

Large spatial variability of GHG emissions from an alpine peatland detected by chamber based measurements.

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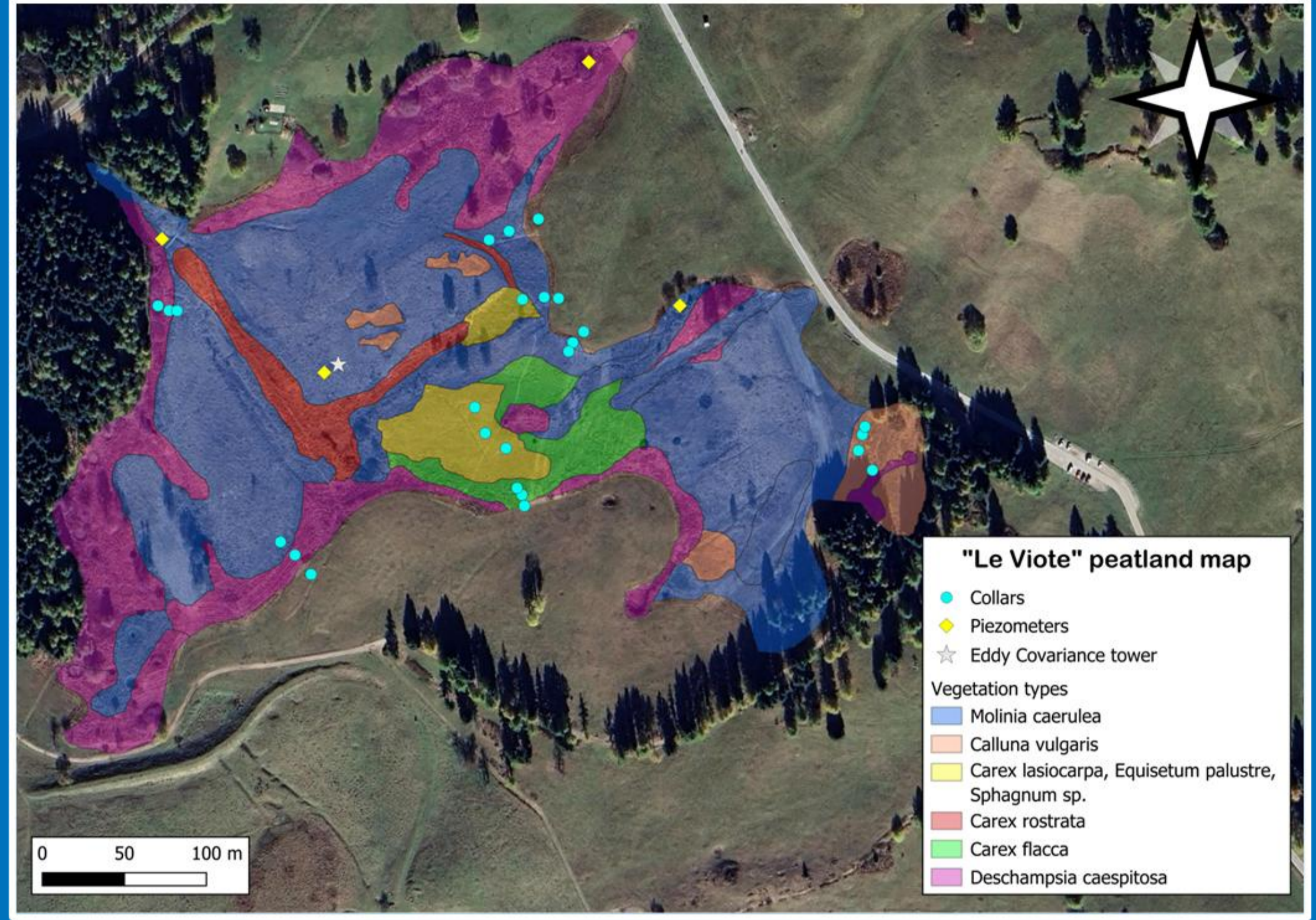







1. Background

- Alpine peatlands poorly studied compared to boreal/tropical ones.
- Climate warming amplification in the Alpine region.
- High plant biodiversity at community level.
- Protected area since 2014 - Special Area of Conservation, Natura (2000).
- Known GHG net source to the atmosphere (Pullens et al., 2017).
- 'Le Viote' GHG fluxes studied using both Eddy Covariance (Pullens et al., 2017) and chamber based technique (Carbognani et al., 2023).

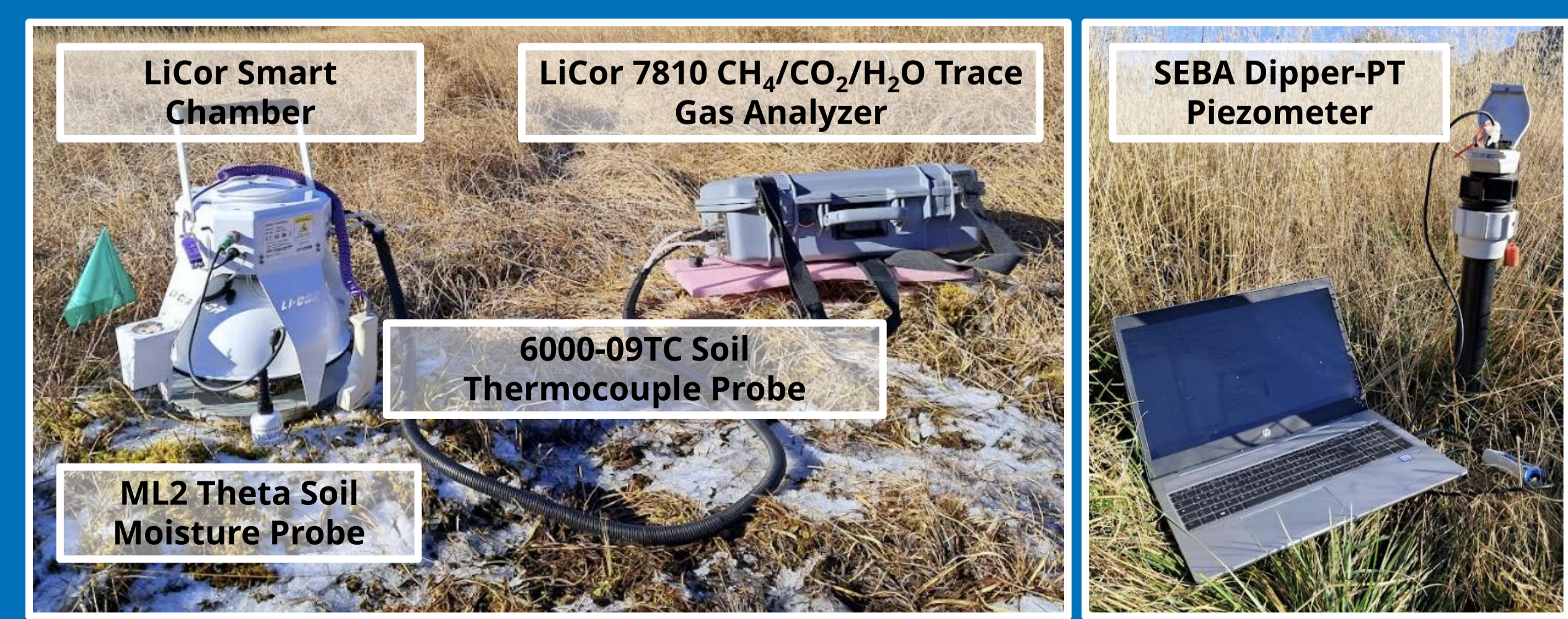


3. Study site

- Mt. Bondone plateau in eastern Italian Alps (46°01'03"N, 11°02'27"E, 1560 m a.s.l.)
- Minerotrophic nutrient-poor fen in a relict glacial lakebed.
- Variety in microtopography, soil moisture levels and vegetation cover types.
- Measurements period: May-November 2025.

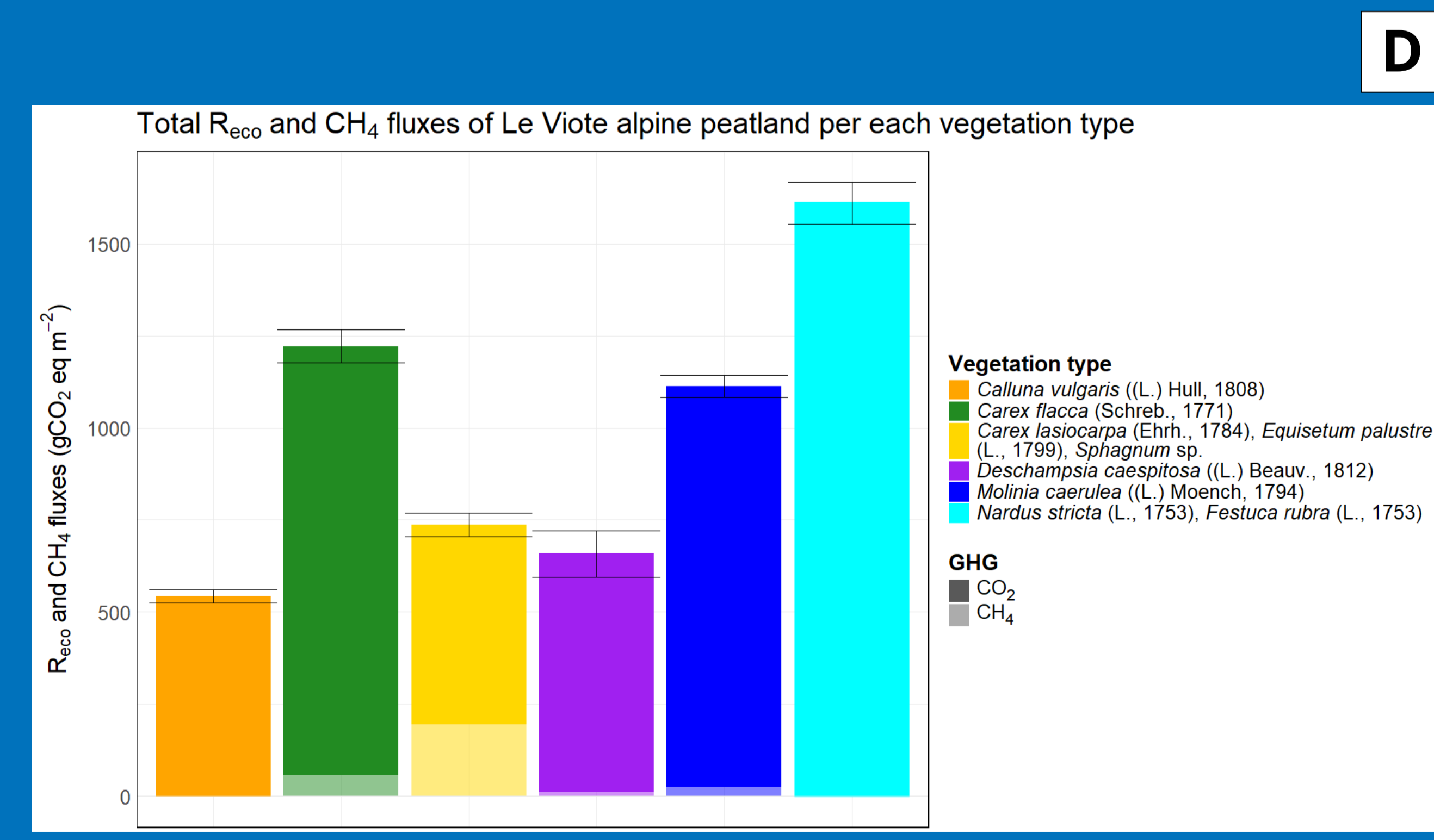
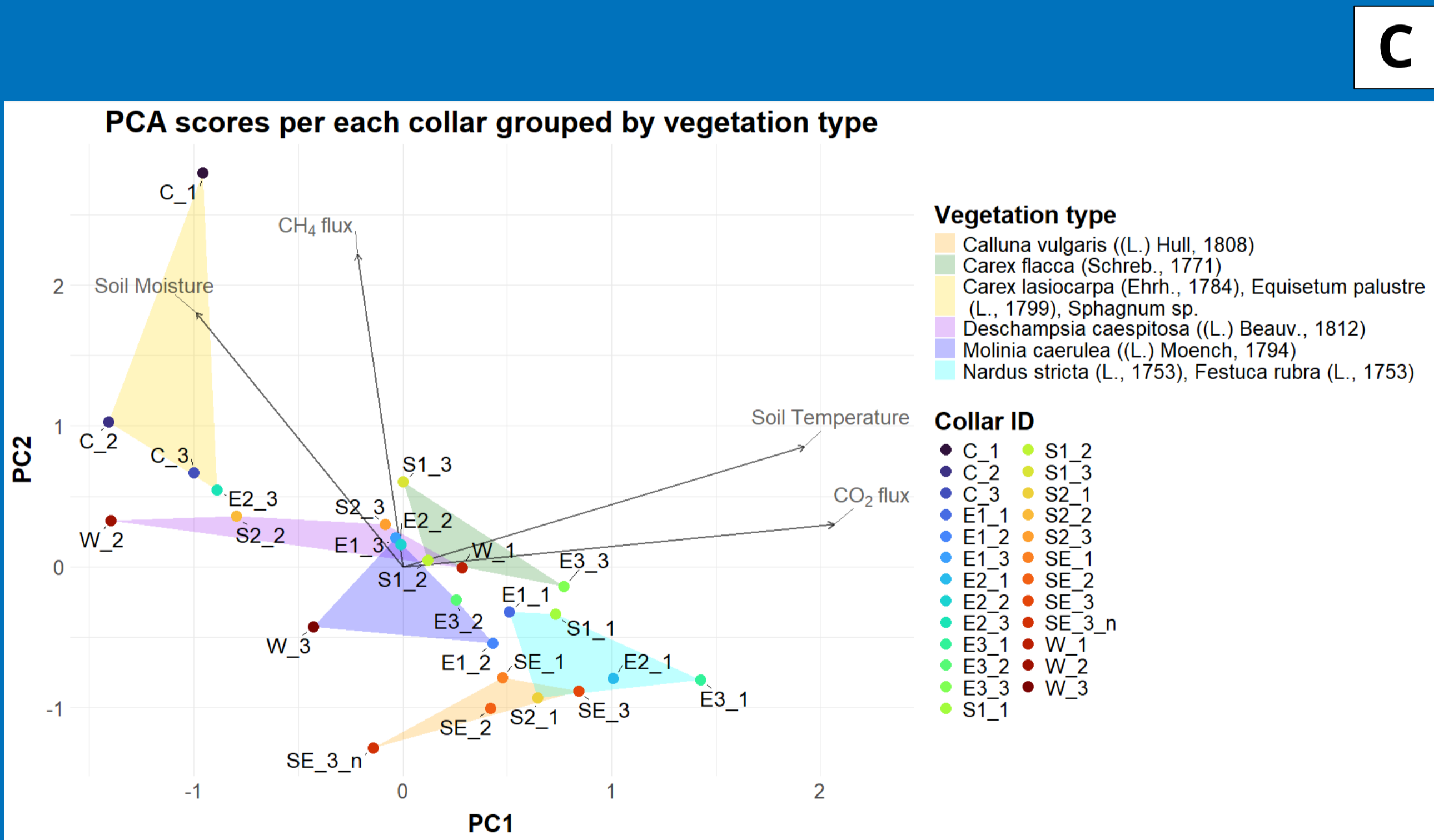
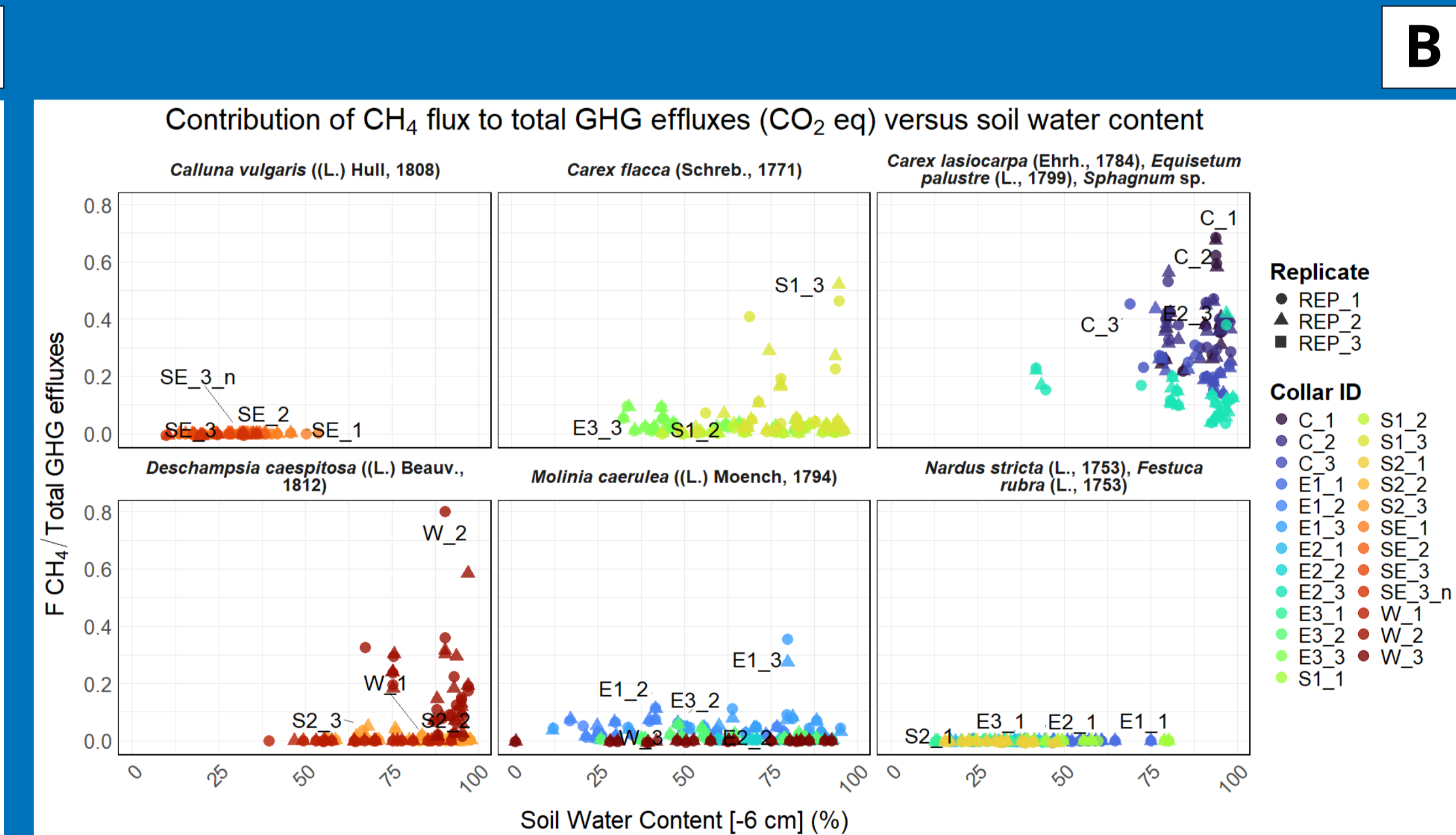
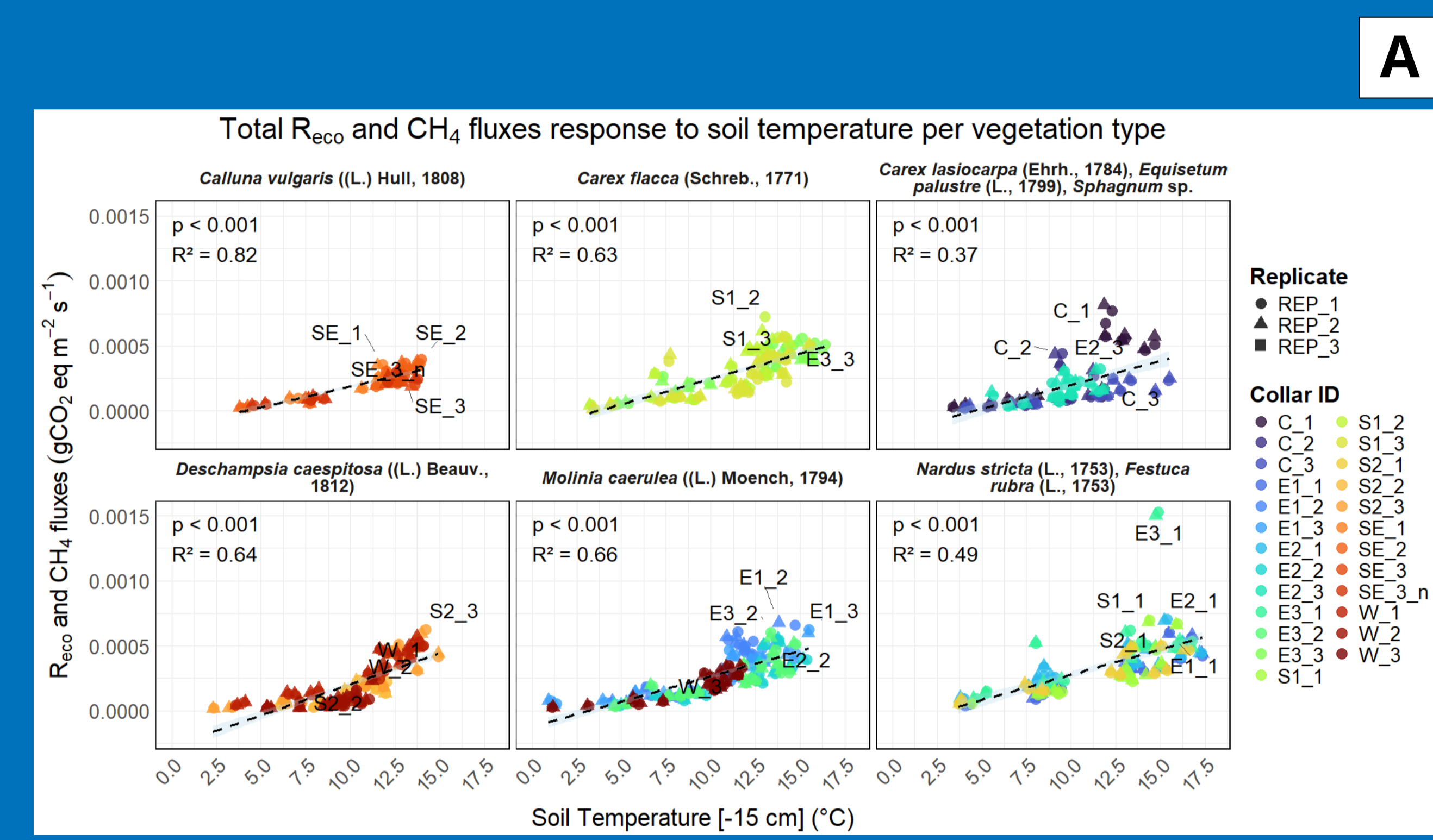
4. Sensors and Instruments

- Closed dynamic chamber (CH₄ and R_{eco}) system.
- 4 piezometers (continuous measurements every 30 minutes).



5. Results and Conclusions

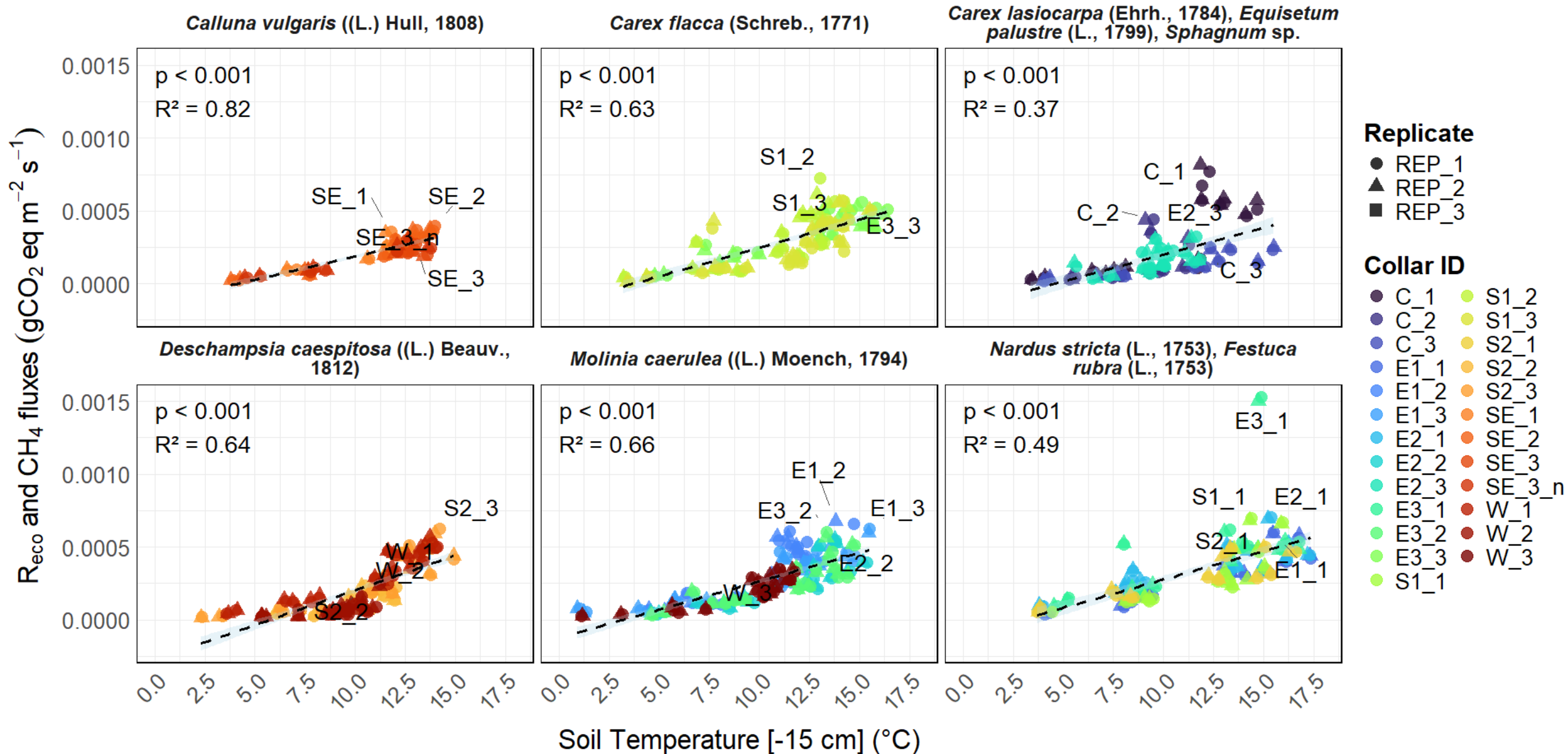
- Large spatial variability for both CO₂ and CH₄ fluxes, even into the same vegetation type (Fig. A-D).
- Up to 80% of CH₄ contribution to total emissions in the wettest areas (Fig. B).
- PCA identification of data clusters corresponding to vegetation types, distributed along clear soil water content and temperature gradients (Fig. C).
- Mean cumulated GHG effluxes of ~942.27 gCO₂eq m⁻² for the whole peatland area (~0.99 km²) (Fig. D).



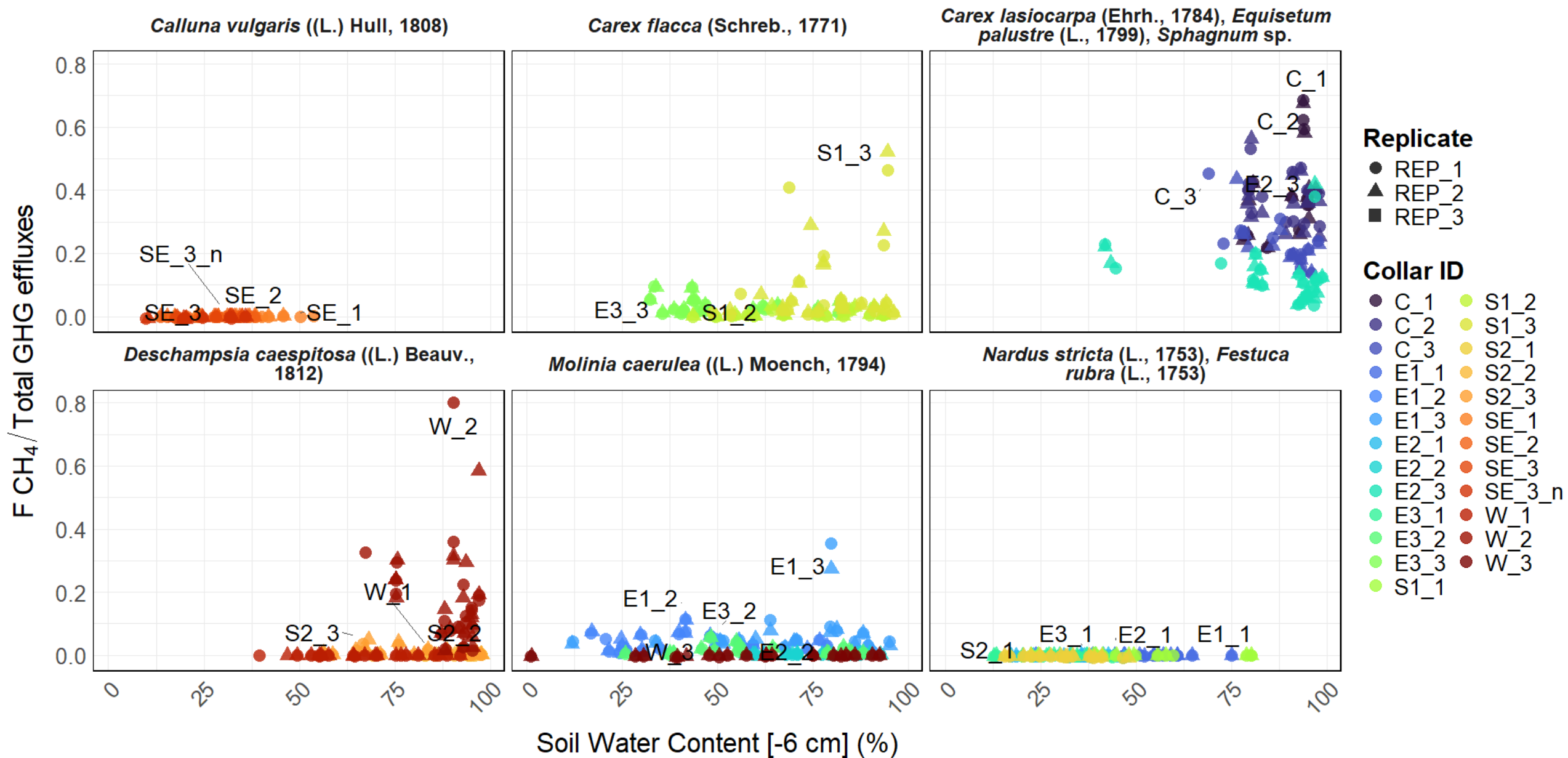
2. Objectives

- Monitor total ecosystem respiration (R_{eco}) and CH₄ fluxes by chamber technique across different peatland vegetation types and surrounding grassland:
- Characterize fluxes spatial and temporal variability.
- Analyze their response to environmental drivers.
- Quantify the cumulated GHG emissions in the peatland area.

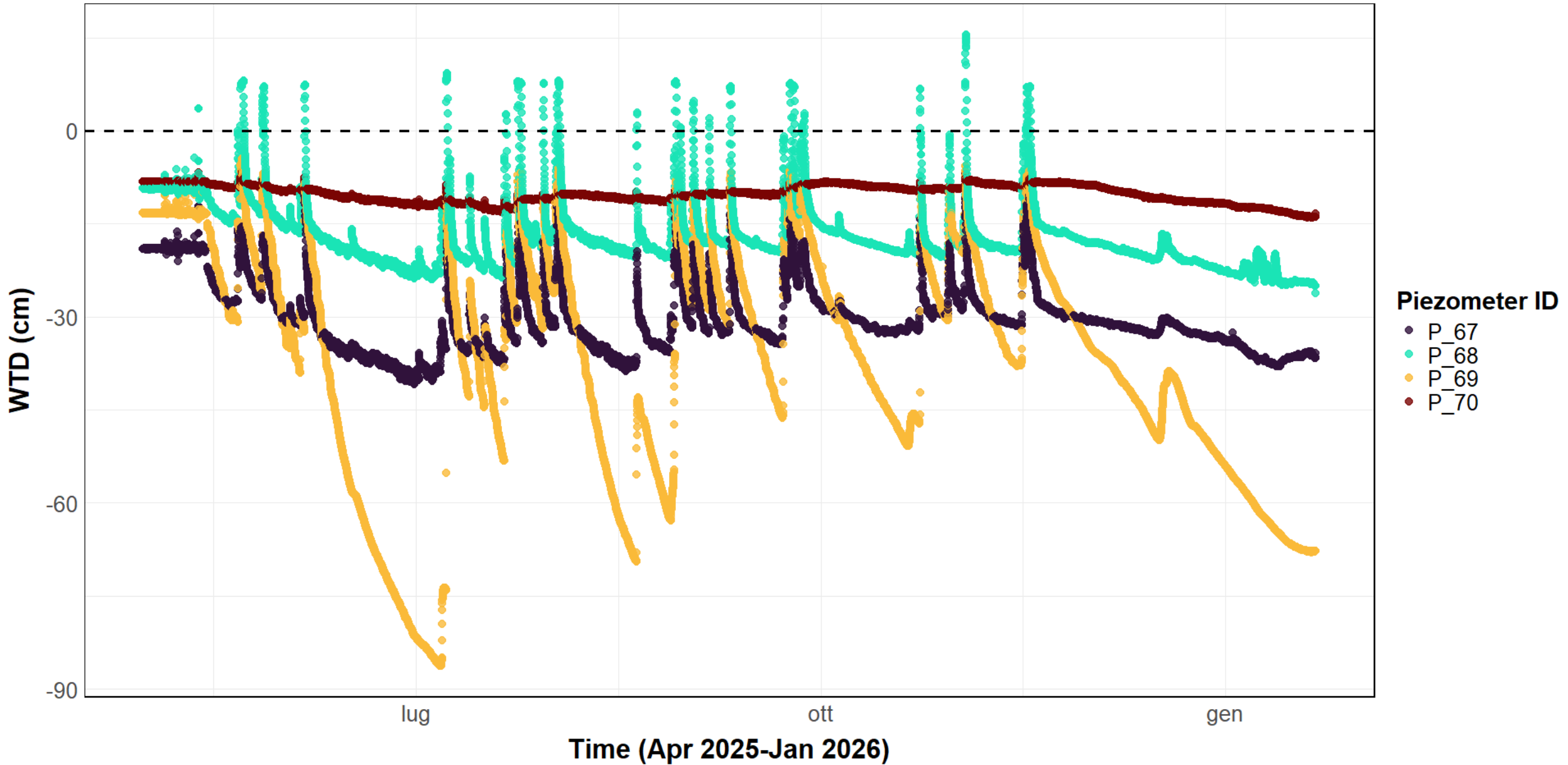
Total R_{eco} and CH_4 fluxes response to soil temperature per vegetation type



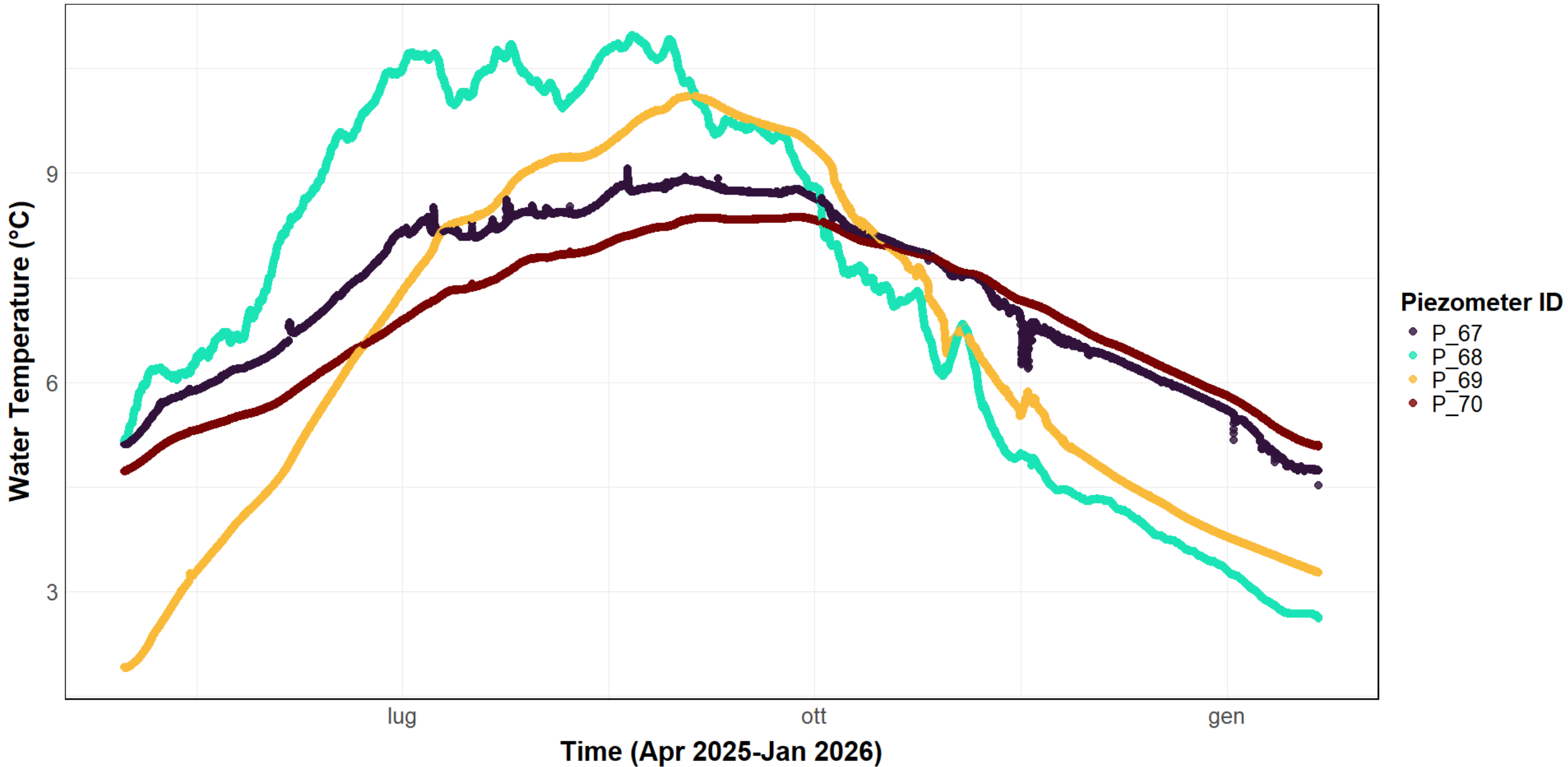
Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus soil water content



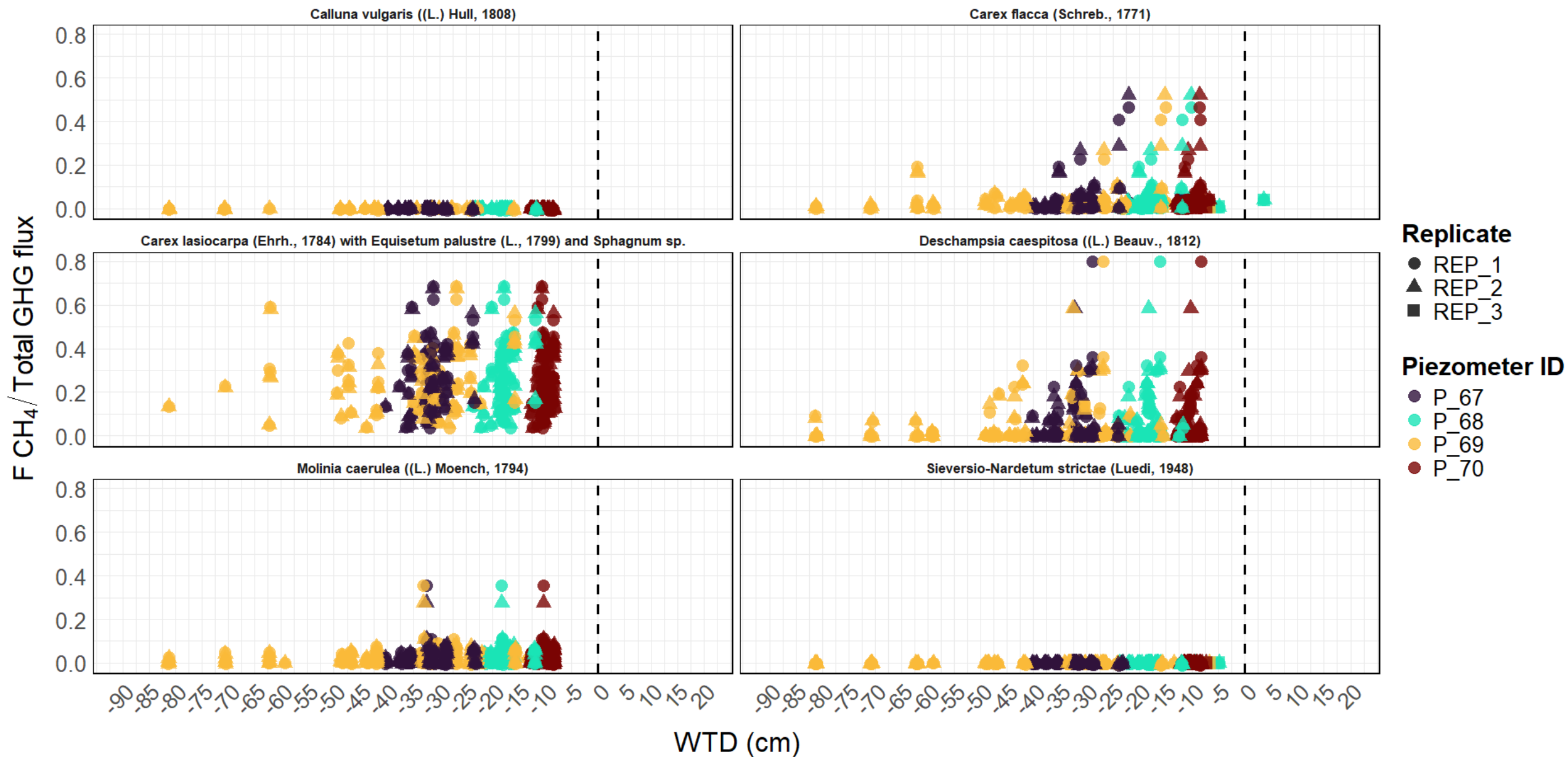
WTD of Le Viote piezometers in different months



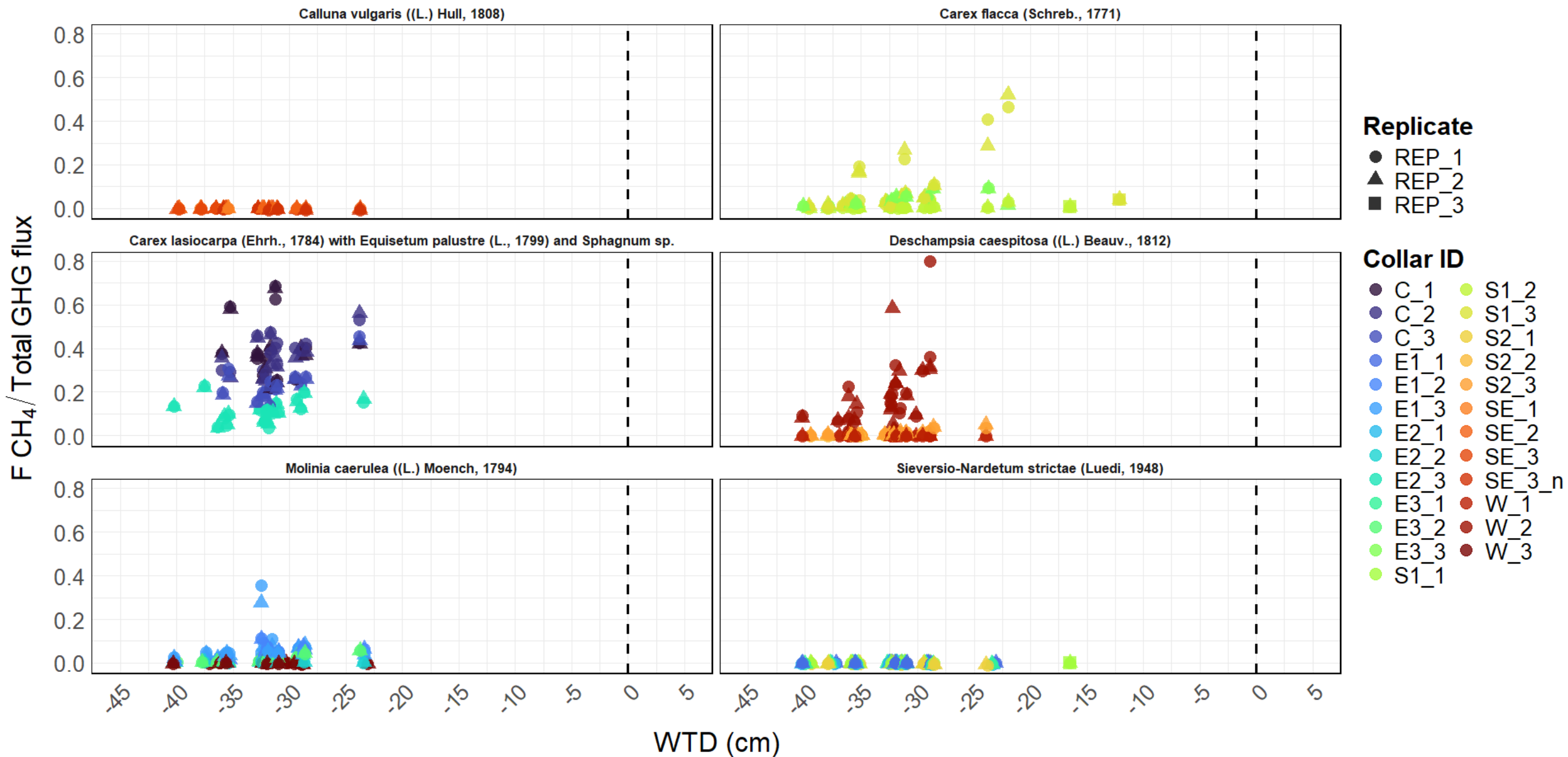
Water temperature of Le Viote piezometers in different months



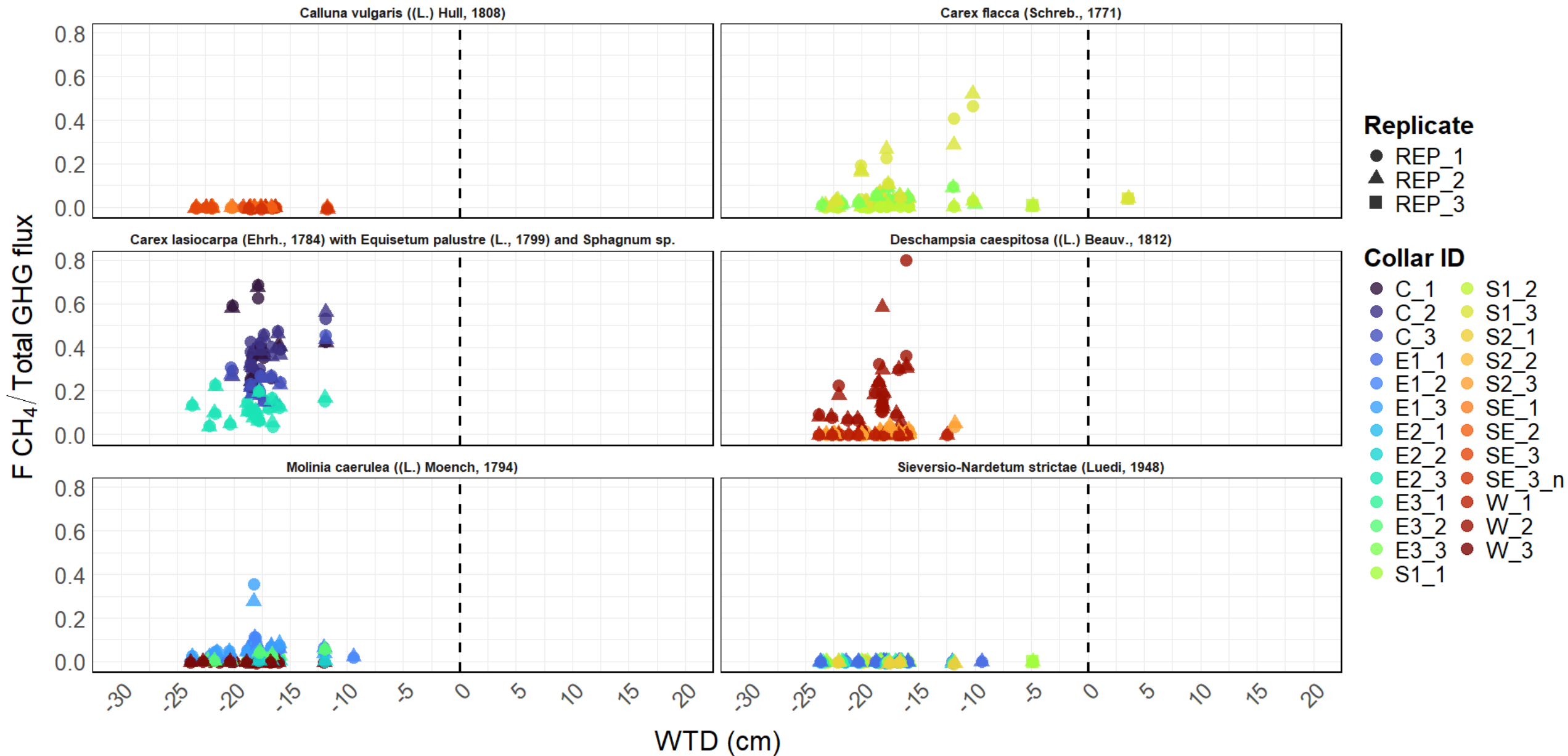
Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus WTD



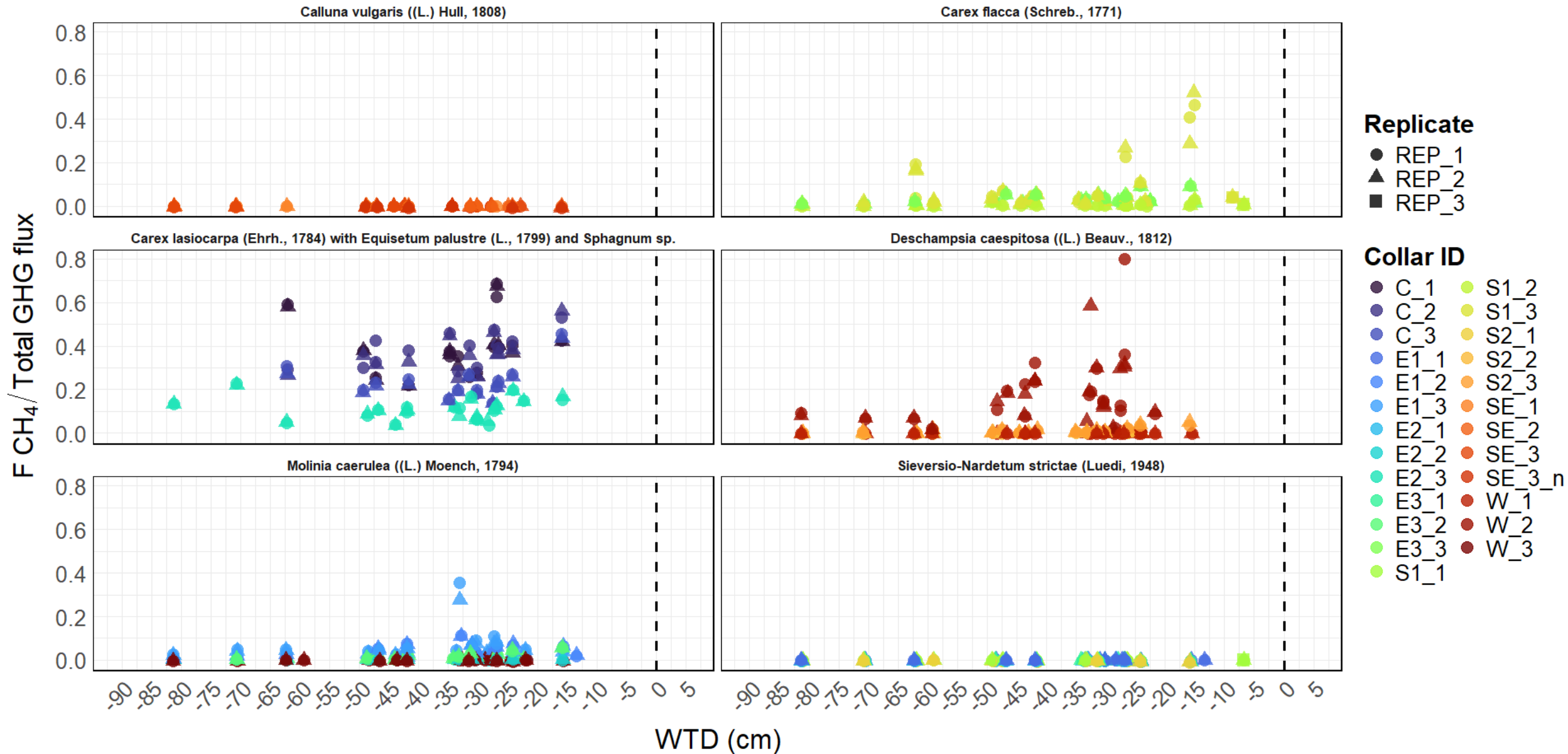
Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus WTD of P_67



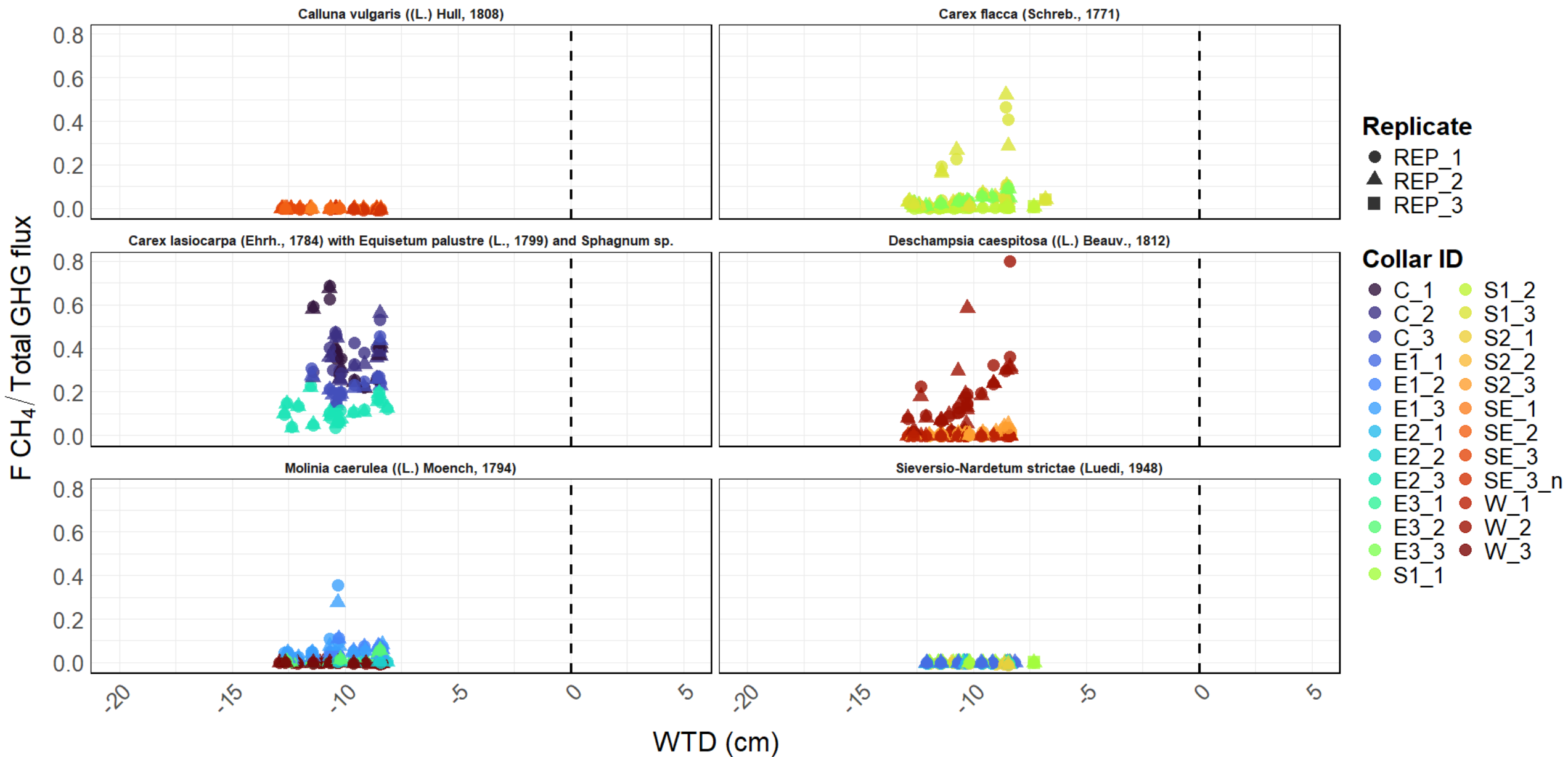
Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus WTD of P_68



Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus WTD of P_69

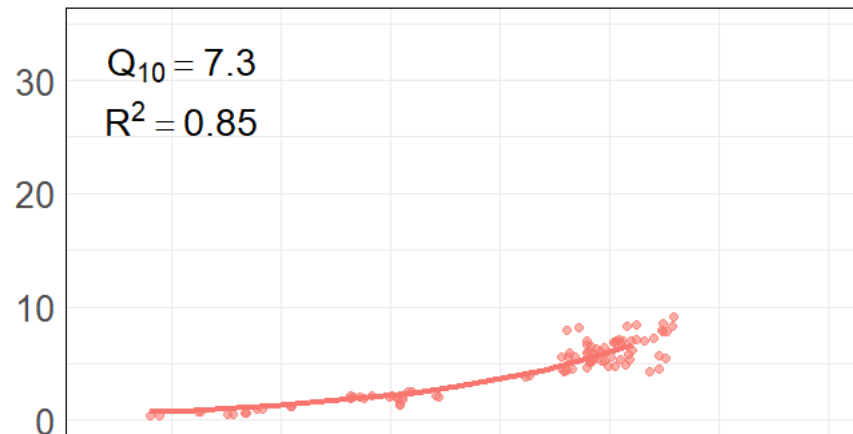


Contribution of CH₄ flux to total GHG effluxes (CO₂ eq) versus WTD of P_70

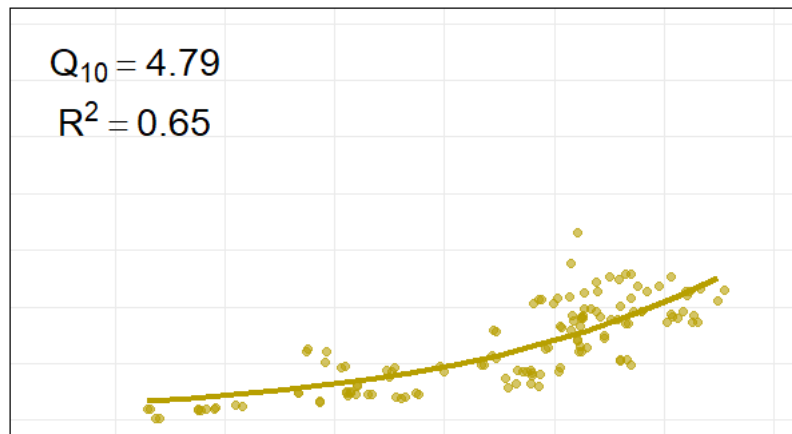


CO₂ flux response to soil temperature (Q₁₀ model fit)

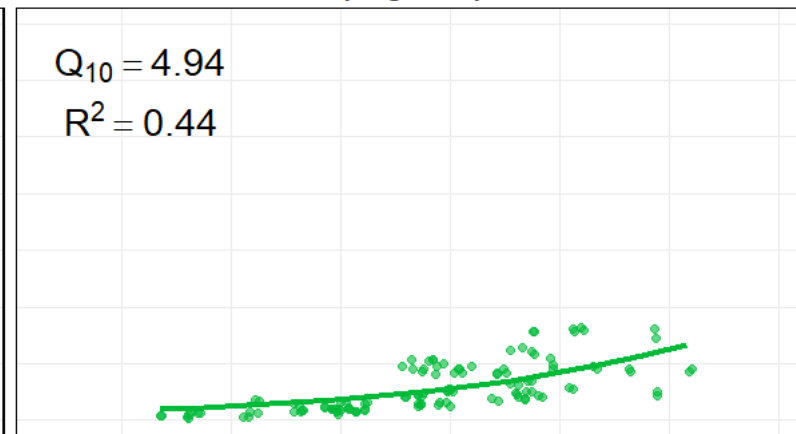
Calluna vulgaris ((L.)
Hull, 1808)



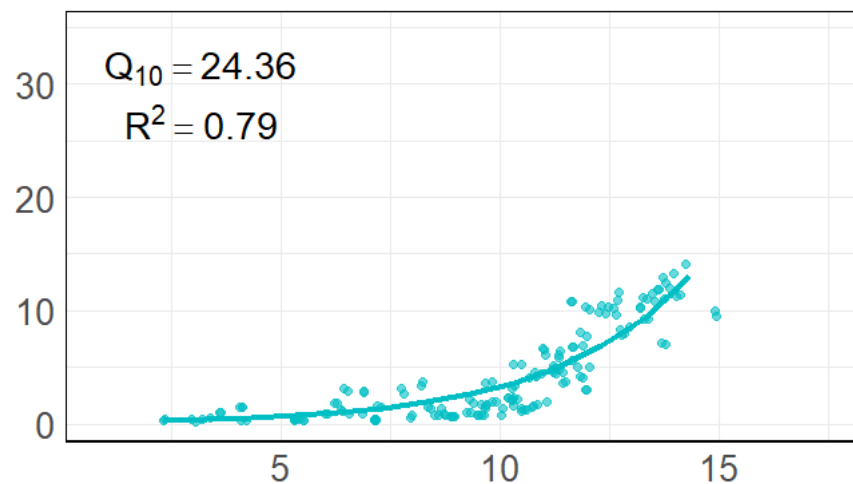
Carex flacca (Schreb.,
1771)



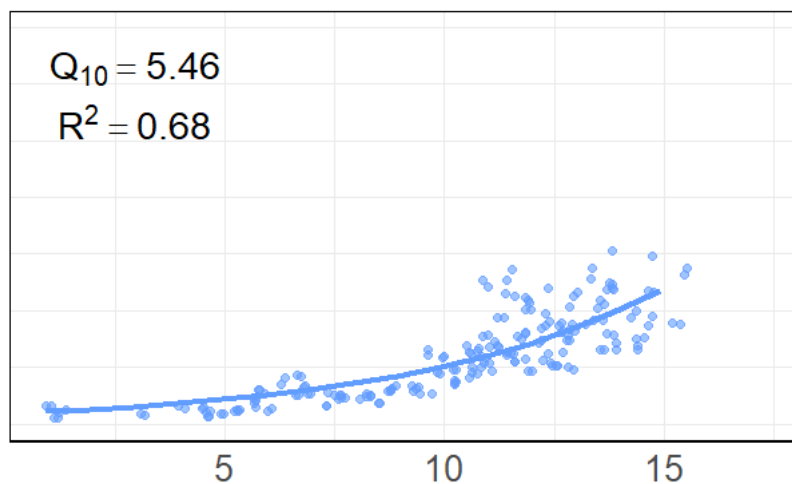
Carex lasiocarpa (Ehrh.,
1784) with *Equisetum*
palustre (L., 1799) and
Sphagnum sp.



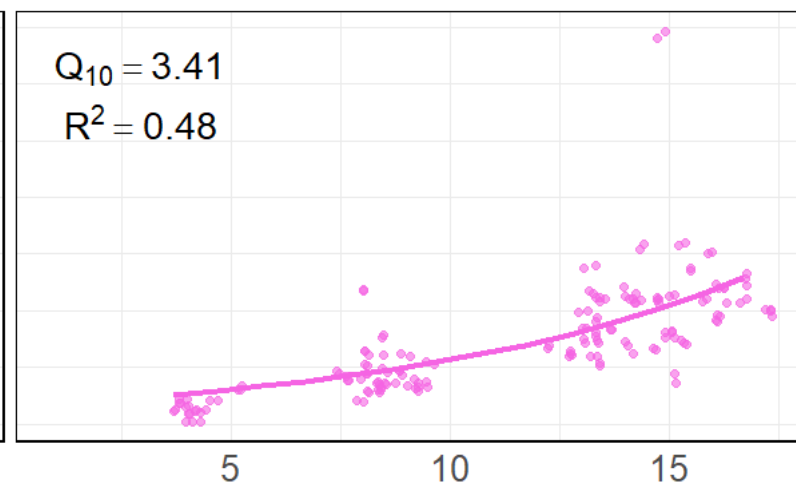
Deschampsia caespitosa
((L.) Beauv., 1812)



Molinia caerulea ((L.)
Moench, 1794)



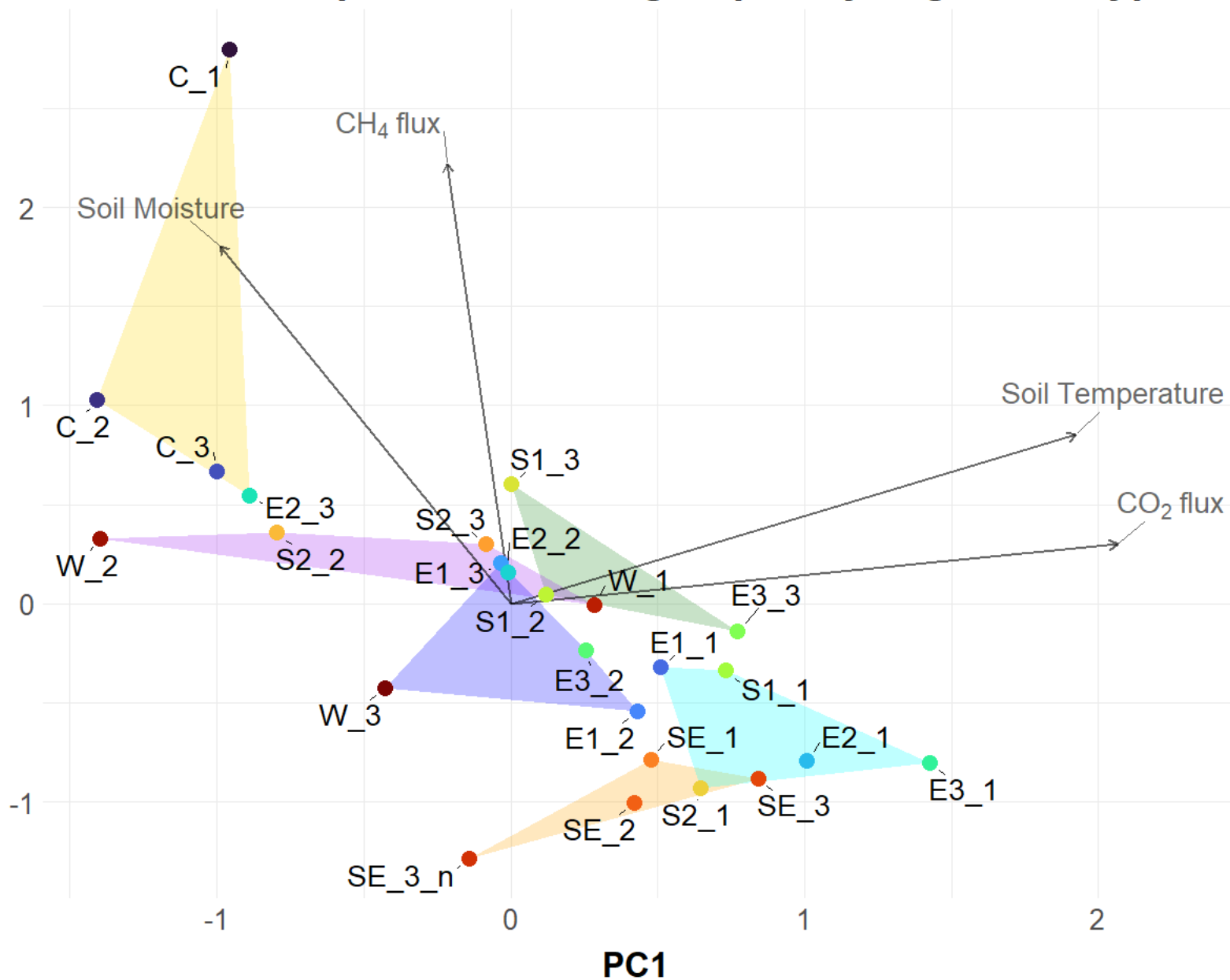
Sieversio-Nardetum
strictae (Luedi, 1948)



Soil Temperature (°C)

FCO₂ (μmol m⁻² s⁻¹)

PCA scores per each collar grouped by vegetation type



Vegetation type

- Calluna vulgaris ((L.) Hull, 1808)
- Carex flacca (Schreb., 1771)
- Carex lasiocarpa (Ehrh., 1784), Equisetum palustre (L., 1799), Sphagnum sp.
- Deschampsia caespitosa ((L.) Beauv., 1812)
- Molinia caerulea ((L.) Moench, 1794)
- Nardus stricta (L., 1753), Festuca rubra (L., 1753)

Collar ID

- C_1
- C_2
- C_3
- E1_1
- E1_2
- E1_3
- E2_1
- E2_2
- E2_3
- E3_1
- E3_2
- E3_3
- S1_1
- S1_2
- S1_3
- S2_1
- S2_2
- S2_3
- SE_1
- SE_2
- SE_3
- SE_3_n
- W_1
- W_2
- W_3

Total R_{eco} and CH_4 fluxes of Le Viote alpine peatland per each vegetation type

