



## 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 (ESR11) Development of an automated sampler for subsoil nutrient flows

## 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

Dansk Miljørådgivning A/S (DMR) is among the leading consultants on the Scandinavian market within three international specialist services: Investigation/risk assessment of soil/groundwater pollution, geo-technics and indoor air climate investigation. DMR's head office is located in Ry, Denmark. DMR maintains 14 branch offices in Denmark and Norway and has 150 employees. DMR employs engineers, biologists, geologists and other specialists with an academic background. DMR's services within the area of Soil and Groundwater focus on engineering, soil-physics, hydrogeology, management, planning, risk assessment as support to our customers in their planning and decision-making processes. From the start of the company, DMR's R&D dept. has been a key player to start new business areas, and find niches, where DMR can distinguish themselves from competing consultancy companies. This strategy has led the R&D dept. to include new cross-disciplinary abilities, like low-power engineering/prototyping which together with the company's core services has resulted in development of several new automatic sampling and investigation devices.

Through more than 30 innovation projects focusing on development of new hardware/methods for site investigation and risk assessment at polluted sites, DMR has built a strong platform to support R&D activities in the field. DMR has the necessary cross-disciplinary know-how and equipment to build and assemble electric prototypes mainly based on the Arduino platform that are ideal for innovation of new hardware for soil investigations. To support this, DMR has developed a network of subcontractors who can build tailored prototype parts e.g. via 3D printing which speeds up the innovative process. Recently an automated pore-water sampler for the unsaturated zone was developed and combined with a new porous steel lysimeter. This will be the starting point for development of a new Real Time Soil Water and Soil Gas Instrument, and the platform will be combined with state-of-the-art sensor technology to develop an automated soil lysimeter.

Claus Larsen will - through his position as owner of [DMR](#), be responsible for quality certification (ISO9000), and general involvement in the R&D department – have the general responsibility for the activities of the company in the project. Per Loll (PhD) will - through his position as R&D manager, 20 years of experience in R&D and consulting within soil and groundwater pollution - be directly involved in the project, via conceptual innovation and quality assessment of choices made to reach milestones. Poul Larsen (PhD) will - through his position as project manager in the R&D department, with responsibility for innovation of novel sampling devices, and his former position as scientific coordinator in EceDesign at the Department of Biotechnology at Aalborg University - be the primary responsible for the project and supervision of the ESR, and focus on the research goals and supervision of the Ph.D. candidate.

The PhD will be co-supervised by Per Gundersen (PGU) at [UCPH](#). PGU is a professor in biogeochemistry at the Dept. of Geosciences and Natural Resource Management ([IGN](#)) where he study the element cycling response to change (climate, deposition or management) in forest and nature areas. The Dept. has a number of highly instrumented large-scale field experiments and monitoring stations that will be used for local ERS training. PGU has previously installed soil water samplers in ForHot that will be used and compared to new sampling concepts by this ERS.

The PhD will also be co-supervised by Maarten Weyn assistant professor at the University of Antwerp and IMEC, Belgium (IDLab research group), particularly on subjects related to low power sensor communication.

## Task description

### Your PhD project (ESR 11)

The overall aim is put together, test and apply new sampling and sensor technology for soil and water observation that can be used in research and monitoring even in remote and harsh environment. First we aim to apply and validate novel soil water and soil gas sensors, and applying a new porous steel soil water sampler (from PRENART). A secondary aim of the project is to investigate the possibility of estimating in-situ soil hydraulic properties (soil-water retention curve and hydraulic conductivity). The data from the new multi-sensors will be applied to assess the plot scale element leaching and nutrient biogeochemistry. This will supply an important data-stream for the smart-analysis of ecosystem-complexity. The data will be coupled to evapotranspiration data of ESR6 in the development of a hydrological model for the ForHot site. The intention is to make a collaboration with ESR9 where new technologies for low power datatransmission and rugged control station will be developed.

### Secondments

For a conceptual understanding of which variables are important to measure in order to get novel and dynamic understanding of the important nutrient fluxes in the ecosystem you will visit UCPH for about 2 months within the first half year. Later after coupling new sensors to the automated lysimeters, the system will be tested and validated via a second Secondment at UCPH for about 3 months.

You will further benefit from secondments to other FutureArctic partners (IMEC, LBHI), to establish a stable low power datalink and field testing of the equipment.

### Benefits of working in an ITN

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, environmental engineer, biology, chemistry or a related discipline.
- Applicants must have interest and flair for technical installations and sensor technology.
- 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 enrol on a PhD programme at the host institution (or at a designated university in case the host institution is a non-academic organisation).

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 organisation (Belgium) 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 organisation, 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 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 through the link below.

<https://www.dmr.dk/job/> (Deadline for application September 15 2019)

Expected starting date: October 2019

More information and other vacant positions can be found on [www.futurearctic.eu](http://www.futurearctic.eu)

## Additional information

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

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