A glimpse into the Arctic future: equipping a unique natural experiment for next-generation ecosystem research

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PhD student - Early Stage Researcher (ESR7)

Unmanaged subarctic grassland growth processes and plant stress evolution in a warmer world

About FutureArctic

The EU-funded Innovative Training Network FutureArctic aims to quantify how much carbon will escape from the Arctic in future climate. How do the multitude of ecosystem processes, driven by plant growth, microbial activities and soil characteristics, interact to determine soil carbon storage capacity? A group of fifteen PhD-students will study the Forhot ecosystem in Iceland, where a natural coincidence has provided us with the exceptional opportunity to actually look into the future.

Given the strong urgency of tackling and managing the climate challenge and the particularly important role herein of (sub)Arctic ecosystems, a rapid assessment of the ecosystem and ambient processes in this natural laboratory is essential. FutureArctic will achieve this challenge by adopting the fast advances made in the field of **machine learning and artificial intelligence** (AI), **unmanned aerial vehicles** (UAV) and (remote) **sensor technology** into **environmental research at the ecosystem scale**, into a new concept of an '**ecosystem-of-things**'.

FutureArctic thus aims to channel an important evolution to automated machine-assisted fundamental environmental research. This is achieved through dedicated training of researchers with profiles at the inter-sectoral edge of computer science, artificial intelligence, environmental and agricultural science, sensor engineering and communication and social sciences. FutureArctic training ensures the **development of unique enviro-technological job profiles**, all with their own specialty, embedded in holistic knowledge on connected high-data throughput ecosystem research, ready for machine-assisted environmental ecosystem science and modelling.

About the host organization

The Agricultural University of Iceland (LBHI), is a small non-profit university located at three campuses in S- and W-Iceland. It was founded in 2005, but its origins date back to 1889. The Faculty of Agricultural and Environmental Sciences of LBHI has 45 researchers, where 5 are full professors, and is today the focal point for biogeochemical and ecosystem ecology research on both natural and managed terrestrial ecosystems in Iceland. Its researchers are working at different hierarchical levels; with the main focus on the field or ecosystem scale, but also down to molecular studies and up to national scale using GIS and other remote sensing tools for scaling. The total number of graduate and post-graduate students is about 75, but the doctoral programme of LBHI is organized jointly with the Centre of Graduate Studies of University of Iceland, which has ca.13.000 students, and gives access to broader PhD courses and training support. The Fac. of Agric. and Environ. Sci. of LBHI offers courses and programs leading to officially recognized higher education degrees in several areas of study, but this project is will give a PhD degree in Environmental Sciences. The ForHot soil warming experiment is located on land own by LBHI and the LBHI research group coordinates all the research that takes place there. The student's main supervisor, Bjarni D. Sigurdsson, who co-founded the ForHot site in Iceland, is a professor at LBHI and he has 20-years experience with studies of responses of plants and soils to environmental changes. Most of his research has been on the effect of climate change and land-use change on ecosystem processes in Iceland. The PhD will be co-supervised by dr. Peter Lootens at ILVO. The ILVO-Plant Sciences and Technology and Food Sciences Units combine their expertise in e.g. (RGB, multispectral, thermal, and hyperspectral) imaging, plant(eco)physiology (photosynthesis, chl. fluorescence), abiotic stresses (drought, cold, frost, heat, …), soil science, data analysis and UAV machinery to create smart digital and precision farming/phenotyping solutions. A specialty which may also be applied to unmanaged subarctic grasslands in Iceland. The second co-supervisor will be dr.

Iolanda Fiella at CREAF. CREAF is a public research and education institution for terrestrial ecology and sustainable management of the environment. CREAF is attached to both the Autonomous University of Barcelona (UAB) and the University of Barcelona (UB) and it disposes all the necessary equipment for conducting ecophysiologycal, elemental and spectroradiometrical analyses that the PhD student is going to work on. The primary objective of CREAF is to generate knowledge and create new methodological tools in the field of terrestrial ecology. Dr. Fiella's field is remote sensing and multi-spectral analyses of plant and ecosystem function. The PhD will be working together with ESR10 at a daily basis during the whole study.

Task description

Your PhD project

How do unmanaged subarctic grassland communities respond to long-term soil warming in their growth processes? Do they show long-term phenological and physiological adaptation to soil warming at a plant or community level? You will start by working on already existing dataset on unpublished multispectral measurements of vegetation structure and function and you will further develop the research by studying plant phenology by visual recording and by regular measurements of plant growth by a LAI-2050 Plant Canopy Analyser and by ground-based measurements of NDVI, PRI and other multispectral indices, that can also be measured remotely by automated UAV measurements. Key eco-physiological stress processes that you might look further into include: i) autumn, winter and spring frost tolerance, ii) summer water stress (Scholander's Pressure Chamber) and stomatal conductance (CIRAS-II Photosynthetic System) for instantaneous responses and 13C isotopes in leaf tissue for seasonal responses and iii) temperature response curves, A/Ci curves and light-response curves with CIRAS-II for identifying physiological adaptation processes.

A multidimensional analysis of in situ plant growth processes and frost-, heat- and water-stress tolerance of key subarctic species will help to understand their future resilience in a warmer world. The phenological response of the key species, and if or how fast it can adjust to relatively rapid warming, is a key issue to improve current modelling predictions. Such a multidimensional approach at many warming levels is currently missing in the analysis of plant response to climate change in the subarctic.

Your research on the grassland growth processes will also offer a ground-truth of remotely sensed hyperspectral data (with ESR 10) and your findings can thereby be used to scale such responses up to ecosystem-, regional and national levels. Your ecophysiological measurements will also contribute the ESR 6 who will work with developing automated measurements of gas exchange (GPP and NEE) to better understand the underlying ecophysiological controlling factors of photosynthesis and respiration. Your work will therefore be very central in the whole Future Arctic study.

Secondments

You will embark on secondments to other FutureArctic partners together with ESR10 (ILVO in Belgium, SVARMI in Iceland and CREAF in Spain), to establish a common pipeline of agricultural and ecosystem science UAV imaging for plant growth processes and plant stress (with ESRs 2 and 10). You will also work closely with the ESRs who are working on gas exchange and isotopic studies in the grasslands (ESRs 5 and 6).

Benefits of working in an ITN

- You will get a hands-on research experience in the subarctic environment of Iceland.
- You will be working within our international group of > 25 researchers
- You will get in contact with the other members of this international consortium and will benefit from the joint training platform to develop skills necessary for developing an "ecosystem-of-things".

Profile and requirements

- Applicants must hold a MSc or equivalent in the field of environmental sciences, biology, chemistry, forest science or a related natural sciences discipline
- Applicants can be of any nationality.
- Applicants must have an ability to understand and express themselves in both written and spoken English to a level that is sufficiently high for them to derive the full benefit from the network training.
- Applicants must be eligible to enroll on a PhD programme at LBHI.
- Applicants must be willing to spend most of their PhD time in Iceland.

In addition:
H2020 MSCA Mobility Rule: researchers must not have resided or carried out their main activity (work, studies, etc.) in the country of the host organization (Iceland) for more than 12 months in the 3 years immediately before the recruitment date. Compulsory national service, short stays such as holidays, and time spent as part of a procedure for obtaining refugee status are not taken into account.

H2020 MSCA eligibility criteria: Early Stage Researchers (ESRs) must, at the date of recruitment by the host organization, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. Full-Time Equivalent Research Experience is measured from the date when the researcher obtained the degree entitling him/her to embark on a doctorate (either in the country in which the degree was obtained or in the country in which the researcher is recruited, even if a doctorate was never started or envisaged).

Benefits

- You will be employed by the host organisation for 36 months.
- A competitive salary plus allowances. Moreover, funding is available for technical and personal skills training and participation in international research events.
- You will benefit from the designed training programme offered by the host organisation and the FutureArctic consortium.
- You will participate in international secondments to other organisations within the FutureArctic network and in outreach activities targeted at a wide audience.

Please, find additional information in the *Information package for Marie Curie fellows*

Application

Interested candidates are invited to apply for this position by sending an electronical application to: https://ugla.lbhi.is/umsoknir/index.php?sid=921

Change the language to English in upper right corner.

When you apply for the position, please also notify:
Prof. Dr. Bjarni D. Sigurdsson
Email: bjarni@lbhi.is

Expected starting date: January 2020

More information and other vacant positions can be found on www.futurearctic.eu

Additional information

For additional information about the research project and this individual position, please contact:

Prof. Dr. Bjarni D. Sigurdsson
Email: bjarni@lbhi.is