Faculty of Science and Engineering

Profile report: Evolutionary plant eco(physio)logy

- Discipline: Life Sciences, Biology, Botany, Plant Physiology, Ecology
- Level: Assistant or Associate Professor with research profile
- Fte: 0.8 - 1.0 fte

1. Scientific discipline

This position is in the field of Evolutionary plant eco(physio)logy, with emphasis on global change biology. The study of plants at the organismal level requires explicit consideration of their environment: the interactions with competitors, pathogens, symbionts, pollinators and herbivores, the acclimation and adaptation to abiotic stressors such as salinity, drought, flooding and temperature extremes. In the context of Ecology and Evolution, plant eco(physio)logy studies the effect of the environment on the performance of the main primary producers in terrestrial ecosystems as well as the evolutionary constraints and adaptations in the face of global change. Evolutionary plant eco(physio)logy is also intertwined with fundamental ecological and evolutionary studies at the basal trophic level. Development of more easily accessible techniques has opened up the hidden half of plant biology: the root-soil interaction. The complex interactions of plants with bacteria and fungi, the shaping of soil community structure through root architecture strategies and root exudation are now recognized as being as important as the more familiar mycorrhizal relationships root/fungi and the nitrogen fixing bacteria, living in symbiosis with legumes.

2. Vacancy

This position is opened by the Board of the Faculty of Science and Engineering (PT/gl/22/00156) and will be embedded in the Groningen Institute of Evolutionary Life Sciences (GELIFES). The position falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for criteria and conditions.

3. Selection committee (BAC)

- Prof. dr. Rampal Etienne (Scientific Director GELIFES)
- Prof. dr. Theo Elzenga (Education Director GELIFES)
- Prof. dr. Chistiaan Both (Animal Ecology, GELIFES)
- Prof. dr. Joana Falcão Salles (Microbial Ecology, GELIFES)
- Prof. dr. Chris Smit (Experimental Conservation Ecology, GELIFES)
- Prof. dr. Christa Testerink (external member, Plant Physiology, WUR)
- student

Advisors: Marlies Beuving (HR), Dr. Jacqueline Stefels, Prof. dr. Pablo Tittonell, Dr. Kira Tiedge

4. Area of expertise

The study of plants at the organismal level has been spurred by several developments in agriculture as well as ecology, both driven by global change, and by technological advances (molecular and imaging techniques, phenotyping facilities, etc.). At all scales the societal demand for more and better integrated expertise of plant functioning is required. Increased but sustainable food production is one of the main challenges for the coming 50 years. The growing world population and the realization that industrial agriculture, depending on high input of fertilizer, large machinery and pesticides, makes it clear that a reform in agriculture is essential. The deterioration of soils at a worldwide scale through desertification, erosion, salinization and loss of organic matter makes this challenge even more pressing. At the national level, expertise in plant biology is required for studies on the effects of nitrogen deposition, circular agriculture and mitigation of the effects of soil degradation. At the regional level, it plays a large role in adaptation to salinization of the coastal region, the initiatives for nature-inclusive agriculture and the use of plant-microbiome interactions to reduce the dependence on chemical crop protection agents.

Essential in solutions for the above-mentioned problems is a thorough knowledge of the plant ecological and evolutionary processes: how plants interact with soil microorganisms, both beneficial and pathogenic, how plants cope with salinity, with drought and suboptimal temperature, how they function in food-webs, with all defence mechanisms against herbivory that have evolved, and in mutualistic (pollination, mycorrhizal symbiosis) interactions networks, and the role they play in biological invasions. The range of study techniques ranges from molecular to anatomical, from genomics to biochemical. Evolutionary plant eco(physio)logy is related to other expertise areas (bioinformatics, microbiology, ecology, soil biology, animal ecology, entomology, etc.)

5. Embedding: institute (and base unit)

The Groningen Institute for Evolutionary Life Sciences (GELIFES) aims to enhance the understanding of adaptive processes and the maladaptive consequences of their limitations, across all levels of biological organization (from molecules and genes to individuals and ecosystems), to advance science and education, inform society and contribute solutions to societal problems. The institute has close connections with the Faculty of Medical Sciences (FMS) and University Medical Centre Groningen (UMCG). It coordinates master programmes in medical and behavioural neurobiology and in evolution and ecology.

GELIFES is organized in a non-hierarchical manner, and staff associate with one (or more) informal expertise groups. The tenure-track assistant professor is free to choose their expertise group. GELIFES currently has six expertise groups, each consisting of several principal investigators with their groups: *Genomics Research in Ecology & Evolution in Nature* (GREEN), *Theoretical Research in Evolutionary Life Sciences* (TRES), *Evolutionary Genetics, Development and Behaviour* (EGDB), *Behavioural and Physiological Ecology* (BPE), *Conservation Ecology* (CONSECO) and *Neurobiology*.

The candidate will have access to GELIFES' excellent facilities for experimental plant research, including well-equipped molecular laboratories, greenhouses, growth chambers, fluorescence microscopy, and IT facilities for data processing.

6. Local and (inter)national position

Local:

GELIFES has a strong reputation in research and education in ecology, evolution, behaviour and neurobiology. GELIFES specifically aims at integrating the study of physiological mechanisms with those of ecology and evolution. Various staff members at GELIFES work successfully in disciplines related to this new position, such as the work on plant ecophysiology with implications for crop science by Prof. J.T.M. Elzenga, the work on the ecology of soil and plant-associated microbiome by Prof. J.F. Salles, the work by Prof. P. Tittonell on resilient landscapes for nature and people, and the work on global change biology (Prof. H. Olff, Prof. C. Both, and Prof. Th. Piersma).

The position will provide opportunities to intensify the links of GELIFES with the university-wide Sustainable Society School, with which we already collaborate in the realm of education (e.g., https://www.rug.nl/education/summer-winter-schools/designing-sustainable-landscapes/?lang=en), as well as with the new Chair on Agroecology for Sustainable Landscapes. Within the university, there are excellent collaboration opportunities with the UG faculty of Campus Fryslan.

National:

Many collaborations exist with other universities and research institutes in The Netherlands on a wide variety of topics, including the universities of Wageningen, Utrecht, Nijmegen, Leiden, both universities in Amsterdam, and the Royal Dutch Academy Institutes (Netherlands Institute for Ecological Research and the Netherlands Institute for Sea Research). Moreover, this new position in Evolutionary plant eco(physio)logy will reinforce the positioning of Groningen University with regards to its strategic vision to as part of the University of the North, which embeds ecological and evolutionary plant biology as one of its strategic pillars. Regionally, this position will contribute to a new multi-actor innovation platform linking private and public partners (i.e., the ARENA Platform www.pablotittonell.net/tag/co-innovation/), anchored by GELIFES. This platform is the results of new strategic regional links between farms and academic partners, e.g. Hanzehogeschool, Van Hall Larenstein School, Wetsus, as well as national links with Wageningen University and the Copernicus Institute of Utrecht University (a joint NWO proposal is currently being developed in collaboration with these partners).

International:

GELIFES, unlike many other institutes in the world, specifically aims at the integration of ecological and evolutionary approaches with neurobiology and physiology in the Life Sciences. Some of our research fields that are internationally well recognized and relevant for the new staff member are the genetics and evolution of insect reproduction, the evolution and physiology of

animal personalities and ageing, microbial genetics and ecology, evolutionary genomics, biological clocks, maternal effects, and theoretical biology.

7. Expected contributions to teaching

Within FSE we teach the basics of prokaryotic and eukaryotic genetics in the Biology and Life Science & Technology programme in collaboration with the Groningen Biomolecular Sciences and Biotechnological Institute (GBB). Our institute has strong links with the medical sciences at the UMCG as we educate the medical biology students in genetics and genomics research. A hallmark of our educational profile is the integration of mechanistic (e.g. genetic and genomic) approaches with evolutionary approaches to understand adaptation.

At the bachelor level, the candidate will participate in teaching for students in Biology and Life Science and Technology. Courses in the current curriculum with a plant biology component are: Ecophysiology of Plants and Animals, Evolutionary Ecology, Systems Ecology, Ecological Interactions, Conservation Ecology, Biochemistry and Cell Biology, Biotechnology, and Marine Biology. The candidate is also expected to supervise BSc and MSc research projects and theses.

8. Expected contributions to research

The candidate is expected to develop a strong research programme in plant biology at the organismal level, focusing on the adaptive traits enabling plants to cope with changing conditions. With this profile the candidate is expected to develop a group that can successfully apply for funding from topical programs of NWO (e.g. NWO-Green, NWO-Closed Circles), national initiatives for circular agriculture, regional programmes for sustainability of agriculture (e.g. Fryslân Kenniscentrum for Salinisation) and participate in EU consortia on sustainable agriculture or urban ecology. The candidate will supervise PhD-students.

9. Expected contributions to the organization

The candidate is expected to have an active interest and to provide a positive contribution to the management and organizational tasks of the institute. At the level of FSE, the candidate will contribute to the organization of the faculty, for example by participating in working groups and committees in the area of education. The candidate will participate in relevant national and international organizations.