Universitat de Lleida

DEGREE CURRICULUM

FOREST DYNAMICS IN A GLOBAL CHANGE CONTEXT: DRIVERS, PROCESSES AND MODELLING APPROACHES

Coordination: COLL MIR, LLUIS

Academic year 2023-24

Forest dynamics in a global change context... 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>Forest dynamics in a global change context: drivers, processes and modelling approaches</td></tr>
<tr><td>Code</td><td>111017</td></tr>
<tr><td>Semester</td><td>ANUAL CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Master's Degree Erasmus Mundus in Spatial and Ecological Modelling in European Forestry</td><td>1</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
<tr><td>Master's Degree Erasmus Mundus in Spatial and Ecological Modelling in European Forestry</td><td></td><td>OPTIONAL</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
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<tr><th>Activity type</th><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>2.5</td><td>2.5</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td></tr>
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<tr><td>Coordination</td><td>COLL MIR, LLUIS</td></tr>
<tr><td>Department</td><td>AGRICULTURAL AND FOREST SCIENCES AND ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>50% lectures (narrated videos)
50% independent student work (assignments)</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English</td></tr>
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Forest dynamics in a global change context... 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
AMEZTEGUI GONZALEZ, AITOR	aitor.ameztegui@udl.cat	2,5	
COLL MIR, LLUIS	lluis.coll@udl.cat	2,5	

Subject's extra information

Forest ecosystems face multiple challenges due to global change with important consequences for their current and future dynamics. This course is designed to provide an overview of the main drivers of change (climate warming, natural disturbances, land-uses) and their impact on key forest properties and processes. It will also introduce the students to the role of dynamic models for understanding and predict the response of forest ecosystems to different disturbance agents.

Learning objectives

Forest ecosystems face multiple challenges due to global change with important consequences for their current and future dynamics.

This course is designed to provide an overview of the main drivers of change (climate warming, natural disturbances, land-uses) and their impact on key forest properties and processes. It will also introduce the students to the role of dynamic models for understanding and predict the response of forest ecosystems to different disturbance agents.

Competences

To have a minimum knowledge of the principles of forest ecology is recommended

Subject contents

1. **Main components of global change**
    1. Climate change, a present threat
    2. Impacts of climate change on European forests
    3. Other components of global change (I)
    4. Consequences of forest expansion on European forests
    5. Other components of global change (II) [Exercise]
    6. Can you guess the driving force? [Quiz]
2. **Disturbance Ecology**
    1. Concept of disturbance. Disturbance regime
    2. Disturbances affecting European forests
    3. Post'disturbance dynamics
3. **Responses of plants to environmental change**
    1. Introduction. Migration
    2. Adaptation. Strategies for conservation.
4. **Resilience and stability**
    1. Concept of resilience. Resilience of what to what.

    2. Measure of resilience. The Persistence Index.
5. **Introduction to forests as Complex Adaptive Systems**
    1. Concept of Complex Adaptive Systems (CAS). Properties of CAS.
    2. Managing forests as CAS. An inspiring talk
6. **Demographical processes and species distribution**
    1. Introduction. Realized vs. fundamental niche
    2. From niche differentiation to the continuum concept
    3. Effects of climate on adult demography
    4. Effects of climate on juvenile demography
7. **Modelling forest dynamics**
    1. Introduction. Main types of models
    2. Individual-based vs. landscape models
    3. Current approaches in the modelling of ecosystem services and biodiversity
    4. SORTIE-ND: a model of forest dynamics. Theoretical issues.
    5. Practices with SORTIE-ND (I): installation, setup and visualization
    6. Practices with SORTIE-ND (II): harvest regimes
    7. Practices with SORTIE-ND (III): climate change
    8. Exercise: simulations with SORTIE-ND

Methodology

- Narrated power point modules and recommended scientific readings will be progressively distributed to the students.
- During the course, and for each week, students are expected to go over the course material and at the end of each section it will be a proposed activity to solve some practical problems. This activity will be evaluated by the instructor and it will be part of final mark of the course.
- Students can participate at times of their own choosing, previous email to the instructor, to post questions, seek clarification, and interact with other students and the instructor.
- The Virtual Campus will be the main mean of communication with students. This medium is very flexible and ensures a fluent communication with all students. In this digital medium, teaching material for lectures will be published (class notes, practical problems, evaluation results, academic publications and website links), and the practical activities announced. Moreover, it will be used for the students to upload their practical work and contact with instructors.
- Discussion among participants will be encouraged

Development plan

Scheduling is by agreement with the students at the beginning of the course.

Evaluation

- Participation is critical in this course
- The student will be asked to present (under different formats) a number of practical exercises/short reports related to each unit of the course.

Bibliography

Recommended literature (additional literature will be supplied during the course)

- Allen, C.D., Macalady, A.K. *et al*. (2010) A global overview of drought and heat-induced tree mor-tality reveals emerging climate change risks for forests. For. Ecol. Manag. 259,660–
- Ameztegui A., Coll L., Messier C. (2015) Modeling the effect of climate-induced changes in recruitment and juvenile growth on mixed-forest dynamics: The case of montane-subalpine Pyrenean ecotones. Ecological Modelling 313: 84-93.

- Filotas E., Parrott L., Burton P.J., Chazdon R.L., Coates D.K., Coll L., Haeussler S., Martin K., Nocentini S., Puettmann K.J., Putz F.E., Simard S.W., Messier C. (2014) Viewing Forests through the Lens of Complex Systems Science. Ecosphere 5:art1
- Oliver, T.H., Heard, M.S., Isaac, N.J.B., Roy, D.B., Procter, D., Eigenbrod, F., Freckleton,R., Hector, A., Orme, C.D.L., Petchey, O.L., Proenc¸a, V., Raffaelli, D., Suttle, K.B.,Mace, G.M., Martín-López, B., Woodcock, B.A., Bullock, J.M., 2015. Biodiversityand resilience of ecosystem functions. Trends Ecol. Evol. 30, 673–684
- Sánchez-Pinillos M., Coll L., De Cáceres M., Ameztegui A (2016). Assessing the persistence capacity of communities facing natural disturbances on the basis of species response traits. Ecological indicators 66: 76-85.
- Schelhaas, M.-J., Nabuurs, G.-J., Schuck, A., 2003. Natural disturbances in the Euro-pean forests in the 19th and 20th centuries. Glob. Chang. Biol. 9, 1620–1633,http://dx.doi.org/10.1046/j.1365-2486.2003.00684.x.
- Seidl, R., Spies, T.A., Peterson, D.L., Stephens, S.L., Hicke, J.A., 2015. Searching forresilience: addressing the impacts of changing disturbance regimes on forestecosystem services. J. Appl. Ecol., http://dx.doi.org/10.1111/1365-2664.12511