

# Comparing the use of resource-intensive and freely available predictors to model soil organic carbon stocks in the Swiss Alps

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## Introduction

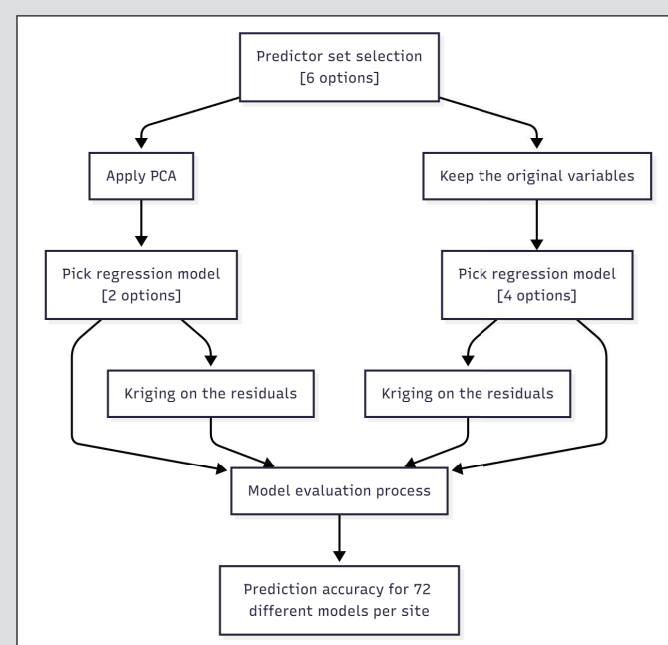
Predicting SOC stocks in montane ecosystems is difficult because bedrock, vegetation, topography, and soil properties vary over very short spatial scales<sup>1</sup>. Information on these predictors is often limited in remote environments and their acquisition is resource-intensive. Understanding the contribution of each predictor enables a targeted approach for accurate assessment of SOC stocks in montane ecosystems.

Here, we performed an extensive survey of SOC stocks at two Swiss montane sites: Ar du Tsan (VS) and Blatt (VS). We interpolated SOC stocks between the measurement locations based on resource-intensive predictors: soil and vegetation<sup>2,3</sup> types maps, and freely available predictors: plant biomass (NDVI), curvature, and published maps for lithology and elevation<sup>4</sup>.

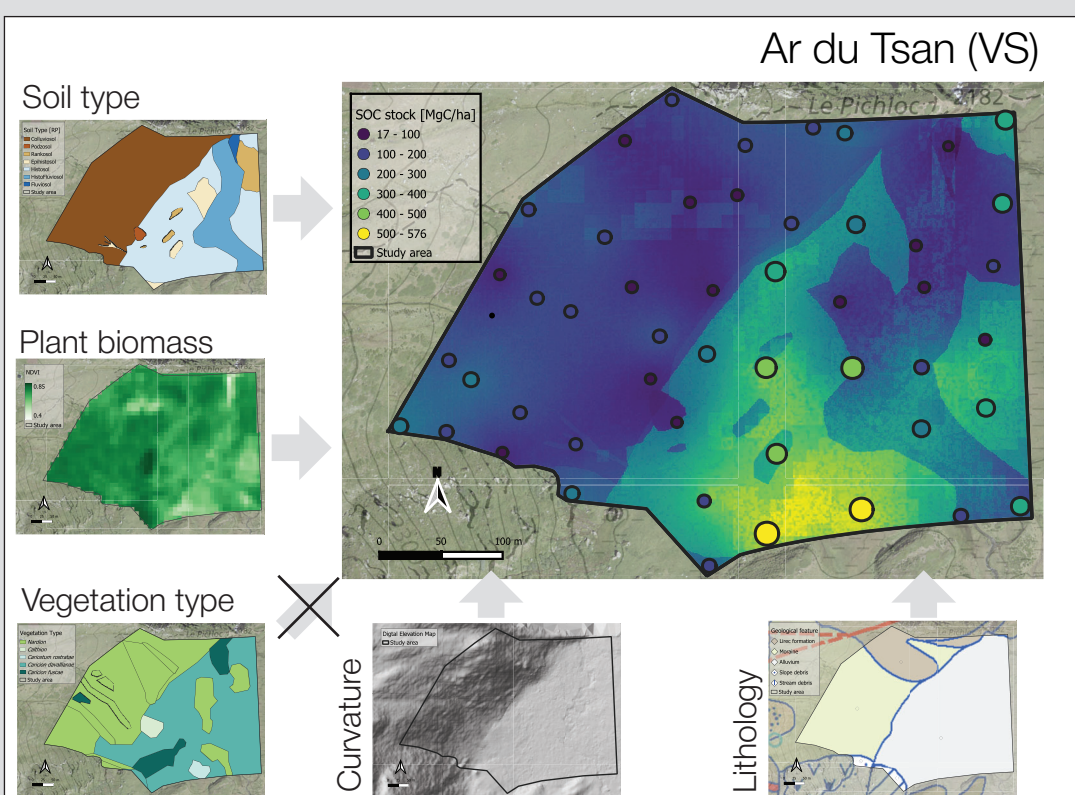
## Approach

**Experimental:** We measured SOC concentrations at 50 locations per site at soil depths of 0-10, 10-30 and 30-50 cm. SOC stocks were calculated based on fine soil (<2mm) abundances<sup>5</sup>.

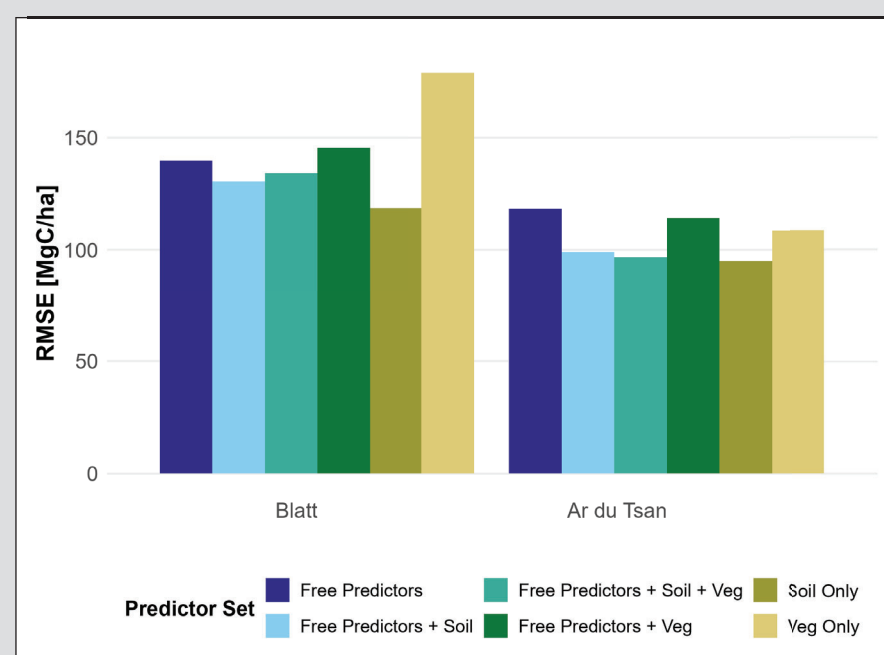
**Modeling:** We tested different sets of predictors and model parameters<sup>6</sup>. We evaluated models' performances and selected the best model based on the lowest RMSE.



## Results



The barplot represents RMSE values averaged over all regression and regression kriging models for untransformed predictors.



## Conclusions

Soil type holds the majority of the predictive power whereas vegetation barely improved or worsened the model.

Models including soil type performed best, adding other variables offered little to no improvement, indicating they do not add relevant information.

The best model including soil type achieved an average RMSE of 85, compared to 111 for the best model using only freely available predictors.

## References

<sup>1</sup>Matteodo, M. et al. (2018): *Decoupling of topsoil and subsoil controls on organic matter dynamics in the Swiss Alps*. Geoderma, 330, 41-51. | <sup>2</sup>Richard, J.-L. et al (1993), Bulletin Murithienne 111. | <sup>3</sup>Freléchoux and Gallandat (1995), Bulletin Murithienne 113. | <sup>4</sup>Federal Office of Topography swisstopo, 2024. | <sup>5</sup>Popleau, C. et al. (2017): *Soil organic carbon stocks are systematically overestimated by misuse of the parameters bulk density and rock fragment content*. SOIL, 3, 61-66. | <sup>6</sup>Hoffmann, U. et al. (2014): *Assessing the spatial variability of soil organic carbon stocks in an alpine setting (Grindelwald, Swiss Alps)*. Geoderma, 232-234, 270-234.