

Digit Soil - A rapid measurement of soil health

According to FAO (Food and Agriculture Organization of the United Nations), a quarter of the global surface of agricultural land is already highly degraded, therefore maintaining long-term soil health gains importance. Nevertheless, there are currently no easy, fast, and reliable ways to assess the effects of soil management on soil health and in particular on soil biology. The planned Thesis-project seeks to support development of an easy-to-use, portable sensor (Digit Soil), measuring the activity of soil enzymes as a soil health indicator.



The objectives of the thesis are to determine boundary conditions for the use of the novel soil enzyme activity sensor in terms of physico-chemical chemical soil properties (texture, pH, soil nutrient contents) and soil environmental conditions (temperature, moisture)

The project is a collaboration between the groups of Plant Nutrition at ETHZ and Soil Functions and Soil Protection at WSL (Birmensdorf), as well as the FiBL Department Suisse Romande and possibly more.

The student will be supervised by Dr. Sonia Meller and Prof Emmanuel Frossard or Dr. Jörg Luster.

The research activities for this topic involves:

- sampling activities in natural and agricultural settings in several locations in Switzerland: measuring in-situ and sampling soil at different depths,
- laboratory work: Sample preparation and analyses of soils for enzyme activity, carbon, phosphorus and nitrogen content,
- data analysis and interpretation.

In addition we offer:

- flexible working hours,
- possibility to co-design and plan experiments with support at every step of work,
- working in a diverse team consisting of engineers (software, electrical, mechanical), chemist, environmental scientist, business experts,

- application oriented topic aiming to develop a real product under umbrella of Innovation & Entrepreneurship Lab;
<https://ethz.ch/en/industry/entrepreneurs/ielab.html>
- possibility to expand additional skills in product development, manufacturing, market analysis, customer surveys,
- possibility of further collaboration after the completion of the master thesis.

We expect:

- background in soil science and experience in laboratory work,
- ability to use R (or other programming language eg. Python) for basic data processing and analysis is essential,
- good theoretical understanding and practical statistical analysis skills are an asset (mixed models),
- we are happy to welcome persons ready to contribute their own ideas and be part of the team.

Location:

Most work will be conducted (preferably) in Swiss Federal Institute for Forest, Snow and Landscape Research WSL in Birmensdorf or the ETH Research Station for Plant Science in Eschikon, on agreement.

Data evaluation: The generated data will be used to assess the performance of novel sensor in a variety of soil conditions and model relationships between soil properties and soil enzyme activity. Data are planned to be used in scientific publication and for supporting development steps of the sensor.

Start: any time 2021 and beginning of 2022 (on agreement)

Project is designed for a master student. Parts of the project can be also conducted by a bachelor student.

Relevant links and partners:

- Group of Plant Nutrition, <https://plantnutrition.ethz.ch/>
- Soil Functions and Soil Protection Group at WSL, Birmensdorf,
<https://www.wsl.ch/en/about-wsl/research-units/forest-soils-and-biogeochemistry/soil-functions-and-soil-protection.html>
- FiBL in Suisse Romande, <https://www.fibl.org/en/locations/switzerland/locations-switzerland/department-suisse-romande.html>
- Digit Soil website <https://www.digit-soil.com/>
- Student Project House, <https://sph.ethz.ch/digit-soil/>
- Innovation & Entrepreneurship Lab
<https://ethz.ch/en/industry/entrepreneurs/ielab.html>

Project funding:

ETH foundation - Pioneer Fellowship, see more:

<https://ethz.ch/en/industry/entrepreneurs/entrepreneurship/pioneer-fellowships/2020/digit-soil.html>

Interested? Questions? Contact Sonia on sonia.meller@wsl.ch.