

# COUNTRY HOT TOPICS

## GOFC-GOLD Network: SCERIN / MedRIN

Country: Czech Republic

Team: Jana Albrechtová<sup>1,2</sup>, Lucie Kupková<sup>1</sup>, Zuzana Lhotáková<sup>1</sup>  
František Zemek<sup>2</sup>, Petr Lukeš<sup>2</sup>, Olga Brovkina<sup>2</sup>, Miroslav Píkl<sup>2</sup>

1 – Charles University, Faculty of Science

2 – Global Change Research Institute of CAS

## Remote Sensing ‘hot topics’:

- Commercial Smallsat data analysis for advancing the HLS products for agricultural and forest productivity (P. Campbell, J. Albrechtová, P. Lukeš et al.)
- Integration of Earth Observation, in situ Leaf Functional Traits, and Continuous Dendronetwork Measurements for Assessing Changes in Forest Stands Vitality in Czechia (J. Albrechtová, P. Lukeš, Z. Lhotáková et al.) – new proposal
- A potential of silver fir regeneration for afforestation after bark beetle outbreak in the Czech Republic: pilot study for RS-based physiological evaluation using leaf-level reflectance and needle functional traits. (**SCERIN/MedRIN 2024 poster of Z. Lhotáková et al.**)
- Assessment of the impact of land cover changes on local hydrology and climate in the Krkonoše Mts. National Park using remote sensing and hydrological modelling (L. Kupková, J. Albrechtová, P. Lukeš, Z. Lhotáková et al.) (**SCERIN/MedRIN 2024 poster of L. Kupková et al.**)
  - Monitoring the spread and management of invasive and expansive species using advanced earth observation methods (Kupková et al.)
  - Earth observation technologies for the surveillance activities of the Czech Environmental Inspectorate (Kupková et al.)
  - Evaluation of evapotranspiration from alpine peat-bog by an advanced UAV technology (Kupková et al.)
- Water management analysis to support natural flooding and the transformation effect of the floodplain (**SCERIN/MedRIN 2024 expert talk of F. Zemek, 07/19**)
- Monitoring of natural and anthropogenic disturbances (**SCERIN/MedRIN 2024 expert talk of O. Brovkina, 07/18**)
- Cal/Val activities for new space mission CHIME (**SCERIN/MedRIN 2024 poster of M. Píkl, 07/16**)

Joint Workshop of the GOFC-GOLD SCERIN and MedRIN Networks

CIHEAM conference center, Chania, Greece, July 16 – July 19, 2024

Land Cover Change (LCC) and Extreme Events in the Context of Climate Change

Mediterranean Agronomic Institute of Chania

Region of Crete

Eratosthenes Center of Excellence, Cyprus University of Technology

Aristotle University of Thessaloniki

NASA LCLUC Program

GOFC-GOLD and START, USA



Presented by J. Albrechtová and O. Brovkina



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**Charles University:** Jana Albrechtová, Lucie Kupková, Zuzana Lhotáková

**CzechGlobe:** Petr Lukeš, Jan Krejza, Růžena Janoutová, Antonín Kusbach

## Joint SCERIN – U.S. Projects:

### 1) LCLUC Program NASA CSD (2024-2025):

“Commercial Smallsat data analysis for advancing the HLS products for agricultural and forest productivity” NASA/ROSES 2023;

- PI – P. Campbell, International Collaborators: J. Albrechtová, P. Lukeš

### 2) Ministry of Education, Czechia (submitted 10/07/2024, planned duration 2025-2028):

Integration of Earth Observation, in situ Leaf Functional Traits, and Continuous Dendronetwork Measurements for Assessing Changes in Forest Stands Vitality in Czechia

PI – J. Albrechtová, Co-I, P. Lukeš, collaborators from NASA LCLUC Program:

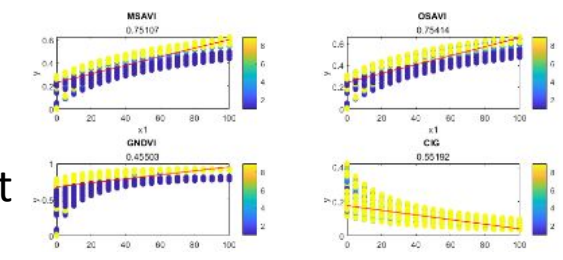
**U.S. collabortors: P. Campbell UMBC / GSFC NASA; H.Epstein, Univeristy of Virginia; J.Eitel, University of Idaho USA**

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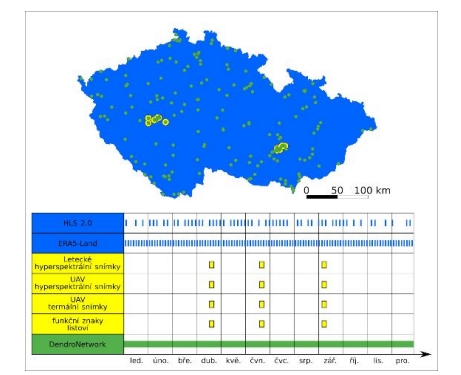
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 NASA LCLUC Program  
 GOFC-GOLD and START, USA



Simulated chlorophyll VIs with wide range of structures



Proposed database of in-situ and RS observations for extrapolating forest vitality from plot to country scale



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Team: Jana Albrechtová, Zuzana Lhotáková, Pavel Bednář

### Charles University Prague - Team of Ecophysiology - groundtruthing;

**Project :** Silver fir as an important tree species for forest conversion in the Czech Republic and the influence of regeneration fellings and site conditions on its growth, vitality, resilience against phytopathological agents and mycorrhizal development (QL24010275): <https://starfos.tacr.cz/en/projekty/QL24010275>

**Funding:** The National Agency of Agricultural Research of the Czech Republic, Project QL24010275

#### Collaborations in joint project:

- Research Institute of Forestry and Game Management ([www.vulhm.cz](http://www.vulhm.cz)) - Pavel Bednář; (Orcid: [0000-0003-1250-5762](https://orcid.org/0000-0003-1250-5762));
- Charles University, Fac. Sci. ([www.natur.cuni.cz](http://www.natur.cuni.cz)) – Jana Albrechtová (Orcid: [0000-0001-6912-1992](https://orcid.org/0000-0001-6912-1992))
- Mendel University in Brno (<https://mendelu.cz/en/>) - Aleš Kučera

#### Aims:

- The evaluation of the physiological status of young fir based on needle functional traits.
- The light-environment related variability in the leaf-level reflectance is evaluated for future remote sensing application.

#### Conclusions:

1. Leaf-level optical properties showed a potential for distinguishing stands adapted to different light microclimate.
2. Differences in the leaf-level reflectance are promising for remote sensing (e.g. UAV-based) evaluation of silver fir physiological status for reforestation.

[www.natur.cuni.cz/en](http://www.natur.cuni.cz/en)

<https://natur.cuni.cz/en/biology/departments-and-work-places/departm-ent-of-experimental-plant-biology/research/plant-ecophysiology>



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Forestry and Game  
Management  
Research Institute

- Mendel
- University
- in Brno
- 

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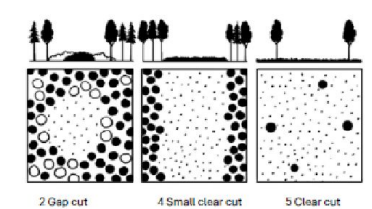
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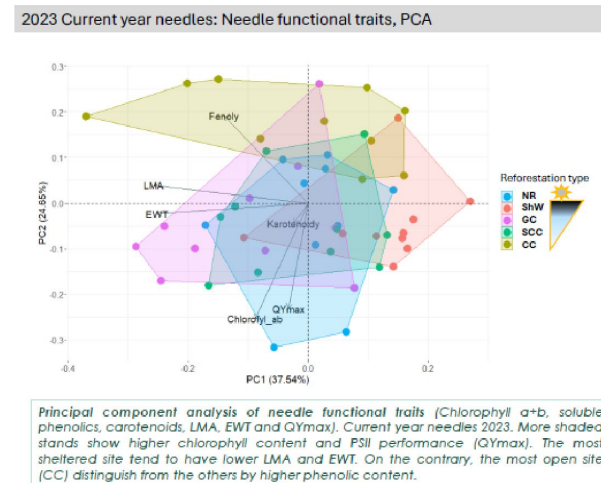


Poster: Zuzana Lhotáková, Eva Kabilková, Pavel Bednář, Jana Albrechtová: A potential of silver fir regeneration for afforestation after bark beetle outbreak in the Czech Republic: pilot study for RS-based physiological evaluation using leaf-level reflectance and needle functional traits.

#### Site location and the light microclimate: natural regeneration and reforestation types



#### Bark beetle outbreak in the Czech Republic



Principal component analysis of needle functional traits (Chlorophyll a+b, soluble phenolics, carotenoids, LMA, EWT and QYmax). Current year needles 2023. More shaded stands show higher chlorophyll content and PSII performance (QYmax). The most sheltered site tend to have lower LMA and EWT. On the contrary, the most open site (CC) distinguish from the others by higher phenolic content.

Type of regeneration - abbreviation	Location (name)	Location (coordinates)	Altitude (m a.s.l.)	Degree of shading
1 Natural regeneration - NR	Holicky	49.9140528°N; 15.6992531°E	385	moderate
2 Shelter-wood cut - ShW	Kocanda 2	49.6635094°N; 15.9746097°E	740	high
3 Gap cut - GC	Kocanda 3	49.6695486°N; 15.9929700°E	740	moderate
4 Small clear cut - SCC	Kocanda 4	49.6660833°N; 15.9929950°E	740	moderate
5 Clear cut - CC	Znetínek	49.4812589°N; 15.9258356°E	579	low



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### Charles University Prague - Team of Image and Laboratory Spectroscopy – EO projects; [www.tilspec.cz](http://www.tilspec.cz)

**Project:** „Assessment of the impact of land cover changes on local hydrology and climate in the Krkonoše Mts. National Park using remote sensing and hydrological modelling“

Collaboration with CzechGlobe (Lucie Homolová, Petr Lukeš, Václav Bárta and Institute of Hydrodynamics CAS – Václav Šípek, Lukáš Vlček)

- Used multispectral data: Sentinel-2A, Landsat series
- Used hyperspectral data: CASI + SASI + TASI sensors
- **Evaluation of forest cover change from 1985 till 2023**
- **Forest health evaluation**

→ inputs for hydrological modelling (influence of forest cover change on local hydrology)

- **Outputs:**
  - **Map of potential forest threats**
  - **Methodology for monitoring the impact of land cover change on local hydrology using RS and hydrological modeling.**

Poster L. Kupková et al.

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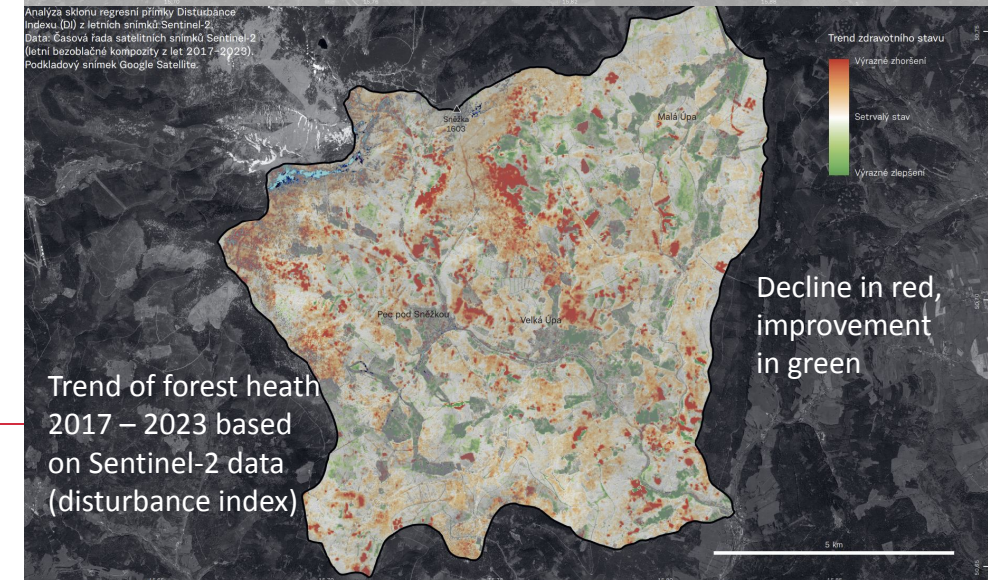
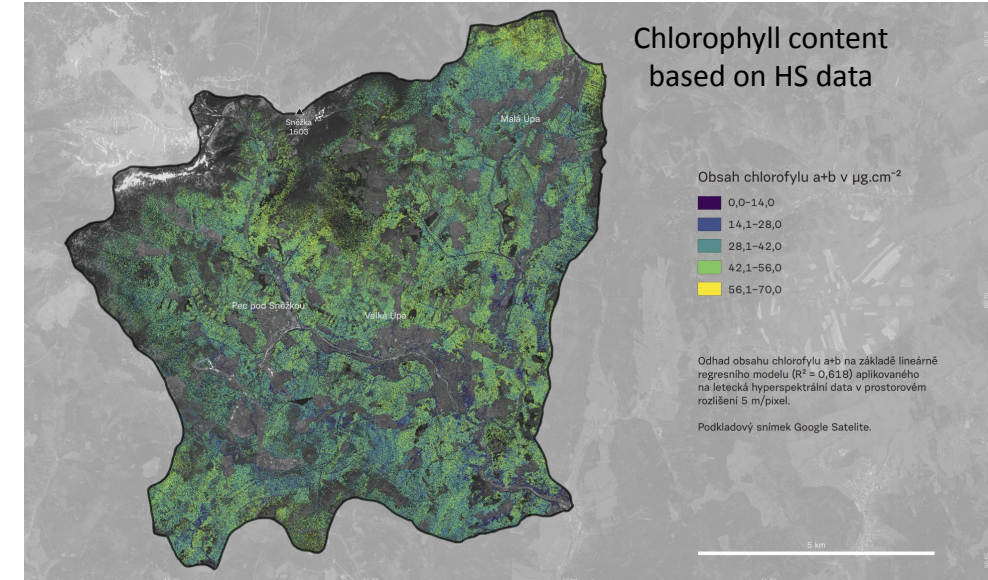
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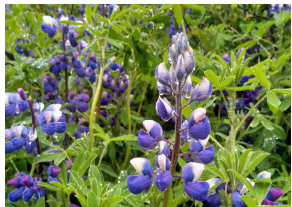
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### New EO projects:

#### 1. Monitoring the spread and management of invasive and expansive species using advanced earth observation methods

- 2 mountains ranges (the Krkonoše Mts., the Orlické hory Mts.)
- 6 species
- UAV and Planet data



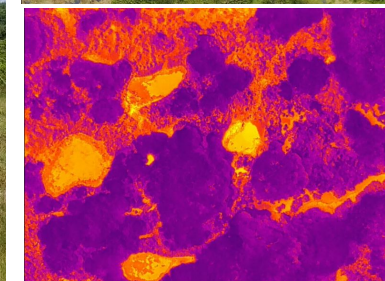
#### 2. Earth observation technologies for the surveillance activities of the Czech Environmental Inspectorate

- Asbestos monitoring
- Rare flower species identification
- Volumes of landfills
- UAV data, satellite data time series, new HS satellite TROLL (TRL Space Company)



#### 3. Evaluation of evapotranspiration from alpine peat-bog by an advanced UAV technology – main goals:

- 1) to estimate evapotranspiration (ET) its components over Úpské peat-bog patches (the Krkonoše Mts.) based on UAV-based TIR images with a high spatial and temporal resolution
- 2) to reveal the spatial variability of peat-bog ET with respect to surface vegetation characteristics and meteorological conditions



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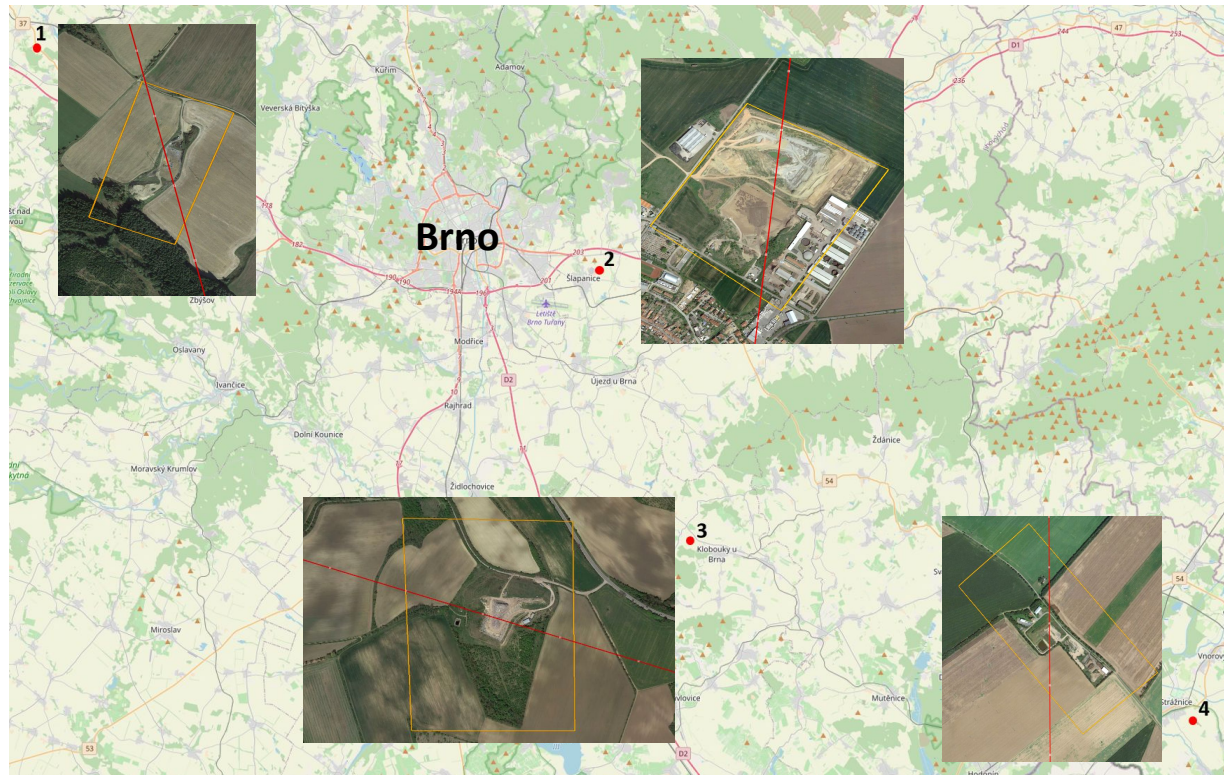
Team: František Zemek, Olga Brovkina, Miroslav Píkl



### Remote sensing monitoring of anthropogenic disturbances

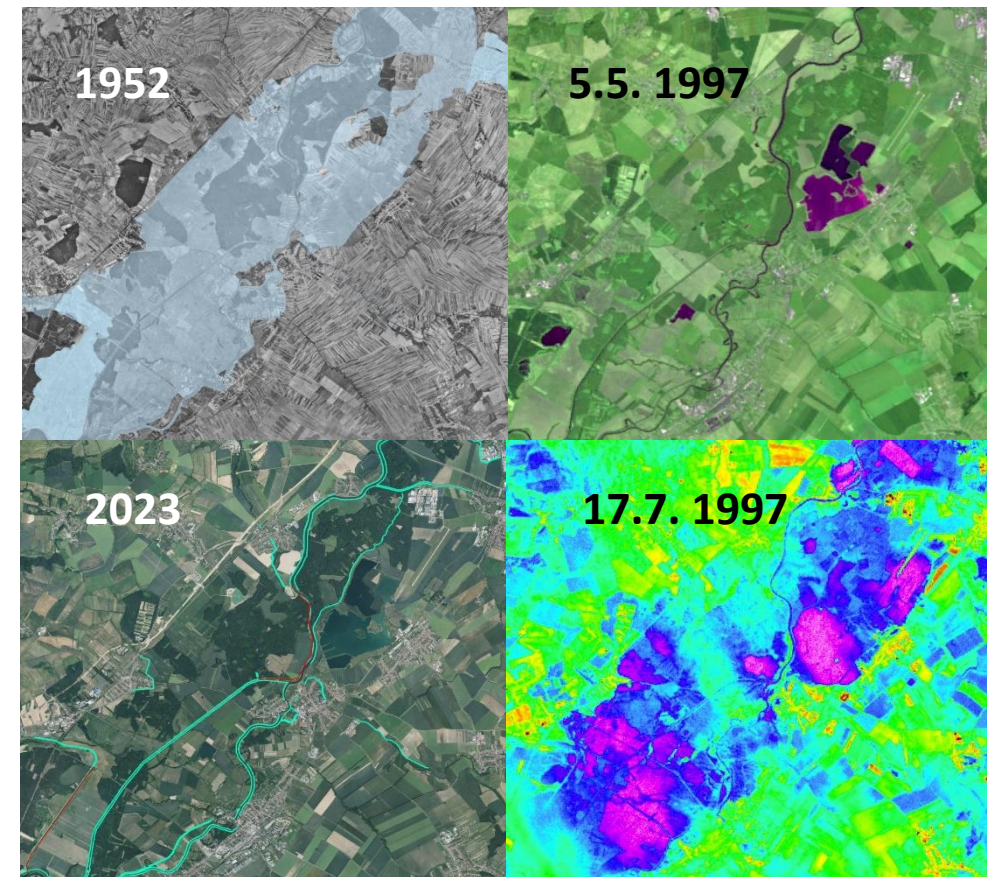
Airborne data VNIR, SWIR, TIR <https://olc.czechglobe.cz/en/home-en/>

Satellite data Landsat, CORONA, GHGSat, EMIT, EnMAP, PRISMA



Projects: Technology Agency of the Czech Republic grant number SS06020164, 2023-2025  
GHGSat/ESA Earthnet - Project 96477, 2024

### NIVALIS – multisource RS archive data for water management analysis to support natural flooding



Projects: Technology Agency of the Czech Republic, No SS07010401; 2024-26

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## Projects/ Success stories / Good practices

### Achieved

- *Geographical dimension: Czechia, Europe, USA;*
- *National and European infrastructure, integration into international research structures;*
- *NETWORKING OPPORTUNITIES (within a GOFC-GOLD SCERIN): joint R&D projects (USA-Czechia: NASA-LCLUC Program, INTER-EXCELLENCE by Ministry of Education of CZ); Slovenia–Czechia), EURIZON project (Ukraine with Czechia as coordinator), scientific publications, participation at the international conferences.*

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GOFC-GOLD  
Global Observations of Forest  
Cover and Land Use Dynamics

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Global Change Research Institute CAS

### Future plans

- *Main objective: to maintain our research goal to develop innovative RS based solutions allowing to study spatio-temporal changes of ecosystems under various environmental and anthropogenic pressure.*
- *NETWORKING OPPORTUNITIES (within a GOFC-GOLD SCERIN): scientific publications, participation at the international conferences, joined R&D project, joined scientific experiments*

1. Pikl, M., Brovkina, O., Zemek, F., Ladyka, M., Starodubtsev, V. 2024. Effects of urbanization and Kaniv Reservoir on the thermal characteristics in the region. EUROPEAN JOURNAL OF ENVIRONMENTAL SCIENCES. 14. 33-42.
2. Neuwirthová, E., Lhotáková, Z., Červená, L., Lukeš, P., Campbell, P. and Albrechtová, J., 2024. Asymmetry of leaf internal structure affects PLSR modelling of anatomical traits using VIS-NIR leaf level spectra. *European Journal of Remote Sensing*, 57(1), p.2292154.
3. Stejskal, J., Čepl, J., Neuwirthová, E., Akinyemi, O.O., Chuchlík, J., Provazník, D., Keinänen, M., Campbell, P., Albrechtová, J., Lstibůrek, M. and Lhotáková, Z., 2023, Nov. Making the genotypic variation visible: hyperspectral phenotyping in Scots pine seedlings. *Plant Phenomics*, 5, p.0111.