

## Environmental Soil Sensing (I002658)

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

**Credits 4.0**

**Study time 120 h**

### Course offerings and teaching methods in academic year 2024-2025

A (semester 2)

English

Gent

lecture

practical

### Lecturers in academic year 2024-2025

De Smedt, Philippe

LA20

lecturer-in-charge

Mouazen, Abdul

LA20

co-lecturer

### Offered in the following programmes in 2024-2025

Master of Science in Bioscience Engineering: Land, Water and Climate

crdts

4

offering

A

Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)

4

A

Exchange Programme in Bioscience Engineering: Land and Forest management (master's level)

4

A

### Teaching languages

English

### Keywords

Environmental Surveying, Soil mapping, Soil sensors, Environmental Geophysics, Soil Spectroscopy, Geochemical Prospection.

### Position of the course

*Environmental Soil Sensing* provides theoretical and practical insights into near surface sensing methods to characterize, map, and monitor variations in the shallow subsurface in space and time. The course focusses on geophysical and geochemical methods to acquire high-resolution continuous information on the pedosphere and its interface with the bio- and lithosphere (critical zone). Emphasis of the course is on providing practical solutions in a broad range of environmental applications including studies into ecology, pollution, utilities, precision agriculture, hydrology and forensics, as well as heritage management. This includes the adaptive design of appropriate survey strategies and accompanying modelling methods and calibration/validation sampling. The provided practical insights build on a robust understanding between subsurface material (soil) properties on the one hand, and geophysical and geochemical properties on the other. These relationships are discussed during the theoretical course units.

The course positions itself alongside other earth inventory course units, including *Teledetectie*, *Geografische Informatiesystemen: basis*, *Geostatistiek*, and builds on insights from *Bodemeigenschappen en bodemprocessen*

### Contents

THEORY:

- 1] Fundamental principles of sampling with sensors;
- 2] Introduction to geophysical soil properties and geophysical soil modelling
- 3] Principles and applications of common near surface geophysical methods (electrical resistivity; ground penetrating radar; electromagnetic induction; magnetometry and environmental magnetism)
- 4] Introduction to spectroscopy and geochemical soil sensing
- 5] Principles and applications of common spectroscopic methods

#### PRACTICE:

- 1] field application of geophysical sensors & introduction to invasive field sampling to complement soil sensor data;
- 2] analysing and interpreting geophysical sensor data;
- 3] analysing and interpreting geochemical & multi-sensor data;

#### Initial competences

Basic knowledge of (geo)statistics, soil science and geographical information systems

#### Final competences

- 1 develop adaptive survey approaches that integrate non-invasive and invasive techniques to support environmental research;
- 2 understand the operating principles of geophysical and geochemical sensors and their limitations for practical implementation;
- 3 have the necessary practical skills to use the sensors for on-site data collection;
- 4 *understand the general principles for data processing and analysis for the different discussed sensing methods;*
- 5 have an overview of the most commonly used and commercially available tools for environmental soil sensing

#### Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

#### Conditions for exam contract

This course unit cannot be taken via an exam contract

#### Teaching methods

Group work, Seminar, Lecture, Practical

#### Extra information on the teaching methods

practicum: fieldwork, practicum and pc-exercises

#### Study material

Type: Syllabus

Name: Online syllabus on basic principles of ESS and practicum info

Indicative price: Free or paid by faculty

Optional: no

Type: Slides

Name: Course slides

Indicative price: Free or paid by faculty

Optional: no

Language : English

Type: Reader

Name: compulsory journal papers to support course units

Indicative price: Free or paid by faculty

Optional: no

Type: Software

Name: jupyter notebooks for practicum

Indicative price: Free or paid by faculty

Optional: no

#### References

References to relevant (non-compulsory) literature is provided during the lectures, and made available via UFora.

These references include:

Evans, M.E., Heller, F., 2003. Environmental Magnetism. Principles and Applications of Enviromagnetics, Academic Press, California.

Jol, Harry M. *Ground Penetrating Radar: Theory and Applications*. Oxford: Elsevier, 2009.

Jordanova, N., 2017. Soil Magnetism. Applications in Pedology, Environmental Science and Agriculture, Academic Press, London, UK;

Webster, R. & Lark, M. (2013). Field Sampling for Environmental Science and Management. Oxon, United Kingdom: Routledge. ISBN: 978-1-84971-368-9

Telford, W. M., L. P. Geldart, and R. E. Sheriff. *Applied Geophysics*. Cambridge University Press, 1990

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

Interactive discussion during lessons: questions before, during and after lecture.  
Individual (for extensive questioning): after appointment with lecturer or assistants.  
Support via Ufora (forum for students). Organisational announcements are made via Ufora.

#### **Assessment moments**

end-of-term and continuous assessment

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

Participation, Written assessment, Assignment

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

Written assessment

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

Peer and/or self assessment, Assignment

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

not applicable

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

Non-periodic: reporting on collected and processed field (sensor + soil sampling) data

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

75% periodic evaluation  
25% non-periodic evaluation