Carbon Budget For Corte Madera Marsh

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Abstract

Tidal salt marshes are important carbon sequestration environments. Heerdt Marsh is located in Corte Madera, California and the dominant vegetation is Pacific Pickleweed (*Sarcocornia pacifica*). In order to calculate the amount of carbon deposited in Heerdt Marsh we analyzed sediment gathered from three core samples collected with a Russian Peat Corer. The cores were collected perpendicular from a tidal channel, at 5 m, 15 m, and 25 m. In the lab we divided the sediment cores into 5 cm samples and undertook Loss On Ignition analysis (LOI) to determine the percent of organic material and density of samples. Carbon accumulation was calculated (Cg/cm2/year) for the past century. We compare our results to other studies undertaken in the San Francisco Bay wetlands. The average sequestration rate was 128.67 g C m^{-2} $year^{-1}$.

Introduction

Corte Madera is located 14.7 miles north of San Francisco (**Fig. A**). Heerdt Marsh is a tidal wetland in Corte Madera, and is an important provider of ecological services (**Fig. B**). Tidal wetlands provide a variety of services like flood control, important species habitat, protection from coastal erosion, pollution filtration, and carbon sequestration. In this project, we have collected data to find the amount of carbon being sequestered by Heerdt Marsh. Carbon sequestration is a process in which carbon dioxide (CO_2) is taken from the atmosphere and stored in organic material. This process is an important contributor to offsetting the current, dangerous level of CO_2 in our atmosphere. Our research measured the amount of organics present in discrete sediment samples. We use this to estimate the amount of carbon present in Heerdt Marsh.

Figure A: Location Map

Methods

Field Work:

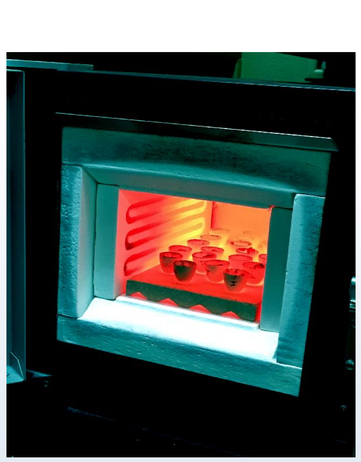
- 3 cores retrieved along a transect at Heerdt Marsh to a depth of 2 m through use of a Russian Peat Corer

Lab Work:

- Top 35 cm of each core was divided into 5 cm increments
- 2 ml samples taken from each 5 cm increment, were put into labeled and weighed crucibles
- Water evaporated from samples over 24 hours at 105ºC
- Samples reweighed and put into furnace for 2 hours at 550ºC to burn off organic material
- Samples reweighed

Analysis:

- Calculated %organics (%OM) & bulk density (g/cm^3) for each sample
- OM converted to %organic carbon (%OC) using relationship modelled by Callaway et al (2012): %OC = [(.001217) x OM^2 + (.3839) x OM)] x 100
- Carbon density (Cg/cm^3) = %OC x bulk density (g/cm^3)
- Determined carbon accumulation using ^{210}Pb rate of sedimentation from China Camp marsh (0.35 cm/yr; Callaway et al. 2012).
- Carbon accumulation = carbon density x sedimentation rate



Crucible samples in furnace

Figure B: Shaded gray area outlined in blue is our research site; orange vertical line is our transect

Results

- Core 1 is located closest to the channel
  - lowest average carbon accumulation
  - due to increased sediment deposition
- Average carbon accumulation increases with distance from channel (Table 1)
  - Cores 2 and 3 have higher average organics than Core 1 (Figure C and D)
- The entire marsh's total carbon stored is 18,607.41 kg/year

Core #	Average Carbon g $m^{-2}year^{-1}$
Core 1	93.2186
Core 2	114.3141
Core 3	178.4732
All Cores Average	128.67

Table 1: Average Carbon per Core

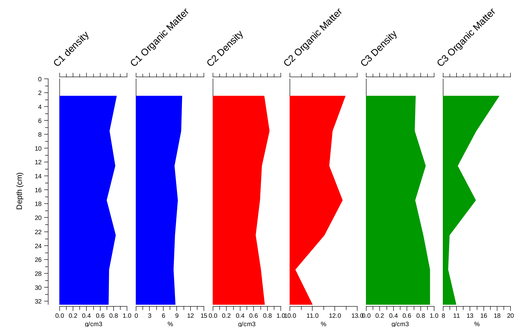


Figure C: Density and %Organic Matter for all cores

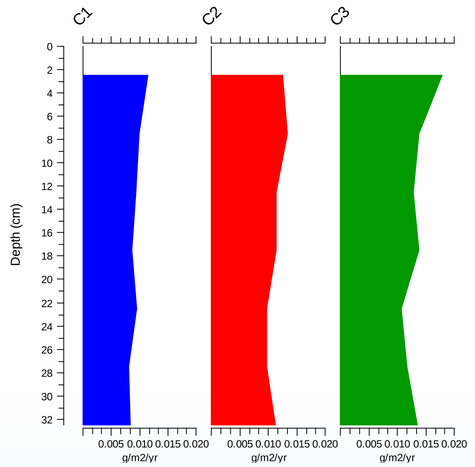


Figure D: Carbon accumulation rate for each core by depth

Discussion

Our carbon sequestration from Heerdt Marsh, averaged higher than nearby China Camp. Carbon sequestration at China Camp, mid-marsh ranges between 72.0-79.8 g m^{-2} $year^{-1}$ (Callaway et al. 2012) and our data at Heerdt Marsh ranged 93.2-178.5 g m^{-2} $year^{-1}$ with an average of 128.67 g m^{-2} $year^{-1}$. Compared to Callaway's findings, our data is significantly higher than the values collected at China Camp. We assume the carbon sequestered under Heerdt Marsh is due to the density of organic material in the area. However, our calculated data may have over estimated the amount due to sedimentation rate assumptions.

Core sample, push 1 (0-50 cm)

Conclusion

- We established the %OM present in the top 35 cm of sediment and from this calculated the amount of carbon being stored in Heerdt Marsh in the last 100 years.
- Our data shows that the total amount of carbon being stored in Heerdt Marsh is 128.67 g m^{-2} $year^{-1}$. For the area designated in Fig B this corresponds to 18,607.41 kg/yr.
- We also determined that the region farther from the tidal channel (Core 3) is sequestering more carbon than the area closer to the channel (Core 1). We believe that this trend is due to the interior receiving less inorganic material due to tidal action.

Acknowledgements

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References Cited

Callaway, John C., Evyan L. Borgnis, R.Eugene Turner, and Charles S. Milan 2012. *Carbon Sequestration and Sediment Accretion in San Francisco Bay Tidal Wetlands*. Estuaries and Coasts, 35:1163–1181