# Effect of belowground structure on coastal wetland functioning and erosion resistance using X-Ray Computed Tomography

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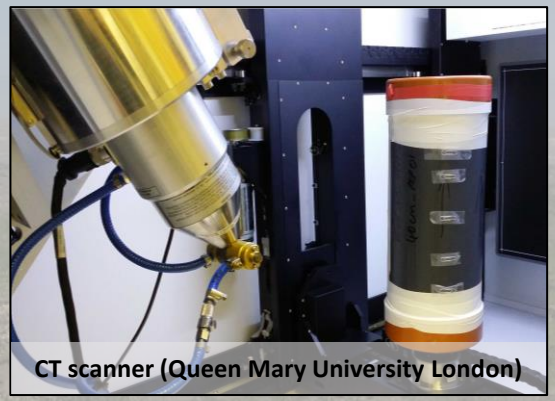
**Rationale: UK-RESIST aims to improve our understanding of what makes a marsh healthy and resistant to eroding forces.** This property and other key ecosystem services such as carbon storage and water treatment are highly dependent on subsurface structures and processes. **Of particular interest is the 3D subsurface organisation of pores and roots.**

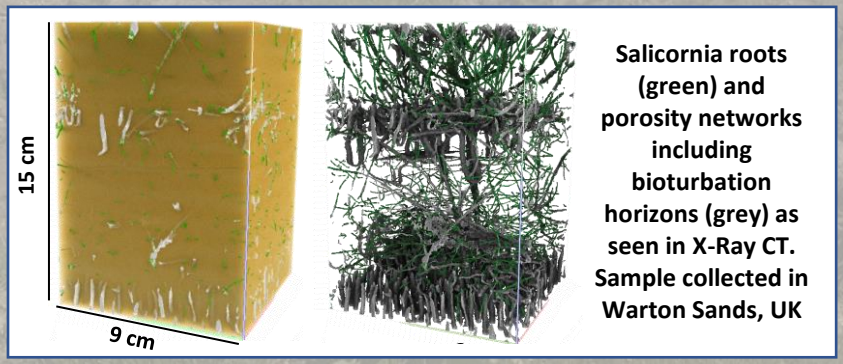
Eroding marsh front at Warton Sands, UK

Collection of undisturbed sediment core



CT scanner (Queen Mary University London)

**Method: X-Ray Computed Tomography (X-Ray CT)** combines the penetrating capacity of X-rays with 3D-volume reconstruction to observe the internal structure of objects in a non-destructive manner. Frequently used in agricultural science, it also offers an unprecedented opportunity to observe the more diverse subsurface environment of a saltmarsh.




**Salicornia roots (green) and porosity networks including bioturbation horizons (grey) as seen in X-Ray CT. Sample collected in Warton Sands, UK**

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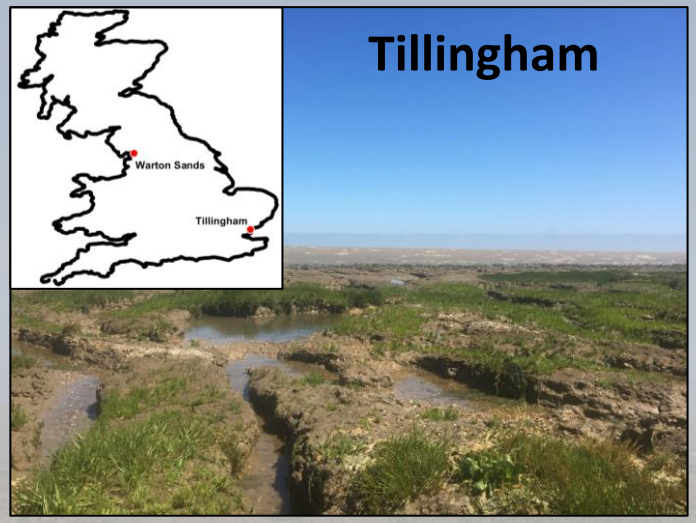
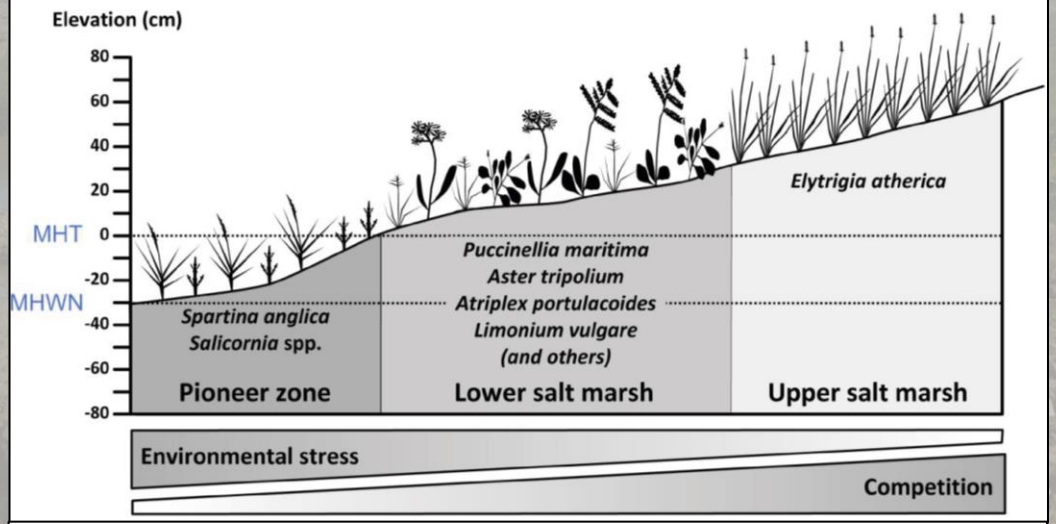
# Study sites: comparison of different sediment types and plant species





We consider 2 sediment types (sandy at Warton Sands, muddy at Tillingham) and 3 ground cover types (bare ground, *Spartina*, *Salicornia*, *Puccinellia*). 3 replicate sediment cores (15cm deep, 15cm diameter) were collected per location in January 2019 and scanned at a 62.5 micron resolution.




**Idealised marsh zonation (Modified from Rebelstein, 2018): depending on other influencing factors, species distribution can be highly variable**

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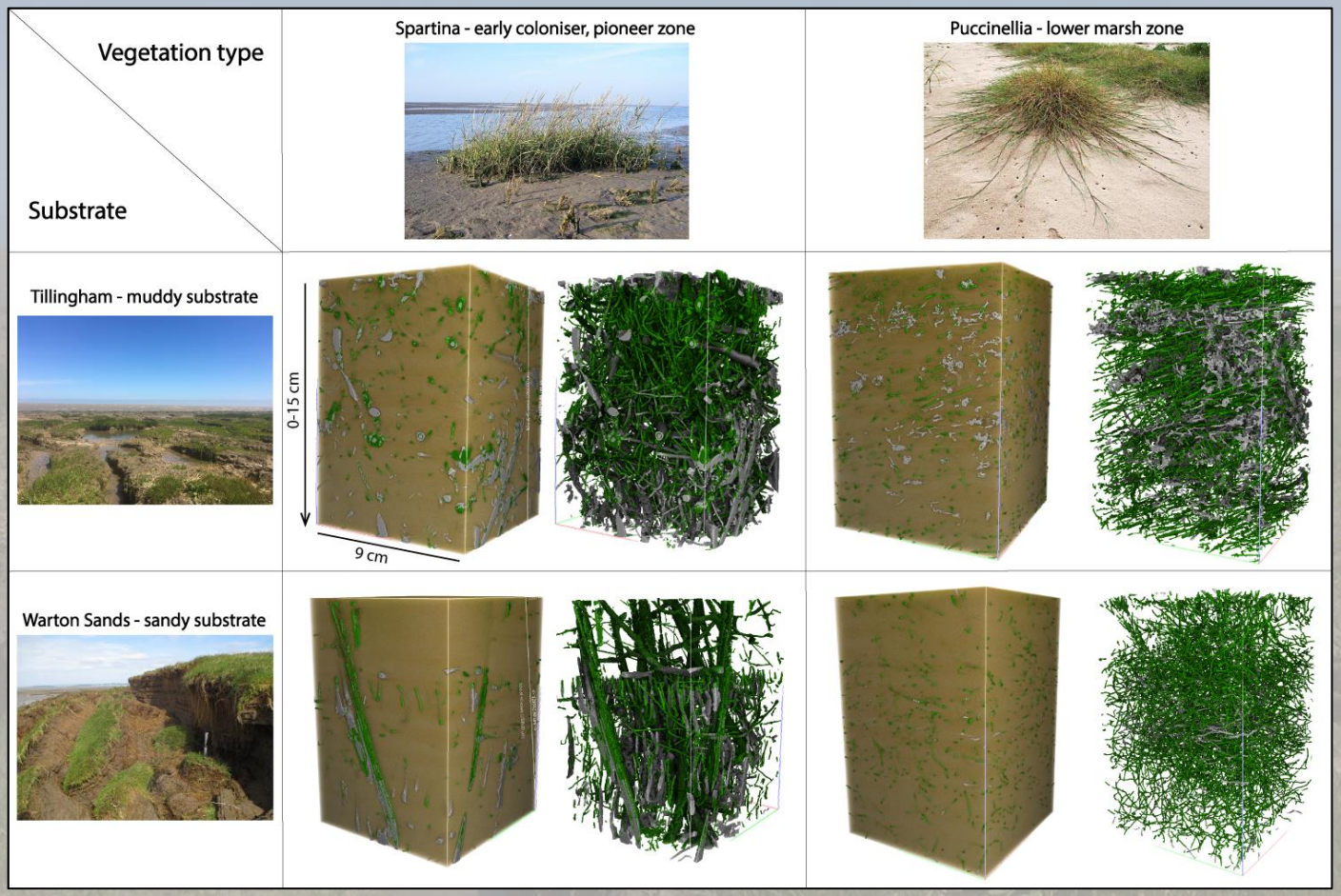
# Visualization of pores and organics

Using recent methods from medical and agricultural science, we developed a workflow that uses the X-Ray attenuation contrasts (~relative densities) and shape detection algorithms to distinguish the pores, roots and other organics from the sediment matrix. Differences in sediment types and vegetation cover have a direct impact on subsurface structures. We will draw links between these different structures and differences in marsh functioning.

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