Multi- dimensional environmental factors drive soil organic matter formation across vegetation communities in a freshwater wetland

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Lower Moors, Isles of Scilly

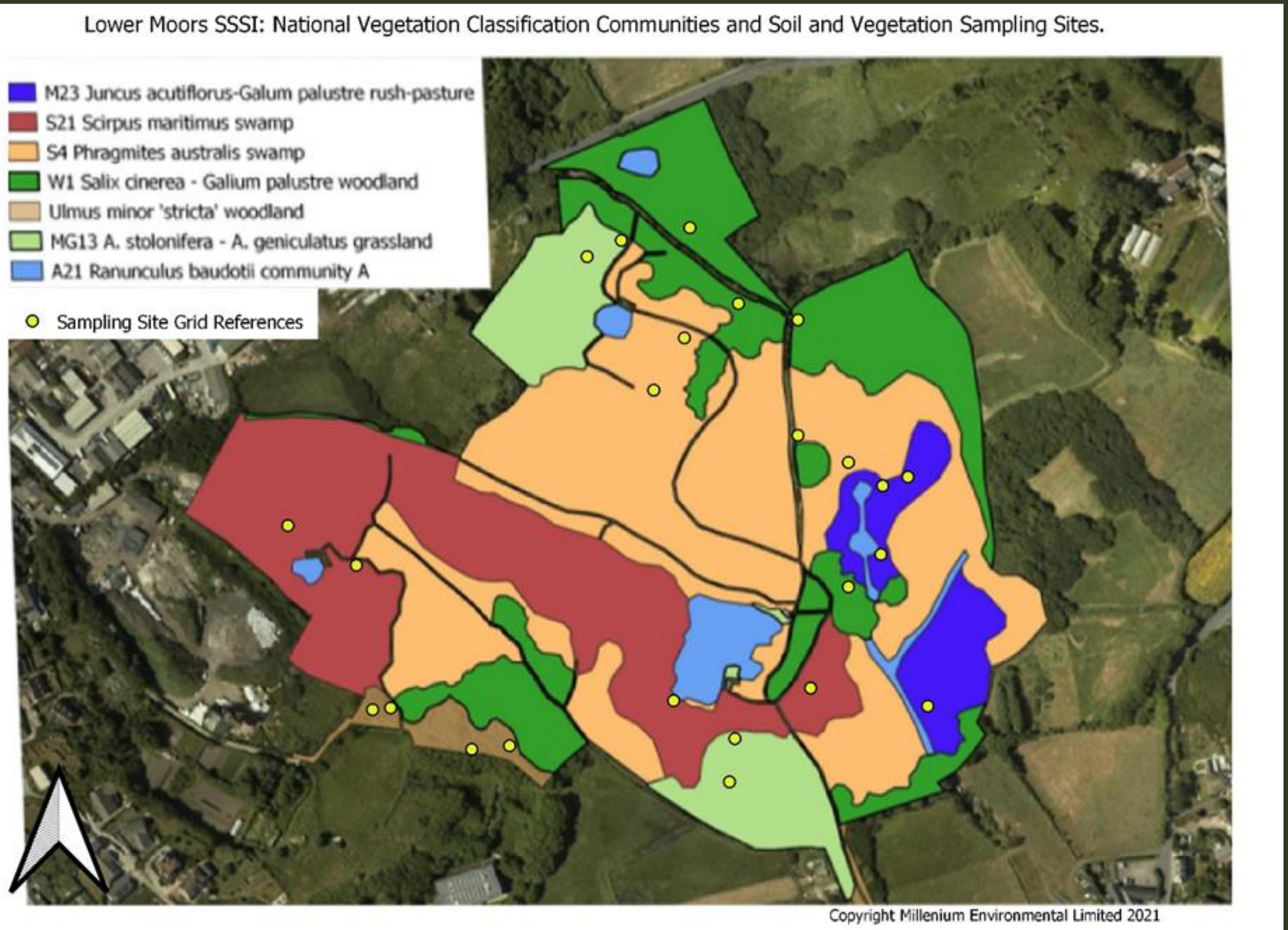
- Temperate freshwater wetland which provides significant amount of St Marys' drinking water.

- Experiencing seawater intrusion which increases the use of the island's desalination plant and risks the sites protected status

Purpose of study:

Understand the applicability of soil organic matter (SOM) formation theories in a complex wetland ecosystem.

Understand if higher soil salinity and lower quality plant litter would result in lower levels of soil organic matter and soil organic carbon across the vegetation communities.



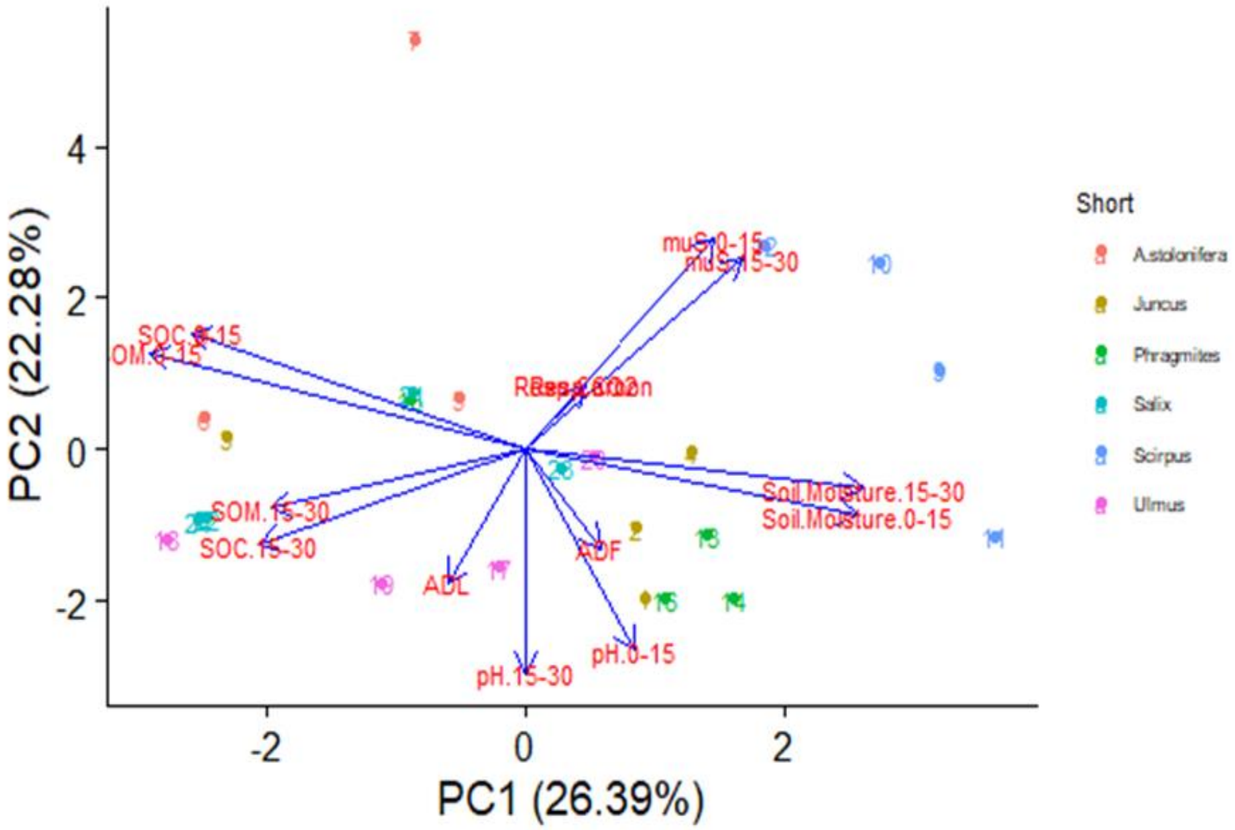
Variables:

- Soil respiration
- pH
- Electrical Conductivity
- Soil organic matter
- Soil organic carbon (SOC)
- Soil moisture
- Acid detergent fibre and acid detergent lignin

Results & Discussion

- No significant relationship between SOM and electrical conductivity or vegetation quality.
- Weak negative correlation between soil moisture content & SOM.
- Root oxygen loss and substrate priming (Mueller et al., 2016).

Results & Discussion



Principal component analysis showing loadings and relationships between the individual environmental factors and principal components 1 and 2

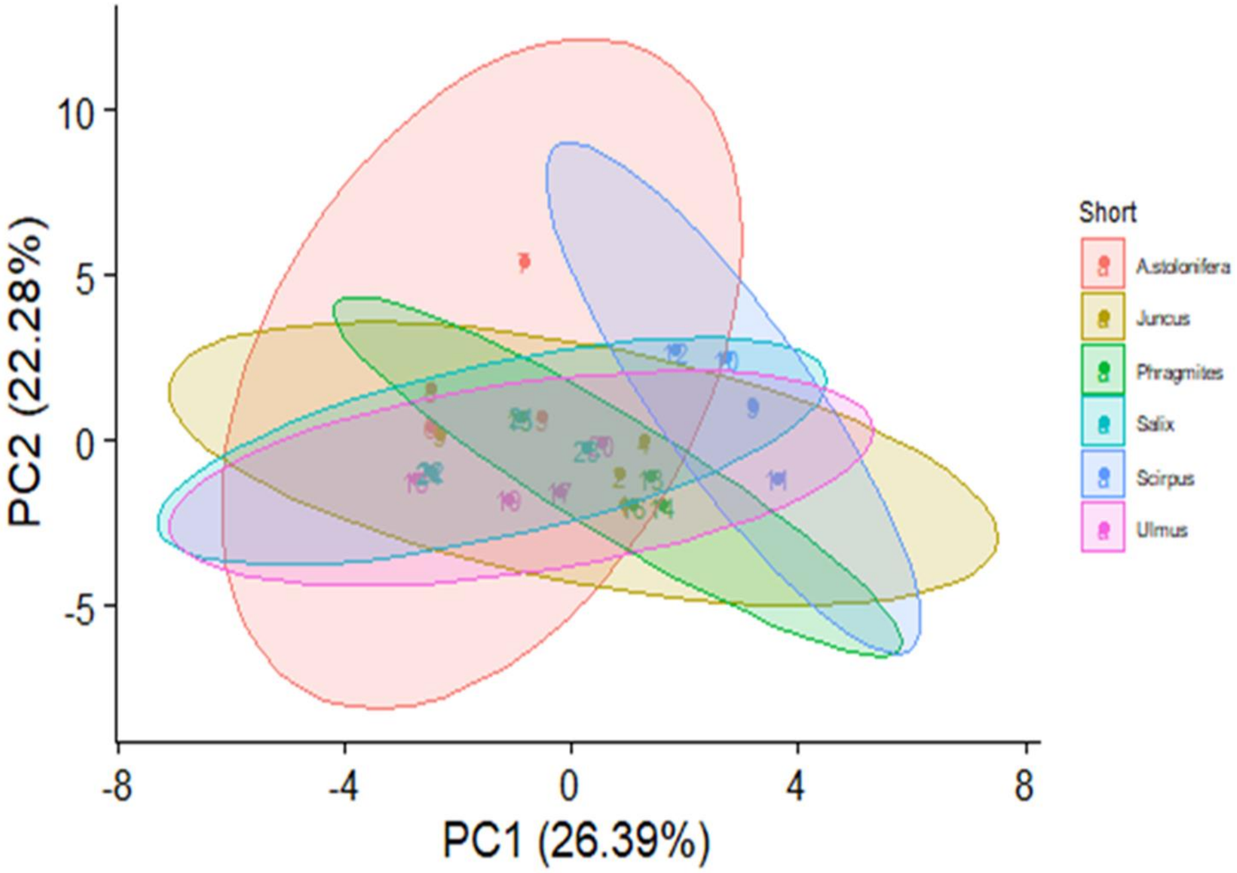
Principle component analysis used to reduce the dimensionality of the data, revealed a weak negative correlation between electrical conductivity and SOM.

Decreased plant production, altered community composition changing plant litter quality or quantity (Morrissey et al., 2014).

Increased decomposition rates as salinity alters carbon availability

Carbon mineralisation rates can be high in brackish soil but that it is difficult to predict or isolate the effects of salinity (Lu et al., 2020)

Results & Discussion



Principal component analysis showing the similarity between the different vegetation communities, and variation within the data.

Principle component analysis shows SOM formation cannot be explained by a single environmental factor.

Multi-dimensional approach more appropriate considering carbon chemistry, microbial systems, mineral soil surfaces, disturbance and climate (Grandy and Neff, 2008).

Supports findings that combinations of multiple factors are more relevant than single predictors of SOC (Ortner et al., 2021).

Conclusion

- In a complex site such as Lower Moors, SOM formation cannot be explained by any one environmental factor, there are multiple dimensions to be considered.

- Conditions within vegetation communities should be studied to determine the relevant drivers for SOM formation in each community.

- A multi- disciplinary approach to SOM formation research is important so all dimensions and processes are considered.

Acknowledgements

Questions

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