

MASTS Small Grants (SG391) – Final Report

Investigating saltmarsh sedimentary carbon sources and particle size composition: Tracing the source to sink journey

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The MASTS Small Grant award facilitated an investigation into the relative contributions of organic carbon sources to the sedimentary carbon sink of an estuarine saltmarsh, using Stable Isotope Ratio Analysis (SIRA) of nitrogen and carbon. Furthermore, supplementary particle size composition analysis is used to illuminate potential relationships between this and the derived carbon source characteristics. The study was focused on the saltmarshes of the Eden Estuary, extending from the surrounding catchment to the marine dominated mouth of the estuary. Across this sampling area sediment and vegetation samples were taken from the saltmarshes, mudflats, rivers, river banks, beach and sand dunes.

Sediment samples were taken using a contact core method, which flash freeze the top 2 mm of the sediment surface using liquid nitrogen. Samples were taken this way to preserve the physical macro-structure of the sediment layers. The cores were then further subsampled to allow analysis of just the top 1 mm of sediment; this restricts signal inputs to the most recent events (i.e. deposits of the prevailing season). To sub-sample the top 1 mm of the contact core a freezing microtome was used, cutting at 50 μm intervals. These samples represent either the 'sink', those taken within the natural and restored marsh, or the potential 'sources', those taken from the surrounding catchment along three feed rivers to the estuary, the mudflats, and from the marine dominated mouth of the estuary.

Vegetation samples were taken from within the previously described source and sink areas. The sampling aimed to gather a representative range of the vegetation types in (and around) the sediment sampling sites; taking both live matter and dead litter. These are used to represent potential sources to the sedimentary sink.

Samples were taken at the end of winter and summer allowing further investigation into seasonal variation and improve understanding of the source to sink dynamics. The samples were analysed to provide data on the ratios of nitrogen ($^{15}\text{N}/^{14}\text{N}$) and carbon ($^{13}\text{C}/^{14}\text{C}$), these data are then used to assess the relative contributions from the assigned 'sources' to the given 'sink'. Data on particle size composition will be analysed in concert with the SIRA. This will illustrate the importance of autochthons versus allochthonous derived organic contributions, potentially of use in forecasting future long-term developments, and highlight the effectiveness for particle size composition to inform on this characteristic.



Figure 1: Taking sediment contact cores using liquid nitrogen from the bank of the River Eden beyond the tidal reach to assess potential sources to the saltmarsh carbon sink. Image: Clare Maynard