Groundwater dynamics in freshwater tidal marshes: natural marsh ↔ restored marsh

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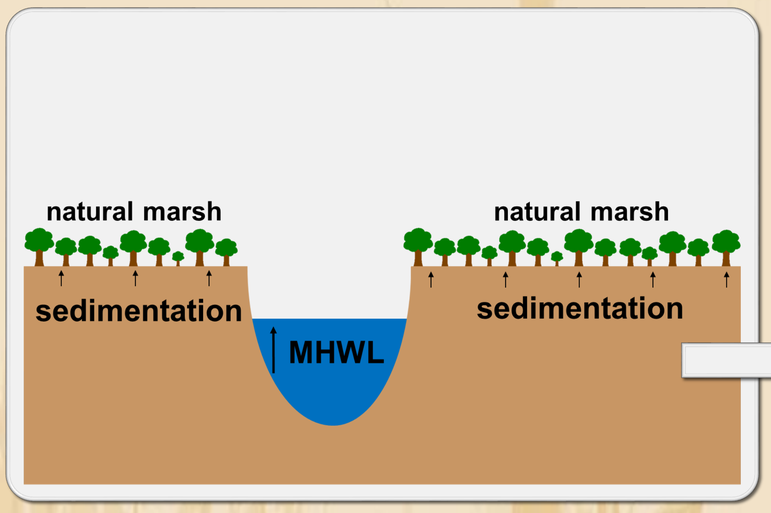
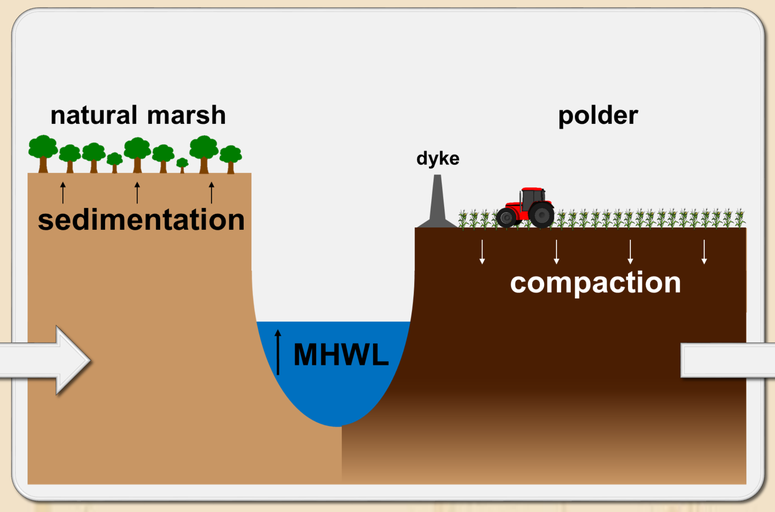
In restored tidal marshes, the soil structure changed because of the historical land use.

original situation



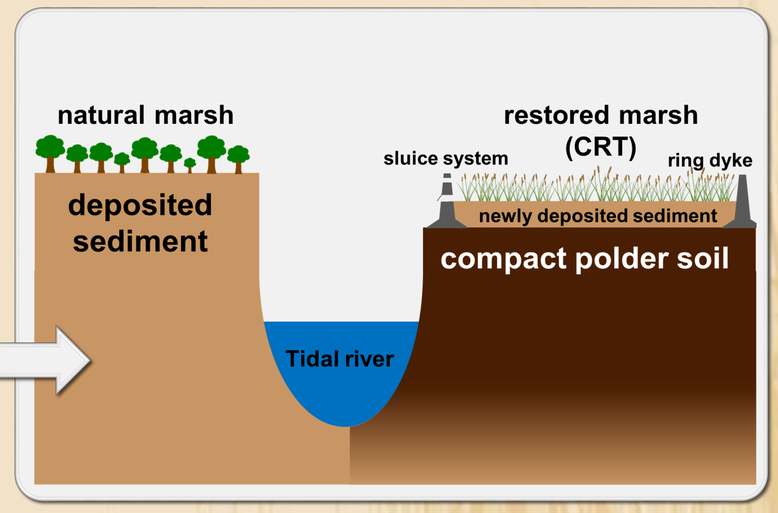
1) The surface level of the tidal marshes increases due to an increasing mean high water level in the tidal river as a result of anthropogenic influences on the estuary.

embankments



2) The marsh is embanked (right side). The use of heavy farming equipment and constant drainage led to **soil compaction** in the embanked site.

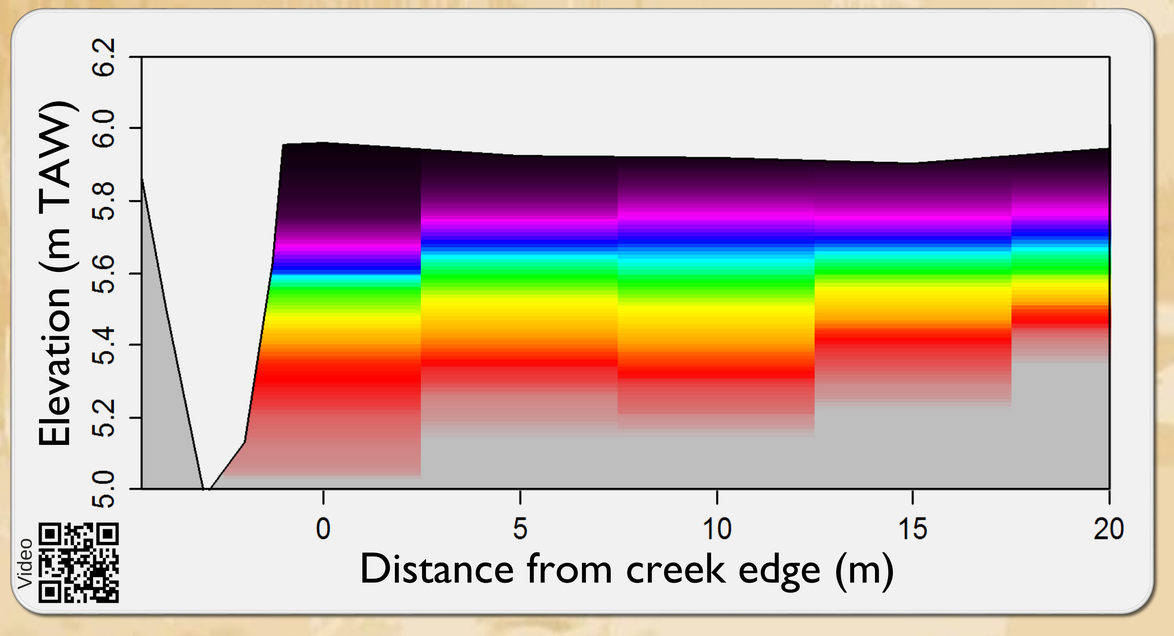
present situation



3) The marsh is restored (right side), marsh vegetation develops and sedimentation occurs again. The restored marsh has a **two layered soil stratigraphy.**

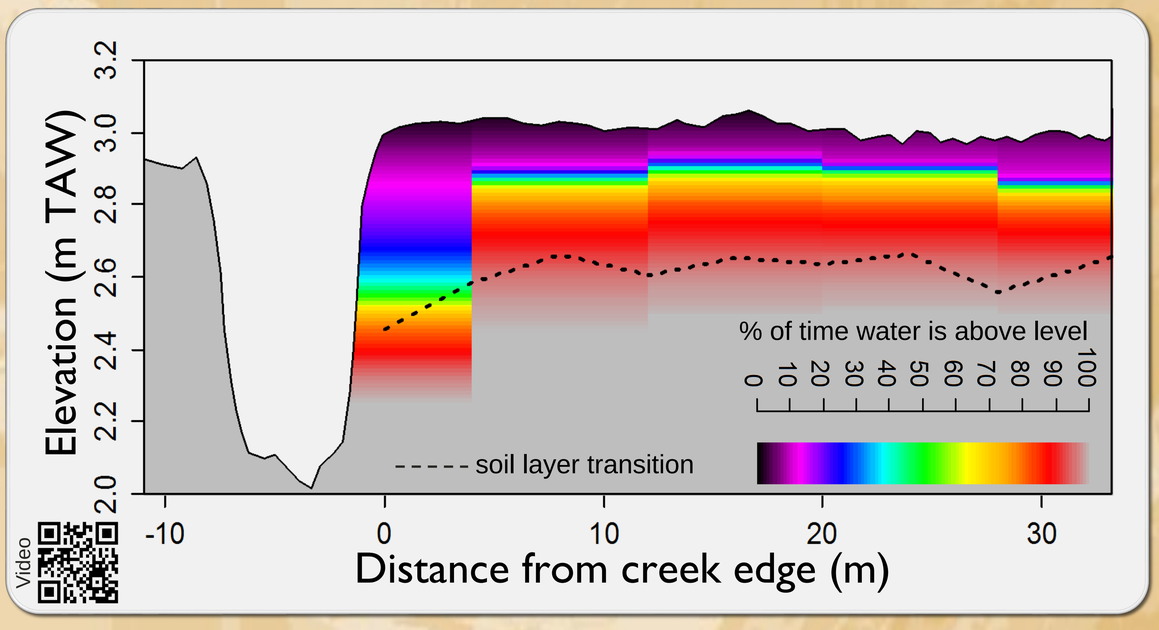
As a result, groundwater dynamics in restored tidal marshes are reduced.

Natural tidal marsh



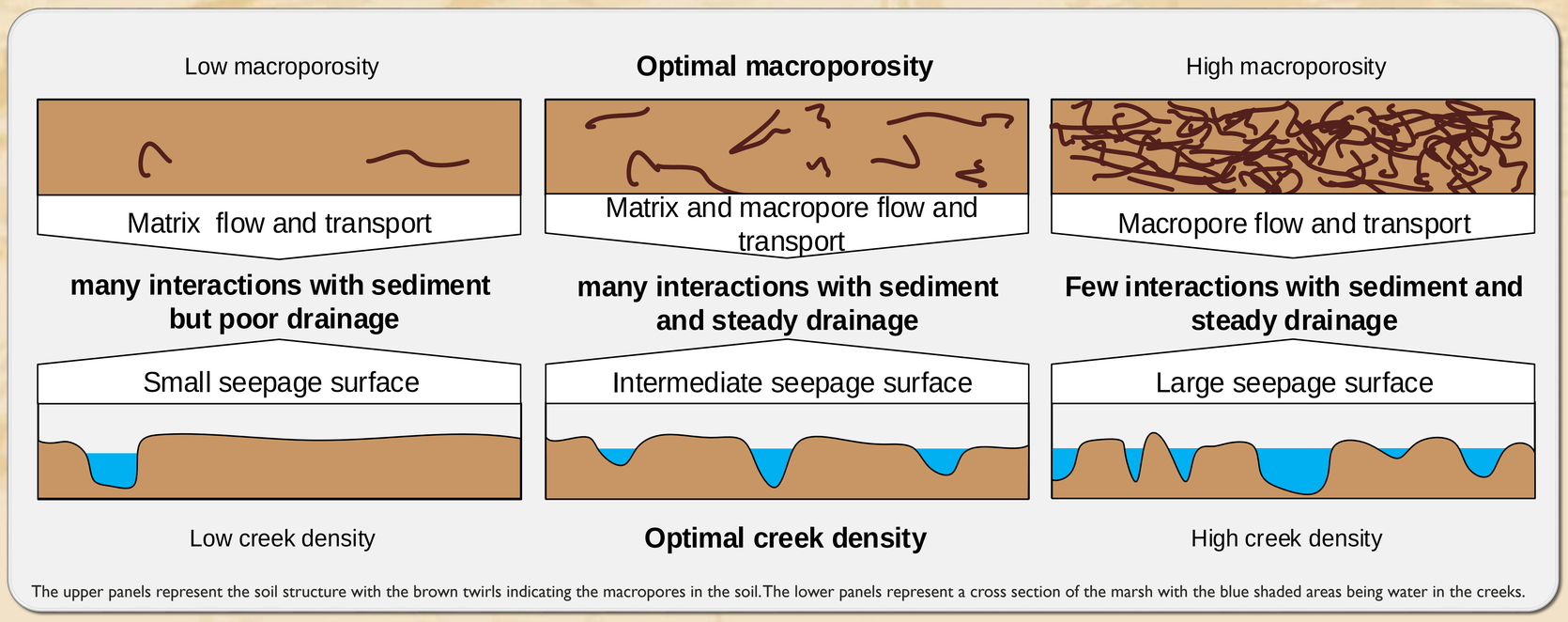
The water in the marsh soil drains towards the creek in between tidal inundations. At the end of the neap tide, the water level close to the creek is as low as the creek bottom (based on field measurements).

Restored tidal marsh



The groundwater level in the restored marsh site does not fall below the top of the thick compact agricultural relict soil. As a result, less water is exported to the tidal creek in between tidal inundations.

There is a pressing need for new design criteria to optimize the groundwater flow and the associated water quality improving function of restored tidal marshes.



The upper panels represent the soil structure with the brown twirls indicating the macropores in the soil. The lower panels represent a cross section of the marsh with the blue shaded areas being water in the creeks.

We found that **macropores** play an important role governing groundwater dynamics in tidal marshes and that groundwater flow predominantly occurs in the **close vicinity of tidal creeks.**

In a new study, we want to determine the best possible soil hydraulic properties and creek density a restored tidal marsh can have to optimize its water quality improving function. These optima will then be translated into **viable design criteria for new marsh restoration projects.** This figure gives a hypothetical framework for the intended research.