

AGRO-ENVIRONMENTAL AND TERRITORIAL SCIENCES

2023-2024

ECOCOMPATIBLE MANAGEMENT OF SOILS

General information	
Year of the course	<i>First year</i>
Academic calendar (starting and ending date)	<i>First semester (September 25th 2023 – January 19th 2024)</i>
Credits (CFU/ETCS):	<i>6 ECTS</i>
SSD	<i>Agricultural Chemistry AGR-13</i>
Language	<i>Italian</i>
Mode of attendance	<i>Not compulsory but recommended</i>

Professor/ Lecturer	
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Virtual room	Microsoft Teams
Office Hours (and modalities: e.g., by appointment, on line, etc.)	From Monday to Friday by appointment

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	32	28	90
CFU/ETCS			
6	4	2	

Learning Objectives
<ul style="list-style-type: none"> - Provide knowledge and competence of the most significant and innovative aspects concerning physical, chemical, and biological properties of soils and the traditional and innovative methods allowing the conservation and valorisation of soil as an agricultural, forest and environmental resource. - Provide knowledge and competence for the choice of traditional and innovative fertilization techniques which are the most appropriate for the various types of soils. - Provide knowledge and competence for the correct and innovative use, recycling, and valorisation of biomass to be used as soil organic amendments with the aim of improving the quality and the overall fertility of the soil. - Provide knowledge and competence to select suitable procedures to preserve and increase the soil content of plant nutrients with an environmentally friendly approach. - Provide knowledge and competence regarding the fate of plant protection products and inorganic and organic contaminants that may be present in soils, and of soil remediation techniques, including biodecontamination and phytodecontamination. - Provide knowledge to communicate and interact with an appropriate

	<p><i>disciplinary lexicon in relation to the main chemical aspects concerning agricultural soils and strategies for the conservation and improvement of the fertility of agricultural and forest soils.</i></p> <p><i>- Provide knowledge useful to make the student capable of successive in-depth study and prolonged individual knowledge and updates relating to traditional and innovative methodologies for the eco-compatible management of agricultural and forest soils.</i></p>
Course prerequisites	<i>The prerequisites are those required for access to the Master Degree course</i>
Teaching strategie	<i>Most of the teaching will be delivered through frontal teaching. In this case, the lectures will be given with the help of Power Point presentations, and the projection of photos and videos. Another part of the teaching activity will consist of lectures and experimental demonstrations in the laboratory of agricultural chemistry, educational visits and seminars held by experts. There will also be individual and group work and discussion about case studies.</i>
Expected learning outcomes in terms of	
Knowledge and understanding on:	<ul style="list-style-type: none"> ○ Knowledge and understanding of the main physical, chemical and biological properties of soils and of traditional and innovative methods to improve soil quality and fertility.
Applying knowledge and understanding on:	<ul style="list-style-type: none"> ○ Knowledge and understanding for the choice and use of the most appropriate traditional and innovative fertilization techniques for solving specific problems in agricultural and forestry systems. ○ Knowledge and understanding for the choice and use of the most appropriate, traditional and innovative fertilization techniques, for the conservation and valorisation of soil as an agricultural, forest and environmental resource.
Soft skills	<ul style="list-style-type: none"> ● <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> ○ Ability to select suitable tools to conserve and increase the quality and fertility of agricultural and forest soils. ○ Ability to implement soil fertility with a view to environmental protection. ● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Ability to communicate and interact with appropriate disciplinary lexicon in relation to the main properties of soils and their optimization for the purposes of agricultural and forest management of soils with a view to environmental sustainability. ● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ Ability to deepen and update knowledge of traditional and innovative tools for environmentally friendly management of soils.
Syllabus	
Content knowledge	<p><i>Introduction to the course: program, objectives, and general concepts. Different types of soils: role of pedogenetic factors and processes, and role of solid mineral and organic constituents of soil.</i></p> <p><i>Factors of physical, chemical, and biological fertility of soil and their interdependence.</i></p> <p><i>Influence of pedoclimatic factors on the properties and transformations of organic matter in soils. Role of organic matter in global soil fertility. Direct effects of soil organic matter on plant growth. Role of soil organic matter in plant and microbial allelopathy processes.</i></p> <p><i>Practices useful to preserve the natural organic and biological fertility of soil. Effects of biomass recycling in agricultural soil. Organic fertilization of soil. Soil addition of fertilizers and soil organic amendments and consequent changes in the main properties of soil.</i></p>

	<p><i>Chemical and physico-chemical characteristics of the native organic substance of soil and of organic amendments studied using traditional and advanced techniques.</i></p> <p><i>Chemical and biological aspects of organic amendments, including the environmentally friendly control of phytopathogenic soil microorganisms.</i></p> <p><i>Nutrients, their cycle and speciation in soil, and their role in plant nutrition.</i></p> <p><i>Environmentally friendly practice of mineral fertilization.</i></p> <p><i>Acid rain and eutrophication.</i></p> <p><i>Soil pollution from organic contaminants and heavy metals. Fate of contaminants in soil: study of the processes of adsorption/desorption, percolation and movement, absorption, immobilization, and degradation.</i></p> <p><i>Soil decontamination practices: biodecontamination and phytodecontamination.</i></p> <p><i>Methods of ascertaining and correcting anomalies (reaction and salinity) of soils for the purpose of their management in respect of the environment.</i></p> <p><i>Protection of agricultural and forest soils from degradation processes.</i></p>
Texts and readings	<ul style="list-style-type: none"> • AA.VV. (2017). <i>Fondamenti di Chimica del Suolo</i>, Sequi P., Ciavatta C., Miano T., (Coord.), Pàtron Editore, Bologna. • Lecture notes • Kim H. Tan. <i>Principles of Soil chemistry</i>. 4th Edition CRC Press, 2011.
Notes, additional materials	<ul style="list-style-type: none"> • <i>Scientific articles will be provided or suggested during the course</i>
Repository	<ul style="list-style-type: none"> • <i>Slides of the lectures will be available on Microsoft Teams Platform.</i>

Assessment	
Assessment methods	<p><i>For students enrolled in the course year in which the teaching is delivered, an ongoing test can be done. This test will take place after about half of the course through an oral interview and will be evaluated out of thirty. The outcome of this test contributes to the evaluation of the final exam and is valid for one academic year.</i></p> <p><i>Both the ongoing test and the final exam consist of an oral test on the topics developed during the theoretical and theoretical-practical lessons in the classroom, in the laboratory and at the didactic visits.</i></p> <p><i>If, during the course, both individual and collective works are carried out by the student, the evaluation of these works will contribute to the final grade.</i></p> <p><i>The assessment of the student's preparation takes place on the basis of pre-established criteria, as detailed in Annex A of the Didactic Regulations of the Master Degree Course in Agro-Environmental and Territorial Sciences.</i></p> <p><i>The exam for foreign students can be done in English with the methods described above.</i></p>
Assessment criteria	<ul style="list-style-type: none"> • <i>Knowledge and understanding</i> <ul style="list-style-type: none"> ○ Capacity to describe the main physical, chemical and biological properties of soils and the traditional and innovative for their improvement in order to achieve good soil quality. • <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> ○ Describe the criteria for selecting and using traditional and innovative fertilization techniques most appropriate for solving specific problems in agricultural and forestry systems. ○ Capacity to describe the criteria for the choice and use of the most appropriate, traditional and innovative fertilization techniques, for the conservation and improvement of soil as an agricultural, forest and environmental resource. • <i>Autonomy of judgment</i> <ul style="list-style-type: none"> ○ Capacity to present reasonable assumptions to select suitable procedures for conserving and increasing the quality of agricultural and

	<p>forest soils.</p> <ul style="list-style-type: none"> ○ Capacity to present reasonable assumptions to select suitable procedures to implement soil fertility with a view to efficient agricultural and forest management and environmental protection. ● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Capacity to present clearly and with appropriate disciplinary lexicon the main properties of the soil and the strategies for their optimization for the purposes of agricultural and forest management of the soils as well as with a view to environmental sustainability, also presented as case studies. ● <i>Communication skills</i> <ul style="list-style-type: none"> ○ Capacity to hypothesize a feasible approach for the choice and application of traditional and innovative methods for the environmentally friendly management of soils, also presented as case studies. ● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ Ability to deepen and update knowledge of traditional and innovative tools for environmentally friendly management of soils.
Final exam and grading criteria	<p><i>The final grade is expressed out of thirty. The exam is passed when the grade is greater than or equal to 18. To achieve a high evaluation, the student, in addition to demonstrate knowledge of the topics, must have developed autonomy of judgment and adequate capacity for argumentation and presentation. During the course, students may be invited to prepare both individual and collective works that will cover the topics discussed in class and present these works through Power Point slides.</i></p> <p><i>The final grade will consider any ongoing test taken, any presentation made and the final exam.</i></p>
Further information	