

## Wildland Fire Behavior and Modelling (E900545)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0**

**Study time 180 h**

**Course offerings in academic year 2023-2024**

A (semester 1)

English

Gent

**Lecturers in academic year 2023-2024**

Planas, Eulalia

BARCELO3 lecturer-in-charge

**Offered in the following programmes in 2023-2024**

[International Master of Science in Fire Safety Engineering](#)

**crdts**

6

**offering**

A

**Teaching languages**

English

**Keywords**

Wildfire dynamics, fire metrics, fuel models, rate of spread models, fire danger, extreme wildfire

**Position of the course**

The course provide students with fundamental knowledge on wildfires. The aim is that students should be able to understand different wildfire behaviour modelling approaches and apply rate of spread models and simulation systems after the completion of the course. Furthermore, students should be able to identify parameters responsible of different types of wildfire dynamics.

**Contents**

- 1 Introduction. Fire in the Earth System – Types of wildfires – Climate and human drivers – Ecological feedbacks.
- 2 Wildfire propagation. Factors influencing wildland fire behaviour: Terrain – Weather variables – Fuel properties. Fire spread and growth.
- 3 Fuel types and models: Intrinsic and extrinsic vegetation fuel parameters – Fuel modelling approaches and scales.
- 4 Geometrical and physical characteristics of wildland fires: fire perimeter – fire behaviour metrics – flame metrics.
- 5 Mathematical fire behaviour and danger modelling: modelling approaches (empirical, semi-empirical, physical and hybrid approaches), simulation systems, fire danger rating.
- 6 Extreme fire behaviour: Types of extreme wildfire events – causes and conditions associated to extreme fires – wildfire disasters.

**Initial competences**

Insight into the basic concepts of physics, chemistry, thermodynamics, heat and mass transfer. Gather, look up, interpret, integrate and present relevant information in a systematic manner.

**Final competences**

- 1 Identify the main drivers and parameters linked to wildfire behaviour.
- 2 Identify the main drivers and parameters linked to wildfire behaviour.
- 3 Compare different landscape and weather scenarios in terms of expected wildfire behaviour.
- 4 Utilize mathematical models to calculate fire behaviour and danger metrics.
- 5 Critically reflect on the benefits and limitations of wildfire simulation systems.

**Conditions for credit contract**

This course unit cannot be taken via a credit contract

#### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

#### **Teaching methods**

Group work, Seminar, Lecture, Practical, Independent work

#### **Extra information on the teaching methods**

- Theory and exercises are taught during lectures, periodic individual assignments, case studies in groups.
- Laboratory exercises are performed at the UPC fire laboratory and with computers

#### **Learning materials and price**

All material needed can be found digitally on the course web (for free)

#### **References**

- Pyne, S. J., Andrews, P.L., Laven, R.D. Introduction to wildland fire, John Wiley and Sons, Ltd. 1996
- Johnson, E.A., Miyanishi, K. Fires fires: behaviour and ecological effects Academic Press, 2001.
- Belcher, C.M. Fire phenomena and the earth system: an interdisciplinary guide to fire science John Wiley & Sons, Ltd. 2013.
- Rego, F.C., Morgan, P, Fernandes, P., Hoffman, C. Fire Science – from chemistry to landscape management. Springer, 2021.

#### **Course content-related study coaching**

Interactive support through the electronic learning environment, in person after agreement on date and immediately before and after hearing classes.

#### **Assessment moments**

end-of-term and continuous assessment

#### **Examination methods in case of periodic assessment during the first examination period**

Written assessment with multiple-choice questions, Written assessment with open-ended questions

#### **Examination methods in case of periodic assessment during the second examination period**

Written assessment with multiple-choice questions, Written assessment with open-ended questions, Written assessment

#### **Examination methods in case of permanent assessment**

Assignment

#### **Possibilities of retake in case of permanent assessment**

examination during the second examination period is not possible

#### **Extra information on the examination methods**

The examination of the course consists of three parts: A written mid-term exam, a written final exam and the continuous assessment.

#### **Calculation of the examination mark**

30% mid-term exam, 40% final exam, 30% coursework

#### **Facilities for Working Students**

There are no special facilities for working students