Project title: Response of meadow species assemblages along a hydrological gradient and impacts on the movement and fate of carbon in the plant-soil system.

Project code: OU2

Host institution: The Open University

Theme: Evolution & Ecosystems or Biogeochemistry

Key words: Biodiversity, Meadows, Carbon cycle, Hydrology

Supervisory team: Dr. Yoseph Araya (Open University); Dr. Phil Staddon (Open University); Prof. David Gowing (Open University)

Project Highlights:
- Research on the coexistence mechanisms in species rich meadows using hydrological and microbiological methods
- Contribute on the understanding of linkage between biodiversity and hydrological gradient
- Explore the fate of carbon in species rich meadows along a hydrology-biodiversity gradient

Overview:
The competitive response of meadow species along a hydrologic gradient is well established. Field and mesocosm experiments have shown species segregate along a hydrological niche gradient. However, the synergistic aspect of increasing species richness hasn’t been tested along hydrologic gradient. In addition, the response of the soil carbon cycle to changing plant species composition and biomass along a hydrologic gradient is of great interest in the context of current global changes and the likely impacts on local hydrology. This link between biological species composition and the flows of carbon to and from the soil and the resulting impacts on carbon sequestration is one of the great challenges in ecology. With changing climate and water availability impacting terrestrial communities across the world, this question of how the changes in biodiversity affect ecosystem function and the soil carbon cycle in particular is of paramount importance to ecosystem stability. We intend to investigate the species response, carbon balance and resilience of multi-species plant assemblages to imposed hydrological change.

Methodology:
The work will involve two aspects: a mesocosm experiment and a field experiment. In the mesocosm: 1, 3, and 7 species mixtures will be grown along 4 water table depths at the OU’s experimental mesocosms. Carbon flows from plant to soil and back to the atmosphere will be monitored by labelling the plant-soil system with $^{13}$CO$_2$ at 99 atom% $^{13}$C and then tracking the carbon through the various components of the plant-soil system, including plant shoot and root, bulk soil and soil-respired CO$_2$. In addition, there is the potential for stable isotope of PLFA/NLFA probing will be used to identify $^{13}$C taken up by different groups of soil organisms, which determine to a large degree the below ground processes involved in either sequestering to or releasing carbon from the soil. Plant species cover, biomass production will be also be monitored.
The field work will be on a natural meadow in the UK, most likely a site from Floodplain Meadows Partnership database. The work will mirror the experimental setup, with a botanical survey, carbon & mycorrhizal assessments and eco-hydrological monitoring.

**Training and skills:**
Student will be trained in practical ecohydrological techniques within the OU group and Floodplain Meadows Partnership team. Training in laboratory skills such as soil microbiological methods will also be arranged with collaborators.

NERC CENTA students are required to complete 45 days training throughout their PhD including a 10 day work placement. In the first year, students will be trained as a single cohort on environmental science, research methods and core skills. Throughout the PhD, training will progress from core skills sets to master classes specific to CENTA research themes.

**Partners and collaboration**
Collaboration with Dr. Karen Olsson-Francis of the microbiology lab, OU. Floodplain meadows Partnership (OU). Professor Pal-Axel Olsson (Lund University) and Prof. Jonathan Adams (Cranfield University).

**Possible timeline:**
**Year 1:**
Pilot monitoring of field site and sampling. Laboratory analysis of samples. Attend British Ecological Society meeting.

**Year 2:**
Set-up of experimental mesocosms with species, hydrology combinations. Main sampling of both vegetation and soil undertaken.

**Year 3:**
Final season data collection and integration of experimental and field observations. Present at British Ecological Society Annual meeting.

**Further reading:**

Weisser, W et al. (2017) Biodiversity effects on ecosystem functioning in a 15-year grassland experiment: Patterns, mechanisms, and open questions, Basic and Applied Ecology: 23, 1


**Further details:**
Students should have a strong background in ecology or plant biology and enthusiasm for both field and laboratory work. Experience of undertaking independent field work and laboratory experience of soil chemistry / microbiology methods is desirable. The student will join a well-established team researching plant ecology/ecohydrology at the Open University.

Please contact [Yoseph.Araya@open.ac.uk](mailto:Yoseph.Araya@open.ac.uk) for further information.

Applications should include:
- a cover letter outlining why the project is of interest and how their skills match those required,
- an academic CV containing contact details of three academic references
- a CENTA application form, downloadable from: [http://www.centa.org.uk/media/1202/centa-studentship-application-form.docx](http://www.centa.org.uk/media/1202/centa-studentship-application-form.docx)
- and an Open University application form, downloadable from: [http://www.open.ac.uk/students/research/sites/www.open.ac.uk.students.research/files/documents/Application%20form.docx](http://www.open.ac.uk/students/research/sites/www.open.ac.uk.students.research/files/documents/Application%20form.docx)

Applications should be sent to [STEM-EEES-PhD-Student-Recruitment@open.ac.uk](mailto:STEM-EEES-PhD-Student-Recruitment@open.ac.uk) by 5 pm on Monday 22nd January 2018