

1. PHD PROJECT DESCRIPTION (4000 characters max., including the aims and work plan)

Project title:

1.1. Project goals

It has been suggested that soil microbiological and biochemical properties can be useful indicators of variation in soil functions and activity as influenced by natural and anthropogenic factors. Then goals of project are:

- 1) to measure influence of soil sealing on the physicochemical soil parameters in controlled environment;
- 2) to measure influence of soil sealing on the soil microbiological properties (microbial biodiversity, biomass, biological activity, respiration activity, soil enzymes and functional diversity);
- 3) monitor changes in properties over time;
- 4) to determine which soil microbiological properties are most susceptible on soil sealing;
- 5) to evaluate ecosystem (dis)benefits caused by soil sealing.

1.2. Outline

Artificial soil sealing in urban areas covers significant and still increasing areas. being hazardous to urban ecosystem. Sealed soils undergo a significant alteration of their physicochemical properties, and in turn, negatively influencing microbial features. Soil sealing for urban and infrastructure development constitutes the most intense form of land degradation and affects all ecosystem services. Policy makers should be constantly informed and updated with scientific achievements to become aware of this fact and develop solutions for limiting development and compensating for new soil sealing with unsealing measures. United Nation's statistics shows that the world urbanization rate will be 66.4% by 2050, which is basis for the increasing importance of urban soil. One of main problems caused by urban sprawl is soil sealing. Obviously, there is a need for studying not only chemical properties of sealed soils, but also microbiological ones to fully understand changes in soil environment and processes, especially in context of health risk assessment and effective protection and remediation of soils in urban environments. Soil microorganisms are fundamental to the development and maintenance of the soil ecosystem. They play an important role in the incorporation of organic matter, decomposition, mineralization and nutrient cycling, as well as in the development and maintenance of soil structure. So far, the research on soil biology has focused mainly on natural and agricultural systems, with insufficient attention paid to those in the urban environment, especially sealed areas. Such gap needs to be filled, what this project is aiming at.

1.3. Work plan

Within this PhD project proposal we plan to perform major research task:

experimental field study will be held to check changes undergoing in soil sealed with bituminous in controlled conditions using state-of-art analytical methods.

October 2020 – March 2021

Review of the literature on the subject under study; analysis of pilot experiment data

conducted in the years 2010-2015; preparation of paper based on the results obtained;
April 2021

Technical preparation of experiment – sealing of plot with bituminous surface; Field works - Soil sampling of reference site before sealing;

April – September 2021

Laboratory analysis – soil physicochemical properties (pH, soil organic carbon, nitrogen and calcium carbonate content, texture, Munsell color); Laboratory analysis – soil microbiological properties (microbial biomass, activity, soil enzymes and functional diversity);

October 2021; April 2022, October 2022, April 2023, October 2023, April 2024

Soil sampling from the sealed surface every 6 months; Laboratory analysis – soil microbiological properties (microbial biomass, activity, soil enzymes and functional diversity);

October 2023 - June 2024

Research summary – preparation of papers based on the results.

Literature

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1.4. Required initial knowledge and skills of the PhD candidate

- The candidate should be a graduate of environmental studies (geography, biology, environmental protection, etc.) with basic soil science course.
- Basic skills in laboratory works

1.5. Expected development of the PhD candidate's knowledge and skills

- the ability to analyse scientific problems and develop skills to detect scientific problems and independently plan the work schedule, choose methods to solve them;
- knowledge of statistical software and the ability to analyse data,
- development of skill to write scientific papers,
- ability to present scientific achievements and lead scientific discussions.