

4-year PhD Position in Space research and technology: Spectral diversity metrics and machine learning for spatially predictive biodiversity modelling

The rapid erosion of biodiversity poses a significant environmental challenge. Assessing biodiversity through ecological field data encounters various challenges, particularly in gathering reliable information for large areas. There is a pressing need for operational techniques utilizing remotely sensed data to aid ecologists and decision-makers.

This PhD project aims to explore diversity indicators derived from optical imagery, based on the spectral variation hypothesis. According to this hypothesis, the diversity of spectral patterns across spatial grids reflects greater niche heterogeneity, facilitating coexistence among organisms. First, you will identify, qualify, and compare methods for operational biodiversity monitoring with remote sensing data. Selected diversity indicators will be evaluated across different scales from suitable remote sensing data sources (Sentinel, Landsat, MODIS). The concept of spectral species has recently emerged, suggesting that spectral heterogeneity at a landscape level corresponds to distinct subspaces with similar spectral signatures. As a next step and using Estonia as a case study and available remote sensing data, this thesis work will investigate the identification of these subspaces as individual spectral entities - "spectral species." Finally, remote sensing data and identified associated drivers will be integrated and processed within a data cube and machine learning models to allow spatially predictive biodiversity modelling.

The aim of this PhD project is to enhance standards for biodiversity mapping using remotely sensed data and to contribute to the identification of pertinent remotely sensed enabled essential biodiversity variables.

The research is part of the Centre of Excellence for Sustainable Land Use. The PhD student will be working in the Tartu Observatory and supported by [Landscape Geoinformatics Lab](#) in the Department of Geography, University of Tartu

Core tasks include:

- Literature review of the state-of-the-art
- Extracting/developing spectral indices from satellite remote sensing data to be matched with biodiversity ground measurements.
- creating machine learning model based for spatially predictive biodiversity modelling

Requirements

Master's degree in remote sensing, geography, geoinformatics, quantitative ecology, physics or wider spatial and natural sciences.

The ideal candidate has proven experience in following essential skills:

- previous work with satellite remote sensing data
- spatial analysis and GIS, comfortable with QGIS
- scripting of workflows and data analysis with Python or R
- confident in English language spoken and written. See more info about language requirements <https://ut.ee/en/sisu/phd-language-requirements> English language test must be submitted by 15th of May

- good communication skills and willingness to work in a team

In addition, following skills would be beneficial:

- understanding of environmental processes (physical geography, ecology)

Desired knowledge

Priority will be given to candidates with experience in remote sensing, programming knowledge, especially in Python and experience in machine learning (e.g. Random Forest). For shortlisted candidates we will also aim to assess technical and spoken communication skills in an online interview.

Funding and Health Insurance

The position is fully funded. Full-time PhD student will be on a junior researcher position with gross salary of 1830 EUR (net approx. 1450 EUR) as minimum with expected increase of 5-10% per year. Living costs in Estonia are very reasonable and the allowance can cover your living costs.

All PhD are provided with Estonian national health insurance. Health insurance coverage is available for the full nominal study period of PhD studies (4 years). University is also covering regular health checks and some health improvement (e.g. gym, swimming) costs for the staff members.

Living in Estonia

In Estonia you will be living in a highly connected society, with free wireless Wi-Fi almost everywhere. Many everyday activities are made easier with various IT solutions: register a company with as little as 18 minutes, park your car with phone, register courses online etc. Entrepreneurship and innovative solutions are highly welcomed in Estonia, which has a strong start-up community and has also become known as the Silicon Valley of Europe. Student life in Estonia is full of activities and events. There are many organizations and events that help foreign students to settle into Estonian life and create a social network in the country. For more information about Living in Estonia <https://studyinestonia.ee/living>

Start of the studies: 2nd of September 2024

To apply

Please submit the following materials via email to jan.pisek@ut.ee by **20th of March** :

- A one-page letter of motivation explaining how your prior research experience qualifies you for the position and why you would like to work on this topic.
- Copies of both bachelor's and master's diplomas, and diploma supplement (bachelor's and master's transcript/mark sheet, including the description of the grading scale). Applicants graduating in 2024 and having their diplomas issued later than the application deadline, should electronically submit their most recent official Transcript of Records by the required deadline along with the rest of the required documents. Please note that you must have graduated from your master's studies by 1 August, 2024.
- A two page (max.) CV (including publications if available).
- Names and contact details for at least two references.
- Applicants selected for an interview will be contacted before the end of March 2024.