

Scotland's Rural College

## Mining Contamination Disrupts Successional Change in Salt Marshes

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# Mining Contamination Disrupts Successional Change in Salt Marshes

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## 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).

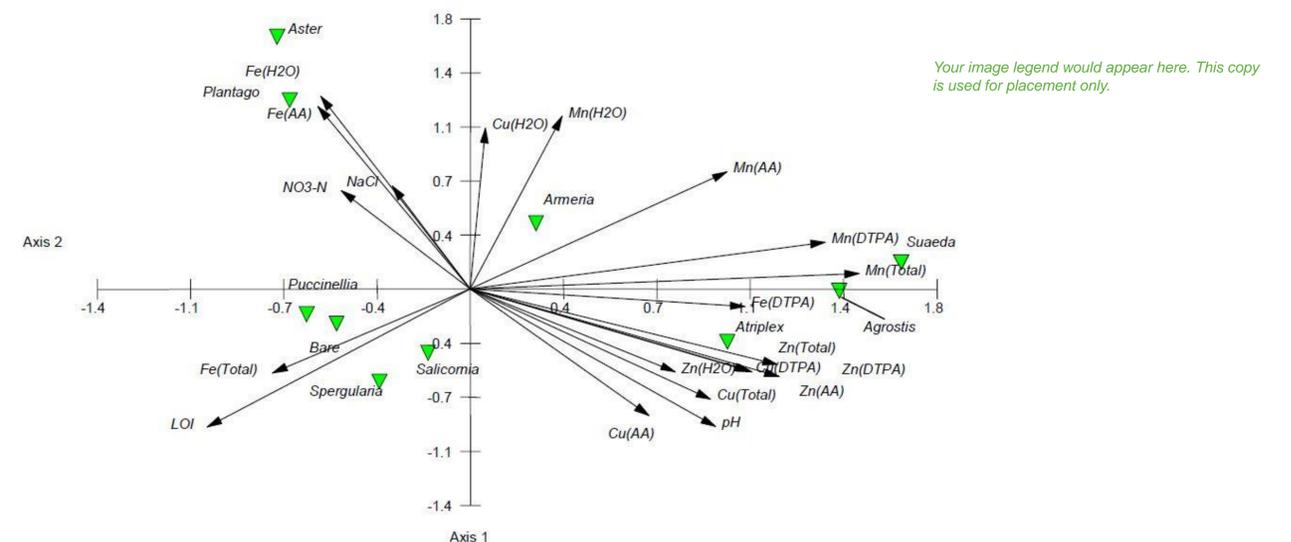
Samples from the rhizosphere were collected to root depth (100 mm), then oven dried for 80°C for 24 hours. To estimate bioavailability, metals were extracted using: water – to represent readily available metals; ammonium acetate (AA) – which can displace the most exchangeable and DTPA - representative 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)



## 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

If the author wants to identify a local address (or group/team name) that should be done using a superscript on the authors name at the top of the poster and a footnote giving the details at the bottom.