



Peat soil thickness and carbon storage in the Belgian High Fens: insights from multi-sensor UAV remote sensing

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INTRODUCTION

- Peatlands are known to store a large amount of carbon stock.
- Peat depth and carbon stock are spatially variable across a peatland landscape even at small scales, and uncertainties remain about the controlling factors.
- There are now new methods (i.e., GPR, UAVs) based on digital soil mapping and/or remote-sensing tools for collecting high-resolution data, thereby providing new opportunities for achieving accurate peat depth and carbon storage estimates.

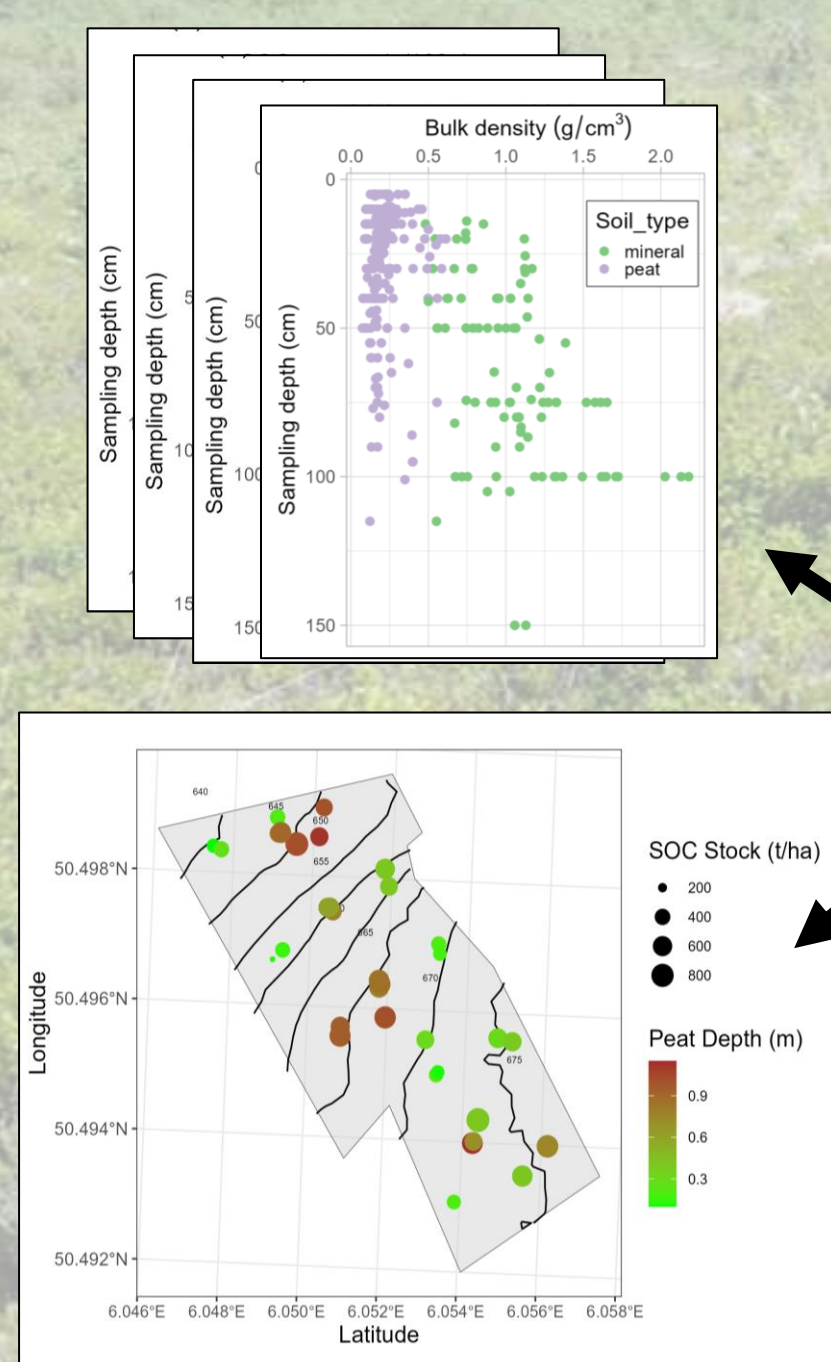
OBJECTIVES

- Characterizing the spatial and vertical distribution of peat soil thickness and carbon stock.
- Identifying factors that control carbon storage, with a specific focus on connections between surface and subsurface.
- Spatial mapping by UAV data.

STUDY SITE

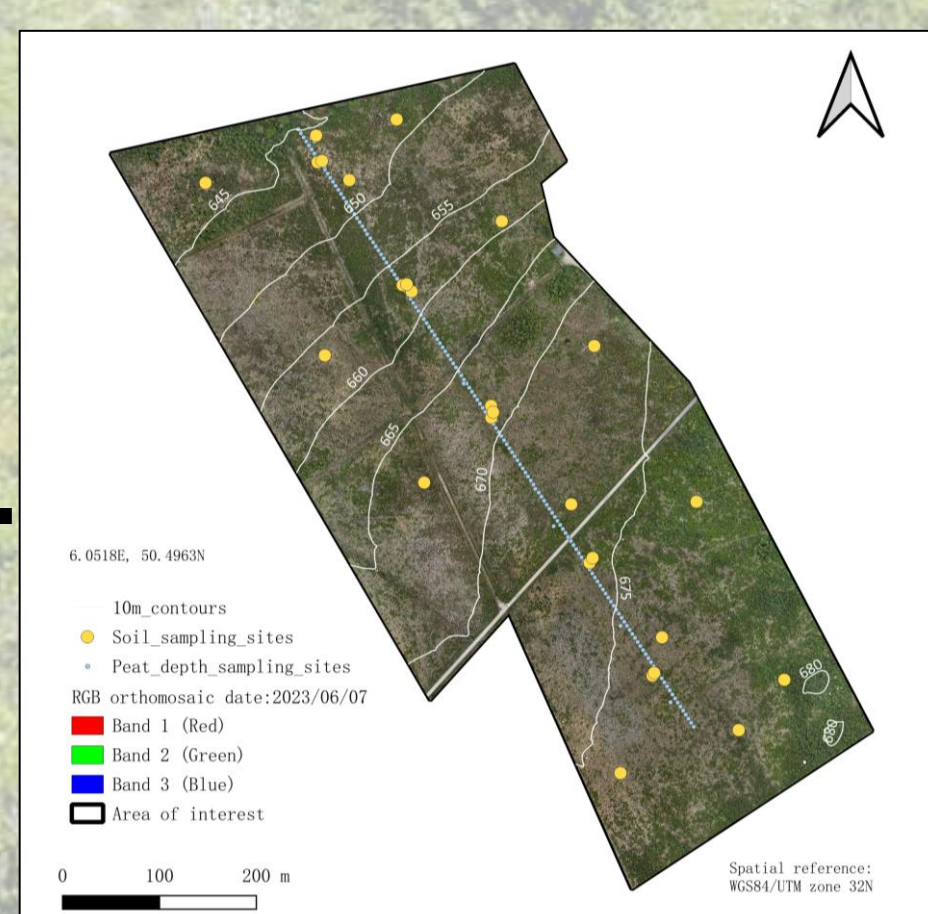
- Belgian Hautes Fagnes Plateau: situated in the east of Belgium and the southern part of peatlands in Europe.
- The site is characterized by a steep topographic gradient and humid climate.
- The site was drained for forestry in the early 20th century and it has been left to undergo natural evolution since 2017.

SOC, TN, bulk density, soil texture



METHODOLOGY

Soil sampling

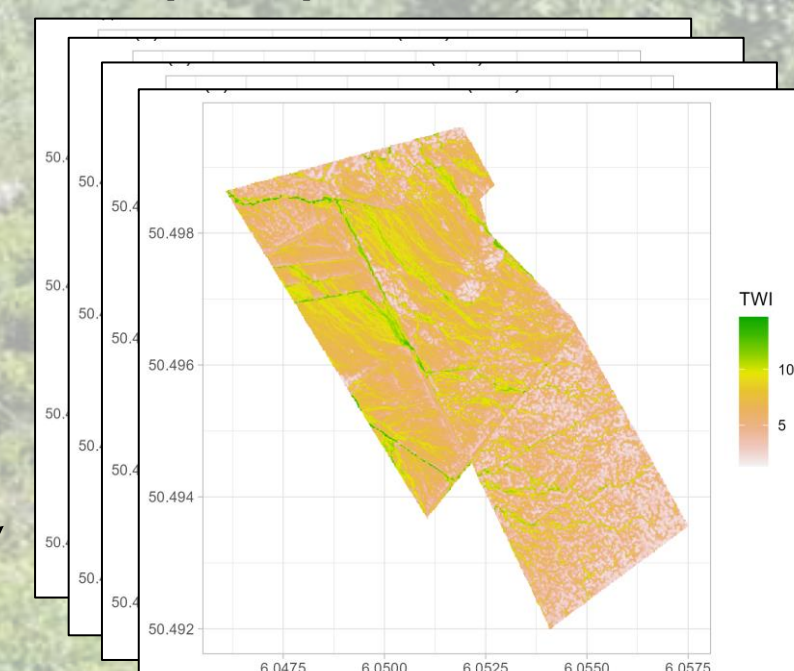


UAV surveys

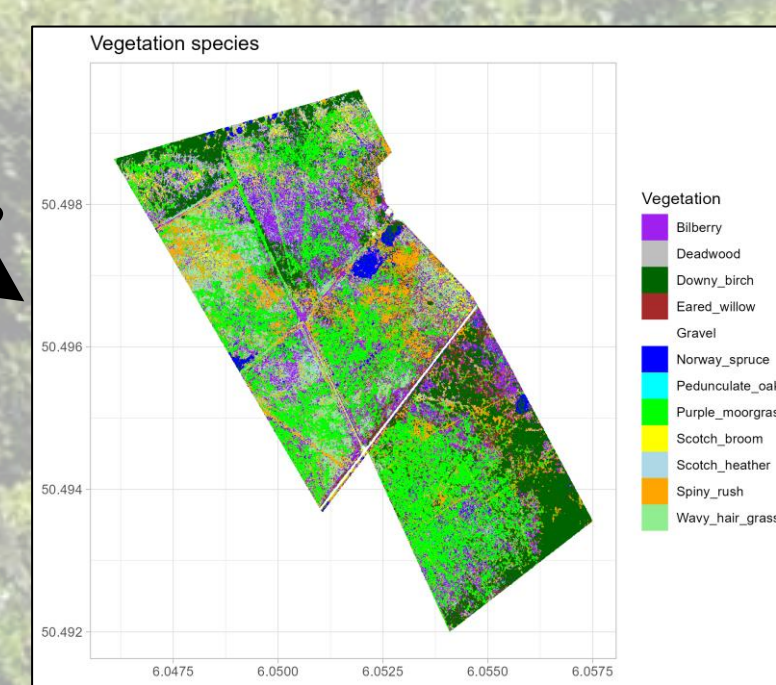


RGB, multispectral, thermal infrared, LiDAR

DEM, slope, aspect, curvature... TWI



topography
vegetation



RESULTS 1: PEAT DEPTH & SOC STOCK

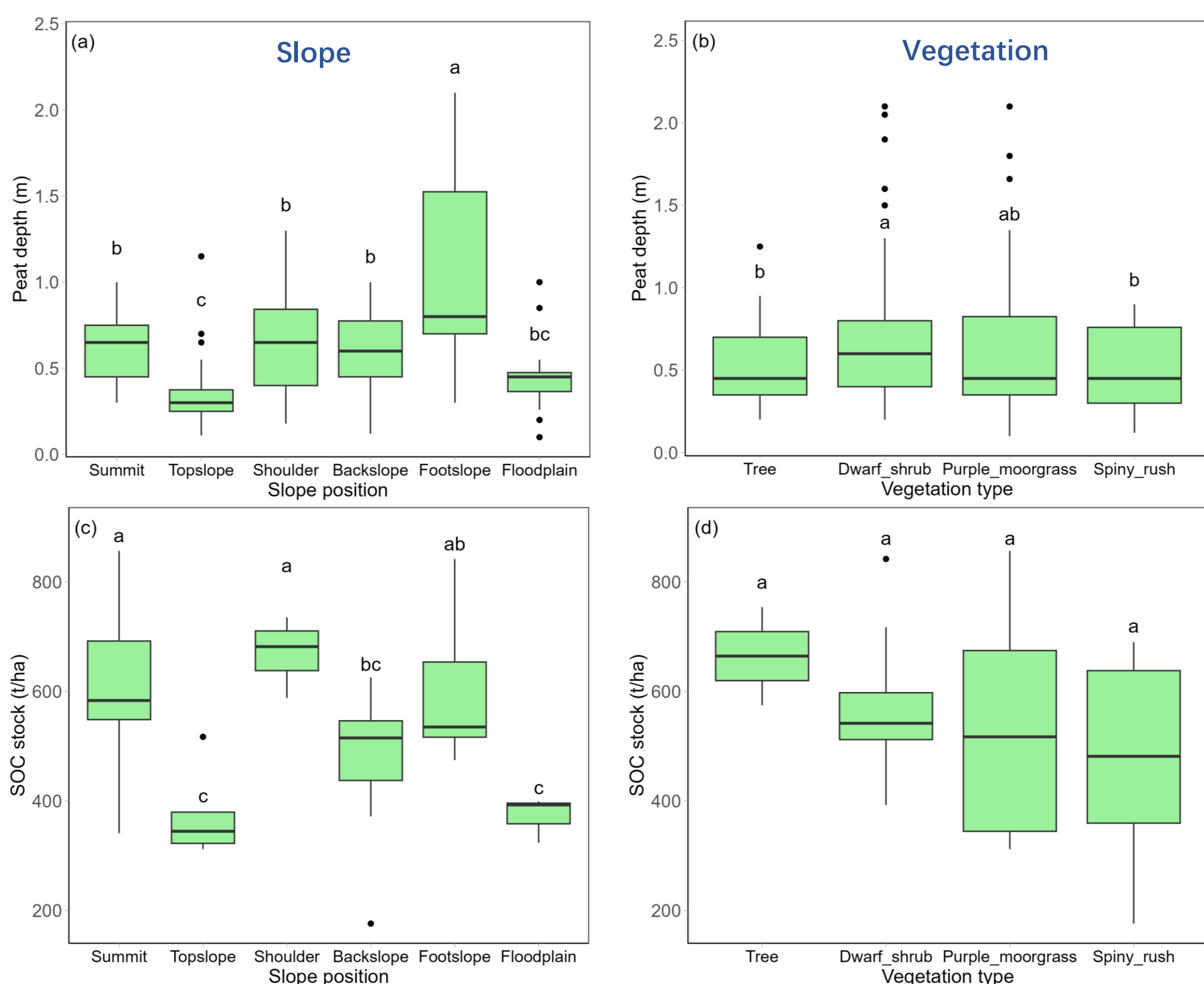


Fig. 1. The peat depth and the SOC stock (top 1 m) of different slope positions (a) (c) and different vegetation types (b) (d).

RESULTS 2: MICRO VS MACRO SCALES

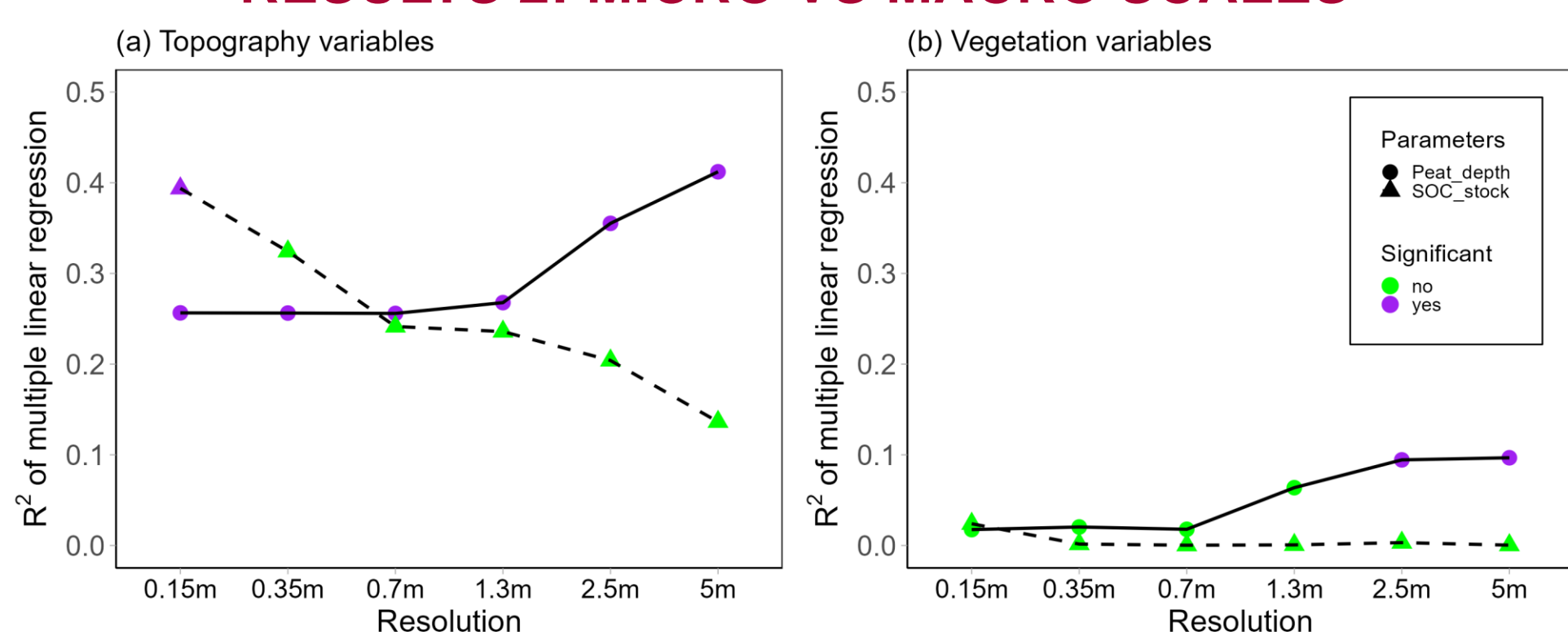


Fig.2. The results of multiple linear regressions of peat depth and SOC storage with topographic attributes and vegetation indices as input variables, respectively.

RESULTS 3: CONTRIBUTIONS FROM ENVIRONMENTAL FACTORS AT OPTIMAL SCALE

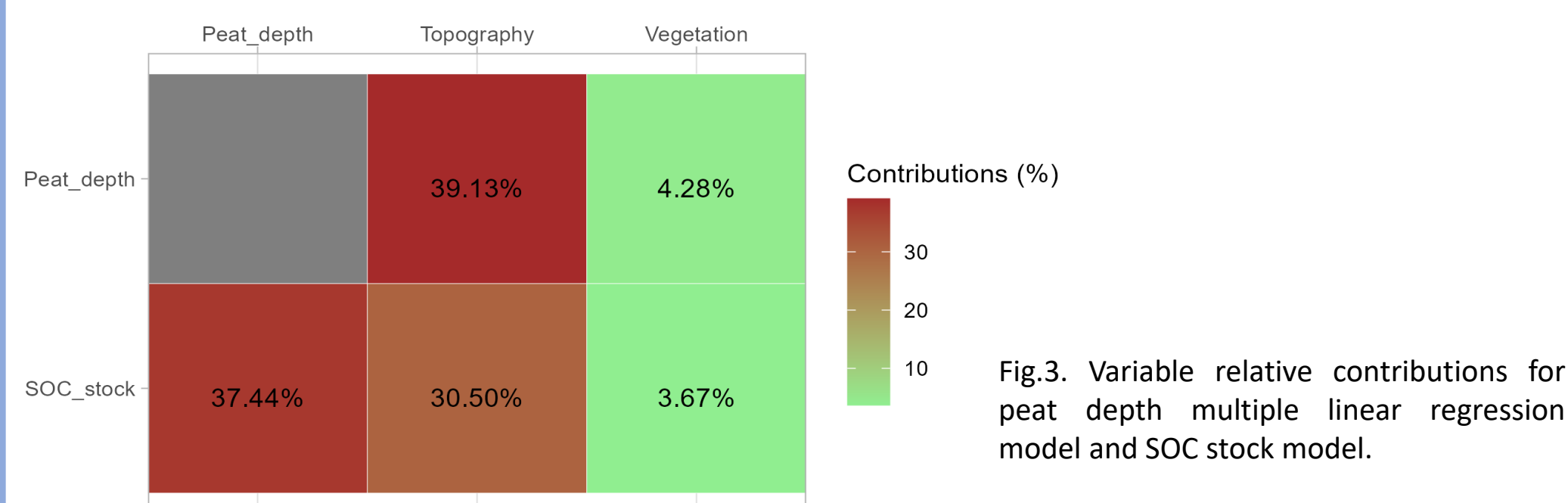


Fig.3. Variable relative contributions for peat depth multiple linear regression model and SOC stock model.

RESULTS 4: SPATIAL MAPPING USING UAV DATA

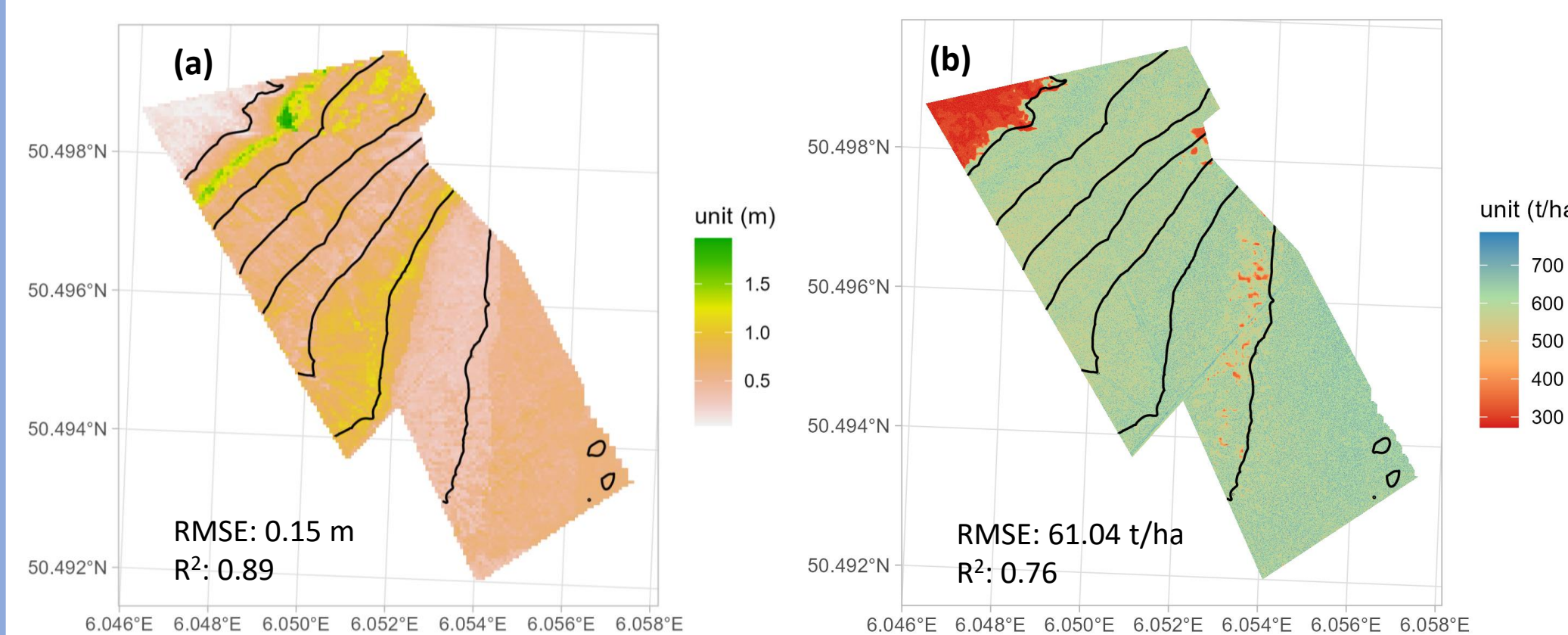


Fig.4. Spatial patterns of predicted peat depth (a) by the Cubist model using both topography and vegetation variables as predictors and spatial patterns of predicted SOC stock (b) by the Random Forest model using peat depth, topography, and vegetation variables as predictors. The black line in the map indicates contours.

CONCLUSIONS

- ❖ Both peat depth and SOC stock showed great spatial variability across the landscape, and the influences from environmental factors varied from micro- to macro-scales.
- ❖ Topography controlled the peat depth distribution, while peat depth was the most influential factor for SOC stock.
- ❖ Vegetation has limited contributions in explaining the spatial variability of both peat depth and SOC stock.
- ❖ UAVs had great potential in achieving accurate peat depth and SOC stock estimates.

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