# BayCEER Kolloquium

Lectures in Ecology and Environmental Research

Summer 2026

UNIVERSITÄT BAYREUTH

Donnerstag/Thursday
**11.06.2026**
**12:30 in H6, GEO**


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## AI approaches to uncover fine-scale variation in plant phylogenomics and phenotypic traits


Deep learning (DL) bridges the gap between growing digital resources and data-intensive fine-scale evolutionary and ecological applications. The desired goal of DL is to capture both species-level and subtle population-level genetic and morphological variation. Using Ranunculus auricomus as a model, along with other species groups, we demonstrate that DL networks can automatically extract phylogenetic signals from single-copy nuclear gene sequences to delimit species under complex evolutionary scenarios. The high dimensionality of data representations (features) automatically extracted by DL first required a dimension reduction, followed by species clustering. We validated species classifications based on direct comparison to recently updated integrative taxonomies. Furthermore, we quantitatively compared state-of-the-art DL delimitation methods using cluster accuracy metrics.
Analyzing morphological variation in Ranunculus auricomus, we also show that DL networks can automatically extract intricate leaf shape traits from images taken in situ and in herbaria, and validate their taxonomic relevance via geometric morphometrics. Looking ahead and moving from limited sampling towards large-scale image data, automated workflows for trait capture offer an efficient way to harness big data from global platforms like GBIF. We show a few examples of accelerating the extraction of functional plant traits—such as flower color in alpine gentians or leaf dissection indices in European trees—for opening new possibilities of high-throughput phenotyping to help us to better understand large-scale macroecological patterns.
Ultimately, deep learning introduces an objective, reproducible standard to species delimitation, which can rapidly accelerate the discovery and revision of plant diversity worldwide.