

## FORFUS-RT3.2

The "Forest function under stress" doctoral training unit (FORFUS) includes a PhD project on soil moisture and vegetation water content estimation using microwave data.



# PROJECT

This project is part of the doctoral training unit [FORFUS: Forest function under stress](#)

### Inspiration

Microwave remote sensing measurements are sensitive to the dielectric constant and to object geometry. So far, we have used this technology to estimate vegetation water content (VWC), provide information on vegetation structure and estimate surface soil moisture (SM). It is well known that the canopy penetration depth varies depending on the wavelength, with shorter wavelengths providing information on the top layer of the canopy and longer wavelengths being most sensitive to the characteristics of trunks and soils. Synthetic aperture radar interferometry (InSAR) retrieves digital surface models by measuring the phase difference between two subsequently acquired radar images. However, recent research has shown that this phase difference is also susceptible to SM, VWC and atmospheric delay. As a result, the aim of this PhD project is to develop models able to fuse backscattering and phase information to estimate SM and VWC more accurately.

### Innovation

The project will focus on enhancing the estimation of surface SM and VWC at high spatial resolution by utilizing SAR sensors with varying frequencies and polarizations. We will start with the assumption that VWC is the principal factor in backscatter attenuation, subsequently integrating this with recent findings concerning phase sensitivity to both VWC and SM. This framework employs innovative algorithms to estimate VWC and SM concurrently, utilizing phase and backscattering, enhanced vegetation models and, when accessible, overlapping multifrequency data to assess VWC across various vegetation layers.

### Impact

The outcomes of this project will help to better estimate the soil moisture in the presence of vegetation at high spatial resolution and, at the same time, identify the plant water content. Automatic and reliable algorithms for estimating the aforementioned parameters on a global scale will enable the implementation of operational services in precision agriculture and forest management. This PhD project will enhance our capacity to comprehend and foresee the resilience and vulnerability of forest ecosystems.

#### Partners

Administration de la nature et des forêts (LU) , BOKU (AT) , Center for International Climate Research , Delft University of Technology (NL) , Groupement des Sylviculteurs a.s.b.l (LU) , INRAE (FR) , Luxembourg Institute of Socio-Economic Research (LU) , Musée national d'histoire naturelle Luxembourg , National Institute of Statistics and Economic Studies (LU) , Sapienza University Rome (IT) , Swedish University of Agricultural Sciences (SWE) , The National Institute for Public Health and the Environment (NL) , Université Catholique de Louvain (BE) , University Göttingen (DE) , University of Agriculture Krakow (PL) , University of Edinburgh (UK) , University of Luxembourg (LU) , University of Naples (IT) , University of Tartu (EE) , University of Trier (DE) , Ville de Luxembourg , Wageningen University (NL)

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