

25241 - Biotechnology and resource conservation

Información del Plan Docente

Academic Year	2016/17
Academic center	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences
ECTS	6.0
Course	
Period	Four-month period
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The method of instruction which has been designed for this course is based on a fundamentally technical and applied approach, such that the activities that have been planned endeavour to promote the knowledge and understanding of the strategies of characterization and conservation of the biodiversity, especially the biotechnologies, in order to train professionals capable of using them. The fundamentals of the technologies will be explained in theory classes and the students will be able to use them in the practical classes.

5.2.Learning activities

25241 - Biotechnology and resource conservation

- Instructor-led participatory classes : 30 hours of attendance. The theory programme of the course is divided into four modules: protection and conservation of flora and fauna, characterization of the biodiversity, strategies of conservation and biotechnology applied to the conservation of organisms.

-Practical classes: 30 hours of attendance

5.3.Program

Block I: Introduction to conservation

BIODIVERSITY

Diversity and biodiversity; expression of biodiversity. Why conserve biodiversity? The sixth extinction? Recorded extinctions. Threatened species. What causes extinction? Endogamy and loss of diversity. Spiral of extinction. Centers of origin, of diversity, of diversification and of dispersión. Biogeographical regions. (2 h)

GENETIC DIVERISTY

Importance of genetic diversity. What is genetic diversity? Extent of genetic diversity.Polymorphism, allele frequencies, heterozygosis, heterozygosity, genetic diversity, nucleotide diversity. Extent of genetic diversity: exogamy, endogamy. (2 h)

Block II: Characterization of the biodiversity .

MOLECULAR MARKERS

What is a molecular marker? Isoenzymes. DNA markers: markers based on hybridization of DNA: RFLP, Minisatellites or VNTR, markers based on DNA amplification: RAPD, Microsatellites or SSRs, mixed markers: AFLP. DNA sequences. (4 h)

DNA CHEMISTRY

Extraction of DNA. Technology of recombinant DNA. Molecular cloning. Tools and processes. Polymerase chain reaction (PCR). DNA sequencing (2 h)

CYTOGENETICS

Chromosomes, karyotype. Intra and interspecific variation in the size of the genome: evolution and adaptive significance. Molecular cytogenetics, (GISH, FISH). (1 h)

THE GENES OF THE POPULATIONS: HARDY-WEINBERG EQUILIBRIUM

25241 - Biotechnology and resource conservation

Description of genetic diversity. Hardy-Weinberg equilibrium. Expected heterozygosity. Deviation of the Hardy-Weinberg equilibrium. Genetic drift. (2 h)

QUANTITATIVE VARIATION

Quantitative variation. Properties of the quantitative characteristics. Quantitative genetic variation. Heritability. Genetic and environmental contribution to a characteristic. Contributions to genetic variation: additive, dominant and from interaction. (2 h)

Block III: Strategies of conservation .

Conservation in situ: natural parks, Natura network. Conservation ex situ: botanical gardens, germoplasma banks and DNA banks. Systems of propagation of plants: sexual reproduction and vegetative multiplication. (3 h)

Techniques of plant conservation. Orthodox and recalcitrant seeds. Material of vegetative propagation: field collections, conservation of clones. Multiplication and regeneration of entries in germoplasma banks. Incident factors in conservation. Physiological and genetic deterioration. Use of natural environments. Use of controlled environments: types of installations. Selection of environment. Effect of sample size. (4 h)

Block IV: Biotechnology applied to the conservation of organisms .

In vitro cultivation: concept and basic requirements. Totipotency: differentiation and development. Phytohormones and phytohormones. Explant: concept and types. Morphogenesis: somatic embryogenesis and organogenesis. Techniques of micropropagation: cultivation of apices and adventitious regeneration. Rooting and acclimatization. (4 h)

Techniques of in vitro preservation: short- and medium-term storage. Encapsulation in calcium alginate: artificial seeds. Long-term preservation: cryopreservation. Techniques of cryopreservation: dehydration and vitrification, cryoprotectants. (3 h).

Off-type plants and somaclonal variants. Methods of analysis of material regenerated in vitro: flow cytometry, molecular markers. (1 h)

2 Seminars given by persons in charge of centres devoted to the conservation of natural resources, 4 hours of attendance. In fact there will be two seminars, one concerning strategies of in situ conservation in natural parks and another about the characterization and use of phylogenetic resources of agronomic interest.

3 Laboratory/library practicals. 20 hours of attendance.

Laboratory experiments: exercises in the characterization of plants through molecular markers, in the reproduction of plants with seeds and multiplication by cuttings, in micropropagation and in cryopreservation (16 h)

Library practicals on the application of bioinformatic tools to the characterization of phylogenetic resources (4 h).

4 Visit to the Horticultural Germoplasma bank in Zaragoza (6 hours of attendance).

25241 - Biotechnology and resource conservation

5 Study for the written test and the preparation of reports on the practicals, a total of 87 hours of independent work by the student. For better progress in the learning process it will be beneficial for the students to use the tutorial hours, especially for the production of the laboratory/practical reports.

6 Written test 3 hours of attendance.

5.4.Planning and scheduling

Week	Theoretical class (2 h)	Practical class (2 h)	Homework	Horas total
1	Lesson 1			2
2	Lesson 2		Estudio (3 h).	5
3	Lesson 3	Seminario sobre parques naturales.	Estudio (6 h).	10
4	Lesson 4	Prácticas de lab.: aislamiento de ADN.	Preparación de la práctica (0.5 h). Estudio (5.5 h).	10
5	Lesson 5	Marcadores de ADN: amplificación.	Preparación de la práctica (0.5 h). Estudio (5.5 h).	10
6	Lesson 6	Marcadores de ADN: electroforesis y codificación de alelos.	Preparación de la práctica (0.5 h). Estudio (5.5 h).	10
7	Lesson 7	Prácticas de gabinete: análisis de marcadores de ADN.	Estudio y elaboración de informe sobre la práctica (6 h).	10
8	Lesson 8	Prácticas de gabinete: análisis de polimorfismos	Estudio y elaboración de informe sobre la práctica (6 h).	10

25241 - Biotechnology and resource conservation

		de secuencias.	h).	
9	Lesson 9	Visita al vivero forestal de Ejea de los Caballeros (6 h)	Estudio y redacción de informe de la visita (4h)	12
10	Lesson 10	Ensayos de escarificación y germinación de semillas forestales. Ensayos de estaquillado.	Preparación de la práctica (0.5 h). Elaboración de informes sobre las prácticas (5.5 h).	10
11	Lesson 11	Seminario sobre caracterización y aprovechamiento de recursos fitogenéticos	Estudio (6 h).	10
12	Lesson 12	Ensayo de micropropagación: medios de cultivo. Desinfección del material vegetal.	Preparación de la práctica (0.5 h). Estudio (5.5 h).	10
13	Lesson 13	Ensayo de micropropagación: siembra de explantos.	Preparación de la práctica (0.5 h). Estudio (5.5 h).	10
14	Lesson 14	Ensayo de criopreservación.	Preparación de la práctica (0.5). Estudio (5.5 h).	10
15	Lesson 15	Lectura de resultados de los ensayos de propagación.	Estudio y elaboración de informe sobre las prácticas (6 h).	10
			Estudio (8h)	8

25241 - Biotechnology and resource conservation

	Written exam (3 h).			3
Horas total	33	30	87	150

5.5. Bibliography and recommended resources

Basic bibliography

Avise, John C.. Phylogeography : the history and formation of species / John C. Avise . Cambridge : Harvard University Press, 2000

Bacchetta, Gianluigi; Ballesteros, Daniel; Piero, Belletti [et.al]. Conservación ex situ de plantas silvestres. [Oviedo] : Gobierno del Principado de Asturias : Obra Social "La Caixa", [2008]

Biología de la conservación de plantas amenazadas / coordinador Ángel Bañares Baudet . [Madrid] : Organismo Autónomo Parques Nacionales, D.L. 2002

Frankham, Richard. Introduction to conservation genetics / Richard Frankham, Jonathan D. Ballou and David A. Briscoe ; line drawings by Karina H. McInness . 2nd ed. Cambridge : Cambridge University Press, 2010

Hunter, Malcolm L.. Fundamentals of conservation biology / Malcolm L. Hunter, J. Gibbs . 3rd ed. Malden, MA : Blackwell Publishing, 2007

Pina Lorca, José Antonio. Propagación de plantas / José Antonio Pina Lorca Valencia : Universidad Politécnica, 2008

Primack, Richard B.. Introducción a la biología de la conservación / Richard B. Primack y Joandomènec Ros . Barcelona : Ariel, D.L. 2002

Complementary bibliography

Atlas y libro rojo de la flora vascular amenazada de España : Adenda 2010 / [editores y coordinación científica del

25241 - Biotechnology and resource conservation

proyecto, Ángel Bañares Baudet ... et al.] . Madrid : Organismo Autónomo Parques Nacionales, 2011

Atlas y libro rojo de la flora vascular amenazada de España : taxones prioritarios / [editores y coordinación científica del proyecto, Ángel Bañares Baudet ... (et al.)] . Madrid : Tragsa : Ministerio de Medio Ambiente, 2003