UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Quality, Degradation and Conservation of Soils

2425-1-F7501Q081

Aims

The course aims to bring the student to:

- know the main soil quality indicators and critically evaluate their reliability
- know the main agents of soil degradation at regional and global level, as well as possible corrective and improvement interventions;
- assess the soils from the point of view of their potential and ability to perform ecosystem services.

At the end of the course the student will be able to:

- assess the risk of soil water erosion, evaluate the effects of actual erosion and suggest measures to contain the phenomenon;
- calculate a simplified balance of soil organic matter, also in relation to land use changes and management techniques;
- apply the main methodologies for the assessment of soil and land, in particular those of land capability;
- read and use the existing soil maps in a critical and informed way, evaluating their intrinsic quality.

After completing the final exam, the student will have acquired adequate autonomy judgment for:

- critically and operationally deal with the main problems of land management and soil evaluation.
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Contents

- Soil quality.
- Degradation and conservation of soils: water erosion, loss of organic matter, acidification, salinization, alkalinization, contamination, structure weakening, water excess, soil sealing.

- Soil and land evaluation: categorical, parametric and integral methods.
- Soil survey and mapping.

Detailed program

Soil quality

- Definitions of soil quality.
- Soil quality indicators: physical, chemical, biological.
- Standards of soil quality assessment.
- Laboratory analyses for the evaluation of soil quality and judgments on analytical results.

Soil degradation and conservation

- Water erosion: USLE and other estimation models; soil loss tolerance; erosion control and soil conservation techniques.
- Biological degradation: loss of organic matter and long-term storage capacity of atmospheric CO2.
- Chemical degradation: acidification, salinization, alkalinization, contamination from diffuse sources.
- Physical degradation: deterioration of the structure; water excesses.
- Soil sealing.

Soil and land evaluation

- General aspects (evaluation process; categorical, parametric and integral methods).
- Land Capability Classification.
- Land Suitability.
- Agronomic assessments (Fertility Capability Classification, soil fertility).
- Environmental assessment (soil protection capability towards water).

Soil survey and mapping

- Methods of soil survey.
- Soil-landscape relationships.
- Cartographic scales in pedology.
- Information content of soil maps.

Exercises

- From soil description to laboratory analysis.
- Introduction to taxonomy: study of soil profiles.
- Modeling assessment of water erosion and antierosive techniques.
- Soil organic matter and nitrogen balance; carbon storage assessment.
- Reading and interpretation of soil maps and derived maps.

Field activities

- Field excursion for the description of natural soils and the study of soil-landscape relationships: the paleosols of the Mindelian plateau.

Prerequisites

- Prerequisites: basic knowledge of the soil (description; physical, chemical and biological characteristics; genesis; horizons; main taxonomies).

Teaching form

- 18 two-hour lectures, in person, Delivered Didactics
- 5 two-hour practical classes, in person, Interactive Teaching
- 1 five-hour field activities, in person, Interactive Teaching

Textbook and teaching resource

Educational material distributed:

- Slides projected during the lessons: made available on the e-learning website.
- Work schemes and materials for exercises: made available on the e-learning website.
- Material for field activities: made available on the e-learning website.

Recommended texts for further information:

- Alexander E.B. (2004). Soils in Natural Landscapes. CRC Press, Boca Raton, FL, USA.
- Blanco H. & Lal R. (2008). Principles of Soil Conservation and Management, Springer, Berlin (available at the Bicocca Library of Sciences).
- FAO (2006). Guidelines for Soil Description, FAO, Rome (available online).
- Giordano A. (1999). Soil Science. UTET, Turin (available at the Bicocca Library of Sciences).
- Giordano A. (2002). Forest pedology and soil conservation. UTET, Turin (available at the Bicocca Library of Sciences).
- Hillel D. (2008). Soil in the Environment. Crucible of Terrestrial Life. Elsevier, Amsterdam (available at the Bicocca Library of Sciences).
- IUSS Working Group WRB (2015). World Reference Base for Soil Resources 2014, update 2015. World Soil Resources Reports No. 106, FAO, Rome (available online).
- Morgan R.P.C. (2005). Soil Erosion & Conservation. Longman, London (available at the Bicocca Library of Sciences).
- Shepherd G. (2000). Visual Soil Assessment, vol. I. Horizons.mw & Landcare Research, Palmerston North, NZ (available online).
- Weil R.R., Brady N.C. (2017). The Nature and Properties of Soils. Pearson, Harlow, England.

Semester

Second semester

Assessment method

Written exam with optional oral exam.
The written exam includes open-ended questions (very short essays or analysis of problems) and closed answer questions (multiple choice answers), related to all the topics covered in the course (lectures, laboratories, field activities); the text is evaluated in thirtieths (24/30 in total for open-ended questions; 6/30 in total for closed answer questions). Upon request of the student or teacher, the written exam can be supplemented by an oral exam (related to all the topics covered in the course), carried out by means of verification questions. The outcome of the oral exam can lead to an increase or decrease of maximum 4 points of the grade of the written exam (therefore, it is possible to be admitted to the oral exam when the grade of the written exam is at least equal to 14/30). There are no intermediate tests.

Office hours

On appointment

Sustainable Development Goals

ZERO HUNGER | CLIMATE ACTION