

Scotland's Rural College

Mining Contamination Disrupts Successional Change in Salt Marshes

Smillie, Chris

DOI:

<https://doi.org/10.5194/egusphere-egu21-15055>

Print publication: 28/04/2021

Document Version

Publisher's PDF, also known as Version of record

[Link to publication](#)

Citation for published version (APA):

Smillie, C. (2021). *Mining Contamination Disrupts Successional Change in Salt Marshes*. Poster session presented at European Geoscience Union General Assembly. <https://doi.org/10.5194/egusphere-egu21-15055>

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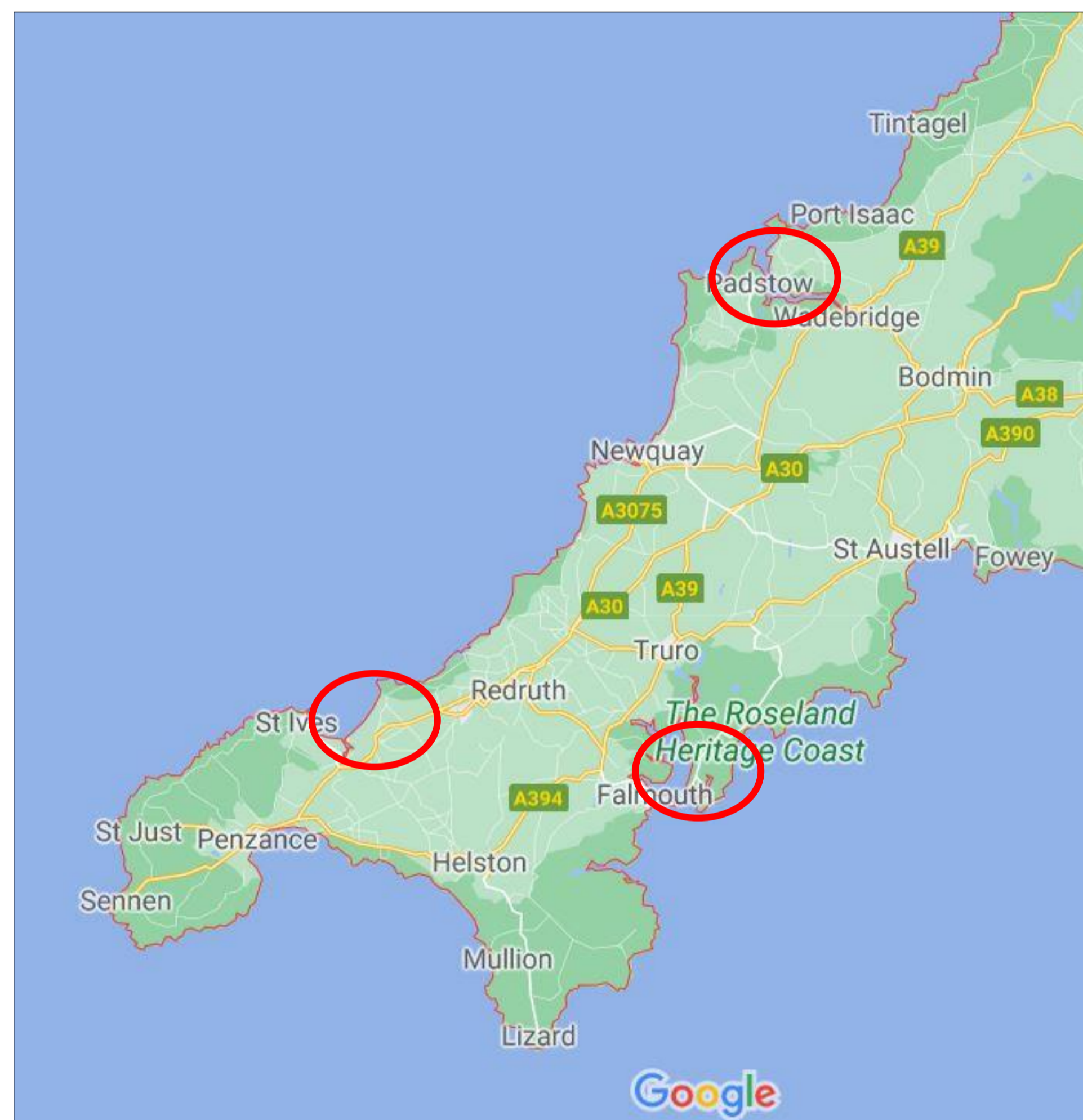
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Mining Contamination Disrupts Successional Change in Salt Marshes

Chris Smillie
SRUC Oatridge Campus
Ecclesmachan
Broxburn, EH52 6NH, Scotland
Email: Chris.Smillie@sruc.ac.uk

Introduction



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Cornwall has a history of metal mining dating back to Bronze Age times, with many of Cornwall's estuaries being highly enriched in metals and arsenic.

Research into the mid-marsh zone heavily impacted by mining contamination suggests these are characterised by a less diverse vegetation compared with less-polluted sites in the same region.

The estuaries chosen for this research were:

- Restronguet Creek: often cited as the most polluted estuary in Europe
- Lelant: subject to moderate pollution
- The Camel: where no significant pulse has been detected.

Methods

Salt marshes characteristically produce clear vegetation zonation patterns, which were used to divide the marsh into separate compartments. Quadrats measuring 4 x 4 m were placed within typical areas, then analysed using UK National Vegetation Classification (NVC).

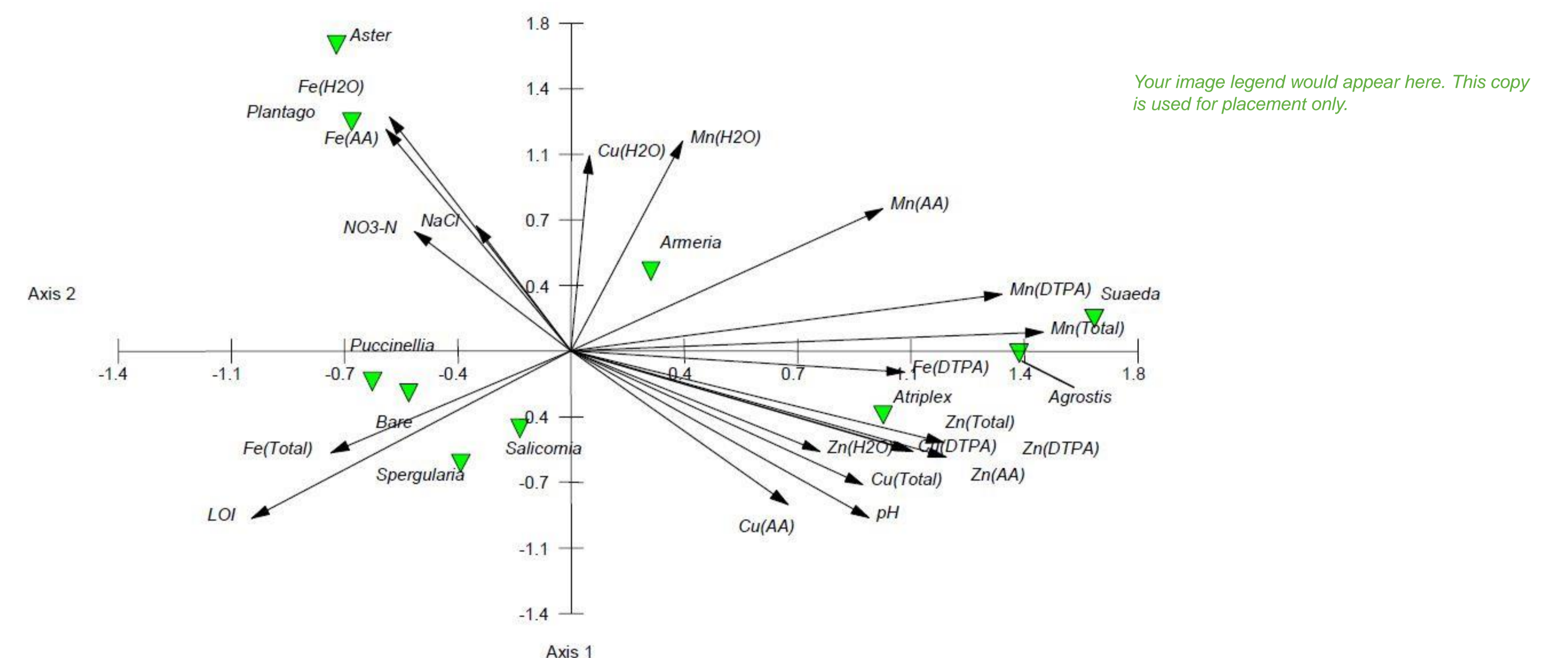
Samples from the rhizosphere were collected to root depth (100 mm), then oven dried for 80°C for 24 hours. To estimate bioavailability, metals were extracted using: water – to represent readily available metals; ammonium acetate (AA) – which can displace the most exchangeable and DTPA - representative of the tightly bound organic phase. Total metals were extracted using X-RF. Multivariate analysis was performed using canonical correspondence analysis.

Results

Plantago maritima was found dominating the mid-marsh of the Camel, whilst *Armeria maritima* dominated in Restronguet Creek. Lelant had both *P. maritima* and *A. maritima* abundant.

The CCA plot indicates *P. maritima* is associated with extractable iron. However, this element is at very low concentrations. More interestingly, *P. maritima* is opposed to the bulk of available metals (i.e. Cu and Zn) but aligned with higher nitrogen concentrations. *A. maritima*, however, is somewhat associated with higher metal concentrations but lower nitrogen than *P. maritima*.

Results (continued)



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Conclusions

When assessing plant-metal relationships in the mid-marsh, this research suggests:

- There is a clear division between the plant species found solely within the less-polluted Camel Estuary and the more polluted marshes of Restronguet Creek and Lelant.
- There is no salt marsh community within the NVC system where *A. maritima* is constant and dominant. This community only occurs in the heavily enriched marsh of Restronguet Creek.
- *A. Maritima* and *P. maritima* appear to be in a successional relationship based upon concentrations of metal pollution.

Zonation in the low-marsh has been associated with abiotic factors, whilst the mid to high-marsh is more closely aligned with competition (Hack and Bertness, 1999). Following Grimes (1977) strategy, plants that are more adapted to stress are then less competitive. *A. maritima*'s ability to manufacture proteins to survive in high-stress environments may therefore come at a cost, when in competition with *P. maritima*.

Significant amounts of *A. maritima* are present by the Dornoch Firth, where a possible source of contaminants could be derived from oil exploration. Similar marshes can also be found near Aberystwyth (Wales) and Sligo (Ireland), both of which are impacted by mining pollution.

Acknowledgements

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