



## 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 (ESR10) Development of an autonomous UAV application for image based (e.g. multispectral) ecosystem climate response assessment**

#### **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**

You will be hired by SVARMI, which is an Icelandic company focusing geospatial analytics using automated UAVs and artificial intelligence founded in 2013. Currently SVARMI has 6 employees and conducts projects both in and out of Iceland. The main verticals of focus are geothermal, energy, construction and other industrial areas and environmental research. Svarmi currently operates multiple UAV platforms and a suit of sensors to mount to the UAVs as well as advanced capability in UAV software and hardware development, GIS programming and web development as well as Artificial intelligence. Your company main supervisor there will be Victor Madrigal. Originally from Spain, Victor moved to Iceland back in 2010. He studied MSc. in Environment and Natural Resources at the University of Iceland, with a specialization in Geography and Remote Sensing. During his studies, he specialized in machine learning, advanced programming, remote sensing and GIS web development. After graduation he joined Svarmi where his focus was on advancing the company in remote sensing and machine learning applied to UAV and satellite datasets. Since then, Victor has successfully developed multiple capabilities for the company in developing Earth Observation products with both merging traditional remote sensing methodologies and deep learning approaches.

You will be enrolled to the doctoral programme of the Faculty of Agricultural and Environmental Sciences of the Agricultural University of Iceland (LBHI), which is a small non-profit university. It was founded in 2005, but its origins date back to 1889. The Fac. of Agric. and Environm. Sci. 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. 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. Your academic main supervisor there is 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. The PhD will be co-supervised by dr. be dr. Iolanda Fiella at CREAM. CREAM is a public research and education institution for terrestrial ecology and sustainable management of the environment. CREAM is attached to both the Autonomous University of Barcelona (UAB) and the University of Barcelona (UB). The primary objective of CREAM 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 ESR 7 at a daily basis during the whole study.

## Task description

### Your PhD project

Your PhD project will consist on developing an automated application to assess biophysical variables, combining AI, IoT and remote sensing approaches. Those variables will be used for monitoring changes induced by climate change such as productivity, soil moisture, soil temperature and species composition. This will supply an important, constant and real-time data stream for the smart analysis of ecosystem complexity (WP3). You will work in an interdisciplinary team where environmental sciences, soil science, botanic, remote sensing and artificial intelligence come together. Ultimately, the application that you will develop will help to quickly asses those variables over different scenarios by flying a UAV over the selected area. Thus, the end goal will be to derive the variables on real time using Svarmi's IoT technology to transfer the data to a server (GestosLite) and to do the analytics using deep neural networks (Hermes). To build up the application you will be using multiple source datasets, from Copernicus imagery, ground sensors placed by other work packages at Future Arctic and Svarmi's autonomous UAV for multispectral ecosystem assessment. Your work will be to harmonize all those data streams to create analytics that will be calibrated with ground-truthing efforts. Your application will be expected to run fully autonomously, by triggering analytical processes on a cloud server, receiving the data directly from the flying UAV on real time.

### Secondments

You will (with ESR 2 and 7) embark on secondments to other FutureArctic partners in Belgium (ILVO), Iceland (LBHI) and Spain (CREAF) to establish common pipeline of agricultural and ecosystem science UAV imaging for plant structure and functioning and to determine which ecosystem aspects and processes should be used to optimize sensor measurements for determining the carbon and soil moisture balance of the research sites. Another secondment at IMEC (Belgium) will involve AI development.

### 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".
- ☒ A successful candidate will get an opportunity to work as a Data Scientist for Svarmi

## Profile and requirements

- ☒ Applicants must hold a MSc or equivalent in the field of environmental sciences, engineering, geography or computer sciences.
- ☒ Applicants must have a solid knowledge of remote sensing principles.
- ☒ Applicants must have some previous knowledge of machine learning.
- ☒ Experience with deep learning techniques well received
- ☒ The candidate must have some experience with Linux operating systems
- ☒ The candidate must be a middle/advanced user of Python
- ☒ Some cloud or container experience (Docker/Kubernetes) is a plus
- ☒ 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://svarmi.is/FutureArctic/> Instructions for application will appear here soon.

Expected starting date: January 2020

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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