liñares, Marcos		E-mail	marcos.lado@udc.es	
	Paz Gonzalez, Antonio			antonio.paz.gonzalez@udc.es	
	Taboada Castro, Maria Teresa			teresa.taboada@udc.es	
Web					
General description	To know the soil quality indicators in order to identify contaminated and degraded soils and their recovery processes				

Contingency plan	1. Modifications to the contents No changes will be made 2. Methodologies *Teaching methodologies that are maintained - Guest lecture / keynote speech. The professor communicates the basic concepts and the most important contents of each topic. In addition, questions that the students should discuss and solve will be suggested in order to foster the involvement of the students in the course. Moodle and / or Teams platforms will be used. - Case study (computed in the evaluation). Moodle and / or Teams platforms will be used. - Objective test. Moodle and / or Teams will be used. - Personalized attention *Teaching methodologies that are modified - Laboratory practices and field trip will be replaced by "supervised work". Moodle and Teams tools will be used. - Oral presentation. This activity is canceled and the weight of the other activities will be modified (as specified in the evaluation section). 3. Mechanisms for personalized attention to students Tools: Email, Moodle, Teams. Personalized attention will be performed according to the needs of the students. 4. Modifications in the evaluation - Delivery of " supervised work" (50%). A written work will be delivered. The depth of the contents, the order in the presentation of contents, the use of terminology specific to the subject and the documentary sources used will be assessed. With the written work an audiovisual presentation will be delivered (video, powerpoint with audio) in which the quality of the selected content, the clarity of the presentation and the adequacy of the duration of the presentation to the indicated time will be evaluated. - Case study (10%). A real case related to soil quality will be proposed to the student, who needs to evaluate it and suggest solutions in an environmental report. - Objective test (40%). The evaluation of the course contents and the acquisition of the competences defined for the course will be evaluated in a final test, which will include theoretical questions and applied problems. Moodle and/or Teams platforms will be used. Moodle and / or Teams tools on the date and time that is officially established will be used. *Evaluation observations: It is necessary to obtain a minimum global mark of 5 over 10 in order to successfully pass the course. Situations: 1) Full time students. First opportunity: the final grade will be calculated as the sum of the marks obtained in each of the activities (supervised

work, case study, mixed test). Those students that fail to appear in the mixed test activity will be qualified as NOT PRESENTED.
Second opportunity: the final grade will be the grade obtained in the mixed test, which will evaluate all the contents of the course. The maximum possible mark in this mixed test will be 10.

2) Part-time students and students with presenciality exemptions.
Their final grade will be calculated from the marks of two activities in both the first and second opportunities. Those activities are:
A project including a summary of each of the topics of the course and the answers to a questionnaire proposed by the professor (50%)
A supervised project that needs to be presented using audiovisual tools (50%).
Honors will be awarded to those students that reach the marks necessary for this mention in the evaluation of the first opportunity.

5. Modifications to the bibliography or webgraphy
There will not be any modification

Study programme competences / results	
Code	Study programme competences / results
A1	Coñecemento das realidades interdisciplinares da Química e do Medio Ambiente, dos temas punteiros nestas disciplinas e das perspectivas de futuro.
A3	Capacitar ao alumno para o desenvolvemento dun traballo de investigación nun campo da Química ou do Medio Ambiente, incluíndo os procesos de caracterización de materiais, o estudo das súas propiedades fisicoquímicas e biolóxicas e dos procesos que poden sufrir no medio natural.
A6	Coñecemento do comportamento de diferentes especies químicas e dos procesos aos que poden estar sometidas unha vez liberadas no medio ambiente, incluíndo as súas relacións entre distintos compartimentos ambientais.
A10	Relacionar a presenza de especies químicas no medio natural cos conceptos de toxicidade e biodisponibilidade.
A15	Coñecer os indicadores de calidade do chan e do aire, os procesos de distribución de contaminantes e as tecnoloxías de recuperación e aplicación en cada caso.
A19	Coñecemento e interpretación da lexislación, normativa e procedementos administrativos básicos sobre medios acuosos, chans e atmosferas. Comprensión das bases científicas e económicas da sustentabilidade.
B2	Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo.
B3	Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e suizos.
B4	Que os estudantes saiban comunicar as súas conclusións e os coñecementos e razóns últimas que as sustentan a públicos especializados e non especializados dun modo claro e sen ambigüedades.
B6	Ser capaz de analizar datos e situacións, xestionar a información dispoñible e sintetizala, todo iso a un nivel especializado.
B8	Comprender, a un nivel especializado, as consecuencias do comportamento humano na contorna ambiental.
C1	Ser capaz de traballar en equipos, especialmente nos interdisciplinares e internacionais.
C2	Ser capaz de manter un pensamento crítico dentro dun compromiso ético e no marco da cultura da calidade.
C6	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C7	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To understand soil behavior under human pressure.	AC1	BC2	CC1
To be able to apply soil analysis techniques to real soil problems	AC3	BC3	CC2
To soil problems involving soil pollution and remediation	AC6	BC4	CC6
To develop the capacity to analyze, evaluate, organize and plan soil use	AC10	BC6	CC7
To understand soil and groundwater pollution propagation	AC15	BC8	CC9
To know laws and norms that affect the use of soil	AC19		

Contents	
Topic	Sub-topic

1 - Soil composition. Mineral and organic fractions: reactivity and interactions. Texture, structure and related properties. Cation exchange and soil reaction. Microorganisms. 2 - Soil functions. Capacity for self-purification 3 - Soil quality. Quality indicators. Risk assessment. 4 - Punctual and diffuse contamination. Degradation of soil structure. Water erosion. Erosion as a source of diffuse pollution. 5 - Impact of metals on soil functioning. Interaction between trace elements and soil composition. Cycle of trace elements in the soil. 6 - Contaminants from agricultural, urban and industrial origin. Retention and mobility of contaminants in the soil. Persistence. Assessment risl contamination. 7 - Investigation and treatment of contaminated soils. Soil recovery. Environmental control. 8 - Methods for decontamination of soils. Mechanical, chemical and biological methods. 9 - Phytoremediation of soils. Perspectives and applications. 10 - Soil as nonrenewable resource. Strategies against pollution of soils. Legislation and plans on contaminated soils. 11 - Introduction to groundwater. Sources of pollution. Behavior and mobility of contaminants in the saturated zone.	The common thread of these issues is the relationship between soil functions and quality indicators
Practices - Soil sampling, observation profiles, phenomena of degradation - Determination of physico-chemical indicators of soil quality - Determination of biological indicators of soil quality - Case study of contaminated soils. - Soil and water pollution	Most common soil profiles in the region

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Laboratory practice	A3 A15 B6 C9	3	7.5	10.5
Guest lecture / keynote speech	A1 A3 A6 A10 A15 A19 B2 B6 B8	9	27	36
Case study	A1 A3 A15 B3 B4 B8 C2 C7	1	8	9
Oral presentation	A3 A15 A19 B2 B6 C1 C6	2	9	11
Objective test	A1 A3 A15 B2	1	0	1
Field trip	A1 A3 A15 B6	4	2	6
Personalized attention		1.5	0	1.5

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

Methodologies	
Methodologies	**Description**
Laboratory practice	In this activity, the students will perform soil analysis in order to measure various soil quality indicators.
Guest lecture / keynote speech	The professor communicates the basic concepts and the most important contents of each topic. In addition, questions that the students should discuss and solve will be suggested in order to foster the involvement of the students in the course.
Case study	Real or hypothetical situations will be suggested, and the students will have to analyze them and propose solutions to specific cases related to soil quality conditions.
Oral presentation	Individual work that the students have to present in front of the class
Objective test	This activity will include a series of questions to evaluate the degree of acquisition of the competences defined for this course.
Field trip	A field trip will be organized to observe different soils and soil degradation processes.

Personalized attention	
Methodologies	**Description**
Oral presentation	During the course, the student will be guided by the teaching staff, individually, in all aspects that will be considered necessary, including the most relevant sources of information and any doubts that the student could have on the topics of the course.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Field trip	A1 A3 A15 B6	Proactive attitudes during the field trip and the development of the tasks will be positively assessed.	15
Objective test	A1 A3 A15 B2	The evaluation of the course contents and the acquisition of the competences defined for the course will be evaluated in a final test, which will include theoretical questions and applied problems.	40
Oral presentation	A3 A15 A19 B2 B6 C1 C6	Evaluation of the depth and quality of the work, supporting methodology, and clarity and precision of the presentation.	20
Laboratory practice	A3 A15 B6 C9	The work and skills demonstrated during the laboratory work will be evaluated. Moreover, the students will hand a final report of their laboratory work, and questions related to this activity could be included in the final test.	15
Case study	A1 A3 A15 B3 B4 B8 C2 C7	A real case related to soil quality will be proposed to the student, who needs to evaluate it and suggest solutions in an environmental report.	10

Assessment comments
Para superar la materia es necesario alcanzar un 5 sobre 10 como calificación global. La concesión de matrícula de honor se otorgará a los alumnos que alcancen tal calificación en la primera oportunidad. Se considerarán no presentados aquellos alumnos que realicen todas las actividades excepto la prueba objetiva.

Sources of information

Basic	- Cheng, H. H. (Ed). 1990. Pesticides in the soil environmental processes, impacts and moedlling, Soil. Sci. Soc. Am. Inc. Madison. USA.- Comisión Europea. 2004. Reports of the Technical working goups. Thematic strategy for soil protection.- Consellería de Medio Ambiente e Desenvolvemento Sostible. 2006. Guía metodolóxica e técnica para a investigación da calidade dos solos de Galicia. Santiago de Compostela.- Doran et al. 1994. Defining soil quality criteria for a sustainable environment. Soil. Sci. Soc. Am. Publication n 35. Madison. USA.- Essington, M. E. 2004. Soil and water chemistry. An integrative approach. CRC Press. USA.- Giraud, M.C. y otros. 2005. Sols et environment. Dunod. Paris.- Kabata-Pendias, A. 2011. Trace Elements in Soils and Plants. Fourth ed. CRC Press. USA.- Lal, R. 2002. Encyclopedia of Soil Science. Marcel Dekker.- Porta, J. et al. 2014. Edafología. Uso y Protección de Suelos. Mundi-Prensa.- Wiley, Neil. Phytoremediation: Methods and Reviews. 2007. Methods in BiotechnologyHumana Press.
Complementary	Barceló, J & Poschenrieder, Ch. Phytorremediation: principles and perspectivas. 2003. Contributions to Science 2: 333-344 Pilon-Smits, E. & Pilo, M. Phytorremediation of metals using transgenic plants. 2002. Crit. Rev. Plant Sci. 21: 439-456

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.