



POLITÉCNICA

INTERNATIONAL
CAMPUS OF
EXCELLENCE

COORDINATION PROCESS OF
LEARNING ACTIVITIES
PR/CL/001



E.T.S. de Ingenieria de Montes,
Forestal y del Medio Natural

ANX-PR/CL/001-01

LEARNING GUIDE

SUBJECT

133000259 - Forest Resilience

DEGREE PROGRAMME

13AD - Master Universitario En Ingenieria De Montes

ACADEMIC YEAR & SEMESTER

2022/23 - Semester 2

Index

Learning guide

1. Description.....	1
2. Faculty.....	1
3. Skills and learning outcomes	2
4. Brief description of the subject and syllabus.....	3
5. Schedule.....	5
6. Activities and assessment criteria.....	7
7. Teaching resources.....	9

1. Description

1.1. Subject details

Name of the subject	133000259 - Forest Resilience
No of credits	3 ECTS
Type	Optional
Academic year of the programme	First year
Semester of tuition	Semester 2
Tuition period	February-June
Tuition languages	English
Degree programme	13AD - Master Universitario en Ingenieria de Montes
Centre	13 - E.T.S. De Ingenieria De Montes, Forestal Y Del Medio Natural
Academic year	2022-23

2. Faculty

2.1. Faculty members with subject teaching role

Name and surname	Office/Room	Email	Tutoring hours *
M Pilar Pita Andreu (Subject coordinator)		pilar.pita@upm.es	M - 12:00 - 15:00 Tu - 12:00 - 15:00
Juan Antonio Martin Garcia		juan.martin.garcia@upm.es	W - 10:00 - 14:00
Ramon Perea Garcia-Calvo		ramon.perea@upm.es	Tu - 10:00 - 11:30 Th - 15:30 - 20:00
Rosa Ana Lopez Rodriguez		rosana.lopez@upm.es	Tu - 09:30 - 11:30 W - 09:30 - 11:30

Jesus Rodriguez Calcerrada		jesus.rcalcerrada@upm.es	Tu - 09:00 - 12:00 F - 09:00 - 12:00
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* The tutoring schedule is indicative and subject to possible changes. Please check tutoring times with the faculty member in charge.

2.2. Research assistants

Name and surname	Email	Faculty member in charge
Salomon Moreno, Roberto Luis	roberto.salomon@upm.es	Pita Andreu, M Pilar
Dorado Liñan, Isabel	isabel.dorado@upm.es	Pita Andreu, M Pilar

3. Skills and learning outcomes *

3.1. Skills to be learned

CB06 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación

CB09 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades

CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.

CE 6.2 - Conocimientos y habilidades para la mejora ambiental del medio

CT04 - Capacidad crítica para el análisis, la síntesis y el aprendizaje mediante el intercambio de opiniones, presentando argumentos sólidos y estructurados

CT06 - Búsqueda bibliográfica, análisis de documentación y tratamiento de la información procedente de diversas fuentes y de su análisis y síntesis aplicándola a la resolución de problemas complejos

CT07 - Perfeccionar el conocimiento oral y escrito de la lengua inglesa

3.2. Learning outcomes

RA134 - Capacidad para realizar búsquedas bibliográficas, consultar y utilizar con criterio bases de datos y otras fuentes de información, para llevar a cabo simulaciones con el objetivo de realizar investigaciones sobre temas complejos de su especialidad

RA155 - Valorar el efecto de las principales enfermedades y plagas que afectan a árboles forestales en el contexto del cambio global

RA157 - Valorar la resiliencia de especies arbóreas a la herbivoría

RA156 - Analizar el efecto del incremento de CO₂ atmosférico y los fenómenos meteorológicos extremos en especies arbóreas

* The Learning Guides should reflect the Skills and Learning Outcomes in the same way as indicated in the Degree Verification Memory. For this reason, they have not been translated into English and appear in Spanish.

4. Brief description of the subject and syllabus

4.1. Brief description of the subject

This course offers a chance to gain a better understanding on how trees respond to several kinds of stress, both biotic (pathogens and pests, herbivory) and abiotic (mainly those related to climate change). Special attention will be given to ageing and regeneration, two key processes in forest dynamics and forest resilience.

The course will combine lectures with laboratory practices and collaborative sessions, where recently published results on different topics will be discussed.

Specific goals for this course are:

Offer up-to-date information on tree and forest responses to Global Change

Develop ecological indicators to assess the resilience of forest and agroforestry systems

Integrate resilience into sustainable forest management

Identify biotic threats to forests and management measures to increase resilience

4.2. Syllabus

1. Topic 1. The physiology of tree responses to increased atmospheric CO₂
2. Topic 2. CO₂ exchange between forest ecosystems and the atmosphere
3. Topic 3. Tree responses to climate change and extreme meteorological events
4. Topic 4. The effects of ageing on tree responses to stress
5. Topic 5. Forest resilience to pathogens and pests in the context of global change
6. Topic 6. The impact of herbivory on forest trees
7. Topic 7. Resilience in agroforestry systems: examples from California and Spain
8. Topic 8. Forest dynamics. Main threats to natural regeneration

5. Schedule

5.1. Subject schedule*

Week	Classroom activities	Laboratory activities	Distant / On-line	Assessment activities
1	Lecture on the contents of Topic 1 Duration: 01:30			
2	Lecture on the contents of Topic 2 Duration: 02:00			
3	Lecture on the contents of Topic 3 Duration: 01:30	Lab practice Duration: 01:00		
4	Lecture on the contents of Topic 3 Duration: 01:30			
5	Lecture on the contents of Topic 3 Duration: 01:30			
6	Lecture on the contents of Topic 4 Duration: 02:00			
7				Student's presentations and debate on the topic choosen Continuous assessment Presential Duration: 01:00
8	Lecture on the contents of Topic 5 Duration: 02:00 Field trip Duration: 03:30			
9	Lecture on the contents of Topic 6 Duration: 01:30	Lab practice Duration: 01:00		
10	Lecture on the contents of Topic 7 Duration: 01:30	Lab practice Duration: 00:30		Problems & Questions about topic 6 and 7 Continuous assessment Presential Duration: 00:30
11	Lecture on the contents of Topic 8 Duration: 01:30			

12				
13	Field Trip Duration: 07:00			
14				
15				Student's presentations and debate on the topic choosen Continuous assessment Presential Duration: 01:30
16				
17				Final Exam Final examination Presential Duration: 01:30

Depending on the programme study plan, total values will be calculated according to the ECTS credit unit as 26/27 hours of student face-to-face contact and independent study time.

* The schedule is based on an a priori planning of the subject; it might be modified during the academic year, especially considering the COVID19 evolution.

6. Activities and assessment criteria

6.1. Assessment activities

6.1.1. Assessment

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
7	Student's presentations and debate on the topic chosen		Face-to-face	01:00	40%	5 / 10	CB10 CE 6.2 CT04 CT07 CB06
10	Problems & Questions about topic 6 and 7		Face-to-face	00:30	20%	4 / 10	CB06 CT07
15	Student's presentations and debate on the topic chosen		Face-to-face	01:30	40%	5 / 10	CB09 CB10 CT06 CT07

6.1.2. Global examination

Week	Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills
17	Final Exam		Face-to-face	01:30	100%	5 / 10	CB10 CT06 CB09 CT07 CB06 CT04 CE 6.2

6.1.3. Referred (re-sit) examination

Description	Modality	Type	Duration	Weight	Minimum grade	Evaluated skills

Written examination for students who failed the final exam		Face-to-face	01:30	100%	5 / 10	CB06 CB09 CE 6.2 CT04
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6.2. Assessment criteria

Continuous assessment:

The students will have to carry two debates and/or oral presentations about different topics related to the contents of the course.

The following items will be considered to evaluate these activities: The soundness of the scientific evidences that support the argumentation. Oral expression. Clarity and originality in data presentation.

These activities will have a weight of 80% in the mark obtained by continuous assessment. The answers to questions in class will account for the remaining 20% of the mark.

Final Exam (Ordinary):

Students who failed the continuous assessment or wish to improve the mark obtained by continuous assessment will take a written exam about the contents of the course (May-June).

Final Exam (Extraordinary):

Students who failed the continuous assessment and the final exam will take a written exam about the contents of the course in July.

7. Teaching resources

7.1. Teaching resources for the subject

Name	Type	Notes
Portable Infrared gas analyzer (LI-6400, Li-Cor INC, NE, USA) for gas exchange measurements	Equipment	
Chen et al (2015). Roles of Climate, Vegetation and Soil in Regulating the Spatial Variations in Ecosystem Carbon Dioxide Fluxes in the Northern Hemisphere. PLoS ONE 10(4): e0125265. doi:10.1371/journal.pone.0125265	Bibliography	
Choat et al. 2018. Triggers of tree mortality under drought. Nature 558 (7711), 531	Bibliography	
Gill, R. M. A. (1992). A review of damage by mammals in north temperate forests: Impact on trees and forests. Forestry: An International Journal of Forest Research, 65(4), 363-388.	Bibliography	
Jiang et al. (2020) The fate of carbon in a mature forest under carbon dioxide enrichment. Nature 580: 227-231	Bibliography	
Leakey et al. (2009). Elevated CO ₂ effects on plant carbon, nitrogen, and water relations: six important lessons from FACE. Journal of Experimental Botany, Vol. 60, No. 10, pp. 2859-2876	Bibliography	

<p>Morellet, N., Gaillard, J. M., Hewison, A. M., Ballon, P., Boscardin, Y. V. E. S., et al. (2007). Indicators of ecological change: new tools for managing populations of large herbivores. <i>Journal of Applied Ecology</i>, 44(3), 634-643.</p>	<p>Bibliography</p>	
<p>Keeling et al (2017). Atmospheric evidence for a global secular increase in carbon isotopic discrimination of land photosynthesis. <i>Proceedings of the National Academy of Sciences</i>. 114. 201619240. 10.1073/pnas.1619240114.</p>	<p>Bibliography</p>	
<p>Teskey R, et al 2015. Responses of tree species to heat waves and extreme heat events. <i>Plant, Cell and Environment</i> 38, 1699-1712</p>	<p>Bibliography</p>	
<p>Schuldt B, et al 2020. A first assessment of the impact of the extreme 2018 summer drought on Central European forests. <i>Basic and Applied Ecology</i> 45, 86-103</p>	<p>Bibliography</p>	
<p>Zhao DF, et al (2017) Environmental conditions regulate the impact of plants on cloud formation. <i>Nature Communications</i>. 8:14067 DOI: 10.1038/ncomms14067</p>	<p>Bibliography</p>	