

University of Genova

Department of Earth, Environmental and Life Sciences

Doctorate Course in Earth and Environmental Science and Technology Università degli Studi di Genova



Dottorato in Scienze e Tecnologie per l'Ambiente e il Territorio

Curriculum in biology applied to agriculture and the environment

Research Theme n. 5

Titolo

Tratti funzionali ed ecofisiologia delle piante: comprendere le proprietà elettromagnetiche per creare sentinelle ecologiche

Title

Functional traits and ecophysiology of plants: understanding electromagnetic properties to create ecological sentinels

Tutor

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Co-tutor

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Program description including the formation program abroad

This PhD project aims to bridge functional plant ecology and plant ecophysiology to support the conceptualization and prototyping of plants as components of novel bio-communication systems, plants as antennas, energy sources, and biosensors.

The research will focus on plant functional traits (e.g. leaf thickness, pigment composition, turgor pressure) and ecophysiological parameters (e.g. water content, membrane potential, ion concentrations) that influence the electromagnetic and energy-generative potential of leaves.

The PhD will integrate trait-based modeling, physiological measurements, and conceptual design, with simulation studies to evaluate leaf performance in communication setups. Special emphasis will be placed on species selection, identifying plant candidates suitable across ecosystems such as forests, agroecosystems, and urban green spaces.

The international formation program will provide the PhD student with interdisciplinary training through the EcoSentinel project's global partnership. Focusing on plant functional traits and ecophysiological properties, the student will receive hands-on experience in trait analysis, physiological measurements, and data integration across diverse environments. Training at leading institutions will cover methods to assess leaf structure, water relations, ion balance, and other traits linked to plant performance in biocommunication and energy systems. Supported by experts in ecology, physiology, and bioengineering, the program fosters a holistic understanding of plants as biosensors, antennas, and energy sources for innovative environmental monitoring technologies.

The period abroad will take place at one of the partner institutions involved in the projects: Fundacio Privada Universitat i Tecnologia, Barcellone Spagna, Ignion srl, Sant Cugat del Vallès, Spagna, PLANT-EBV, Renkum, Netherlands, Universite Cote D'Azur, Nice, France.

The specific location will be selected based on the project's needs, while also considering the doctoral candidate's aptitudes.

Financial support: 100022-2024-ER-HE-FOOD-ENV_EcoSentinel

Funds are already fully available.

Funds are available for the purchase of research materials and for a laptop dedicated to the doctoral candidate.

We intend to apply for the merit-based funding and are available to co-finance the remaining amount.

Co-financing to cover the 0.6 point missing (0.4 from UniGE).

Tutor's publications of the last 3 years

- Mosca, F., Calbi, M., Roccotiello, E., & Perini, K. (2025). A computational approach to assess the effects of ecological building envelopes on outdoor thermal comfort. *Sustainable Cities and Society, 120*, Article 106170. https://doi.org/10.1016/j.scs.2025.106170
- Perini, K., Castellari, P., Calbi, M., Prandi, S., & Roccotiello, E. (2025). Fine dust collection capacity of a moss greening system for the building envelope: An experimental approach. *Building and Environment, 267*, Article 112203. https://doi.org/10.1016/j.buildenv.2024.112203
- Schröder, A., Schloter, M., Roccotiello, E., Weisser, W. W., & Schulz, S. (2024). Improving ecosystem services of urban soils how to manage the microbiome of Technosols? *Frontiers in Environmental Science*, *12*, Article 1460099. https://doi.org/10.3389/fenvs.2024.1460099
- Ampatzoglou, T., Mosca, F., Pianta, M., Roccotiello, E., Geropanta, V., & Perini, K. (2024). A methodological approach for vertical greening systems modeling optimization: A case study in Athens, Greece. *E3S Web of Conferences, 585*, Article 01013. https://doi.org/10.1051/e3sconf/202458501013
- Delzanno, G., Grosso, D., Guerrini, G., Lebole, F., Priarone, S., Roccotiello, E., Sugliano, A., Zanone, G., & Adorni, G. (2024). BotBid - From Botany to Big Data: Combining Citizen Science and Innovative Teaching Methodologies. *Communications in Computer and Information Science, 2076 CCIS*, 112–127. https://doi.org/10.1007/978-3-031-67351-1_8
- Pianta, M., Calbi, M., Dagnino, D., Turcato, C., & Roccotiello, E. (2024). Peri-urban Mediterranean plant communities are shaped by chronic anthropogenic disturbances. Urban Forestry and Urban Greening, 95, Article 128333. https://doi.org/10.1016/j.ufug.2024.128333
- Calbi, M., Boenisch, G., Boulangeat, I., Bunker, D., Catford, J. A., Changenet, A., Culshaw, V., Dias, A. S., Hauck, T., Joschinski, J., Kattge, J., Mimet, A., Pianta, M., Poschlod, P., Weisser, W. W., & Roccotiello, E. (2024). A novel framework to generate plant functional groups for ecological modelling. *Ecological Indicators*, *166*, Article 112370. https://doi.org/10.1016/j.ecolind.2024.112370
- Weisser, W. W., Hensel, M., Barath, S., Culshaw, V., Grobman, Y. J., Hauck, T. E., Joschinski, J., Ludwig, F., Mimet, A., Perini, K., Roccotiello, E., Schloter, M., Shwartz, A., Hensel, D. S., & Vogler, V. (2023). Creating ecologically sound buildings by integrating ecology, architecture, and computational design. *People and Nature*, 5(1), 4–20. https://doi.org/10.1002/pan3.10411
- Priarone, S., Romeo, S., Di Piazza, S., Rosatto, S., Zotti, M., Mariotti, M., & Roccotiello, E. (2023). Effects of bacterial and fungal inocula on biomass, ecophysiology, and uptake of metals of *Alyssoides utriculata* (L.) Medik. *Plants*, *12*(3), Article 554. <u>https://doi.org/10.3390/plants12030554</u>