

UNIGreen's International Summer School

***From invisible to indispensable:
Harnessing unexplored microbial
biodiversity for resilient and sustainable
agriculture***

2026 Edition
July 27th – August 7th

SYLLABUS

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I. Presentation

This summer school delves into the vital roles of environmental microbes for the Earth's biosphere and for agriculture.

Through dynamic lectures and hands-on workshops, the program proposes to examine the intricate interactions between microbes, other living organisms (humans and plants), and their physical environment (soil). Participants will gain insights into how microbial diversity underpins key ecosystem services, particularly those critical for human nutrition and food security, and will also consider the adverse impacts of modern farming practices on microbial communities. The latest technical approaches used to study microbiomes, and their functions will be covered in both lectures and practical lab sessions.

In a second part, the lectures will be focused on bioinspired innovations in biological control and biostimulation, two fields that are pivotal to advance the development of sustainable agriculture.

The last part of the summer school is designed to foster systems thinking, equipping participants with the skills to address complex environmental and agricultural challenges and develop sound innovation.

This Summer School includes lectures (16 h), hands-on training (20 h), and workshops (2 h).

II. Objectives

- Discover and understand the importance of microbial biodiversity for the ecosystem services it delivers to nature and agriculture
- Understand how microorganisms can contribute to sustainable farming
- Acquire knowledge and technical competences in metagenomics
- Acquire competences in bioinformatics to define the composition and functionality of microbiomes
- Acquire systems thinking skills to improve the capacity to analyze complex problems and create sound solutions based on biotechnologies

The lecture sessions will address the following points:

- Relationships between microbiomes and human and environmental health
- Interaction of microbes with plant-host
- Microbes for biocontrol and biostimulation

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- Metagenomics
- Ecotoxicology
- Systems thinking as a tool to design acceptable socio-economical innovation

III. Contents

Lectures	
<p style="color: yellow; margin: 0;">Lecture 1:</p> <p style="margin: 0;">Addressing microbial biodiversity hidden connections with Health</p>	<p>This course will introduce the concept of microbiome and holobiont. It will highlight the essential roles and functions of microbial biodiversity for human and environmental health.</p> <p style="text-align: right; margin-top: 10px;">5 hours</p>
<p style="color: yellow; margin: 0;">Lecture 2:</p> <p style="margin: 0;">Technological advances behind the science of microbiomes</p>	<p>Technological breakthroughs have allowed us to gain unprecedented capacity to describe and analyze the microbial composition and functions of microbiomes. This course will be an in-depth presentation of some of these game-changing technologies.</p> <p style="text-align: right; margin-top: 10px;">2 hours</p>

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<p>Lecture 3: What is soil?</p>	<p>This course will demonstrate the fascinating properties of soil by encompassing its physical, chemical and biological characteristics.</p> <p>2 hours</p>
<p>Lecture 4: Plants-microbes interactions</p>	<p>In this lecture, plant holobiont will be described through case studies that illustrate the intimate interactions between microbes and plants' physiology.</p> <p>2 hours</p>
<p>Lecture 5: Microbes for Biocontrol and Biostimulation</p>	<p>This lecture will introduce participants to the field of Biocontrol and Biostimulation. It will more specifically illustrate the biotechnological advances that allow microbes to be used to protect plants from pathogens or to improve growth, yield or stress resistance.</p> <p>2 hours</p>

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<p>Lecture 6: Introduction to system thinking</p>	<p>System thinking is a discipline that helps make sense from complex problems by understanding them holistically. It is particularly useful for addressing multidimensional challenges, such as environmental issues.</p> <p>This module will present valuable tools used to support complex thinking:</p> <ul style="list-style-type: none"> - Causal loop diagrams - Stock and flow diagrams - System dynamics modeling - The iceberg model <p style="text-align: right;">1.5 hours</p>
<p>Workshop Systems thinking workshop: why and how to change farming practices based on the usage of pesticide?</p>	<p>Through gamification, students will be invited to apply the concepts of system thinking to decipher the causes and consequences of pesticides usage. This workshop will allow participants to develop a full holistic picture of the relationships that entangle the usage of pesticides in our agricultural model with human, animal and environmental health.</p> <p>Based on the results obtained, students will engage a discussion on the putative biotechnological solutions and their social, economic and environmental implications.</p> <p style="text-align: right;">2 hours</p>

<p>Hands-on training: Ecotoxicological impacts of pesticides on human and environmental health</p>	
<p>Hands-on training: Culturomics and metagenomic approaches to</p>	<p>This practical training is dedicated to the evaluation of the impact of pesticides on the microbial biodiversity of soil. Participants will make a qualitative evaluation by a culturomics approach and will achieve in depth characterization of bacterial</p> <p style="text-align: right;">20 hours</p>

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**characterize the
environmental
impact of pesticides
on soil microbiome**

content through 16sRNA sequencing. This approach includes experimental design, sample collection, DNA extraction, library preparation, next-generation sequencing and data analysis.

IV. Assessment

Summative assessment will be performed at the end of each week with multiple choice questions, and short-answer questions. An analysis of scientific papers will also be performed and evaluated.

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