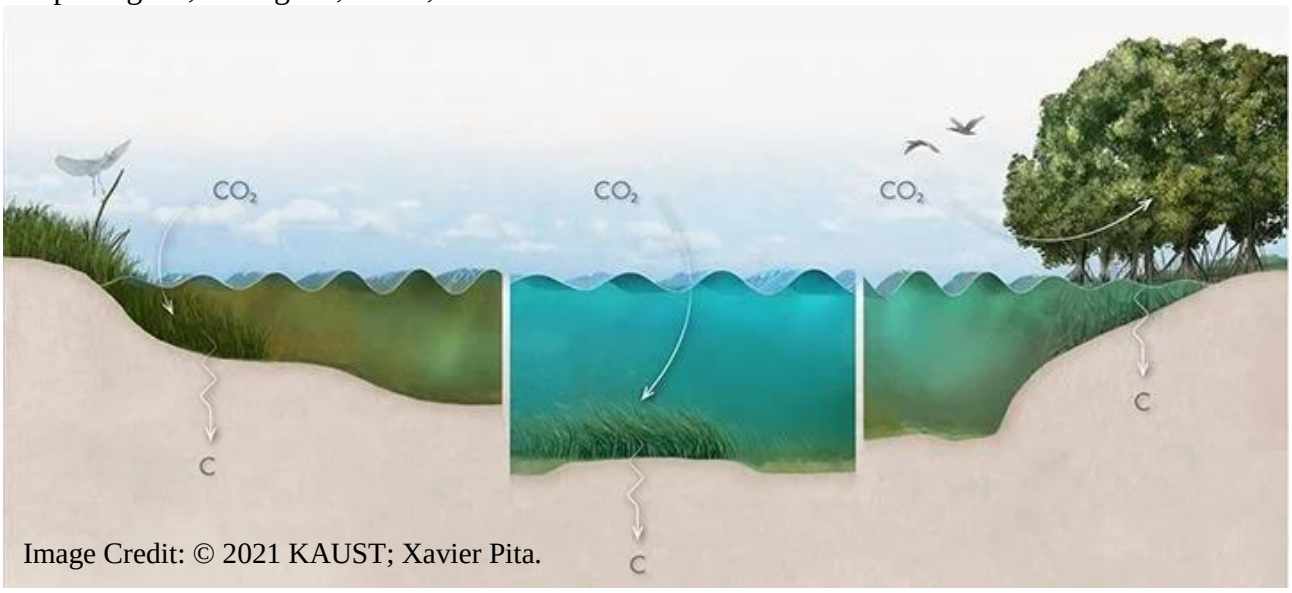
Effective role of salt-marsh and seagrass ecosystems in organic carbon sequestration

(Proposers: Andrea D'Alpaos, Sonia Silvestri & Marco Marani)

Summary: Coastal ecosystems such as mangrove forests, salt marshes and seagrass meadows (see Figure) are simultaneously some of the most socio-economically relevant and vulnerable ecosystems on Earth. They provide fundamental ecosystem services, like habitats for fisheries and several marine species, protection from erosion and storms, regulation of coastal water quality and also serve as efficient natural carbon (C) sinks, thus helping to offset CO_2 emissions and fight climate change (they are called Blue Carbon Ecosystems – BCEs). BCEs can store up to 30% of the global terrestrial soil C (Trettin & Jurgensen, 2003) and trap carbon 50 times faster than typical "green" forest biomes (McLeod et al., 2011). Interestingly, BCEs can store 80% of the C in their soils, where it is locked away for hundreds to thousands of years.
In this project we aim at describing the dynamics of tidal landforms in the Venice Lagoon and in what today remains of an ancient and vast lagoon belt extended, in the post-glacial period, from Ravenna to Aquileia, and also in other tidal systems worldwide. Important questions that need to be addressed are e.g., **"How will tidal landforms and ecosystems respond to and their ecosystem services be affected by climate changes and human interferences?"** Addressing these questions is of the utmost importance, both from a theoretical and practical point of view, for the great morphological, ecological, social, and economic value of BCEs.



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Aim of the project. Despite a number of studies have addressed the biogeomorphic response of tidal landforms to changes in the environmental forcings and of human activity, most of these studies have been carried out within separate disciplines. **Within this project we aim at developing** an **innovative, integrated, interdisciplinary approach** that combines hydrodynamic, geomorphological, ecological, and sedimentological analyses, carried out through field observations, laboratory analyses and numerical modelling.
The main goals of the project are to:
i) quantify the **capacity** of seagrass and salt-marsh ecosystems to **sequester C**, and improve current knowledge of the drivers that make marshes efficient carbon sinks;
ii) highlight the often unaccounted or underestimated **true value of BCEs**, which are valuable resources generating positive net benefits over time that can balance their conservation costs.

Expected Results. The results of this project will allow the PhD candidate to:
i) bring new insight into the biogeomorphic processes driving BCE dynamics and the related ecosystems services;
ii) integrate different techniques to study BCE dynamics through an interdisciplinary approach and clarify the drivers of C-sequestration, such as the rate of relative sea-level rise, soil accretion, primary productivity, and vegetation biodiversity;
iii) use the observational quantification of C-sequestration to set up a mechanistic model of the changing seagrass and marsh biomorphodynamics and C stocks at the marsh scale.

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