



# UNIVERSIDAD DE CASTILLA - LA MANCHA

## GUÍA DOCENTE

### 1. General information

Course: CLIMATE CHANGE

Type: CORE COURSE

Degree: 2335 - Master Degree Program in Environmental Sustainability in the Local and Territorial

Center:

Year: 1

Main language: Spanish

Use of additional languages:

Web site:

Code: 310727

ECTS credits: 6

Academic year: 2022-23

Group(s): 40

Duration: First semester

Second language: English

English Friendly: Y

Bilingual: N

Lecturer: ROCIO ARANZAZU BAQUERO NORIEGA - Group(s): 40				
Building/Office	Department	Phone number	Email	Office hours
Sabatini/0.26	CIENCIAS AMBIENTALES	5466	rocio.baquero@uclm.es	By appointment by email.
Lecturer: ROSA MARIA CARRASCO GONZALEZ - Group(s): 40				
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Sabatini / 07	INGENIERIA GEOLÓGICA Y MINERA	5437	rosa.carrasco@uclm.es	By appointment by email.
Lecturer: FEDERICO FERNANDEZ GONZALEZ - Group(s): 40				
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Edificio Sabatini, Despacho 0.24	CIENCIAS AMBIENTALES	925265753	federico.fdez@uclm.es	By appointment by email.
Lecturer: MIGUEL ANGEL GAERTNER RUIZ VALDEPEÑAS - Group(s): 40				
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Lecturer: MARIA ROSA PEREZ BADIA - Group(s): 40				
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Sabatini, Despacho 0.25	CIENCIAS AMBIENTALES	ext. 5443	rosa.perez@uclm.es	By appointment by email.
Lecturer: ALFONSO RODRIGUEZ TORRES - Group(s): 40				
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	CIENCIAS AMBIENTALES		alfonso.rodriguez@uclm.es	
Lecturer: ENRIQUE SANCHEZ SANCHEZ - Group(s): 40				
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Lecturer: FRANCISCO JAVIER TAPIADOR FUENTES - Group(s): 40				
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Lecturer: IVAN TORRES GALAN - Group(s): 40				
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Sabatini/0.35	CIENCIAS AMBIENTALES	5472	ivan.torres@uclm.es	By appointment by email.
Lecturer: MARIA OLGA VIEDMA SILLERO - Group(s): 40				
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ICAM (Lab Teledeteccion y SIG)	CIENCIAS AMBIENTALES	96874	olga.viedma@uclm.es	By appointment by email.

### 2. Pre-Requisites

Not established

### 3. Justification in the curriculum, relation to other subjects and to the profession

Not established

### 4. Degree competences achieved in this course

## Course competences

Code	Description
CB06	Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
CB07	Apply the achieved knowledge and ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to the area of study
CB09	Know how to communicate the conclusions and their supported knowledge and ultimate reasons to specialized and non-specialized audiences in a clear and unambiguous way
CB10	Have the learning skills which allow to continue studying in a self-directed or autonomous way
CE02	Know the main drivers of global change, their causes, trends, interactions and scales of action, and identify and analyze their impacts on natural heritage and environmental quality
CE05	Know the methodological requirements of the monitoring applied to the evaluation of sustainability and interpret them within the framework of adaptive management
CE06	Know the methods for generating projections of anthropogenic climate change and be able to apply them in the evaluation and monitoring of the impacts of said change
CE07	Identify the mechanisms and processes by which climate change can modify the behavior and distribution of organisms and apply procedures for its projection and monitoring
CE08	Understand the behavior of CO <sub>2</sub> sinks and emission tracking and accounting methods
CG01	Be able to carry out a critical analysis, evaluation and synthesis of new and complex ideas.
CG02	Use specialized software for environmental management, analysis of environmental problems and environmental research
CG03	Be able to integrate information from various sources and sectors in a critical and relational way, and incorporate it into decision-making processes to identify the most appropriate management options
CG04	Be able to participate in multidisciplinary teams for designing and carrying out plans, projects and monitoring on conservation and sustainable management of natural heritage and environmental quality
CG05	Know how to communicate and discuss proposals, results and conclusions in multilingual, specialized and non-specialized forums

## 5. Objectives or Learning Outcomes

### Course learning outcomes

#### Description

Know the methods of accounting and monitoring of emissions, and the behavior and function of CO<sub>2</sub> sinks, as well as apply models to simulate the behavior of sinks.

Advise those responsible for taking measures to adapt and mitigate climate change.

Find and select information on climate change projections suitable for impact studies.

Accurately understand the physical processes that allow environmental measurements from satellites and airborne sensors.

Interpret, analyze and evaluate the potential effects of climate change on the distribution, phenology and demographics of species.

Know and apply statistical methods on satellite images to obtain environmental parameters and indicators of environmental sustainability, and use and correctly handle specific software in digital image processing.

Use different data analysis and climate change impact modeling tools.

Understand, describe and critically analyze the role of satellites in climate change and environmental sustainability studies.

Know the projections of anthropogenic climate change and the methods by which they are generated, as well as their causes, their main consequences, the techniques for their study and the strategies for their mitigation.

Understand scientific articles in the field of climate change projections and its impacts.

## 6. Units / Contents

### Unit 1:

Unit 1.1

Unit 1.2

Unit 1.3

Unit 1.4

Unit 1.5

Unit 1.6

Unit 1.7

### Unit 2:

Unit 2.1

Unit 2.2

Unit 2.3

Unit 2.4

Unit 2.5

Unit 2.6

## 7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	CE02 CE05 CE06 CE07 CE08	1.28	32	N	-	Theoretical classes corresponding to the syllabus
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	CB07 CG02	0.96	24	N	-	Practical sessions on various elements of the syllabus, which will lead to the preparation of autonomous reports that will be evaluated by the teachers responsible for these sessions

Final test [ON-SITE]	Assessment tests	CB06 CB07 CB09 CE02 CE05 CE06 CE07 CE08 CG01 CG03 CG05	0.16	4	Y	Y	Final exam
Writing of reports or projects [OFF-SITE]	Self-study	CB06 CB07 CB09 CB10 CG03 CG05	1.4	35	Y	N	These reports correspond to the face-to-face practice sessions, which will be non-mandatory, and recoverable in the extraordinary call.
Writing of reports or projects [OFF-SITE]	Guided or supervised work	CB06 CB07 CB09 CG03 CG04 CG05	2.2	55	Y	Y	Bibliographic or analysis works, associated with a worksheet and a teacher / tutor, which are assigned at the beginning of the subject. They will be recoverable in the extraordinary call.
<b>Total:</b>			<b>6</b>	<b>150</b>			
<b>Total credits of in-class work: 2.4</b>			<b>Total class time hours: 60</b>				
<b>Total credits of out of class work: 3.6</b>			<b>Total hours of out of class work: 90</b>				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Practicum and practical activities reports assessment	25.00%	0.00%	Reports of practices associated with the activity developed in various parts of the subject.
Theoretical papers assessment	45.00%	50.00%	Individual and group assignments, usually bibliographic or analysis, assigned at the beginning of the course by means of an information sheet and a tutor.
Final test	30.00%	50.00%	Eminently theoretical final exam, based on short questions, test or development, on all aspects related to the theoretical classes
<b>Total:</b>	<b>100.00%</b>	<b>100.00%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

- For the competences acquired in the theoretical classes: final test (short questions or test questions)
- For those acquired in the practical classes: Delivery of reports of results and analysis carried out in the sessions
- For the work: Assessment of the report submitted for the work assigned by the corresponding tutor.

##### Non-continuous evaluation:

The evaluation will be based on a final test and on theoretical work, both with 50% of the mark. The modality assigned by default to the student will be the continuous evaluation. Any student may request the change to the non-continuous evaluation modality (before the end of the class period) by sending an email to the teacher, provided that they have not completed 50% of the evaluable activities.

#### Specifications for the resit/retake exam:

The same criteria of the ordinary call will be applied. The work and the reports of practices are recoverable, and therefore they can be carried out again in this call, in coordination with the professors responsible for these activities of practices. The non-continuous evaluation will be done through a theoretical exam (50%) and a theoretical work (50%), as in the ordinary call.

#### Specifications for the second resit / retake exam:

The mark of this call will coincide with the one obtained in the corresponding final test.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Final test [PRESENCIAL][Assessment tests]	4
<b>Unit 1 (de 2):</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	16
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	6
<b>Unit 2 (de 2):</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	16
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	18
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	24
Final test [PRESENCIAL][Assessment tests]	4
Class Attendance (theory) [PRESENCIAL][Lectures]	32
<b>Total horas: 60</b>	

10. Bibliography and Sources
Publishing

Author(s)	Title/Link	house	Citv	ISBN	Year	Description
Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)	IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change <a href="https://ipcc-wg2.gov/AR5/report/">https://ipcc-wg2.gov/AR5/report/</a>	Cambridge University Press			2014	
Benn, D.I., Evans, D.A.	Glaciers & Glaciation	Hodder Arnold Publication		10: 0340905794	2010	802 pp
Chuvieco, E.	Fundamentos de teledetección espacial	Rialp	Madrid		1996	568pp
Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwicker and J.C. Minx (eds.)	IPCC, 2014: Climate Change 2014: Mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change <a href="http://www.ipcc.ch/report/ar5/wg3/">http://www.ipcc.ch/report/ar5/wg3/</a>	Cambridge University Press			2014	
Eggleston H.S., Buendia L., Miwa K., Ngara T. y Tanabe K. (eds)	IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme <a href="http://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/index.html">http://www.ipcc-nggip.iges.or.jp/public/2006gl/spanish/index.html</a>	IGES, Japon			2006	
Ehlers, J., Gibbard, P.L.	Quaternary Glaciations Extent and Chronology. Part I: Europe	Elsevier	Amsterdam	0 444 51462 7	2004	488 pp
Elachi, C., Jakob J. van Zyl	Introduction To The Physics and Techniques of Remote Sensing	John Wiley & Sons			2006	
Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)	IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change <a href="http://www.ipcc.ch/report/ar5/wg2/">http://www.ipcc.ch/report/ar5/wg2/</a>	Cambridge University Press			2014	
Gaertner, M. A., J. M. Gutiérrez y M. Castro	Escenarios regionales de cambio climático <a href="http://revistadefisica.es/index.php/ref/article/view/1331">http://revistadefisica.es/index.php/ref/article/view/1331</a> ; <a href="http://digital.csic.es/bitstream/10261/93845/1/Escenarios%20regionales%20de%20cambio%20clim%C3%A1tico.pdf">http://digital.csic.es/bitstream/10261/93845/1/Escenarios%20regionales%20de%20cambio%20clim%C3%A1tico.pdf</a>			0213-862X	2012	
García-Mozo H., Mestre A. & Galán	Phenological trends in southern Spain: A response to climate change				2010	
Gitay, H., A. Suárez, R.T. Watson y D.J. Dokken	Cambio climático y Biodiversidad <a href="http://www.ipcc.ch/pdf/technical-papers/climate-changes-biodiversity-sp.pdf">http://www.ipcc.ch/pdf/technical-papers/climate-changes-biodiversity-sp.pdf</a>	IPCC		92-9169-104-7	2002	
Knight, P.G.	Glacier Science and Environmental Change	John Wiley & Sons	Oxford	1 4051 0018 4	2007	544 pp
Lillesand, T. M.; Kiefer, R. W.; Chipman, J. W	Remote sensing and image interpretation				2004	763pp
Meier, U	Growth stages of mono and dicotyledonous plants	Federal Biological Research Centre for Agriculture and Forestry			2001	
Menzel A, Sparks TH, Estrella N, Koch E, Aasa A, Ahas R, Alm-Kübler K, Bissolli P, Braslavská O, Briede A, Chmielewski FM, Crepinsek Z, Curnel Y, Dahl Á, Defila C, Donnelly A, Filella Y, Jatczak K, Måge, F, Mestre A, Nordli Ø, Peñuelas J, Pirinen P, Remišová V, Scheffinger H, M, Striz A, Susnik A, Van Vliet JH, Wielgolaski FE & Züst ASZ	European phenological response to climate change matches the warming pattern				2006	
	Special Report on Emissions Scenarios. A Special	Cambridge				

Nakicenovic, N., and R. Swart (eds.)	Report of Working Group III of the Intergovernmental Panel on Climate Change <a href="https://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf">https://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf</a>	University Press		2007
Pearson, R.G.	Distribution Modeling for Conservation Educators and Practitioners. Synthesis <a href="http://ncep.amnh.org">http://ncep.amnh.org</a>	American Museum of Natural History		2007
Peterson A.T., Soberón J., Pearson R.G., Anderson R.B., Martínez-Meyer E., Nakamura M. & Araújo M.B.	Ecological niches and geographical distributions	Princeton Univ. Press.		2011
Rummukainen, M.	State-of-the-art with regional climate models <a href="http://onlinelibrary.wiley.com/doi/10.1002/wcc.8/abstract">http://onlinelibrary.wiley.com/doi/10.1002/wcc.8/abstract</a>	Wiley		2010
Schowengerdt, R.A.	Remote Sensing: Models and Methods for Image Processing	Academic Press		1996
Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)	IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change <a href="http://www.ipcc.ch/report/ar5/wg1/">http://www.ipcc.ch/report/ar5/wg1/</a>	Cambridge University Press	978-1-107-66182	2013
van Vuuren DP, Edmonds J, Kainuma MLT, Riahi K, Thomson A, Matsui T, Hurtt G, Lamarque J-F, Meinshausen M, Smith S, Grainer C, Rose S, Hibbard KA, Nakicenovic N, Krey V, Kram	Representative concentration pathways: An overview <a href="http://link.springer.com/article/10.1007%2Fs10584-011-0148-z">http://link.springer.com/article/10.1007%2Fs10584-011-0148-z</a>	Springer		2011
	Bilan Carbone, Guide des facteurs d'émission	ADEME		2009
	PAS 2050:2008 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	BSI		2008
	Skepticalscience <a href="http://www.skepticalscience.com/">http://www.skepticalscience.com/</a>			Explaining climate change science & rebutting global warming misinformation