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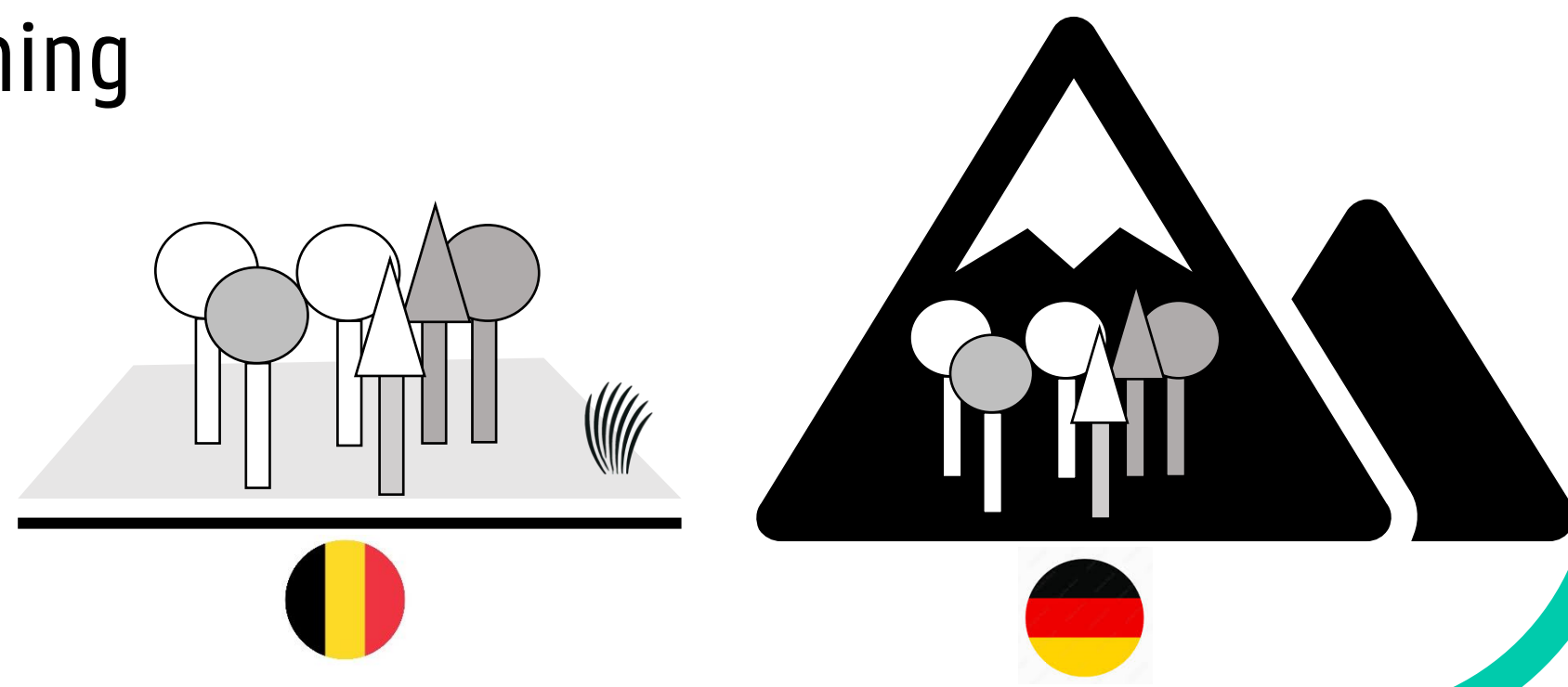
UTILISING LIDAR TO QUANTIFY FOREST STRUCTURE AND ITS RELATIONSHIP WITH FOREST MICROCLIMATE

Highlights

- High-resolution terrestrial laser scanning of forests to measure structural properties up to individual tree level
- Effect of forest structure on microclimate buffering capacity
- Tracking forest structural changes across seasons using **Permanent Laser Scanning**

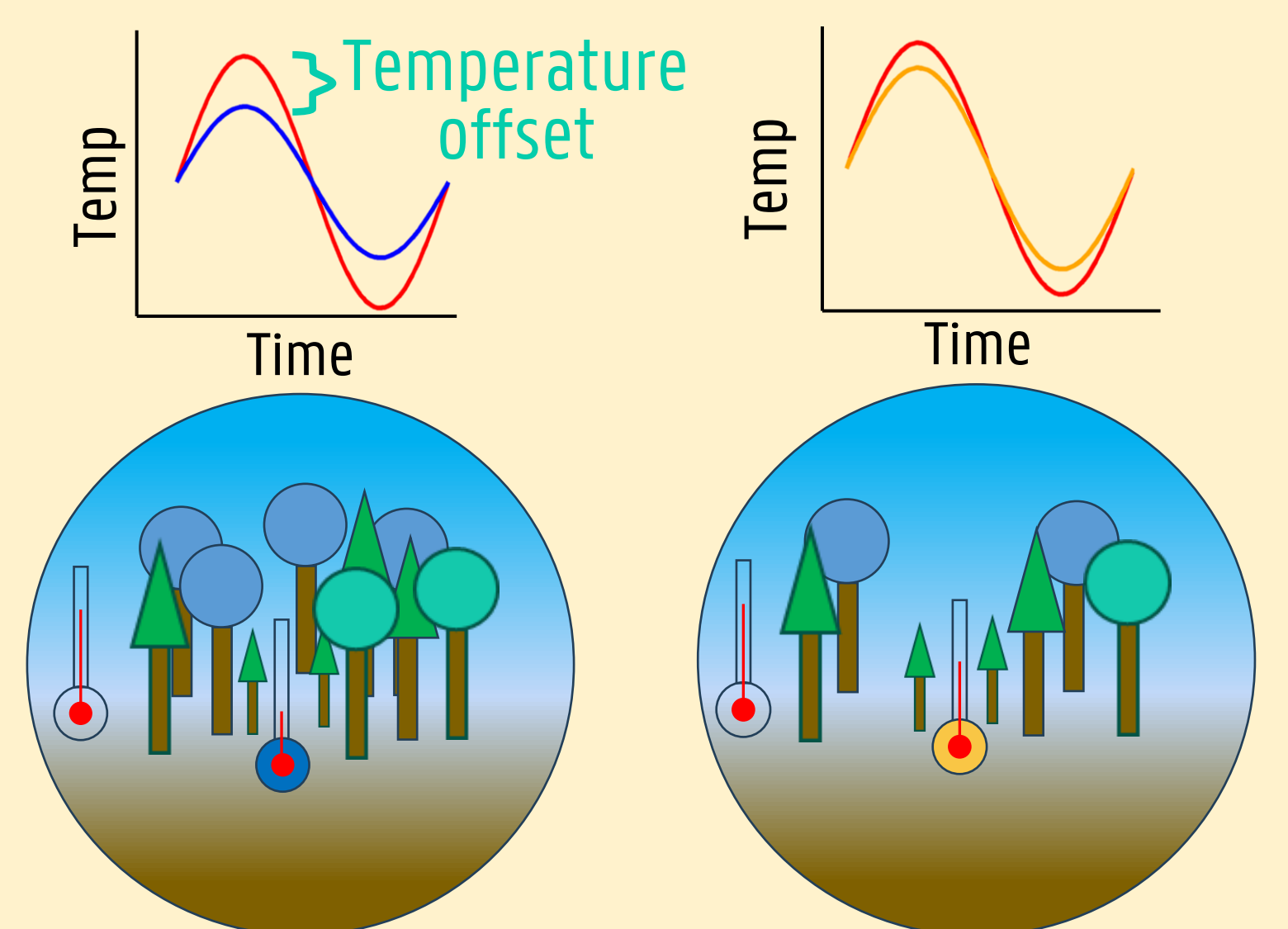
Study Area

- Eight 1-hectare sites
- 4 temperate maritime
- 4 alpine



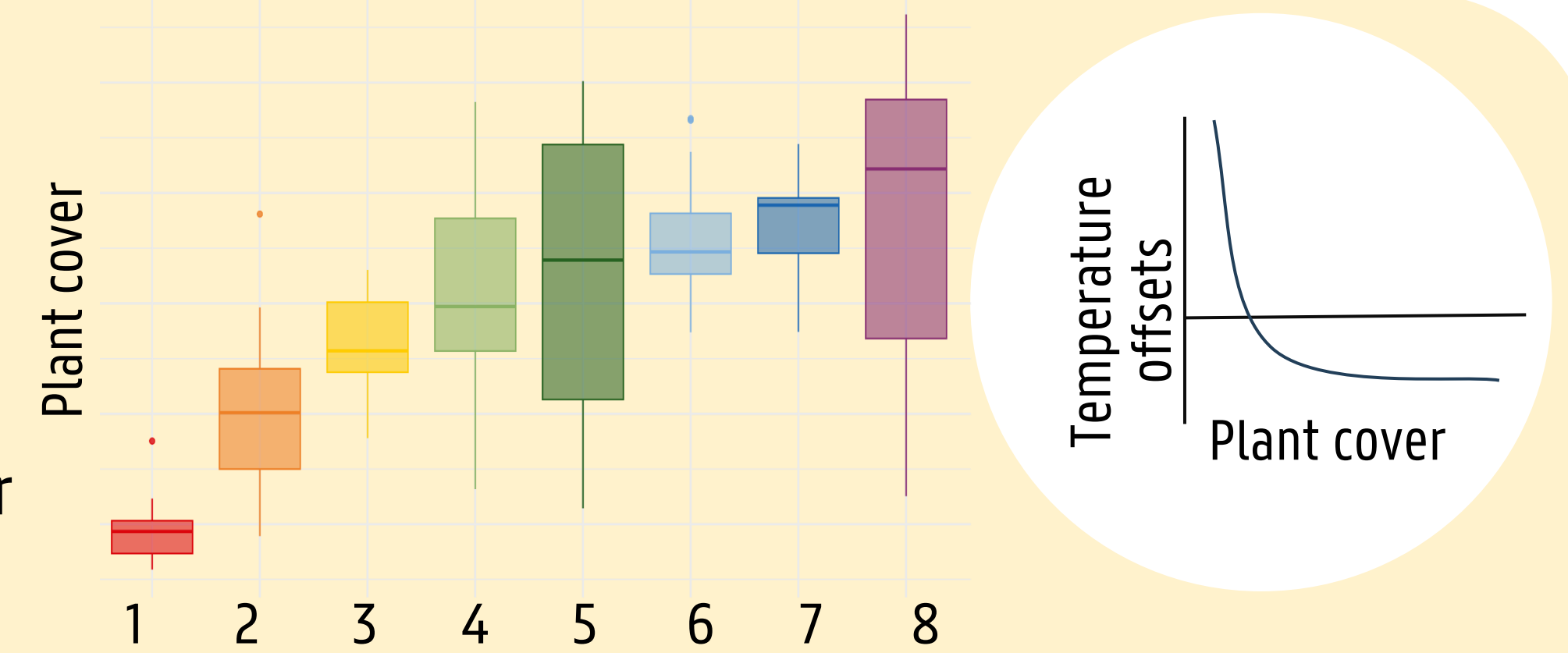
Context

Quantifying forest structure is essential to understanding its role in microclimate buffering, offering insights into how vegetation stabilises local environmental conditions



Results

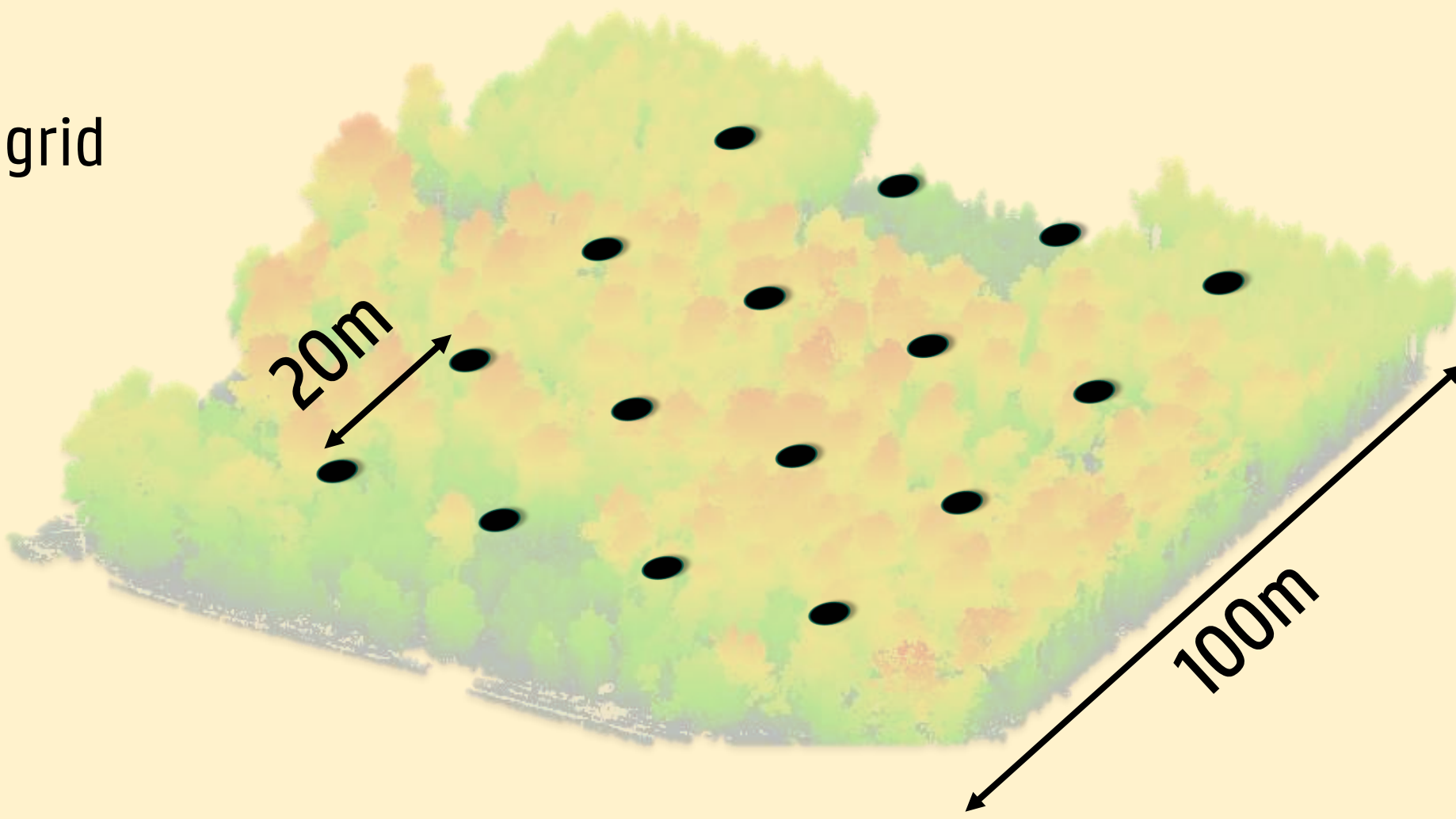
- Plant cover (PAI) influences offsets
- Saturation at higher PAIs



Methods

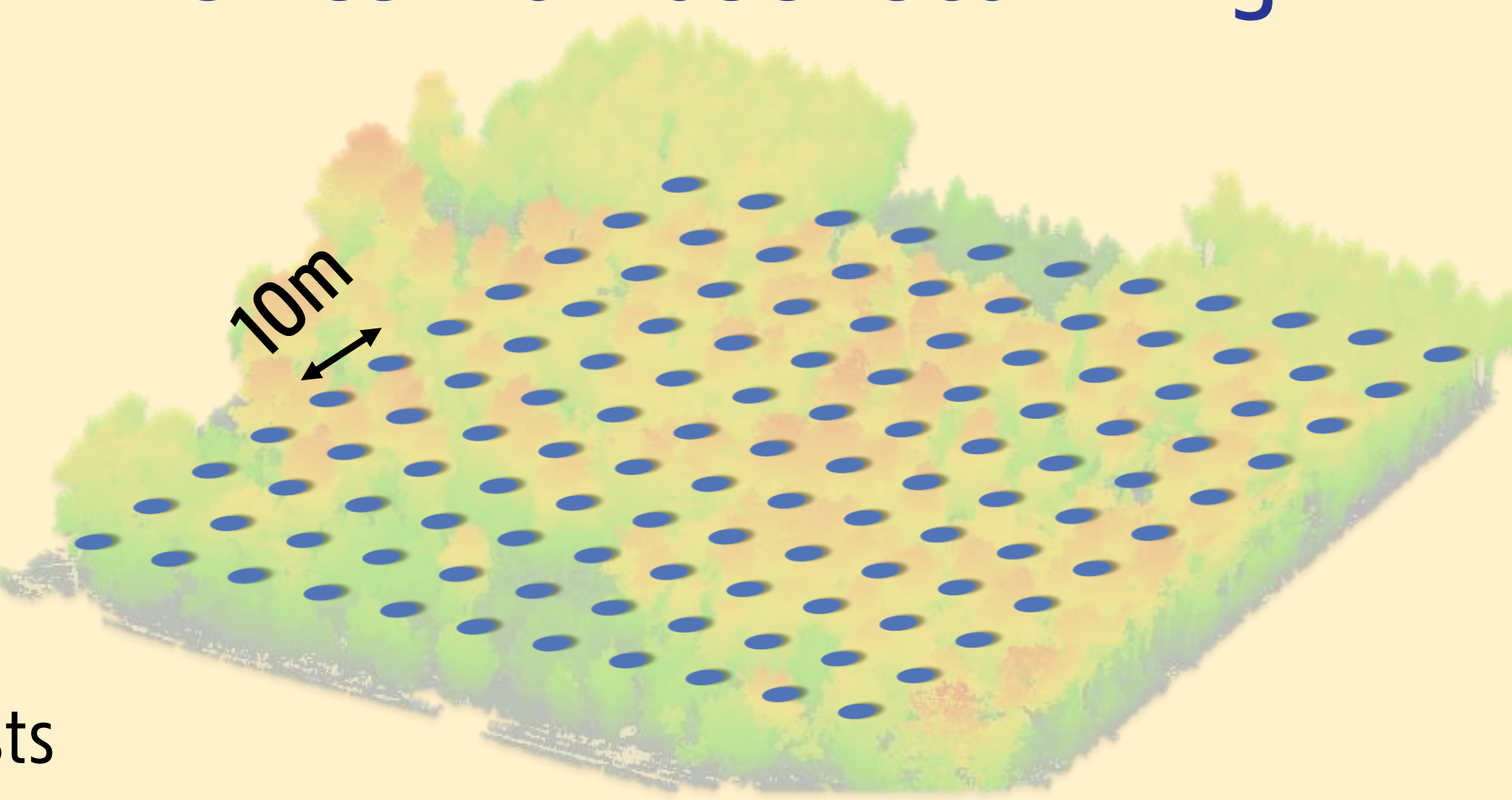
Microclimate measurements

- Forest temperature measurements in a 4 × 4 grid at a 20m spacing
- Temperature logging every 15 minutes
- $\frac{1}{n} \sum_{i=1}^n \begin{pmatrix} T_i^{\text{micro,max}} \\ -T_i^{\text{macro,max}} \end{pmatrix}$



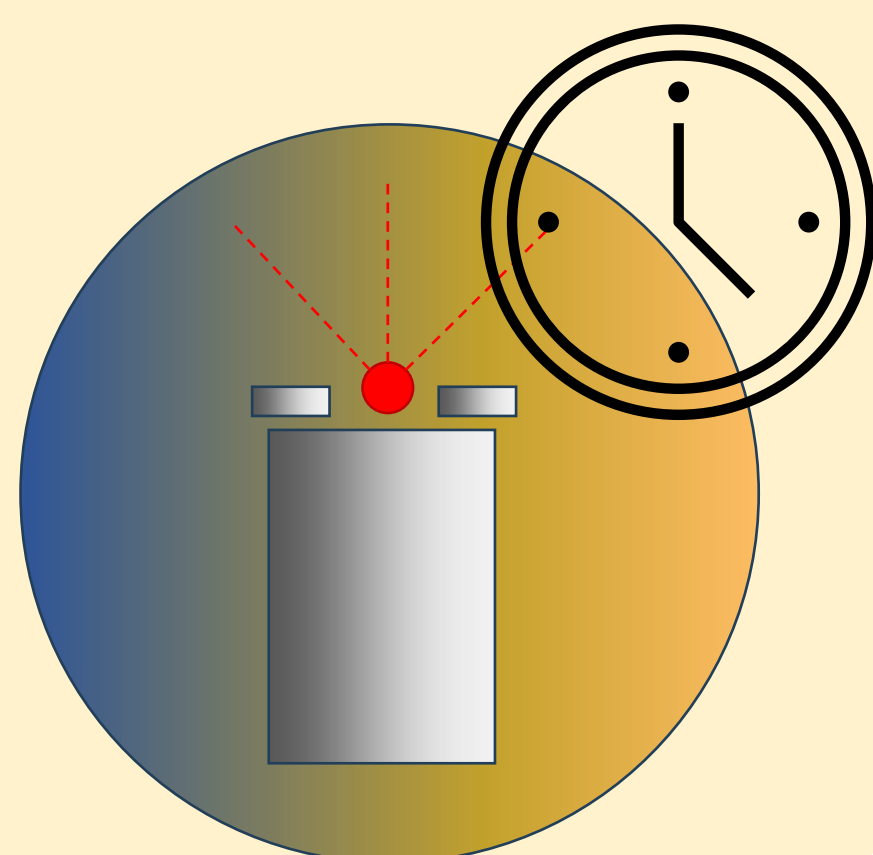
Terrestrial laser scanning

- **Annual** terrestrial laser scanning every summer
- Laser scanning in a 10m × 10m grid to **minimise occlusion**
- High resolution TLS allows for estimating structural characteristics of the forests based on **gap-fraction-based** methods and **3D modelling**

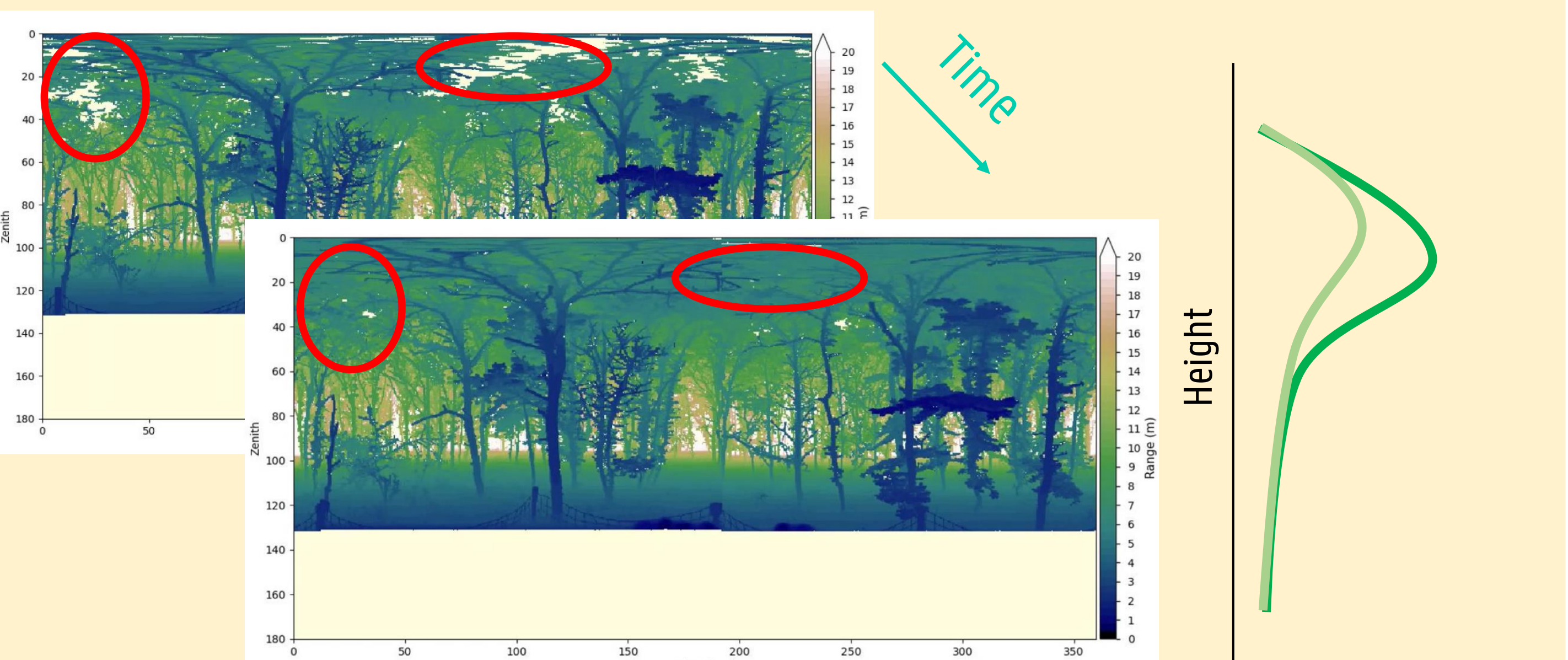


Permanent laser scanning

- **Permanent laser scanners (PLS)** were installed in the sites in summer 2024
- Sites contain 1-2 sensors, which **scan autonomously** at 0.45° resolution
- **Daily gap-fraction-based estimates** of plant area index



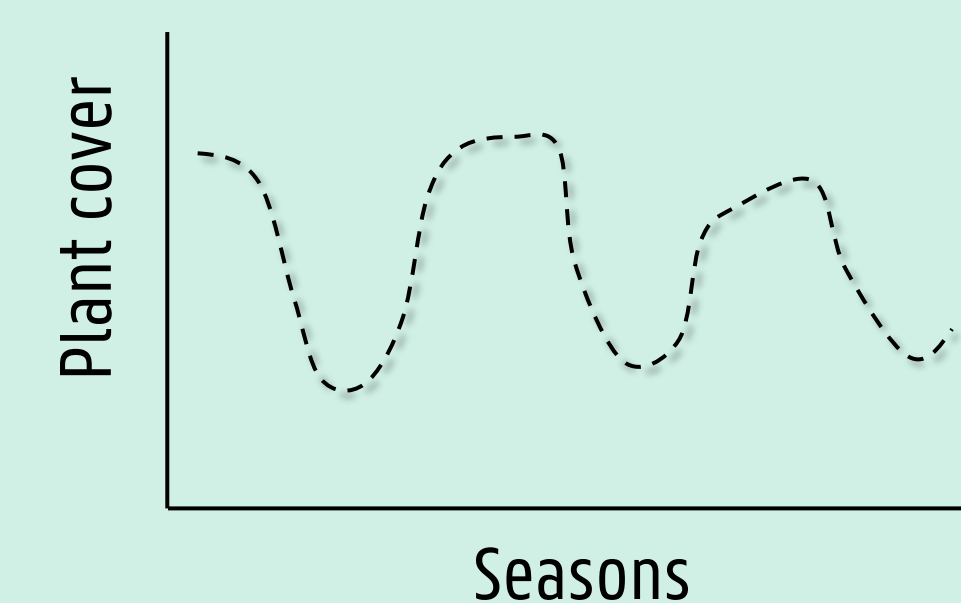
- Individual trees identified in high resolution TLS data
- Metrics computed for individual trees



- Daily PLS data capture changes in the canopy

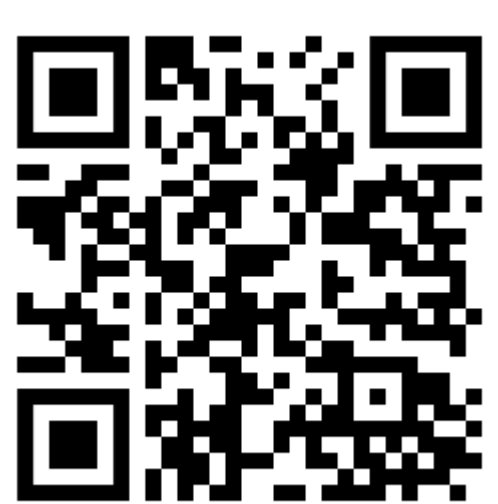
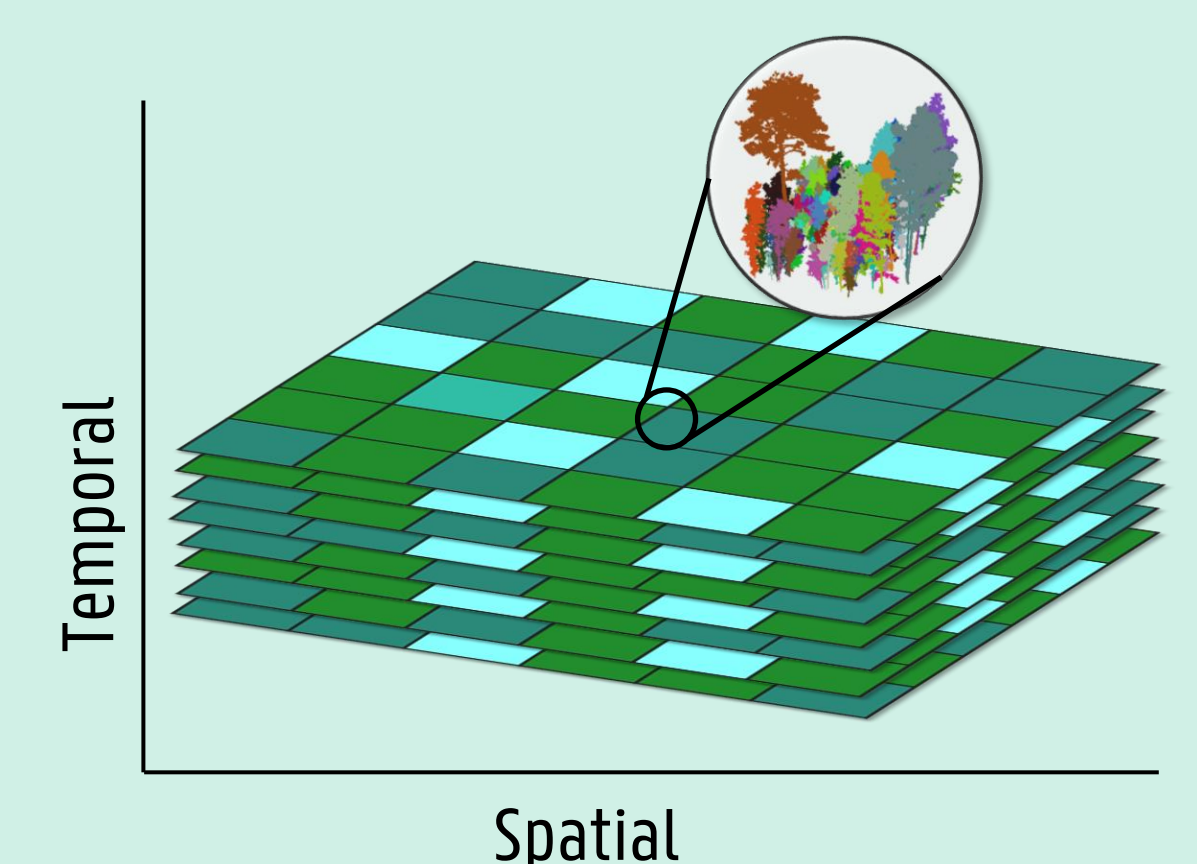
Current Work

- Identification of relevant forest structural parameters across space that influence forest microclimate
- Sensor calibration and capturing seasonal dynamics with permanent laser scanning



Future Work

- Assessment of spatiotemporal variation of forest structure
- Upscaling site-level assessment of microclimate buffering using satellite imagery



StrucNet

A growing global network of PLS

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