

PhD Research Studentship

Project Title: Evaluating the effect of plant species on soil carbonation flux

Abertay University / University of Edinburgh

Supervisors:

Dr Ehsan Jorat – Abertay University
Dr Saran Sohi – University of Edinburgh

Scottish Alliance for Geoscience, Environment & Society (SAGES) and Abertay University's Graduate School are fully-funding new doctoral studentship, including stipend. The doctoral program is in collaboration with the University of Edinburgh and the prospective PhD student would benefit from supervisory team from Abertay and Edinburgh universities and access to facilities belonged to the both institutes.

Abertay University is one of the fastest growing universities in the UK. In the latest Guardian University League Tables, Abertay University is ranked 15th in the UK in Civil Engineering among 60 institutes. Abertay University is one of just six universities in across the UK and the only one in Scotland to receive the nomination as the "University of the Year" in 2016 Time Higher Education (THE) Awards. According to the results of the Research Excellence Framework 2014 (REF2014) published on 18 December 2014, Abertay was the highest ranked modern university in Scotland for 'research intensity'. School of Science, Engineering and Technology at Abertay University is equipped with a modern geotechnical laboratory and staff with exceptional skills, knowledge, expertise and experience in this field. In addition, the school owns the state-of-the-art XRCT unit.

The COP21 Paris Agreement has given renewed impetus to tackle the effects of climate change. According to the agreement, it will be essential to embrace nature-based solutions for sequestering existing atmospheric CO₂ as well as reducing current emissions. Improved design of urban soils could also lead to significant gains in soil carbon via carbonation. This may offer a distinct and more permanent alternative to building stocks of actively cycling carbon in soil organic matter. Given a source of soluble calcium, CO₂ can be stably captured and sequestered into soils in the form of calcium carbonate (CaCO₃). Urban soils often contain calcium in suitable forms, or are close to low-cost materials required to provide them. Plants have a significant role in carbonation, since their root activity determines the elevation of CO₂ that occurs in soil. So far, the effect of carbonation on plants has been studied in more detail than that of plants on carbonation. The influence of plant species on the soil carbonation process has not been fully discovered.

The proposed PhD project will use established plots to measure soil carbonation in engineered soils, using various selected plant species. The overarching research question is: *Are there root traits that markedly enhance carbon capture in soils already conducive to carbonation?*

Research approach

The first carbon capture trial plots (CCTP) in the UK consisting of yellow sand and crushed concrete or crushed dolerite as a source of calcium were established in Newcastle. The primary purpose was to monitor geotechnical properties of artificial engineered soils during carbon sequestration. The influence of various kinds of plant species in carbon sequestration has not been much investigated. Newcastle University has agreed to access to the CCTP as a secondary partner in the proposed project.

Replicate planted and non-planted PVC pipes will be installed in selected CCTP plots. Various plant species will be used, selected for quality, quantity and placement of carbon arising from roots. Soil samples will be collected from the CCTP immediately before installation of PVC pipes and after one and two years. The inorganic carbon content of the soil will be measured and compared. The position and co-location of carbonate minerals and other elements will be visualised by scanning electron microscopy (SEM) and x-ray tomography (CT). In further CCTP experimentation, the effect of maintaining elevated CO₂ concentration at the soil surface will be considered.

In parallel to work with CCTP samples, lab microcosm and planted mesocosms will be used to elucidate interactions postulated at the root/mineral interface. Organic and inorganic carbon analysis would be conducted at University of Edinburgh School of GeoSciences analytical facilities.

The project is the combination of laboratory and experimental work which enables the PhD candidate to acquire skills of working *in-situ* and in laboratory during the course of the program.

Entry requirements: A related Masters level qualification is desirable but not essential, but candidates must have, or expect to obtain a first class or upper second-class honours degree in a relevant discipline; for example, geoscience, engineering geology or geotechnical engineering (with strong mathematics).

Applicants who are non-native speakers of English, the University requires IELTS of 6.5 (with no band less than 6.5) or an equivalent qualification accepted by the Home Office.

The Studentship is available for an October 2017 start for a period up to 3.5 years.

Further details on this project can be obtained from Dr Ehsan Jorat (e.jorat@abertay.ac.uk).

Further information on Abertay University may be obtained from the Graduate School, University of Abertay Dundee, Bell Street, Dundee, DD1 1HG, Tel:+44 (0)1382 308150, email: GraduateSchool@abertay.ac.uk

Applicants should submit through HIREWIRE submitting a CV (including references) and a personal statement of application detailing why you are interested in undertaking this project. (*NOTE: HIREWIRE ONLY ALLOWS YOU TO SUBMIT ONE DOCUMENT, PLEASE MERGE YOUR SUPPORTING DOCUMENTS*).

The deadline for applications is Friday 10 February with interviews for candidates in Edinburgh between 21 - 24 February, 2017

