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| Course Name: Forest dynamics in a global change context: drivers, processes and modelling approaches | | Coordinator: Lluís Coll |
| Semester: 1 | ECTS: 5 | Instructors: Lluís Coll Aitor Ameztegui Cristina Vega |

Website: <https://cv.udl.cat/portal/site/XXXXXX-1718>

Course recommended for Track:

1. Decision support systems for resource management
2. Resource management for ecosystem services
3. Spatial and Ecological Modelling **X**
4. Resource economics and policy

Previous knowledge required:

Principles of forest ecology

Goal:

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 outcomes:

Students completing the course should be able to:

- Summarize and detail key concepts concerning the different components of global change and their impacts on forest ecosystem functioning and dynamics.
- Describe disturbance ecology, including the components of disturbance regimes and the main factors driving post-disturbance forest dynamics.
- Detail the concepts of resilience, stability and complex adaptive systems.

- Explain the principles of different types of forest dynamic models, understand how their outputs depend on parameters, and discuss potential applications of simulation models for predicting the impacts of global change on forest ecosystems.

- Critically read, interpret and use scientific literature about forest ecosystem dynamics.

Contents:

1. Introduction to the main components of global change (climate change, land-use changes, biotic exchanges, nitrogen deposition...).

2. Disturbance ecology and regimes.

3. Impacts of environmental changes on forest functioning (physiology, phenology, species interactions).

4. Resilience and stability.

5. Introduction to the concept of forests as complex adaptive systems.

6. Demographical processes and species distributions.

7. Modelling approaches for the study of forest dynamics (statistical, process-based and population models)

Learning Activities (Methods and Planning):

- The main mean of communication among the students and between the students and the instructors will be the *Virtual Campus (VC)* tool of the University of Lleida.

- Power point modules and recommended scientific readings will be progressively distributed to the students via the *VC*.

- The students will be divided into groups and asked to critically evaluate one scientific article per each course section. They will need to prepare a short presentation with the results of their evaluation that will be distributed and commented by all the students via the *VC*.

- Once the topic regarding modelling approaches will be addressed in the course, the students will be divided into groups and asked to solve practical exercises involving the use of a forest dynamic model (SORTIE). The outcome of these exercises will be discussed and debated via the *VC*.

- At any time students can interact with the instructors via the *VC* (posting questions, seeking for clarification etc.).

Evaluation System:

- Participation in the debates/discussions of the course (25%).

- Writing and oral tasks (group work) related to the evaluation/comment of the distributed readings (50%).

- Result and presentation of the practical modelling exercise (group work) (25%).

Bibliography:

- Ameztegui A, Brotons L, Coll L (2010) Land-use changes as major drivers of Mountain pine (*Pinus uncinata* Ram.) expansion in the Pyrenees. *Global Ecology and Biogeography* 19 (5): 632-641.

- Campbell EM, Saunders SC, Coates KD, Meidinger DV, MacKinnon AJ, O'Neill GA, MacKillop DJ, DeLong SC (2009) Ecological resilience and complexity: a theoretical framework for understanding and managing British Columbia's forest ecosystems in a changing climate. B.C. Min. For. Range, For. Sci. Prog., Victoria, B.C. Tech. Rep. 055. www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr055.htm.

- Coomes D, Burslem DFRP, Simonson WD (eds.) (2014) *Forests and Global Change*. Cambridge University Press. 473 p.

- Filotas E, Parrott L, Burton PJ, Chazdon RL, Coates DK, Coll L, Haeussler S, Martin K, Nocentini S, Puettmann KJ, Putz FE, Simard SW, Messier C (2014) Viewing Forests through the Lens of Complex Systems Science. *Ecosphere* 5:art1 [dx.doi.org/10.1890/ES13-00182.1](https://doi.org/10.1890/ES13-00182.1).

- Oliver C., Larson B (1996). *Forest Stand Dynamics*. J. Wiley & Sons. 509 p.

- Purves D, Pacala S (2008) Predictive models of forest dynamics. *Science* Jun 13;320(5882):1452-3. doi: 10.1126/science.1155359.

- Seidl R, Schelhaas MJ, Rammer W, Verkerk PJ (2014) Increasing forest disturbances in Europe and their impact on carbon storage. *Nat Clim Chang*, 4:806-810.