Course Syllabus

Subject	FOREST SOILS AND CARBON SEQUESTRATION		
Qualification	Degree in Forest Engineering and Natural Environment		
Plan	449	**Code**	42211
Period	Spring semester	**Type**	Optative
Level	Degree	**Course**	4th
Credits ECTS	3 ECTS		
Language	English		
Lectures	María Belén Turrión, Francisco Lafuente Álvarez		
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Department	*Ciencias Agroforestales (Área de Edafología y Química Agrícola)* Agroforestry Sciences (Soil Science and Agricultural Chemistry)		
Fecha de revisión por el Comité de Título	20 de julio de 2022		

1. General course description

1.1. Scope

In the current global climate change context, soils play a vital role in the carbon cycle. Understanding factors that control soil carbon sequestration and evaluating management techniques for mitigation and adaptation to climate change, related to soil fixation, are useful tools for forestry, agricultural and environmental engineers, or specialists.

Quantification and evaluation of soil organic carbon stocks under different land-use systems will be carried out through laboratory and field practices.

1.2. Pre-requisites

This subject provides a technical and environmental view of soil organic carbon that is one of the principal factors of soil fertility and global carbon cycle.

1.3. Relationship with Academic Program

Basic concepts of Chemistry, Biology, Soil science and Climatology are needed, as well as Agricultural and Forestry engineering concepts.

English language skills for reading, speaking, and writing are needed.

2. General skills

G3: Be able to analyse and synthesise

G5: Be able to communicate effectively, orally and in writing, in specialized meetings as well as for non-expert people

G12: Ability to work in teams

G15: To show critical reasoning

G17 Learning autonomously both individually and cooperatively

3. Course Objectives and Student Learning Outcomes

By the end of the course, students should be able to:

- Understand the role of forest soils on carbon fixation and how different land-use managements affect this fixation.
- Explain the soil carbon process stabilization and its management.
- Quantify and evaluate the carbon fixation in soils.
- Explain the structural properties, functions, and process of soil organic matter.

4. General Outline of Topics Covered

Topics

1. Climate change and carbon sequestration.
2. Carbon cycle and organic matter dynamics.
3. Factors influencing soil carbon sequestration.
4. Characterization and modelling of soil organic matter.
5. Soil carbon capture quantification.
6. Sampling techniques and results analysis.

Recommended readings

- Heath L.S., Birdsey R.A., Williams D.W. (2002) Methodology for estimating soil carbon for the forest carbon budget model of the United States, 2001. Environ. Pollut., 116: 373-380
- Lal, R. Ed. (2001) Soil Carbon Sequestration and the Greenhouse Effect. Soil Science Society of America. SSSA Special Publication Nb. 57. 236 p.
- Lefèvre, C.; Rekik, F.; Alcantara, V.;Wiese, L. (2017) Soil organic carbon: the hidden potential. FAO, ONU. Roma. http://www.fao.org/3/a-i6937e.pdf
- Ussiri D.A.N., Lal R. 2017. Carbon Sequestration for Climate Change. Mitigation and Adaptation. Springer International Publishing AG 2017 ISBN 978-3-319-53843-3 ISBN 978-3-319-53845-7 (eBook) DOI 10.1007/978-3-319-53845-7

More general and complementary readings will be provided in each topic.

5. Methods of Instruction and methodological principles

This course consists mainly on practical activities, with 14 h of theoretical lessons and seminars, and 16 h of different practical lessons.

- **Theoretical lessons (6h): 3 sessions of 2h each one.** These sessions include explanations by the lecturers, and more participatory activities such as discussions and debates about doubts and programmed readings.
- **Seminars (8h): 4 sessions of 2h.** In which students will solve problems and questions with the lecturers' help and will present individual and team activities.
- **Field work (4h): 1 session of 4h.**

- **Lab practices (10h): 4 sessions of 2,5h** students will follow lab protocols for soil analysis. They will determine quantity and quality of soil carbon in specific samples and other soil properties in order to find relationships among soil carbon and soil properties. Soils under different land-use and management will be analysed. The effect of land-use change on soil organic carbon stock will be quantified. Finally, students will elaborate a report and will give an oral presentation as part of the subject grading.
- **Oral presentation Seminar (2h): 1 session of 2h.**

Different individual assignments will be requested throughout the course, as well as reports about the laboratory practices and a **study area** and **soil profile descriptions** (activities of the field work).

Laboratory reports must be elaborated after each lab sessions. The laboratory reports and the **study area** and **soil profile descriptions** must follow the indicated format (an example will be given in class) and its submission will be mandatory to pass the course. They must be printed for submission.

The **final report** is also mandatory (following the format that will be delivered in class), as well as its defense through an **oral presentation** of about 10 minutes with visual support in PowerPoint or similar software. Instructions will be provided throughout the course. Final report must also be printed for submission.

The Moodle platform in the electronic campus (UVa virtual campus) will be used to deliver documents, and to propose and deliver tasks, to carry out learning activities both individually and in teams, and as a communication channel between lecturers and students and among students.

Lecturers will offer the objectives, theoretical materials, questions, practical exercises, and bibliography for each topic. Solutions to proposed questions will be considered for the subject final grade.

Individual assignments should be sent by email or Moodle (lecturer will indicate the preferred method).

5. Work plan (subjected to eventual changes)

Session	Duration (hours)	Session Content	Session Type	Mandatory Assigments	Classroom
1	2.0h	Introduction. Climate change and Soil Carbon sequestration (SCSeq). C cycle.	LECTURE		Lecture room
2	2.0h	Soil Organic C, Soil organic matter. Forms and dynamic. Different soil types.	LECTURE		Lecture room
3	2.0h	Soil Factors influencing SCSeq. Soil Management and SCSeq.	LECTURE		Lecture room
4	2.0h	Bibliography searching. PROJECT and Final report information.	SEMINAR		Computers Classroom
5	2.0h	Soil and litter Sampling. Carbon Stock Quantification.	SEMINAR		Lecture room
6	4.0h	Field work: soil and litter sampling, site description.	FIELD WORK	Soil Profile and Area Descriptions	FIELD
7	2.5h	Soil and litter samples preparation, Bulk density, Texture (I).	LAB PRACTICE	Lab report	Soil Lab
8	2.5h	Texture (II), pH, Electric conductivity, Carbonates.	LAB PRACTICE	Lab report	Soil Lab
9	2.5h	Easily oxidable Carbon.	LAB PRACTICE	Lab report	Soil Lab
10	2.5h	Total Carbon and Total Nitrogen.	LAB PRACTICE	Lab report	Soil Lab
11	2.0h	Statistical data analysis I. Graphical presentation of data.	SEMINAR		Computers Classroom
12	2.0h	Statistical data analysis II. Elaboration of Final report	SEMINAR		Computers Classroom
13	2.0h	Elaboration of Final report. Discussion	SEMINAR		Lecture room
14	2.0h	Oral presentation and results discussion	ORAL PRESENTATION	FINAL PROJECT	Lecture room

6. Student dedication to the Course

For virtual sessions it has been the equivalence in hours of work.

Face to face learning	Hours	Online learning	Hours
Lectures	6	Individual study	6
Seminars	8	Statistic treatment of data	8
Field work	4	Study area and soil profile descriptions	3
Laboratory	10	Elaboration of Lab reports	8
Oral presentation	2	Preparation of final report and oral presentation	20
Total	**30**	**Total**	**45**

7. Grading Criteria

Student Evaluation	Percentage of final grade	Type of activity	Comments
Lab work Lab reports	10 % 20 %	Group activity Individual activity	Mandatory assignments
Field work and Study Area and Soil Profile descriptions	10 %	Group activity	Mandatory assignments
Assignments and participation in lessons	10 %	Individual activity	
Final report	30 %	Group activity	Mandatory assignment
Oral presentation	20 %	Group activity	Mandatory assignment

Students who do not reach the required minimum class attendance (**80% attendance**), who do not attend the field and laboratory practices, or who do not submit the compulsory assignments, must take an exam to pass the subject.

8. Course Policies

Attendance:
Lessons and laboratory work are a core component of this course. Students must ensure that they are available to attend lessons and arrive on time. They should pay close attention to the class schedule and read the material prior to each lesson. They are welcome to share new ideas during lessons and are encouraged to read related papers. **Attendance at 80% of teaching hours is mandatory to pass the subject.**

Technology in classroom:
Mobile phones are not allowed, as long as the lecturer does not indicate otherwise. Please turn off your cell phone before lessons begin. You will be asked to leave the lesson if you are using your phone.

Policy on Academic Ethics and Honesty:
The University of Valladolid (UVa) regards plagiarisms and cheating as a serious academic offense. Anyone caught cheating will automatically receive a 0/10 for the quiz/exam/assignment and will be reported to the dean. Your responsibility, besides maintaining a high standard of personal honesty, includes taking precautions to prevent others from copying your work. A student's assessed work may be reviewed with plagiarisms detection computer software. The use of other authors' work in your assignments must be properly referred and/or acknowledged.