Fate of Soil Carbon Following Sea Level Rise-Induced Coastal Wetland Submergence

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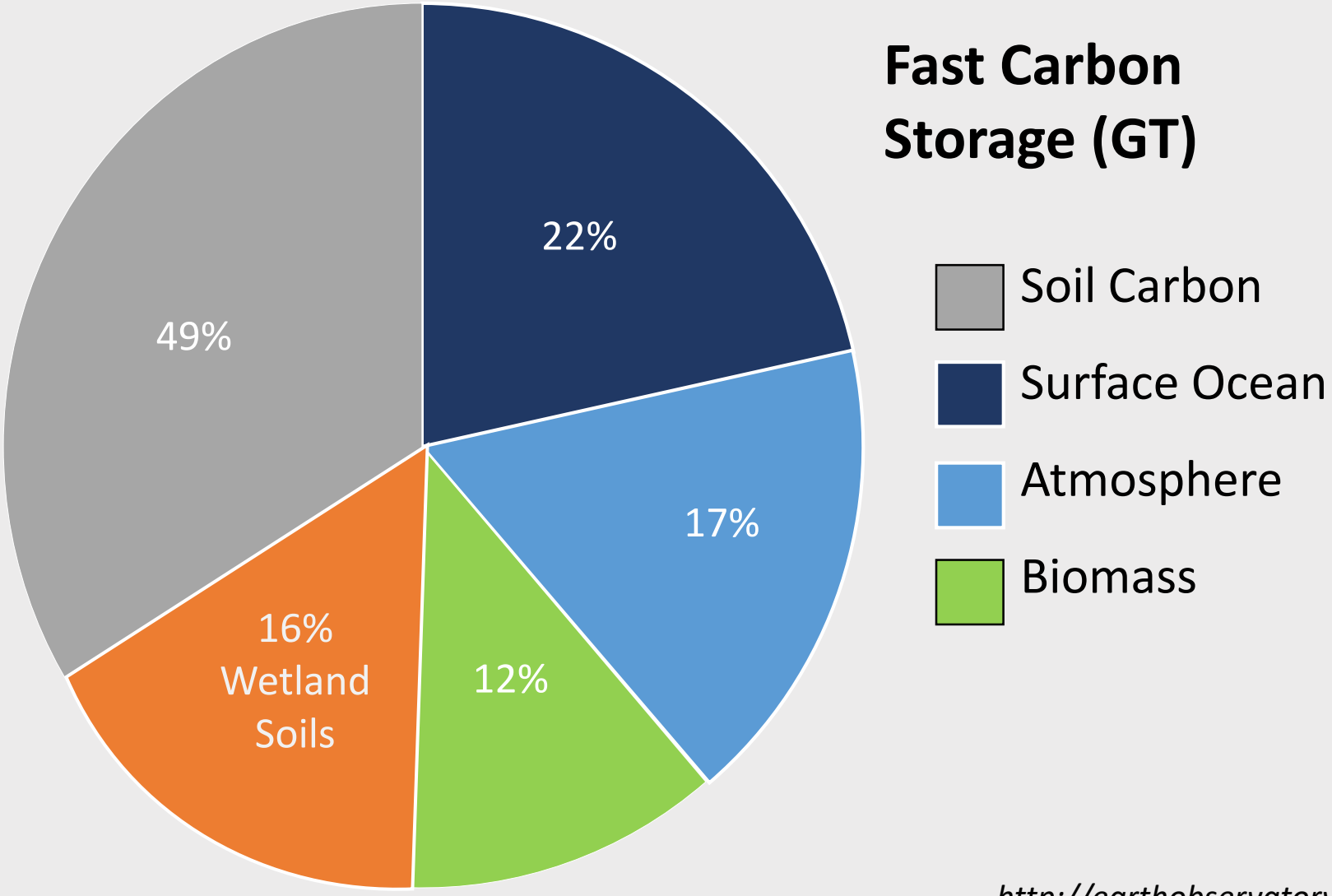
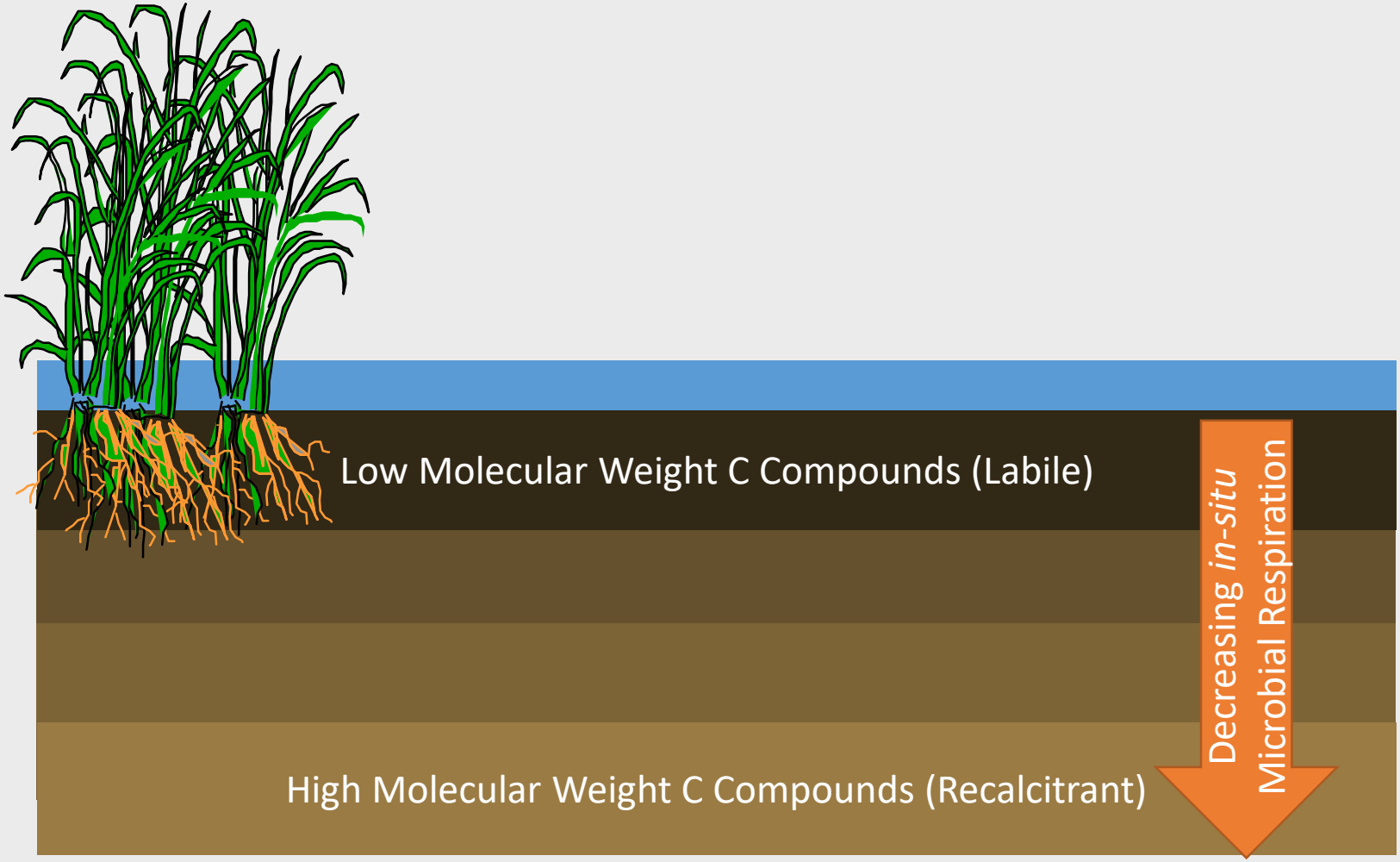
Wetlands store a disproportional amount of C in relation to land area.

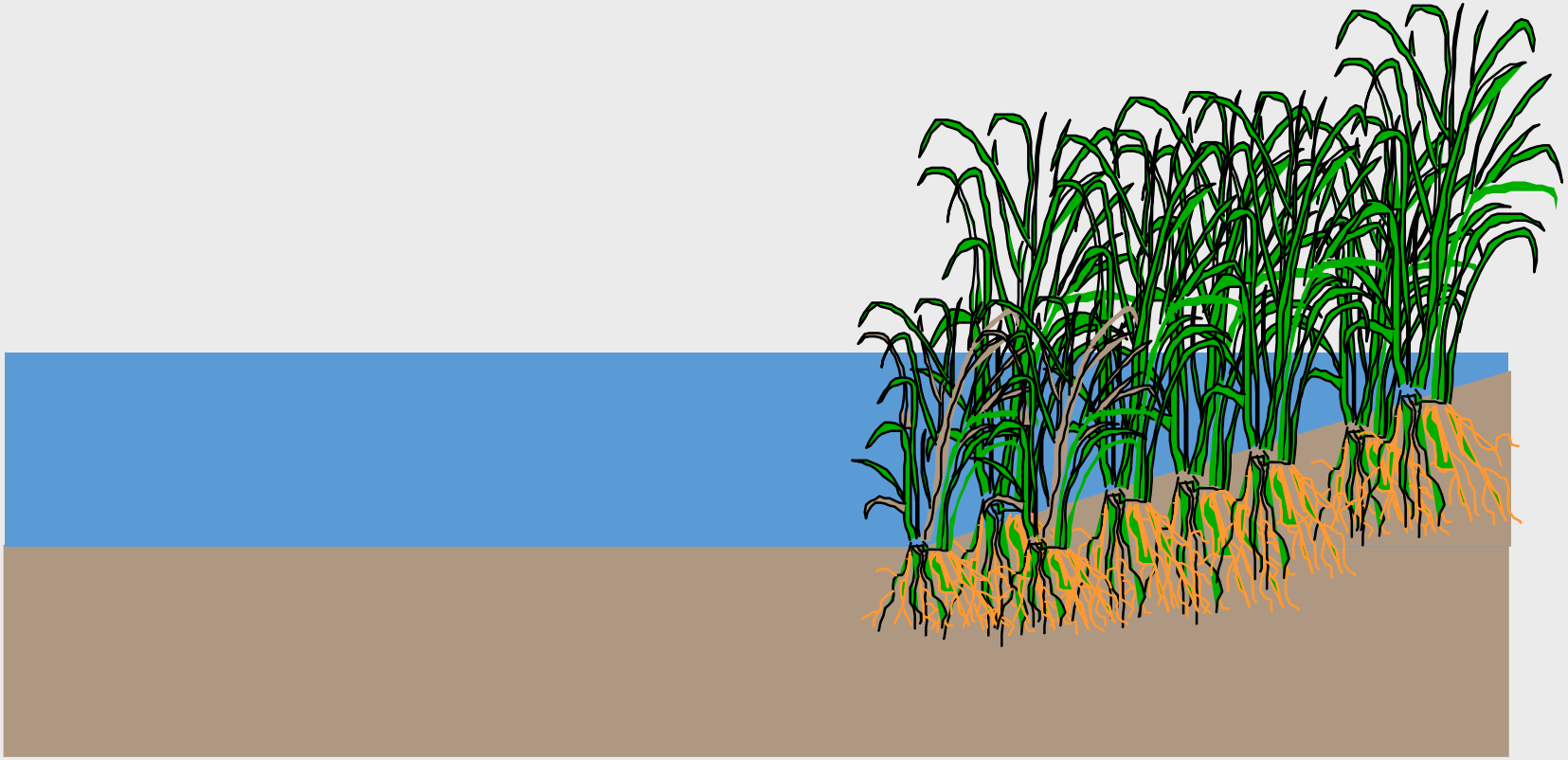


http://earthobservatory.nasa.gov

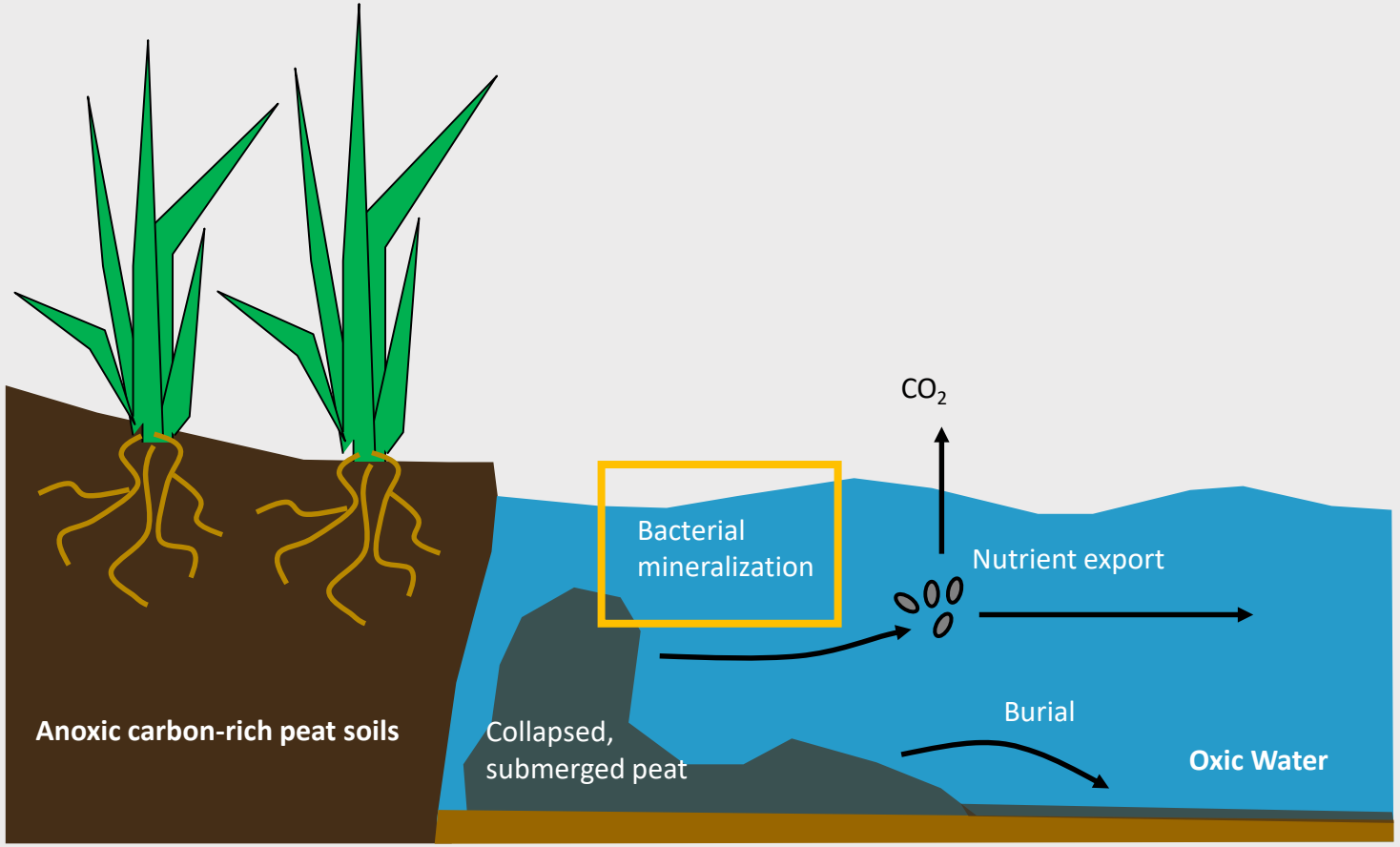
Labile C is prevalent at the soil surface, while recalcitrant C is buried at depth.

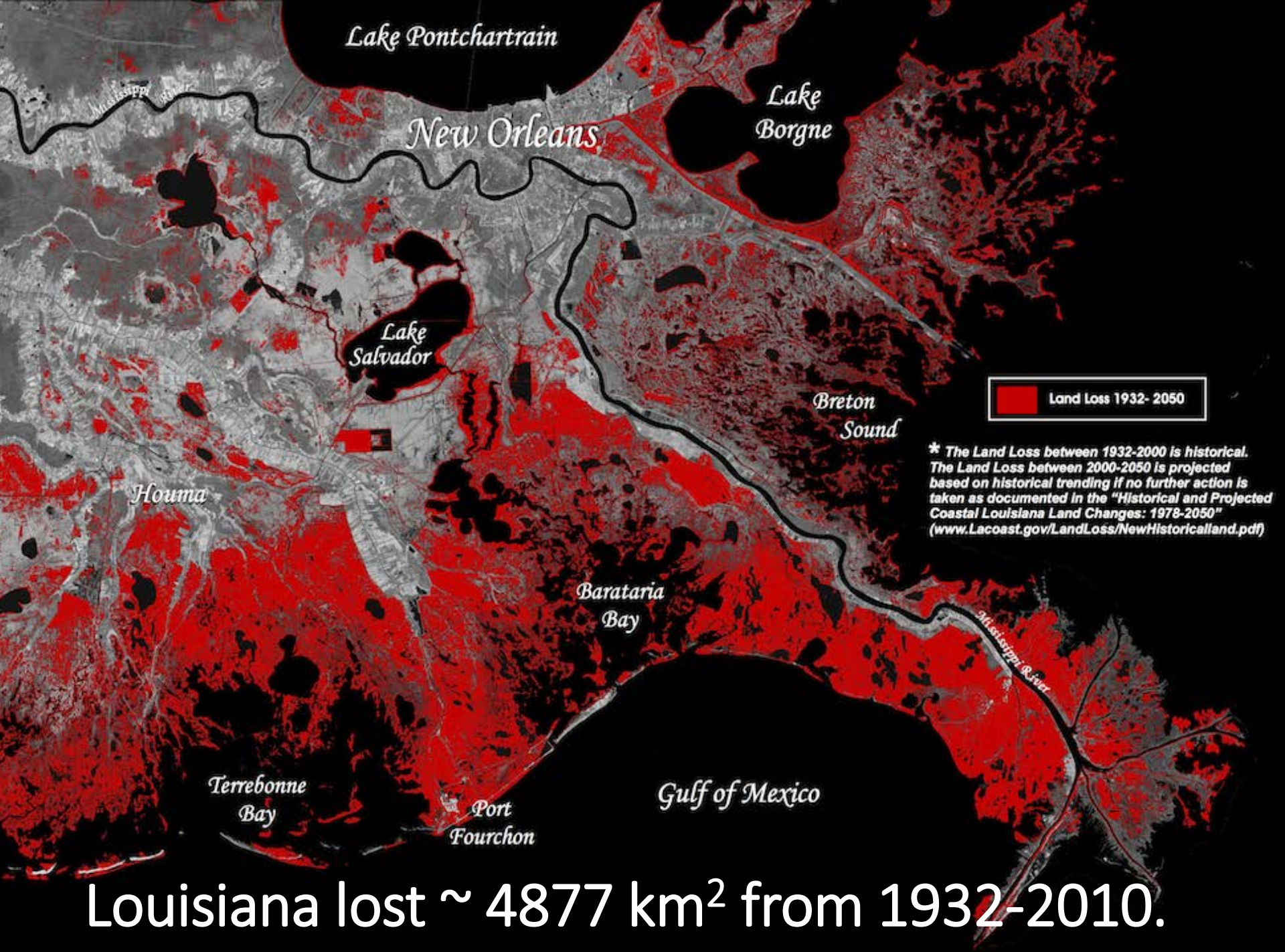


Coastal wetlands can submerge in response to SLR, disarticulating the soil structure.



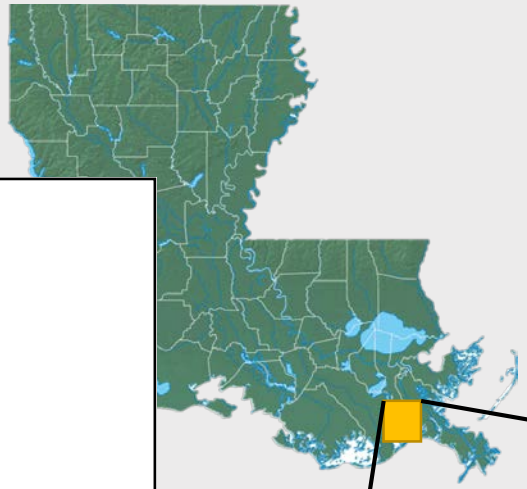
What is the fate of soil C following wetland submergence?





Louisiana lost ~ 4877 km^2 from 1932-2010.

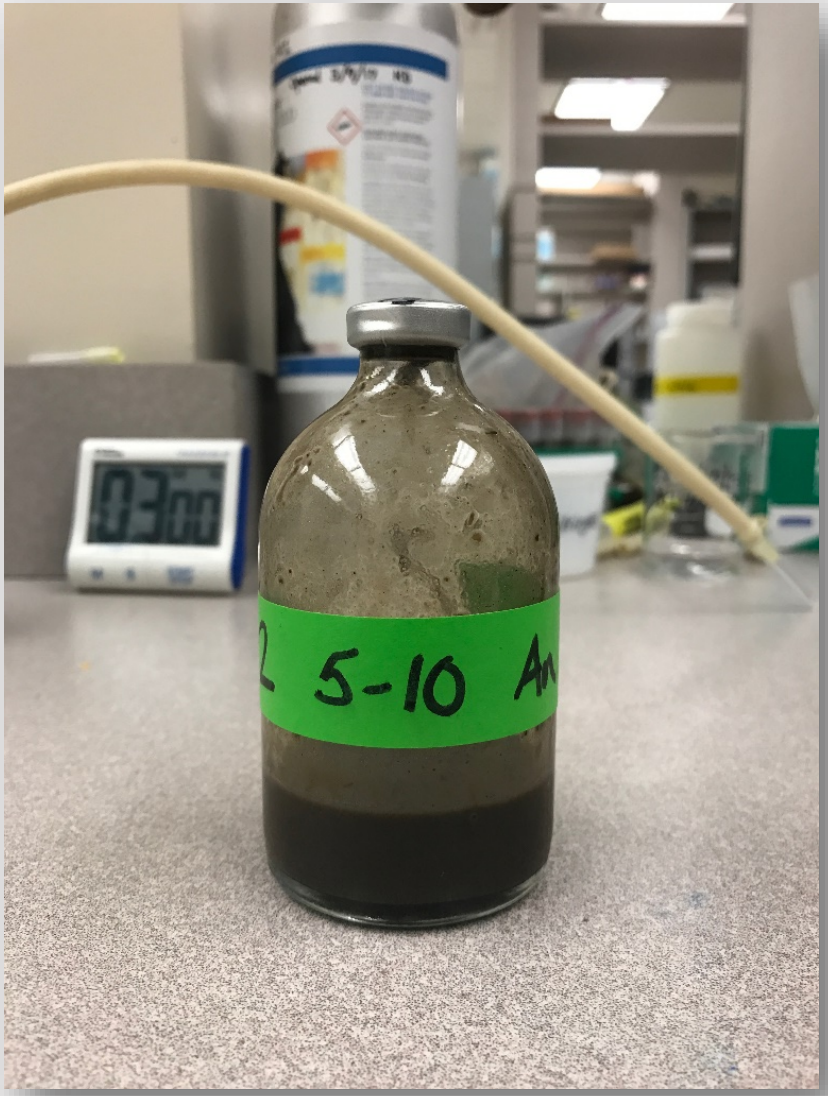
RSLR rates of > 10 mm yr^{-1} threaten 1-2m of sequestered peat in Barataria Bay.



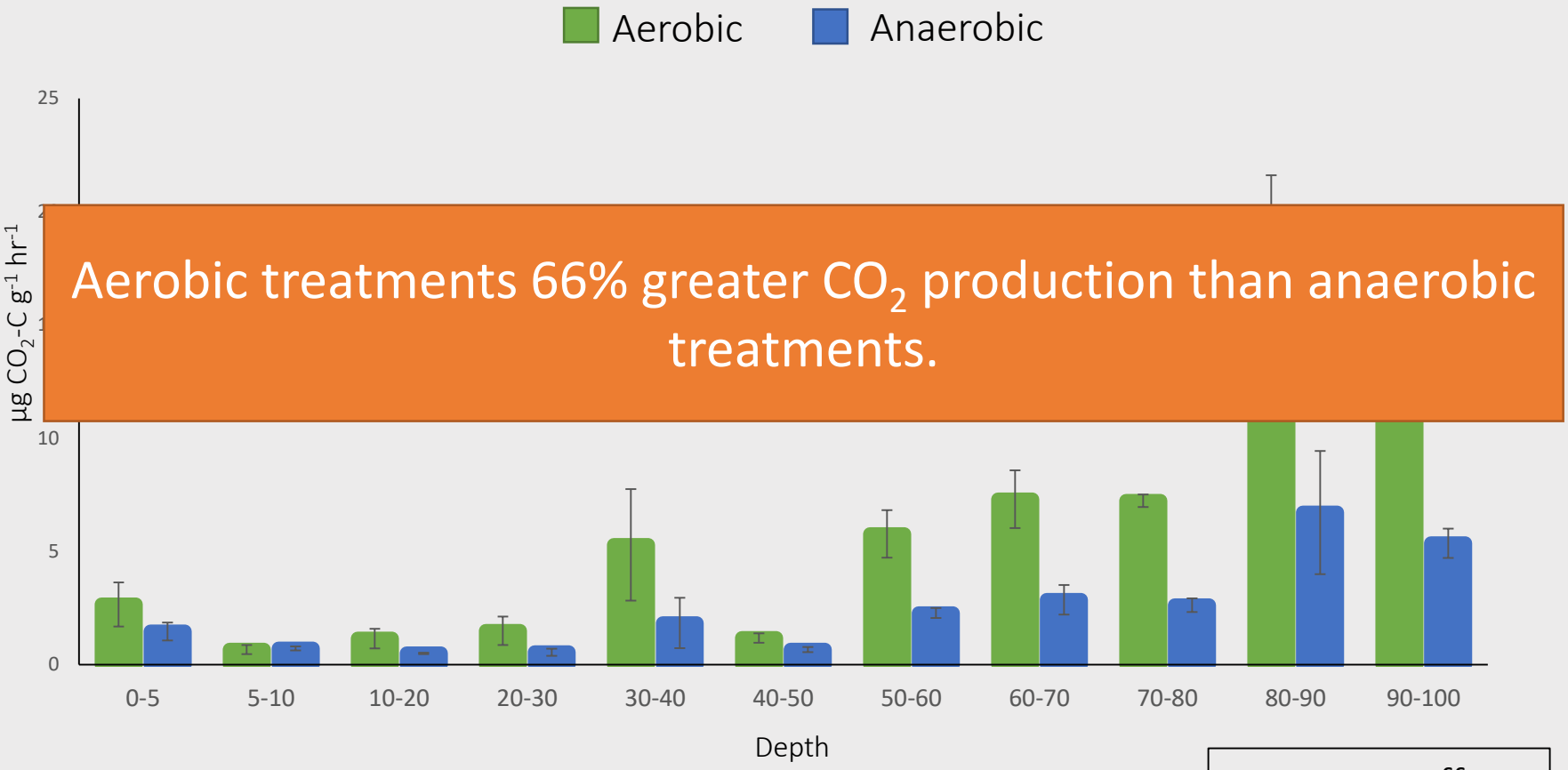
How does O_2-rich seawater impact mineralization of organic matter following submergence?

Submerging marsh: Purged with breathing air

Intact marsh: Purged with N_2 gas



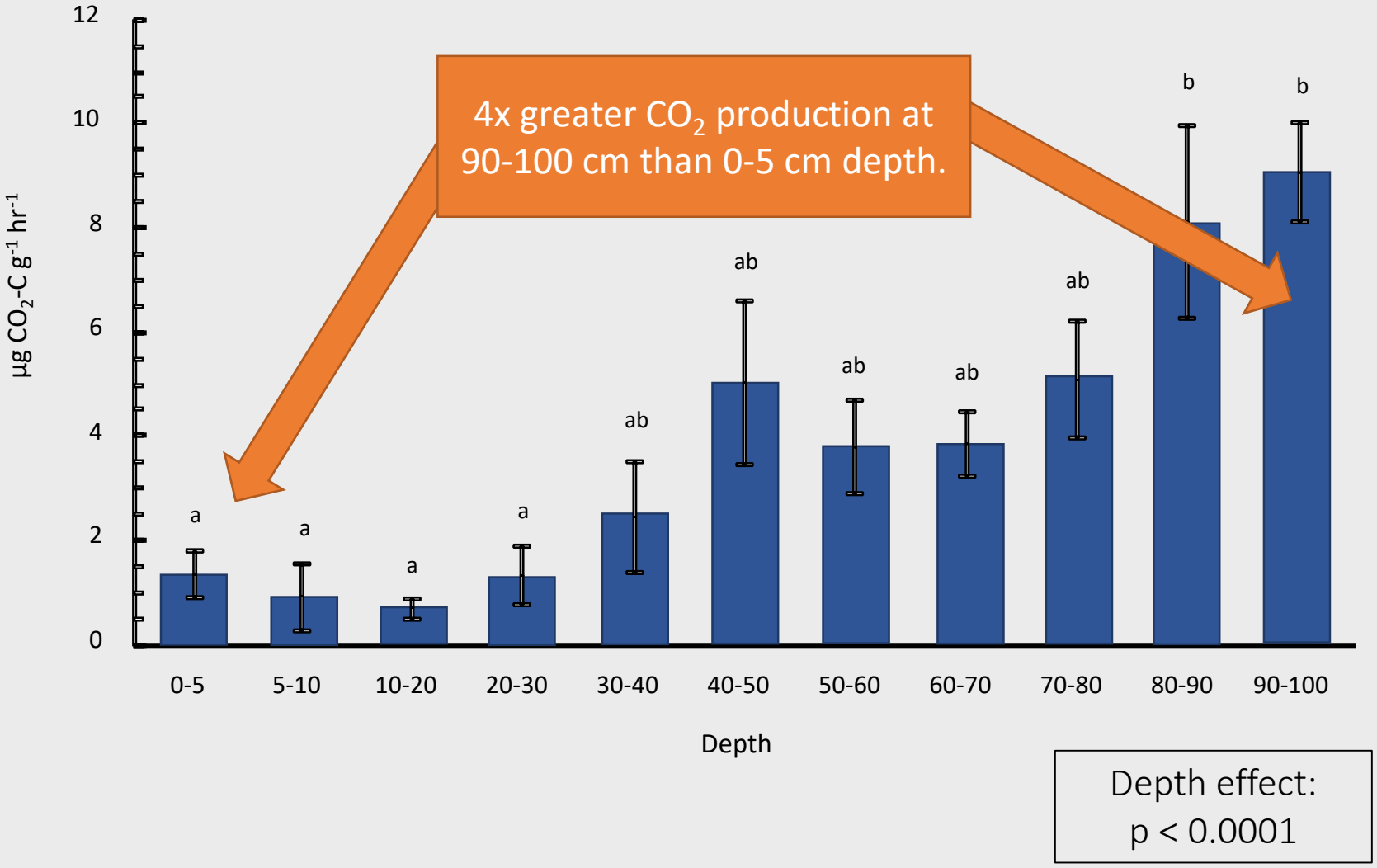
Aerobic treatments produce more CO_2 than anaerobic treatments, especially at greater depths.



Aerobic treatments 66% greater CO_2 production than anaerobic treatments.

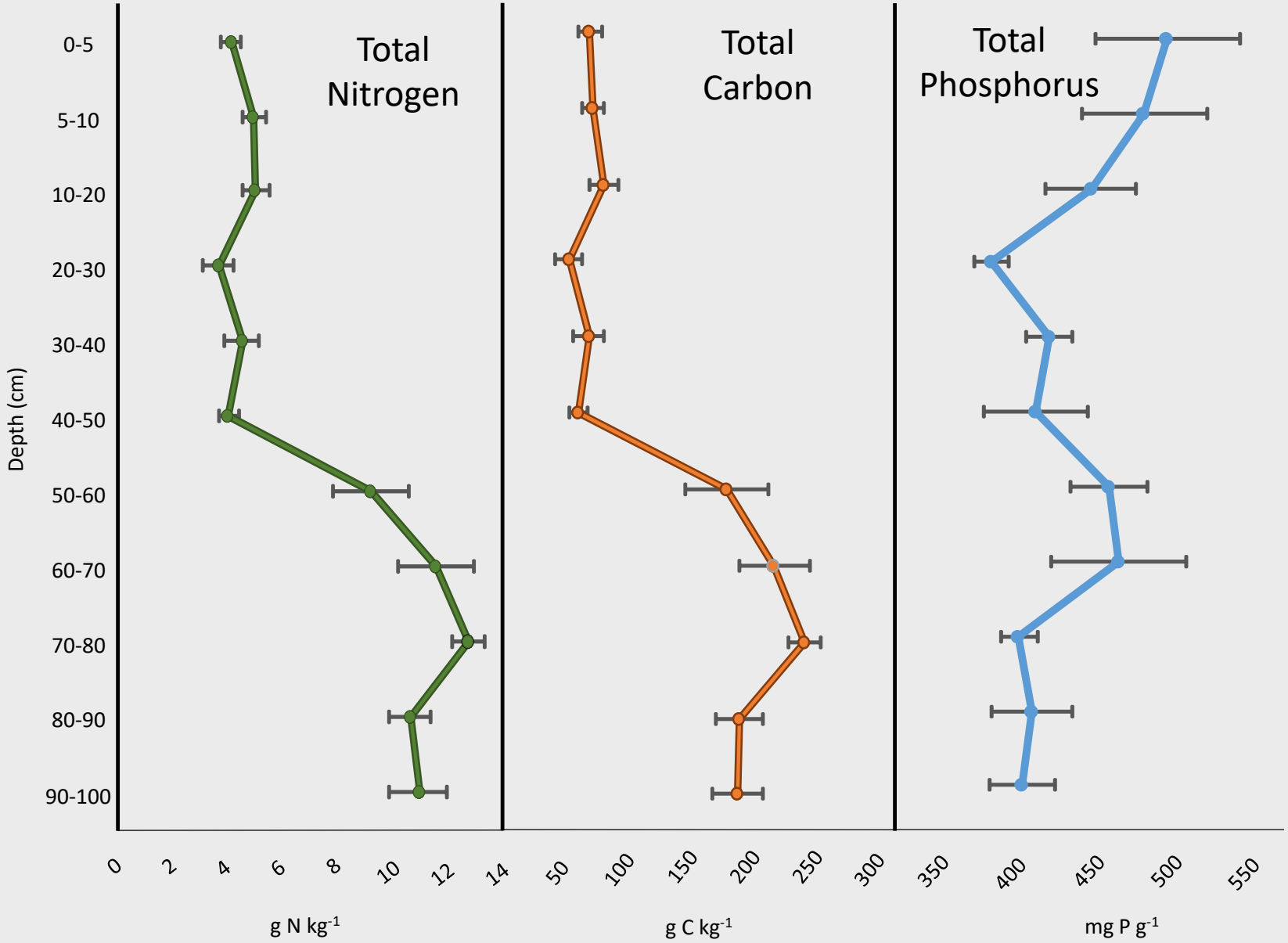
Treatment effect:
$p < 0.0001$

Increasing depth increases potential mineralization of organic C.



Depth effect:
$p < 0.0001$

Total soil C and N concentrations between 0-50cm significantly different from 50-100cm.



Past depositional environments affect response of coastal wetlands to SLR.

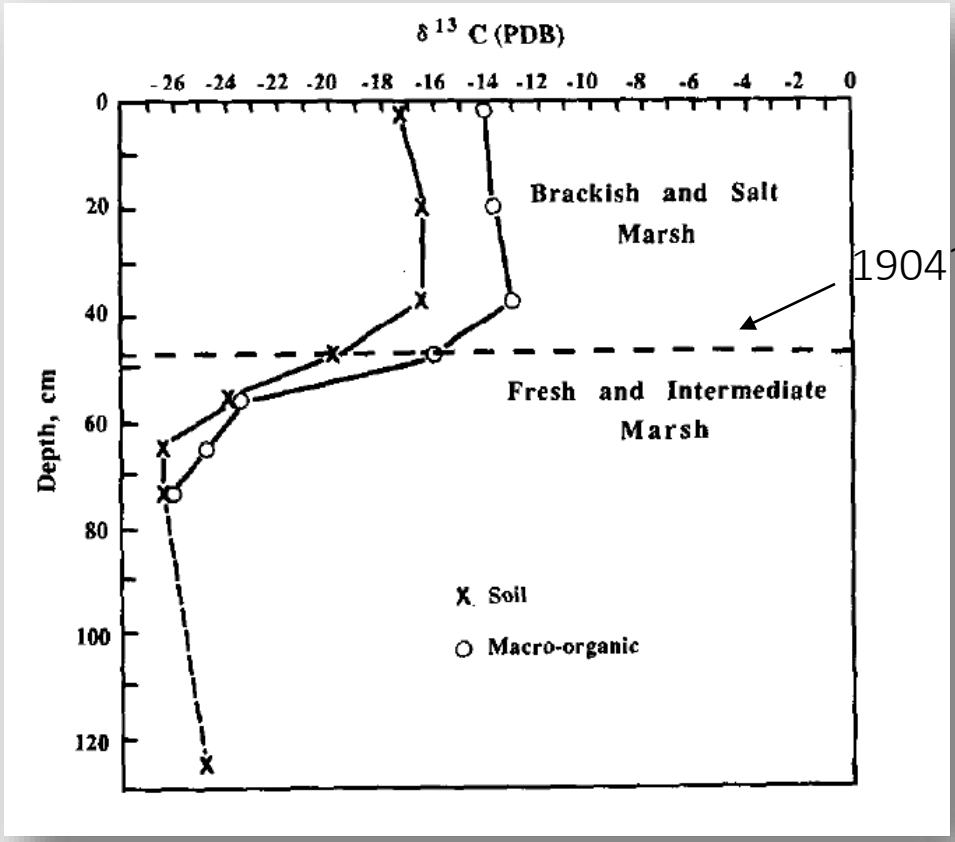
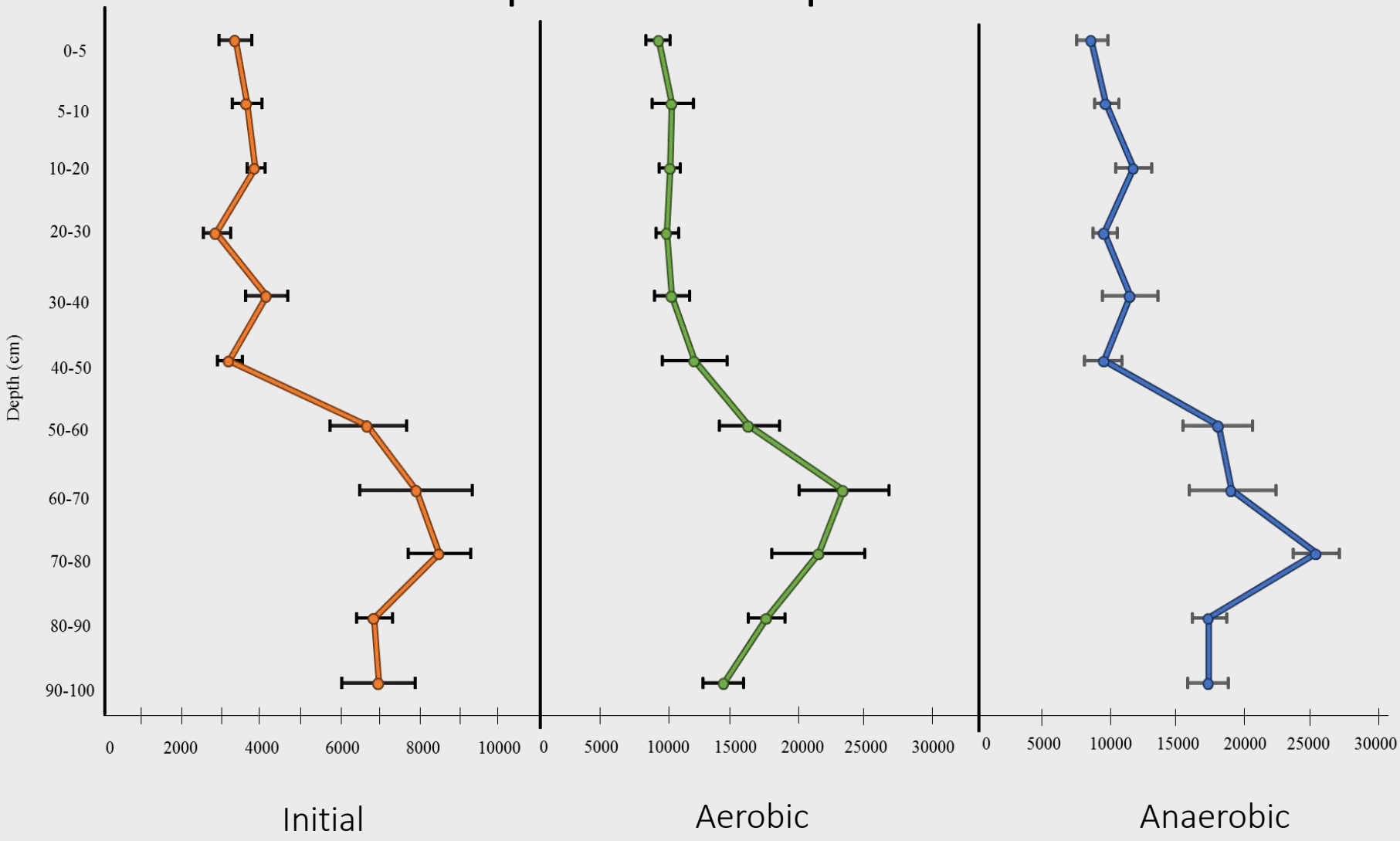
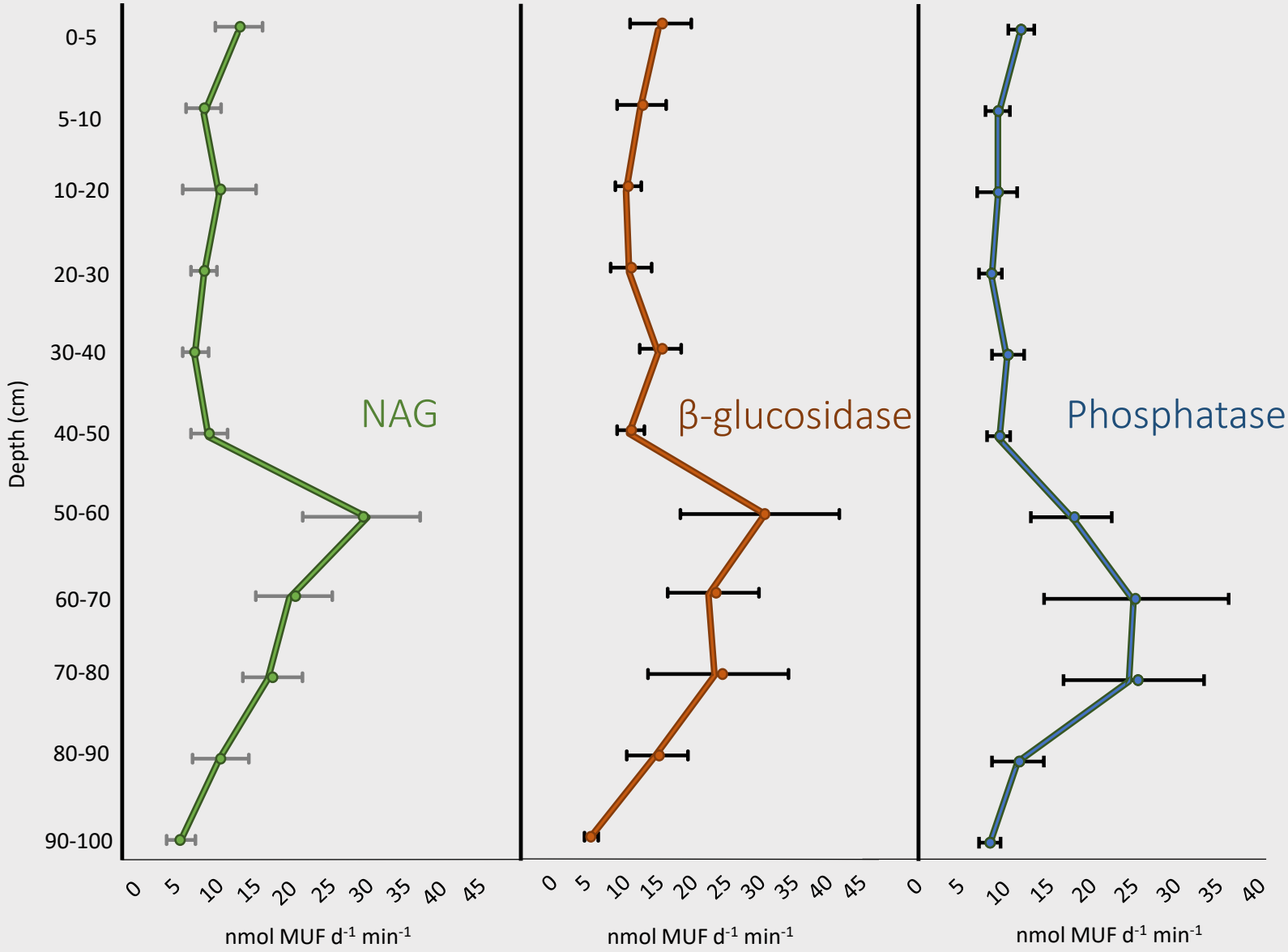


Fig. 2 from DeLaune, 1986

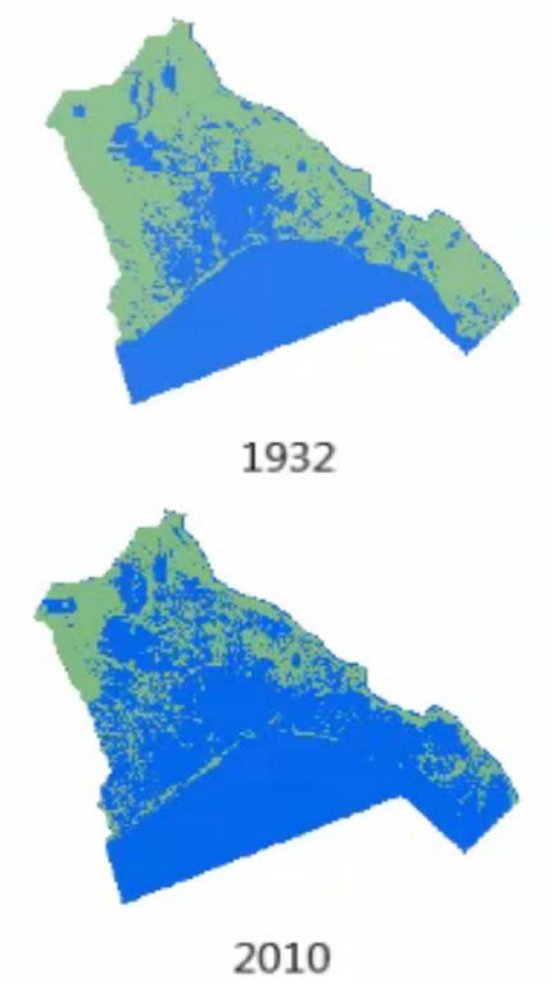
Both in situ and after incubation, microbial biomass C peaks deeper in the core.

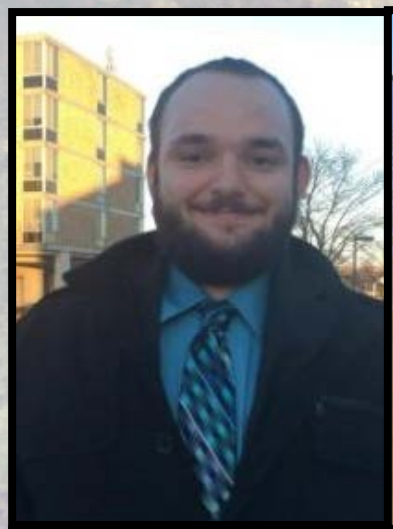


Increases in enzyme activity indicate microbial activity at deeper depths.



25% of the organic C mineralized (1m) = 8,000 – 11,000 Gg of C released to the atmosphere annually from this region of coastal LA.







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