Agriculture and Cimate Change

Agroecology Module

Prof. Vincenzo Tabaglio

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The course aims to lead the student to a better understanding of the need to review cultivation techniques towards greater agri-environmental sustainability. This revision is possible only when the functions, mechanisms and limits of the ecosystem are fully understood, from which the agrosystem will have to mimic most of the operating laws.

**Expected learning outcomes**: at the end of the course, students will have acquired a basic knowledge of the problem of climate change and its repercussions on agricultural productivity. Furthermore, students will be able to understand the fundamental laws that regulate the functioning of, mainly terrestrial, ecosystems. With this basic knowledge, students will then be taught to apply as many of these ecological interactions as possible to agrosystems, so attaining the highest level of agroecological, environmental and economic sustainability. In the end, students will be able to correctly interpret the implications of various agricultural practices from an ecological point of view, and be able to motivate the choice of the most appropriate ones for conservative agriculture.

COURSE CONTENT

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|  | ECTS |
| Climate change |  |
| Definition, causes and effects of climate change. The Anthropocene. The greenhouse effect. Greenhouse gas emissions. The role of agriculture. | 0.5 |
| The carrying capacity of the planet |  |
| Definition and methodologies for studying the carrying capacity of planet Earth. *Earth Overshoot Day*. Measurement of human impact on ecosystems. Index of the living planet. Ecological footprints. Resource consumption: energy, water, soil, phosphorus. | 0.5 |
| The ecosystem as a model of the Sustainable Agrosystem |  |
| Ecology: definition, aims and historical notes. The ecosystem: structure and components. Ecosystem stability. Energy in ecological systems. Ecosystem productivity. Food chains and trophic levels. Population growth models. Species diversity and its components. The indices of diversity. | 0.5 |
| Agroecology and Sustainable Agriculture |  |
| Definition of Agroecology. From the ecosystem to the agrosystem: biomimicry. The problem of deforestation. Agrarian systems: definition, characterisation and classification. Sustainable agriculture and organic farming: similarities and differences. The sustainable intensification of agricultural production and humanity's food needs. | 0.5 |
| Agronomic strategies for facing climate change |  |
| Adaptation and mitigation strategies. Non-tillage of the soil. Allelopathic cover crops. Alternative weed control methods. The importance of soil organic matter. Soil health and soil quality indices (*Maturity Index*, QBS-ar). The role of forage crops. Polycultural systems. Reuse and use of resources. Relative indices for assessing productivity and efficiency.  | 1.0 |
| Tutorials |  |
| Seminars, educational visits and classroom tutorials. | 1.0 |

READING LIST

Odum E.P., Barrett G.W., 2007. *Fondamenti di ecologia*. Piccin, Padua.

Altieri M.A., Nicholls C.I., Ponti L., 2015. *Agroecologia. Una via percorribile per un pianeta in crisi*. Edagricole New Business Media, Milan.

Jordan C.F., 2013. *An Ecosystem Approach to Sustainable Agriculture.* Springer, Dordrecht.

Parvatha Reddy P., 2016. *Sustainable Intensification of Crop Production*. Springer Nature, Singapore.

Further reading references for the individual topics will be provided during the course.

TEACHING METHOD

Theoretical frontal lectures in which the main topics of the course will be addressed with the aid of PowerPoint presentations.

In-depth seminars held by professors, technicians or experts in the sector.

Frontal tutorials during which students will be given practical exercises to solve according to the methods seen during lectures. The slides used in the lectures and tutorials will be made available at the end of each lesson on the Blackboard platform.

Educational visits to agricultural companies, research institutes and other companies in the sector, where some of the topics addressed in lectures will be analysed in detail.

ASSESSMENT METHOD AND CRITERIA

Final oral exam, on all the topics covered during the course. The duration of the discussion is approximately 30 minutes. The student must demonstrate their acquisition of the basic notions of agroecology and their understanding of its interdisciplinary and holistic character, to then be able to discuss the interrelations that must govern the process of agricultural production in a sustainable manner.

NOTES AND PREREQUISITES

For a fruitful understanding of the topics covered during lectures, the student must possess a basic knowledge of plant physiology, agronomy and herbaceous cultivation.

Should the health situation relating to the Covid-19 pandemic not allow face-to-face teaching, remote teaching in synchronous or asynchronous mode will be guaranteed; this will be communicated in good time to students.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.

Arboreal Agrosystems Module

Prof. Alberto Vercesi

COURSE AIMS AND INTENDED LEARNING OUTCOMES

The aim of the course is to provide the main basic knowledge on the effects and techniques of climate change adaptation in the field of arboreal agrosystems, with particular reference to fruit and viticulture.

Knowledge and ability to understand

At the end of the course, students will know and understand:

1) Quantity and quality of the interactions between climate change and the efficiency of arboreal plants.

2) Main adaptation and mitigation techniques.

Understanding and applying knowledge

At the end of the course, students will be able to:

1) Apply the knowledge acquired regarding the type of event/climactic change and its correlations with phenology as well as the development and ripening of fruit.

2) Identify possible and realistic adaptation and/or mitigation solutions.

Autonomous judging skills

At the end of the course, students will be able to:

Produce objective, site-specific analyses of the state of balance in an orchard/vineyard, judge the current impact due to climate change, and identify corrective actions.

Communication skills

At the end of the course, students will be able to:

1. Appropriately use the scientific language and specific technical lexicon of the topic that connects climate change with tree production.
2. Know how to join and participate in the discussion within a technical group attended by various stakeholders in the fruit and wine supply chains.

Learning ability

At the end of the course, students will be able to:

1. Increase their knowledge on the effects that the evident climate change is having on the main fruit tree species and on the relative short- and long-term adaptation solutions.
2. In addition to the course, this learning ability will permit the self-consultation of specialised texts, and scientific and sector journals, as well as enable interactions in technical blogs or dedicated social groups.

COURSE CONTENT

|  |  |
| --- | --- |
| Topics  | ECTS |
| Terminology and physical characteristics of climate change. Scales of influence. Expected trends. The regional situation. | 1 |
| Effects of climate change on a number of fruit tree species and identification of the most appropriate adaptation and/or mitigation techniques. The case studies addressed will cover, in particular: citrus, apple, banana and coffee bean trees. | 1 |
| Effects of climate change on wine grape viticulture and identification of the most appropriate adaptation and/or mitigation techniques.  | 1 |

**READING LIST**

The lecturer will provide lecture notes and materials on the Blackboard platform.

Further texts for in-depth reading

Various Authors 2008. Tutte le principali specie arboree e vite. Collana Coltura e Cultura, Bayer Crop Science.

Palliotti A., Poni S., Silvestroni O. 2015. *La nuova viticoltura*. Edagricole, Bologna.

TEACHING METHOD

Theoretical frontal lectures in which the main topics of the course will be addressed. The teaching method is highly interactive with frequent requests for students to provide opinions on or answers to the case studies presented. In this way, it is seen, to a certain extent, to also be fulfilling a "tutorial-type" function, given that the brevity of the course prevents the dedication of specific hours to these.

ASSESSMENT METHOD AND CRITERIA

A final oral exam. Three general questions will be asked on the macro-topics of anatomy, physiology and growth cycles. Each question carries a maximum mark of 10/30.Within each question, the mark is broken down as follows:

6 marks: objective correctness of the answer given

2 marks: ability to express oneself with a proper command of the technical language and in good Italian

2 marks: ability to produce conceptual links between the course topics

NOTES AND PREREQUISITES

Attendance of lectures is recommended.

The necessary prerequisites are a basic knowledge of plant biology and physiology, and the elements of general arboriculture.

Should the health situation relating to the Covid-19 pandemic not allow face-to-face teaching, remote teaching in synchronous or asynchronous mode will be guaranteed; this will be communicated in good time to students.

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