UNIVERSITY OF COPENHAGEN
DEPARTMENT OF GEOSCIENCES AND NATURAL RESOURCE MANAGEMENT

Sharing not permitted

Identifying the dominant hydrochemical processes post wetland restoration along stream valleys, Denmark

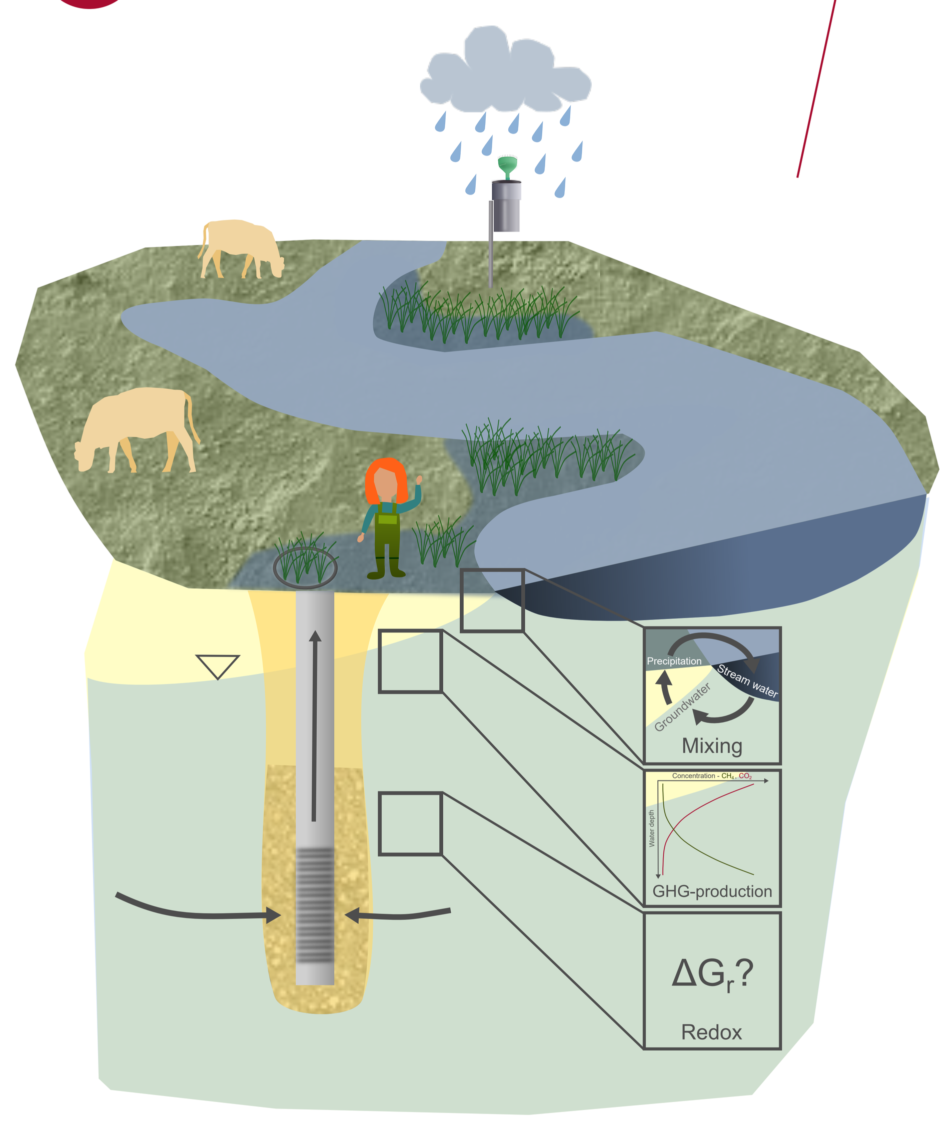
Filippa Fredriksson[1], Marta Baumane[2], Lars Båstrup-Spohr[2], Hans Henrik Bruun[2], Kenneth Thorø Martinsen[2], Sofie Aagaard[1], Bjørg Friis Michelson[1], Kaj Sand-Jensen[2], and Søren Jessen[1]

[1]Department of Geosciences and Natural Resource Management, University of Copenhagen, Copenhagen, Denmark
[2]Department of Biology, University of Copenhagen, Copenhagen, Denmark

1 Introduction

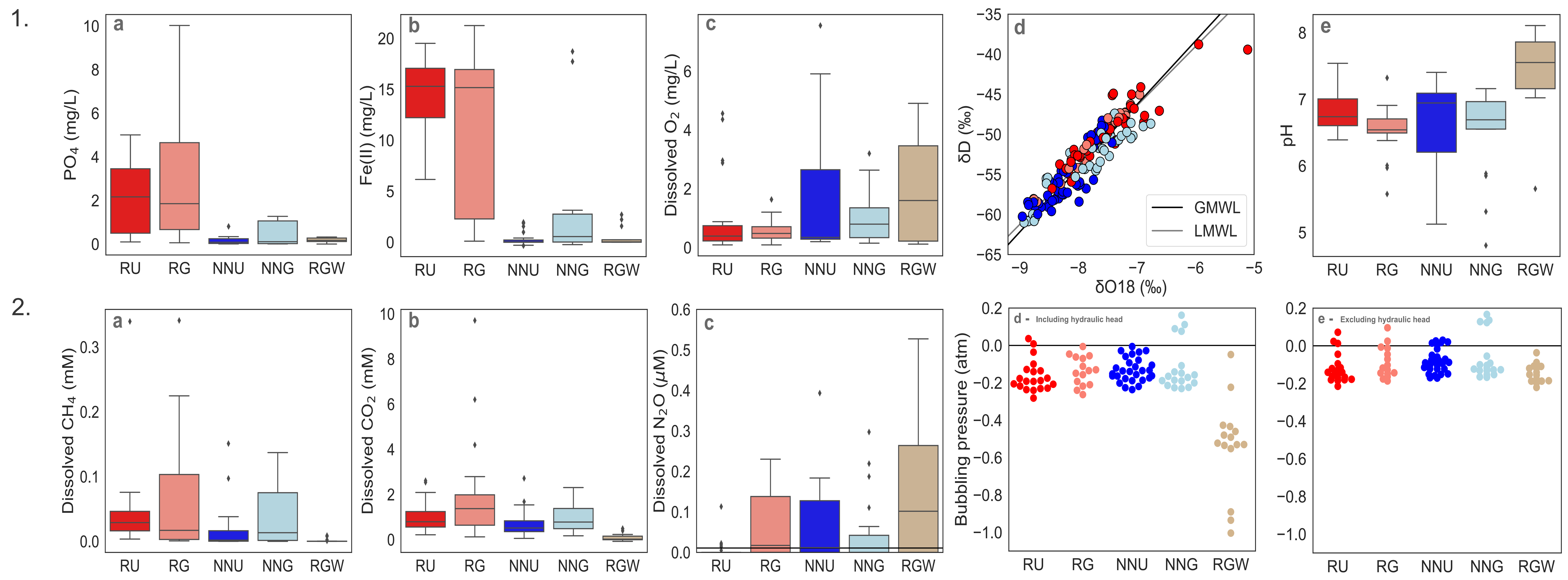
Wetland restoration has become an important tool for greenhouse gas (GHG) retention, while improving biodiversity. Wetland hydro(geo)logy exerts key control on GHG-emissions and on conditions facilitating biodiversity, yet knowledge of the major hydrochemical processes in restored and near-natural wetlands is limited. To reduce the knowledge gap, surface waters, precipitation and groundwater are sampled in six restored and six near-natural wetlands of the riparian zone, distributed along three separate stream valleys with differing subsurface geology and management (unmanaged or grazed).

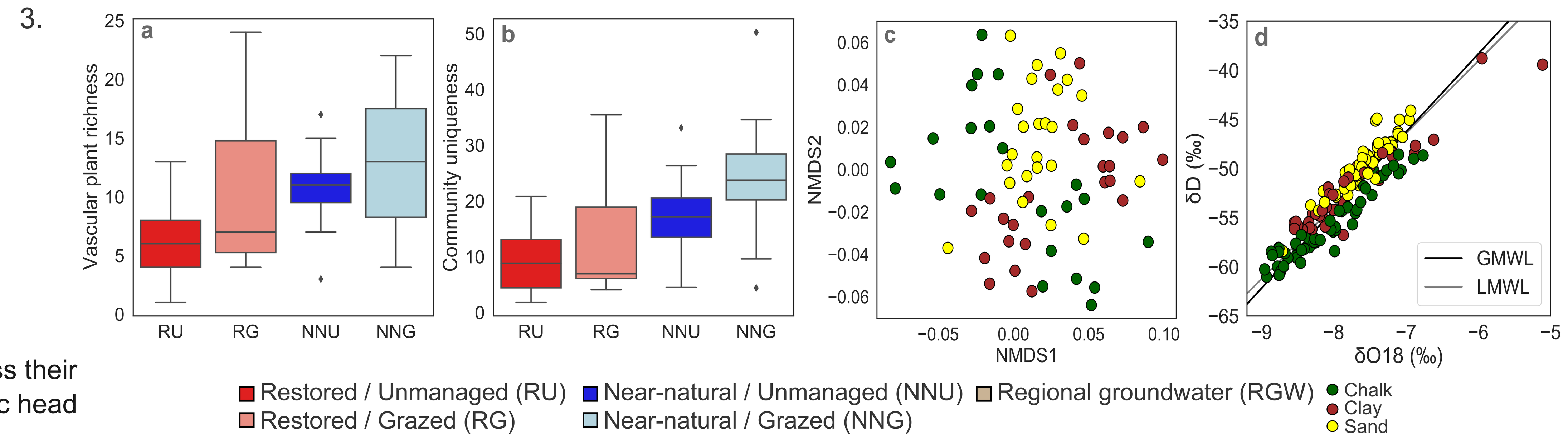
2 Field sites



- Installation of 66 shallow wells. Screen: ~0.5-0.8 mbgl.
- Installation of 11 deep wells. Screen: 3-8 mbgl.
- Seasonal surface and groundwater sampling.
- Continuous water level data collection.
- Vascular plants identified in 72 circular vegetation plots (D: 0.6 m, A: 0.3 m^2).

3 Preliminary results





- PO_4-release in restored sites (Fig. 1a), interpreted as a result of reduction of Fe-oxides (Fig. 1b). More easily degradable organic carbon in restored sites, as oxygen is depleted from restored sites' groundwater (Fig. 1c) despite younger groundwater age (Fig. 1d).

- CH_4 and CO_2 are produced locally in the shallow groundwater (Fig. 2a-b). N_2O is likely produced during denitrification (Fig. 2c).
- Higher CH_4 in grazed sites (Fig. 2a), and higher CO_2 in restored sites (Fig. 2b).

- For most points, the total dissolved gas pressure does not surpass their respective bubbling pressure, >0 atm (Fig. 2d), also when hydraulic head pressure is excluded (Fig. 2e).

- Lower vascular plant richness in restored than in near-natural wetlands, and slightly lower richness in unmanaged than in grazed wetlands (Fig. 3a).
- Vascular plant species found in restored wetlands were more regionally widespread (i.e. less unique)(Fig. 3b).

- Plant communities were more similar to each other in sand-dominated catchments than in clay- or chalk-dominated ones (Fig. 3c NMDS ordination of community species composition). The sand-dominated catchments also have a smaller isotopic range than the chalk- and clay-dominated catchments. It indicates a higher level of mixing (Fig. 3d).

4 On-going activities

Continuous sampling at all field sites and subsequent analyses are taking place up to and including the summer of 2023. Current efforts aim to expand the data set and to provide a more complete mapping of the hydrochemical processes in DOC-rich pore waters. The project currently awaits results for anions, DOC and fluorescence. The work also targets mapping of sediment cores from all 72 plots.

5 Conclusions

- PO_4-release resulting from reduction of Fe-oxides in restored wetlands.

- CH_4 and CO_2 are produced locally in the shallow groundwater (<1 mbgl). N_2O is produced during denitrification.

- Lower vascular plant richness and more regionally widespread vascular plant species in restored wetlands.

FUNDED BY
INDEPENDENT RESEARCH FUND DENMARK

Filippa Fredriksson
kjff@ign.ku.dk