

## LOGO DELLA STRUTTURA PRIMARIA

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**ACADEMIC YEAR: 2018-2019**

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COURSE: Plant Physiology

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TYPE OF EDUCATIONAL ACTIVITY: Optional course

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LECTURER: Adriano Sofo

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Language: Italian

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ECTS: (lessons / tutorials/practice): 6	n. of hours: 40 hours of lessons 16 hours of practice	Campus: Potenza School: SAFE Program: LM Forest and Environmental Sciences	Semester: II
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### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course will cover the following topics: eco-physiological responses of plants to environmental stimuli and to abiotic stresses. plant metabolism and biochemistry. carbon cycle in plant ecosystems. transport of water and minerals in plants. function of plant secondary metabolites. biogeochemical cycles of major nutrients. studies of experimental systems and laboratory experiments.

- **Knowledge and understanding:** knowledge and ability to understand the general principles governing, both qualitatively and quantitatively, macroscopic behavior of plants, plant metabolism and physiology, water transport, nutrition, photosynthesis, xylematic and phloematic transport, metabolites, hormone balance, and soil interactions. Knowledge and ability to understand the key relationships between metabolism and the environment in the most important plant groups. Knowledge and ability to understand the rules of the specific scientific nomenclature.
  - **Applying knowledge and understanding:** ability to read and write the formulas of the compounds involved in the photosynthetic metabolism. Ability to apply the basic laws of physics and chemistry to the resolution of simple numerical problems. Ability to identify the main physical and chemical properties of water and its relationships with plants. Ability to handle appropriately, both qualitatively and quantitatively, the general properties of plant metabolism. Ability to recognize the main models of photosynthesis and to identify the priorities of molecules involved in photosynthetic processes. Ability to handle appropriately the most accredited models of gaseous exchanges, water transport and photosynthesis processes for the interpretation of the most obvious climatic, light and plant relations. Ability to identify interactions between adverse environmental factors and plant physiology (stress physiology). Ability to recognize and describe the essential factors controlling the kinetics of the chemical reactions of the plant metabolite. Ability to recognize and interpret the principal relationships between nutrients and the physiological state of plants.
  - **Making judgements:** Ability to evaluate and apply the most appropriate procedure to solve simple numeric problems of physics and chemistry applied to plant physiology. Ability to build the main relationships between soil, atmosphere, and macroscopic and microscopic properties of plants. Ability to discriminate between the different macroscopic properties of plants and to apply their correct physiological interpretation. Ability to predict the main chemical, biochemical and physiological responses of plants in response to environmental changes and climatic parameters.
  - **Communication skills:** ability to organize in a logical way and to communicate, using an appropriate and correct language and mathematical and graphical tools as well, the acquired knowledge.
  - **Learning skills:** ability to collect and organize in a functional way the information coming from class lectures, suggested books, and literature data.
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### PREREQUIREMENTS

- Inorganic and organic chemistry
- Botany

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### SYLLABUS

#### *Lessons*

Water and plant cell: chemical and water potential; diffusion and mass transport; osmosis; Measurement of water potential and its components.

The plant and the water: photosynthesis-transpiration compromise; structure, mechanical and stomatal control mechanisms.

Absorption of water and minerals: the water in the soil; absorption of water and salts by the roots; mycorrhizae; transport across membranes, absorption characteristics of the solutes; ascent of water in the plant: perspiration-cohesion theory.

Mineral nutrition: study methods, functions, and symptoms of deficiency of the essential elements.

Transport in the phloem: theories on the transport of assimilates, distribution and control mechanisms.

Carbon cycle: photosynthetic cycle control; structure and organization of the photosynthetic apparatus, the four major complexes of thylakoids, the oxygen evolving system, the electron transport in the chloroplast membranes, photophosphorylation; distribution of energy between the photosystems. Photosynthesis in bacteria. Carbon organization: C3, C4, CAM plants. Photorespiration.

Environmental and agronomic aspects of photosynthesis. Environmental factors affecting photosynthesis.

Nitrogen Assimilation: molecular nitrogen fixation. Free and symbiotic nitrogen-fixing microorganisms. Assimilation of nitrate and ammonium.

Assimilation of sulfates.

The development of plants: growth and development.

Plant hormones: biosynthesis, transport, effects, mechanisms of action and degradation of auxins, gibberellins, cytokinins, ethylene, abscisic acid. Other classes of hormones. Interactions between hormones.

Movements of plants: nastic movements and tropisms.

Photomorphogenesis: phytochrome and cryptochrome. Physical and chemical properties, distribution in different species, cells, tissues, the phytochrome transformations. Responses induced by phytochrome. Interactions phytochrome-endogenous rhythm.

Totipotency of plant cells, and genetic modification of plants through biotechnology.

The seed and germination: events of seed germination, mobilization of the reserves. Seed dormancy. Effects of light and temperature on seed germination.

#### *Practices*

Laboratory training regarding eco-physiological plant and soil measurements.

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### TEACHING METHODS

40 hours of lessons (frontal lessons and case-studies) and 16 hours of practice (laboratory and educational visits).

During practices, students will be asked to analyze specific case-studies and to work in the laboratory.

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### EVALUATION METHODS

The learning will be verified on the basis of checks during the course, of group work on specific case-studies (in groups of maximum 4-5 students), on the frequency of laboratories and educational visits and, finally, on an oral exam on all the topics of the course. If the overall grade does not suffice (<18), the exam will not be passed.

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### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Sanità di Toppi L. Interazioni Pianta-Ambiente. Piccin Editore. Pp. 352. ISBN: 978-88-299-2870-5.

Reviews and articles provided during the course.

Lesson notes.

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### INTERACTIONS WITH STUDENTS

- in the office at planned days/hours (usually on Tuesday, Wednesday and Thursday)
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### EXAMINATION SESSIONS

Calendar online:

<http://docenti.unibas.it/site/home/docente.html?m=003255>

### EVALUATION BOARD

Prof. Adriano Sofo (president)  
Prof. Sabino A. Bufo (member)  
Dr. Laura Scrano (member)  
Prof. Bartolomeo Dichio (additional member)  
Dr. Maria Nuzzaci (additional member)  
Prof. Vitale Nuzzo (additional member)  
Dr. Alba Nicoletta Mininni (additional member)

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### SEMINARS BY EXTERNAL EXPERTS: NO

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