UNIVERSIDADE DA CORUÑA

Teaching Guide					
Identifying Data					2020/21
Subject (*)	Statistical Methods for Environmental Data			Code	610500006
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	MatemáticasQuímica				
Coordinador	Jacome Pumar, Maria Amalia		E-mail	maria.amalia.jacome@udc.es	
Lecturers	Andrade Garda, Jose Manuel Estevez Perez, Maria Graciela Jacome Pumar, Maria Amalia		E-mail	jose.manuel.andrade@udc.es graciela.estevez.perez@udc.es maria.amalia.jacome@udc.es	
Web					
General description	Environmental studies imply usually large amounts of experimental data, whose analysis should allow extracting the relevant information hidden behind them. This subject introduces some core advanced multivariate statistical techniques. They will allow a reduction in the dimensionality of the datasets and the discovery/description of sample groups. Commonly-available computing power simplify the treatment of large databases, which are quite frequent nowadays and, therefore, this subject is of general interest for environmentalists.				

Contingency plan	1. Modifications to the contents No changes 2. Methodologies *Teaching methodologies that are maintained Collaborative learning (90% of the final score). The students work in small groups to achieve a common goal under the supervision of the teacher. This cooperative process improves the learning experience of all members of the group. The goal is a practical project that consists of the statistical analysis of a real data set related to environmental data using statistical computer software. This learning activity is strongly based on the student?s autonomous work *Teaching methodologies that are modified Guest lecture / keynote speech (5% of the final score). They will given using TEAMS in the time slot the subject is asigned in the official calendar. Attendance and active involvement are highly recommended Problem solving (5% of the final score). They will given using TEAMS in the time slot the subject is asigned in the official calendar. Attendance and active involvement are highly recommended 3. Mechanisms for personalized attention to students E-mail Daily, to make queries, ask for tutorial sessions and for the follow-up of the practical projects. Videoconference (Teams) Individual and group tutorial sessions on request. Moodle Daily, according to the student?s needs. In the web platform Teams, the learning material will be stored. Discussion forums will be created linked to the units of the subject, to make queries and solve questions. 4. Modifications in the evaluation None of the assessment methods requires physical presence, so the assessment system will not be modified *Evaluation observations: Attendance and active involvement are highly recommended 5. Modifications to the bibliography or webgraphy No changes, all the materials are available in Moodle.udc.es

Study programme competences	
Code	Study programme competences
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.
A12	Coñecer as distintas estratexias para o tratamento estatístico de series de datos relacionadas con datos ambientais.
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.
B5	Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en gran medida autodirixido ou autónomo.
B6	Ser capaz de analizar datos e situacións, xestionar a información dispoñible e sintetizala, todo iso a un nivel especializado.
C1	Ser capaz de traballar en equipos, especialmente nos interdisciplinares e internacionais.
C3	Ser capaz de adaptarse a situacións novas, mostrando creatividade, iniciativa, espírito emprendedor e capacidade de liderado.

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.
C9	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C10	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes			
Learning outcomes	Study programme competences		
Design experiments, get information and interpret results	AC3 AC12	BC3 BC6	CC1 CC6 CC9 CC10
Apply critical, logical and creative thinking to solve problems as effectively as possible.	AC1 AC3	BC5	CC3

Contents	
Topic	Sub-topic
Introduction	A review of the basic methods to describe a dataset, univariate and multivariate approaches.
Relationships among variables	Dependence measurements: correlation matrix, simple and multiple linear regression; multicolinearity.
Multivariate analysis	Description of multivariate datasets Principal components analysis Discriminant analysis Cluster analysis

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Problem solving	A1 A3 A12 B3 C3 C1 C6 C10	5	15	20
Collaborative learning	A3 A12	0	6	6
Guest lecture / keynote speech	A12 B5 B6 C6 C9 C10	16	32	48
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Problem solving	After finishing the theoretical classes, practical exercises will be reviewed in the classroom, and might be proposed as autonomous work.
Collaborative learning	Collaborative learning groups work, consisting on applying the concepts to a real dataset dealing with environmental issues. This training example may be reviewed in the classroom.
Guest lecture / keynote speech	Theoretical lessons will be devoted to teach the basic concepts involved in the selected data treatment techniques, along with practical examples of each of them.

Personalized attention	
Methodologies	Description

Problem solving	Students will be required to develop a study on a particular dataset. They will apply the different techniques learnt in this subject, along with a critical discussion of the results and addressing several predefined questions. They will be monitored by the teachers so that they can solve their doubts with both "face-to-face" and online advice sessions. Tutorships will take place at the office of the teachers for solving doubts, correcting mistakes, suggesting proper approaches to deal with the proposed problems and reviewing initial versions of the works. Online advice sessions will be by means of e-mail, virtual platform, and similar. Part-time students may also perform these works and provide them to the teachers for their assessment. Part-time students can also receive personalized assistance using both in-person and online approaches.

Assessment			
Methodologies	Competencies	Description	Qualification
Guest lecture / keynote speech	A12 B5 B6 C6 C9 C10	Attendance to the theoretical classes and participation there will be scored positively.	5
Problem solving	A1 A3 A12 B3 C3 C1 C6 C10	Participation in the class, in particular, to address the resolution of the exercises will be scored positively.	5
Collaborative learning	A3 A12	Students will analyze a dataset and they will present their findings in a written report. The study may be individual or forming small working teams	90

Assessment comments
Attendance to the guest lectures and active participation will be scored positively (up to 10% of the final overall score of the subject). Attendance should not be lower than 80% of the total hours of the subject (but for clearly justified reasons). The remaining 90% of the overall score will be obtained by performing a written report on a practical case-study. This task may be supervised by the teachers so that main doubts are solved. Scoring of the reports will consider: formal aspects, clarity in the written explanations, sound defence/basement of the explanations and, when required, the performance on the oral presentation. All activities (problem solving, working team essays) posed by the teachers must be addressed by the students, otherwise the subject will not be passed. The overall final score will be a weighted sum of the scores obtained in the different parts. For part-time students and/or with academic exemption, 100% of the overall score will be obtained by performing a written report on a practical case-study and they are not required to defend their works in class. To obtain a NR (No Grade Reported), the student must not participate in the collaborative learning activities.

Sources of information	
Basic	Jobson, J.D. (1992). Applied Multivariate Analysis. Vol. II: Categorical and Multivariate Methods. Springer Texts in Statistics, Springer-Verlag: NewYork.Miller, J.N. & Miller, J.C. (2002) Estadí-stica y Quimiometrí-a para Quí-mica Analí-tica. Edit. PrenticeHall. Mongay Fernández, C. (2005) Quimiometría. Servicio Publicaciones Universidad de Valencia.Morrison, D.F. (1990) Multivariate statistical method. 3rd Edition. McGraw-Hill Series in Probability and Statistics.Peña, D. (2002). Análisis de Datos Multivariantes. McGraw-Hill.Pérez López, C. (2004) Técnicas de análisis multivariante de datos. Aplicaciones con SPSS. Pearson Prentice Hall, Madrid.Pérez López, C. (2005) Métodos Estadísticos Avanzados con SPSS. Thomson, Madrid.Ramis Ramos, G. (2001) Quimiometría. Síntesis, Madrid.
Complementary	Millard, S.P. & Neerchal, N.J. (2001) Environmental Statistics with S-Plus. Springer. CRC Press LLCMillard, S.P. & Neerchal, N.J. (2001) Environmental Statistics with S-Plus. Springer. CRC Press LLC

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
Active participation in the classes is recommended. It is also important to combine the notes taken by the students with the books and reports suggested by the teachers. Tutorships are available for the students, specially for those whose basic skills in statistics may be faulty. It is recommended to review the notes of the subject daily.

(*)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.