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Litter decomposition in ponds across a large latitudinal gradient

Martín, L.^{1*}, Pastor, A.¹, Cuenca-Cambronero, M.², Antón-Pardo, M.³, Colina, M.^{4,5}, Dede, C.⁶, Demierre, E.⁷, Fahy, J.C.⁷, Girard, L.⁸, Greaves, H.⁹, Lemmens, P.^{10,11}, Meerhoff, M.^{4,12}, Müláym, E.B.⁶, Patmore, I.R.⁹, von Plüskow, L.M.^{10,11}, Wijns, R.¹⁰, Brucet, S.^{2,13}, Boix, D.¹, Romaní, A.M.¹

¹GRECO, Institute of Aquatic Ecology, University of Girona, Spain; ²Aquatic Ecology Group, University of Vic - Central University of Catalonia, Spain; ³Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Spain; ⁴Department of Ecology and Environmental Management, Centro Universitario Regional del Este-Universidad de la República, Uruguay; ⁵Department of Ecology, Radboud Institute for Biological and Environmental Sciences, Radboud University, The Netherlands; ⁶Limnology Laboratory, Biological Sciences Department, Middle East Technical University, Turkey; ⁷Ecology and Aquatic Systems Engineering group, HEPIA, University of Applied Sciences and Arts Western Switzerland, Switzerland; ⁸Agroecology and Environment Research Unit, France; ⁹University College London (UCL) Pond Restoration Research Group, Department of Geography, Gower Street, London; ¹⁰Laboratory of Freshwater Ecology, Evolution and Conservation, KU Leuven, Belgium; ¹¹Leibniz Institute für Gewässerökologie und Binnenfischerei (IGB), Germany; ¹²Department of Ecosciences, Aarhus University, Denmark; ¹³ICREA, Catalan Institution for Research and Advanced Studies, Spain



Introduction

Ponds play an important role in the process of plant litter decomposition, contributing to the carbon cycle. Ponds are highly vulnerable to pollution and climate change, which can affect decomposition.

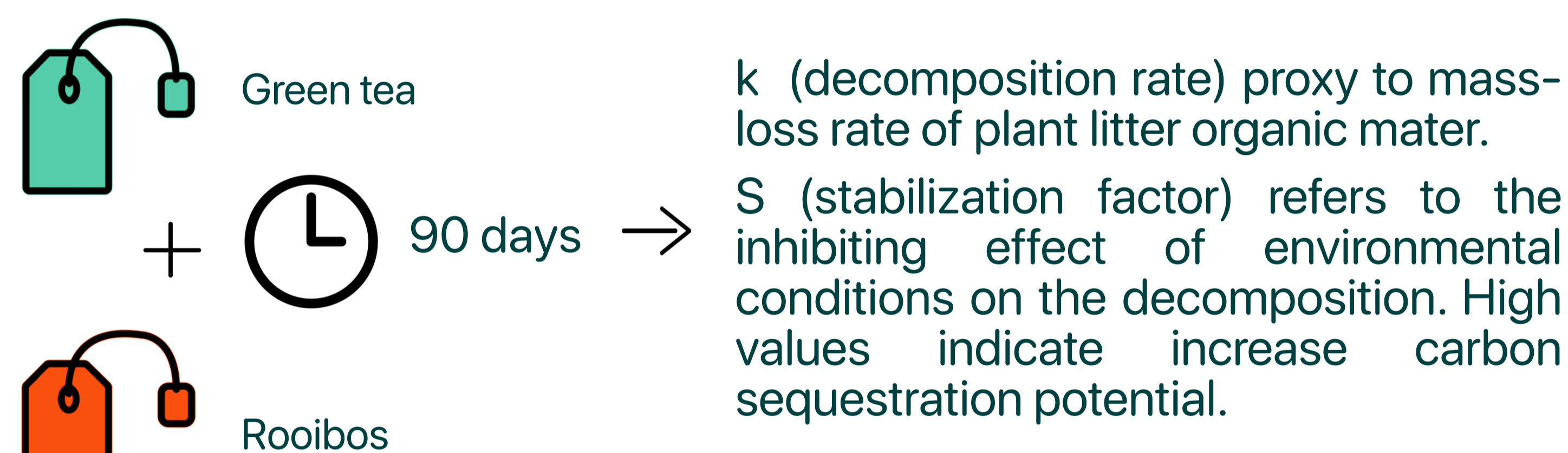
The aim of this project was to quantify the potential for microbial litter decomposition rate in ponds along a latitudinal gradient in different ecoregions, to identify the main drivers of its variability by using the Tea Bag Index (TBI), defined by the different decomposition of a labile tea (green tea) and a recalcitrant tea (rooibos).

Objectives

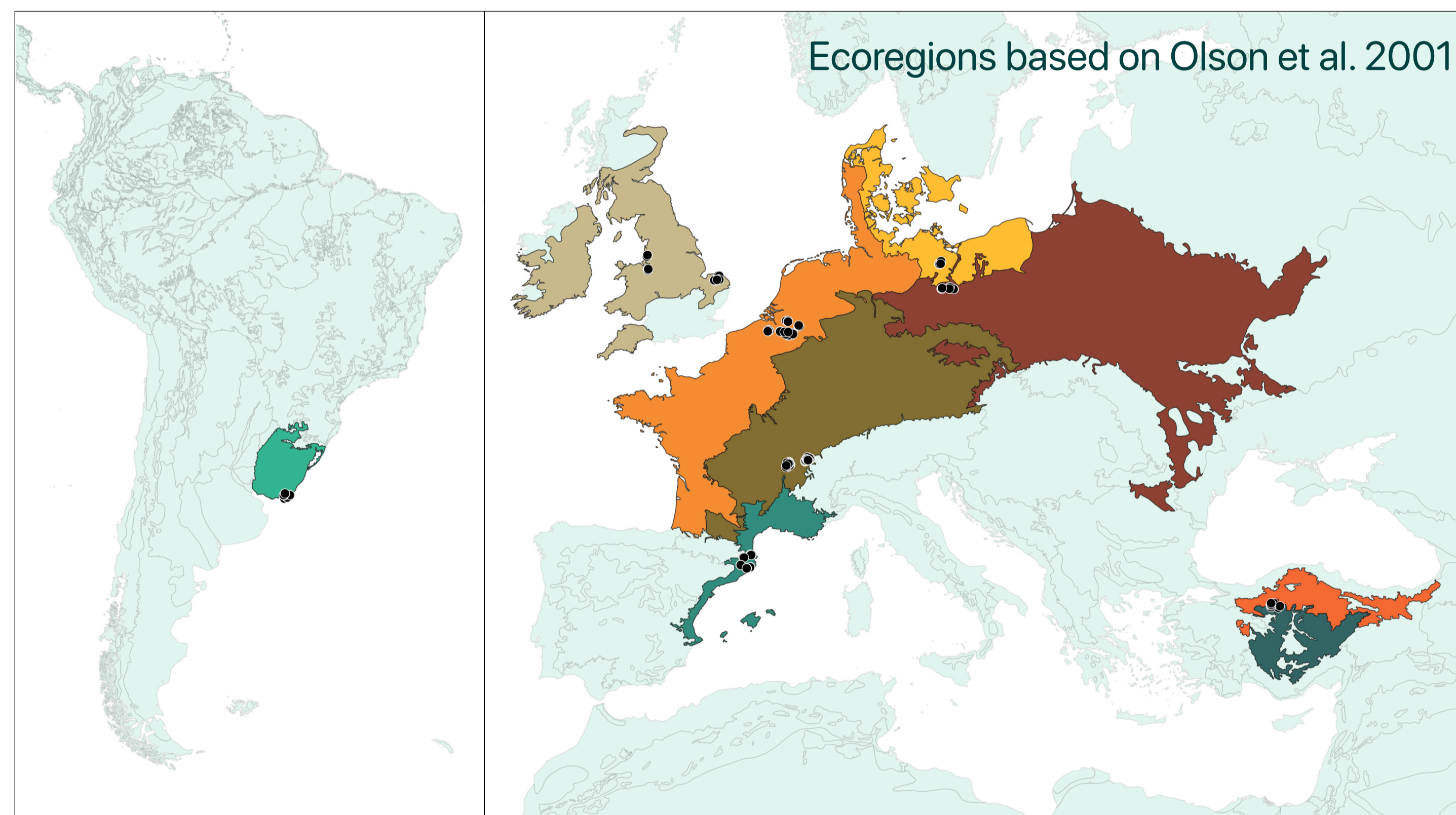
1. To quantify microbial litter decomposition in ponds along a latitudinal gradient.
2. To test the effect of latitudinal versus ecoregions to microbial litter decomposition.
3. To investigate the effect of hydroperiod and nutrients availability to microbial litter decomposition.

Materials and methods

A total of 250 ponds were selected, distributed across eight countries compassing nine ecological regions. The ponds were located at varying latitudes and exhibited diverse land-use intensities, including both permanent and intermittent ponds. Nutrient samples were collected concurrently from the water.



Study sites



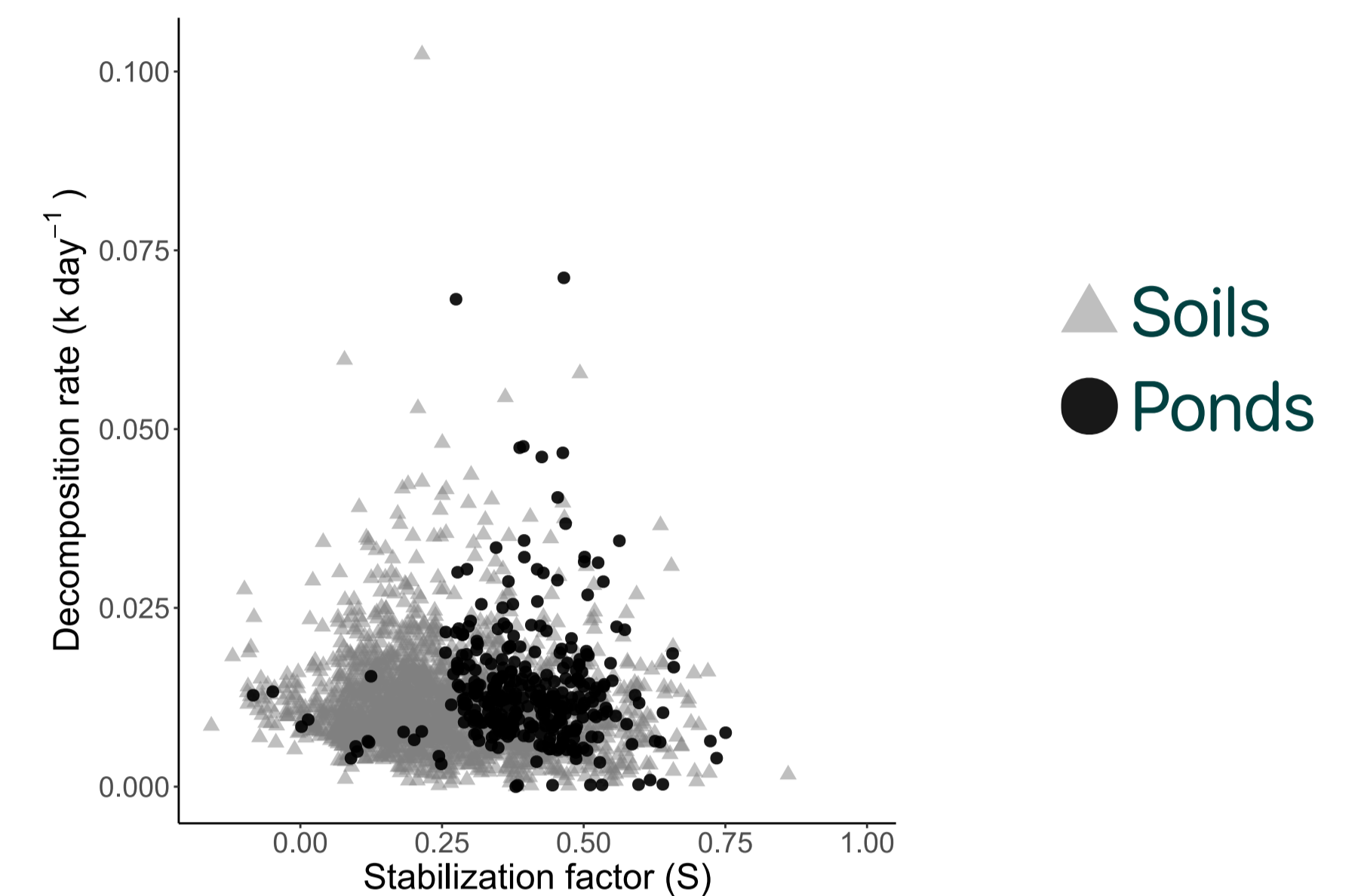
- 574 Uruguayan **savanna**
- 652 Central Anatolian **steppe and woodlands**
- 703 Northern Anatolian **conifer and deciduous forests**
- 799 Northeast Spain and Southern France **Mediterranean forests**
- 686 Western European **broadleaf forests**
- 664 European Atlantic **mixed forests**
- 654 Central European **mixed forests**
- 647 Baltic **mixed forests**
- 651 Celtic **broadleaf forests**

Conclusions

1. In contrast to soils, the results suggest that ponds favor carbon sequestration.
2. Within the studied latitudinal range, the vegetation land cover might be more relevant than latitudinally climate-related factors
3. The existence of drought periods in temporal ponds limits the decomposition process.
4. Total Phosphorus in water positively correlated with k, showing nutrient influence on decomposition dynamics.

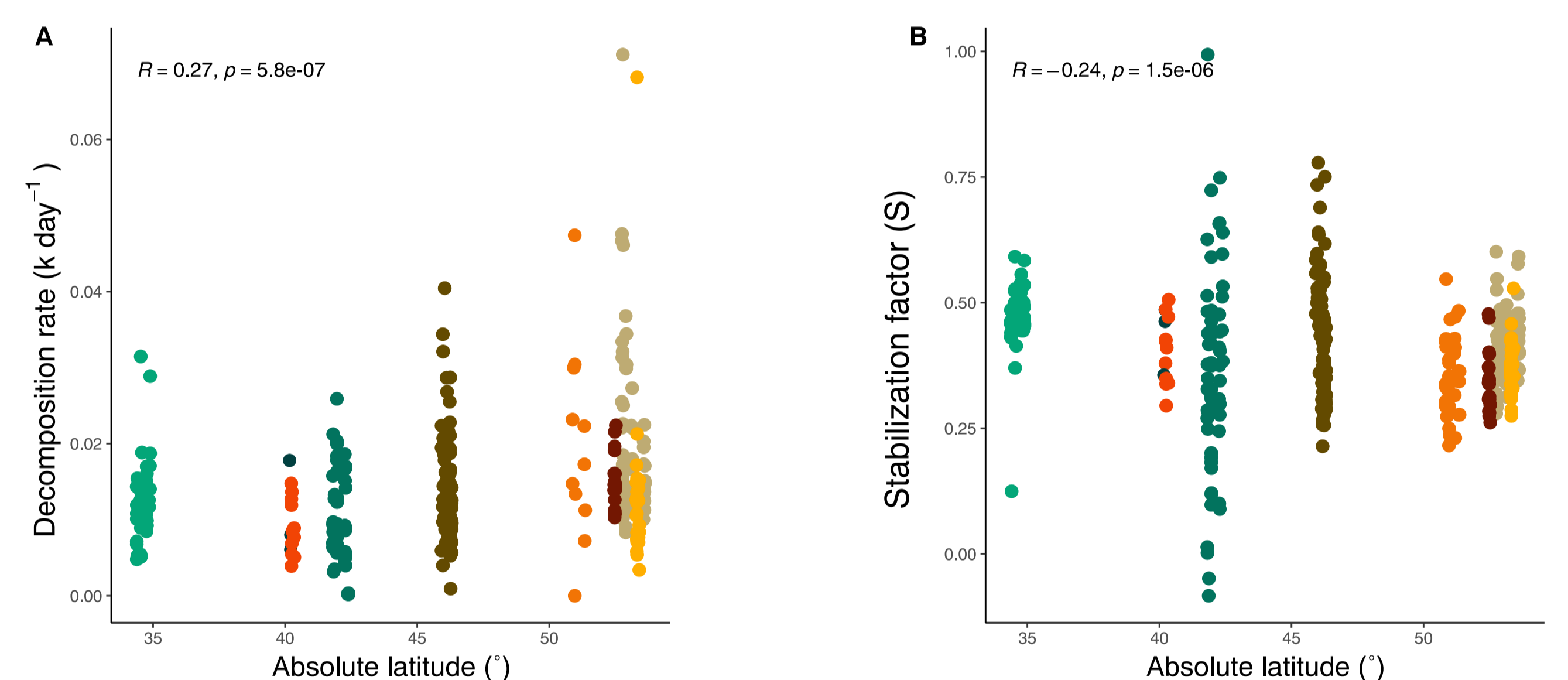
Results and discussion

Comparison to soils



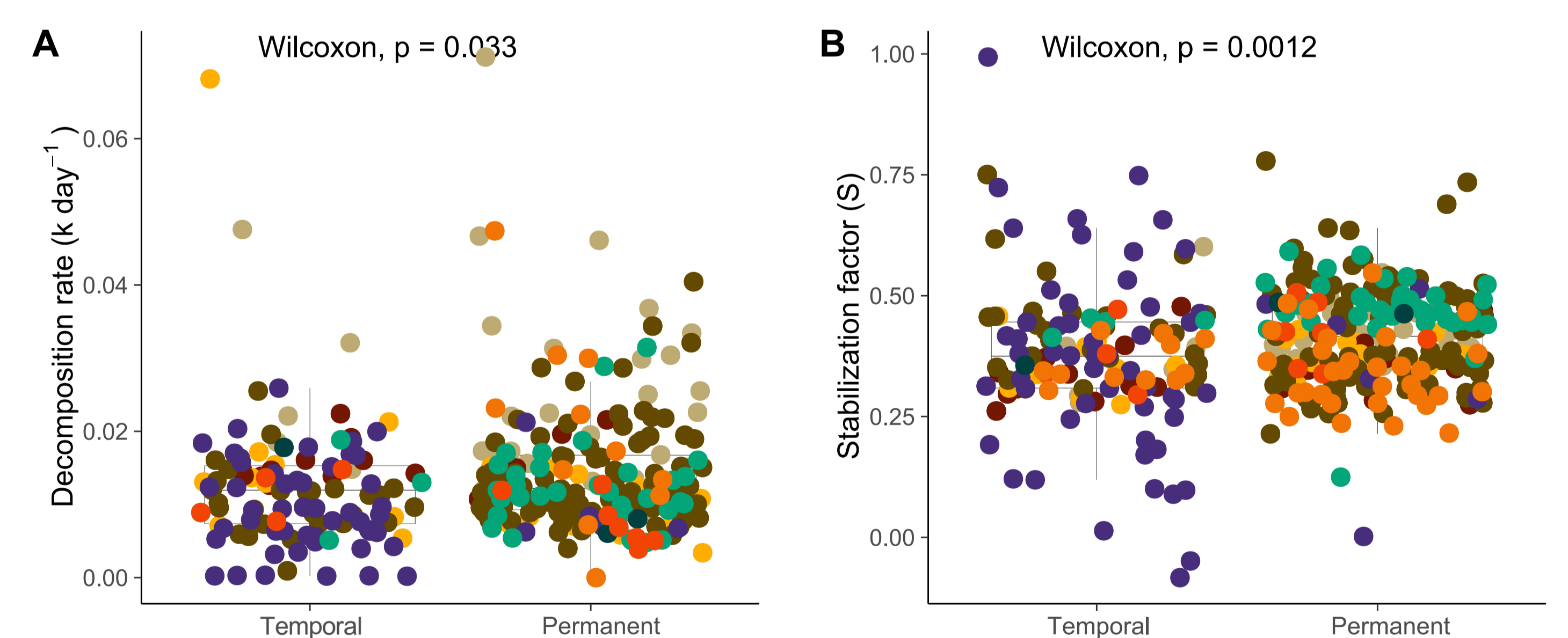
The decomposition rate in ponds was similar to the previous results measured in soils by Sarneel et al. (2024), but with a higher stabilization factor.

Relation to latitude



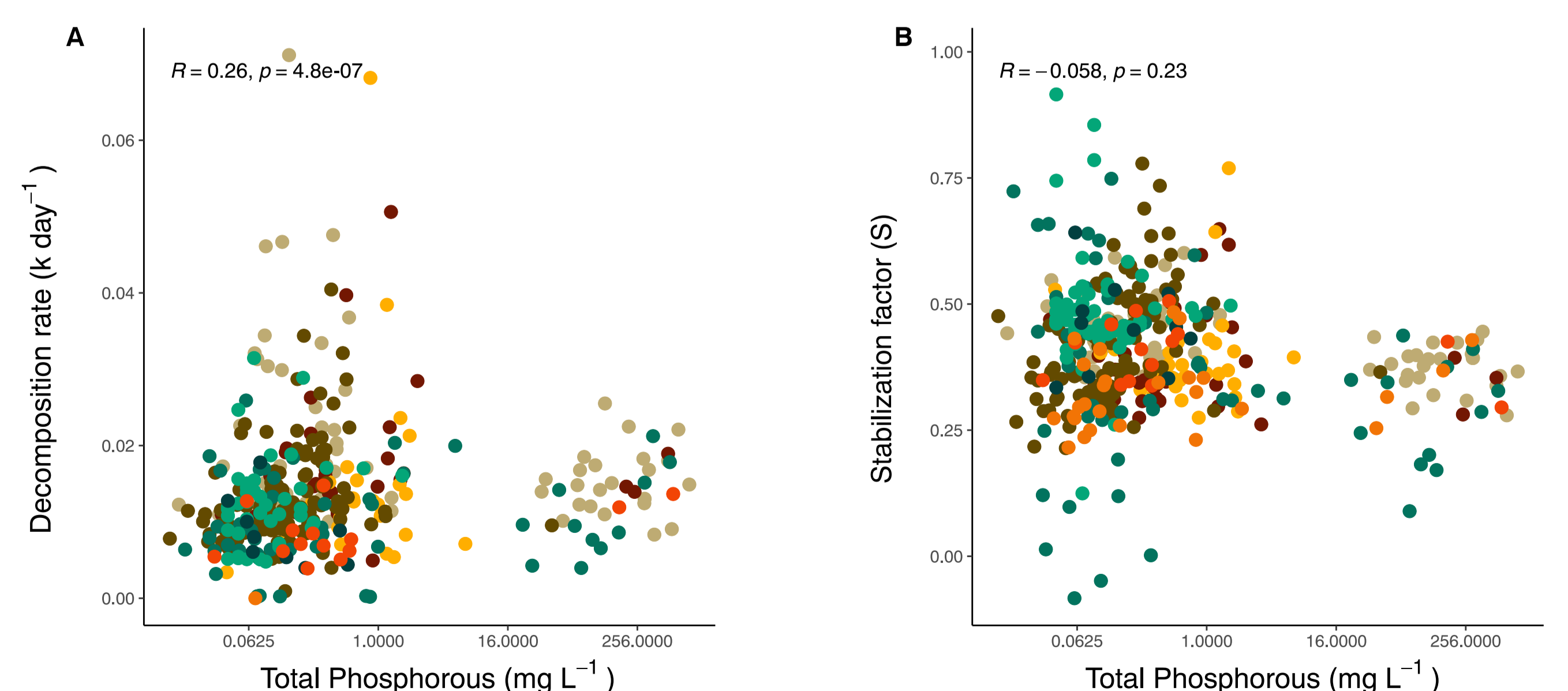
We observed contrasting patterns of decomposition parameters across the latitudinal gradient. While k (A) increased with absolute latitude, S (B) decreased.

Relation to hydroperiod



Decomposition rate (A) and stabilization factor (B) were lower in temporal ponds than in permanent ponds.

Relation to nutrients



We observed a positive correlation between water total phosphorus (TP) and k (A), indicating the influence of nutrients on decomposition dynamics. In contrast, a negative relations between TP and S (B) was observed, but only with marginal significance.

References

