# Project Database of ICP Forests
# PROJECT DESCRIPTION

## PROJECT INFORMATION

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| **Project title:** | **ENVision: a platform for analysing natural ecosystems using aerial and satellite data** |
| **Project ID:** | **310** |
| **Contact person:** | **Ruzena Janoutova (janoutova.r@czechglobe.cz)** |

## PROJECT DESCRIPTION

The project aims to leverage advanced deep learning techniques, specifically convolutional neural networks (CNNs), to estimate critical vegetation parameters from remote sensing data. We will employ supervised learning using radiative transfer models (RTMs) for vegetation reflectance simulation (e.g., DART, PROSAIL), where we will provide ground-truth evaluations. This will generate Look-Up Tables (LUTs) of spectral data corresponding to training examples. A suitable distance metric will be used to match simulated and real spectra, resulting in vegetation parameter evaluations. The project will involve extensive experimentation with hyperparameters such as batch size, network architecture, and more.

Our focus will be on plant functional traits, including LAI, chlorophyll and carotenoid content, canopy water content, equivalent water thickness, specific leaf area and phenology indicators. These traits have significant implications for plant fitness and ecosystem functioning, making their remote sensing-based estimations invaluable for ecological research and forest management.

We plan to utilize state-of-the-art deep learning frameworks such as PyTorch and potentially Tensorflow 2.x. The computational power required for this research will be provided by new compute nodes equipped with NVIDIA A40 graphics cards in a MetaCenter environment. Quality validation of predictions will be conducted using several metrics, including RMSE, rRMSE, and R2, based on ground measurements.

The project's significance lies in its potential to advance our ability to monitor plant functional traits at a global scale efficiently and cost-effectively. Retrieving such traits from remote sensing data, as opposed to labor-intensive field measurements, offers both spatial and temporal advantages. It enables us to understand the impact of changing environmental conditions on forest ecosystems, aiding in the development of adaptation strategies and ecosystem services management.

In summary, this project combines cutting-edge deep learning techniques with remote sensing data from satellites like Sentinel-2 and HLS to empower seasonal monitoring of plant functional traits. The research will contribute to our understanding of forest ecosystems, their responses to environmental changes, and the potential for improved ecosystem services estimation.