

**Subject:** PhD position - plant-microbial interactions

In the Group of Plant Nutrition we combine basic research on mechanisms driving and mediating plant nutrition with field trials to solve topical problems in plant production. In the multidisciplinary team, we are recruiting a motivated PhD student for a project that combines community ecological analyses of microbial root symbionts with plant physiological ecological analyses to mechanistically elucidate microbe-plant-soil feedbacks. Specifically, the PhD student will address soil constraints to sustainable plant production, in a project entitled 'Ecological intensification of organic rooibos cultivation in South Africa (Ecolnt)'.

Root-associated microbes are powerful mediators of plant nutrition and health and for this they are increasingly considered promising for farming on marginal land. The collaborative research project with Stellenbosch University and various stakeholders in South Africa aims to establish a knowledge base on suspected declines of beneficial and accumulation of antagonistic microbes, which are thought to be responsible for yield declines in monospecific and long-term cultivation of Rooibos tea, *Aspalathus linearis*, a legume bush endemic to South-Africa. The research will also engage producers to test promising methods of raising on-farm biological soil fertility. The PhD student will find out what aspects of root-associated microbial communities (composition, structure, or abundance) is determinant for the tea bushes' growth, health, and tolerance against drought. This will be done by combining data of molecular barcoding analyses on rhizobia (R), arbuscular mycorrhizal fungi (AMF) and oomycetes (O) and isotopic and total nutrient and water status indicators of leaf samples. Based on i) a field survey in remaining wild stands, prospering and declining plantations, and ii) nursery-type common garden experiments with different soil origins and organic fertilizer amendments, as well as, iii) interviews with small- and large-scale farmers, the following main research questions are to be addressed:

- 1) Is plant performance related to consistent patterns of community composition, structure, and overall abundance of AMF, O, and/or R?
- 2) Are nursery seedlings healthier when raised in soil from remaining semi-natural vegetation patches, because of more balanced and mutualist-rich root-associated microbial communities?
- 3) Can natural nutrient flushes be replaced by application of mulch, dung and/or compost?

Linking observations with data from experimental manipulation has good potential to reveal mechanistic linkages between complex interactions between microbes, physicochemical soil properties and plant performance. Such process-based knowledge is needed to identify opportunities for agronomic intervention to 'intensify' advantageous microbe-root interactions for sustaining yields with little use of external resources.

Highly motivated students with an excellent academic track record are encouraged to apply.

Applicants should be willing to travel internationally and work under remote and harsh environmental conditions.

Preference will be given to candidates with demonstrated (international publications) and broad interests in ecology, evolutionary biology, microbial ecology and application of related knowledge. Desirable skills include experience in working with next generation DNA sequencing data (metagenomics), including associated bioinformatic analyses, and use of natural abundances of stable isotopes. The successful applicant will also be required to interview local farmers in a socio-economic component of the project.

Requirements include an MSc in plant science (environmental or agricultural sciences) or

(microbial) ecology, good spoken and written English, and a driver's license. Funding is guaranteed for three years by the collaboration between the Mercator Research Foundation and the World Food System Center at ETH, via the ETH Foundation. Salary follows the fixed salary rates for doctoral students at ETH.

For further information please contact Dr. Hannes Gamper (no applications) by email:

[hannes.gamper@usys.ethz.ch](mailto:hannes.gamper@usys.ethz.ch), or Prof Johannes J. Le Roux (no applications) by email:

[jleroux@sun.ac.za](mailto:jleroux@sun.ac.za) and/or visit the working group's websites: <http://www.plantnutrition.ethz.ch>,

[http://academic.sun.ac.za/cib/team\\_research.asp](http://academic.sun.ac.za/cib/team_research.asp)

Applications online with a short motivation letter describing your reasons for applying and qualifications for the position, a detailed CV, and contact details of three referees by April 15, 2016 (Go to Apply Now below.) to: ETH Zurich, Olivier

Link to apply: <https://apply.refline.ch/845721/4483/pub/1/index.html>