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Examining sources of sediment carbon stored in seagrass habitats across the Skagit Delta and Padilla Bay

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The Salish Carbon Blues

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April 5, 2018

UNIVERSITY of WASHINGTON

Padilla Bay

LAIRD NORTON FAMILY FOUNDATION

What is Blue Carbon?

280 metric tons C/hectare

250 metric tons C/hectare

140 metric tons C/hectare

(x 28)

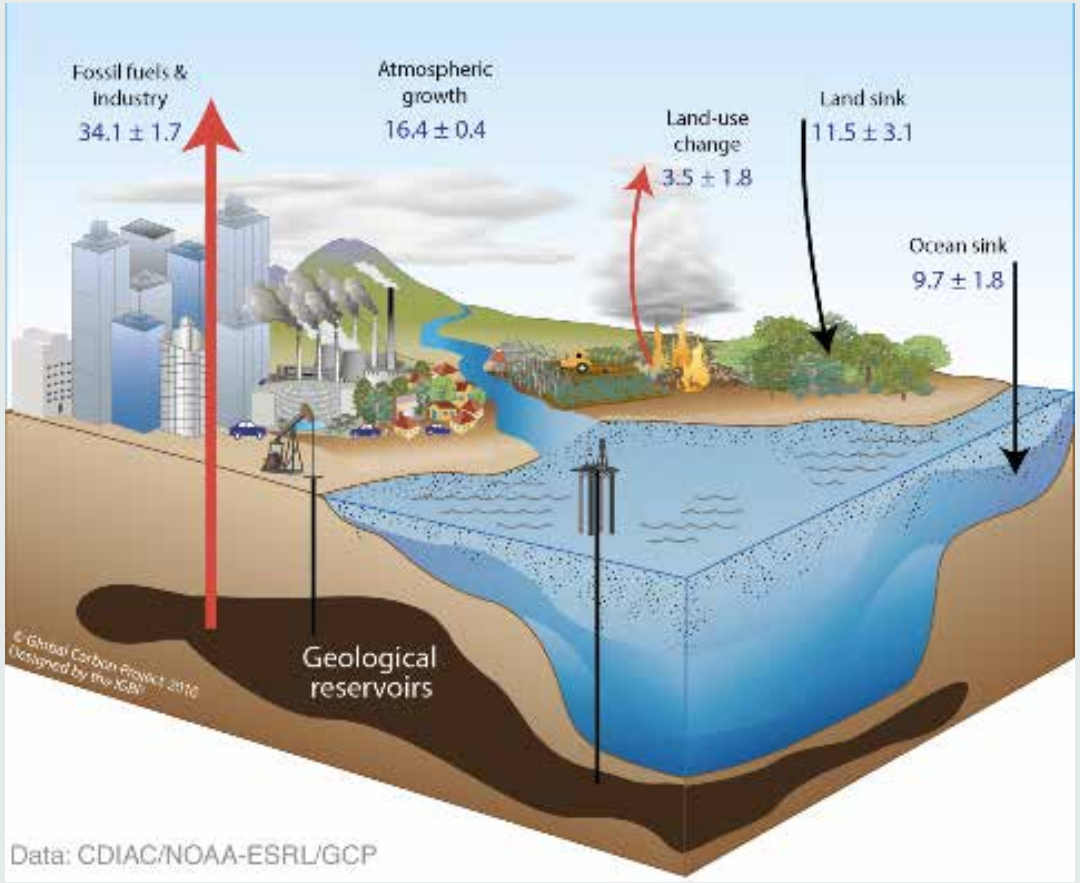
(x 25)

(x 14)

https://tizona.files.wordpress.com/2008/01/size_01.jpg

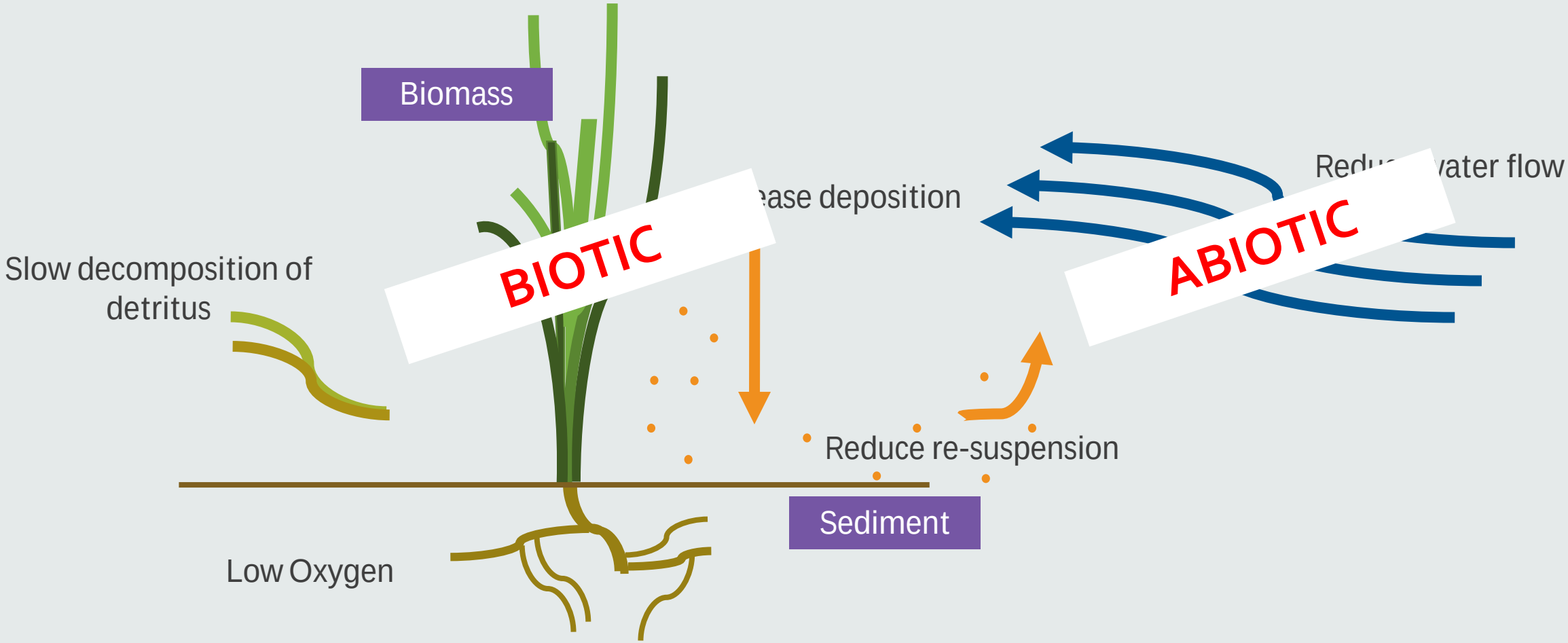
Why study Blue Carbon?

- Carbon Financing
- Calculating Carbon Emissions from Land Use Change
- Coastal Management Plans



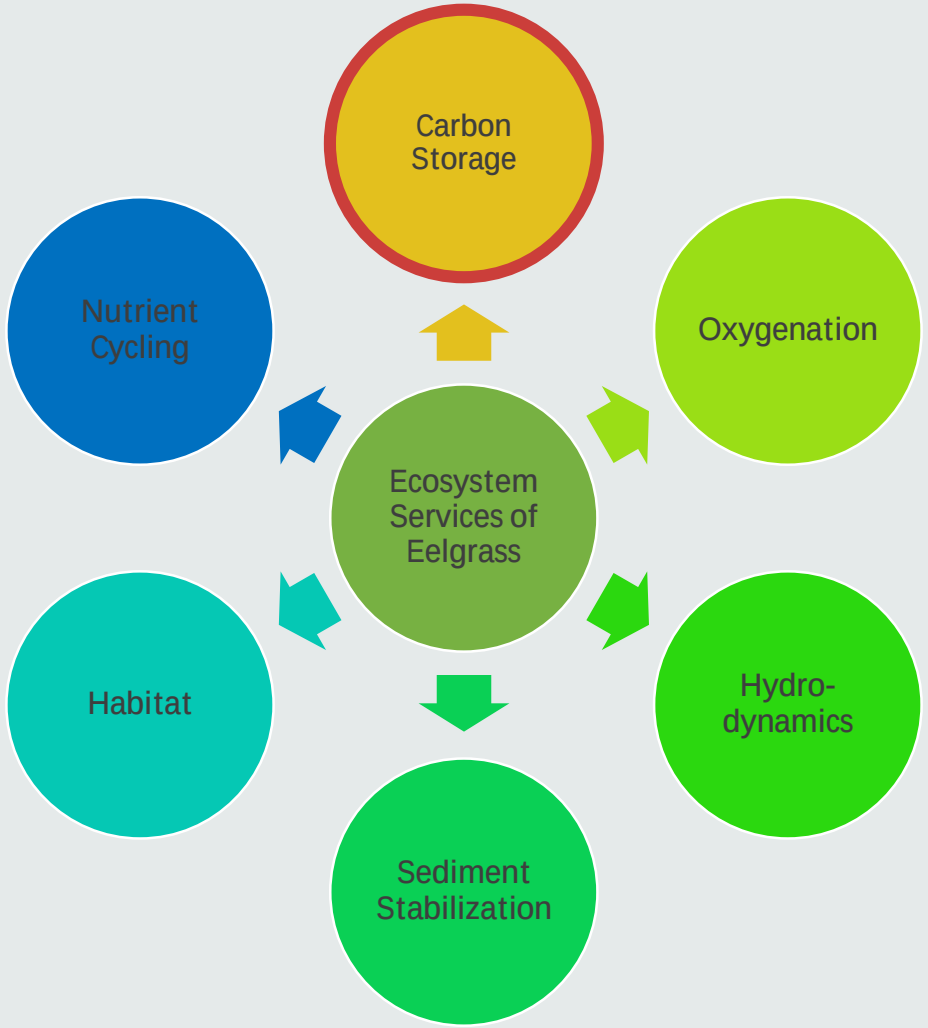
http://cdiac.ornl.gov/GCP/

How seagrasses trap carbon



Questions:

- Is the ecosystem service of carbon storage in Puget Sound robust enough to be included in coastal management plans or carbon budgets?
- Does carbon storage differ between a natural estuary to a diked shoreline?
- If there is carbon storage in these habitats, where is it coming from?



http://www.salishsea.org

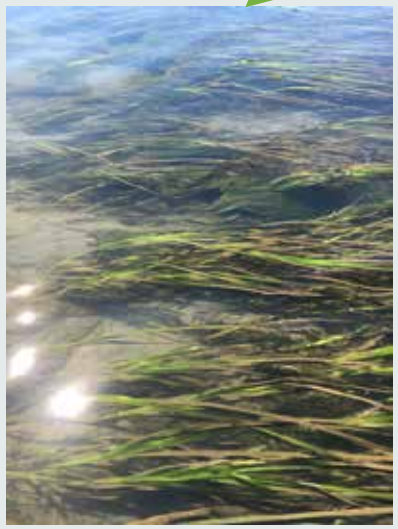
Geomorphic Variability:

Skagit River
(active delta)

Padilla Bay
(diked and drained in 1900s)

Sample Design

Site



Vegetated

3 Cores

Bare

3 Cores

N = 12 Cores

0 – 20cm
Subsample every 2cm

20 – 50cm
Subsample every 5cm

50cm – end
Subsample every 10cm

N = 217 Subsamples

Lab Analyses

1. How much Carbon is there?

Total Carbon and Nitrogen Elemental Analysis

2. Where is the Carbon from?

Stable Isotopes ^{13}C & ^{15}N

3. How dense is the sediment?

Bulk Density

4. Is the sediment muddy or sandy?

Grain Size Analysis

Statistical Analyses

Whether a core was located in a delta or inactive delta or vegetated or bare site is influential for total carbon stock?

- 2 Way ANOVA

What variables had more of an effect on total carbon and where it came from?

- Linear Mixed Effects Models
  - **Response Variable**: Carbon/N15/C13
  - **Fixed Factors**: Delta, Vegetated, Top 20 cm, and % Fine Sediment

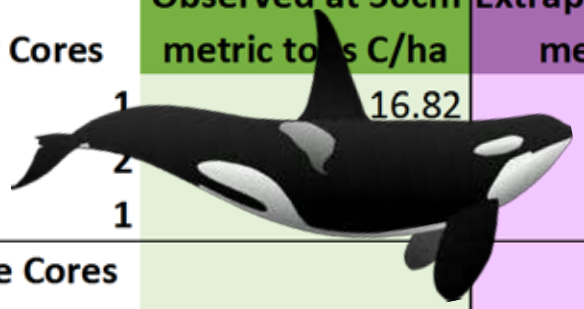
Where is the stored carbon coming from?

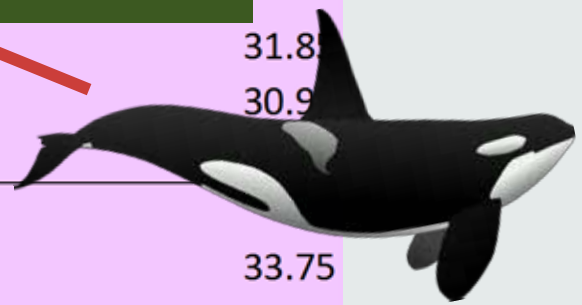
- MixSIAR model

Results: Total Carbon Stock

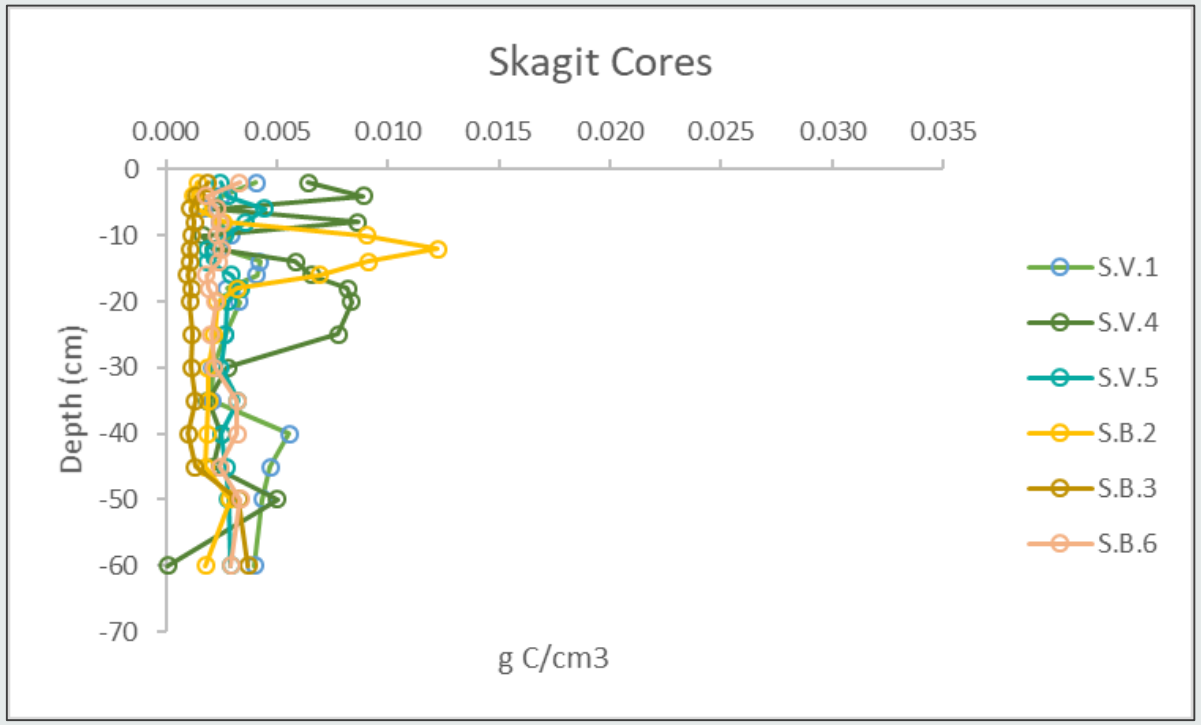
	Observed at 50cm metric tons C/ha	Extrapolated to 1 meter metric tons C/ha
Skagit Veg Cores		
1	16.82	33.64
2		45.63
1		27.96
Skagit Bare Cores		
1	16.17	32.35
2	7.09	14.17
		25.64
Padilla		
1	15.92	31.8
2	15.46	30.9
3	19.09	
Cores		
1	16.88	33.75
2	15.77	31.54
3	32.94	65.89
Average	**17.15**	**34.29**

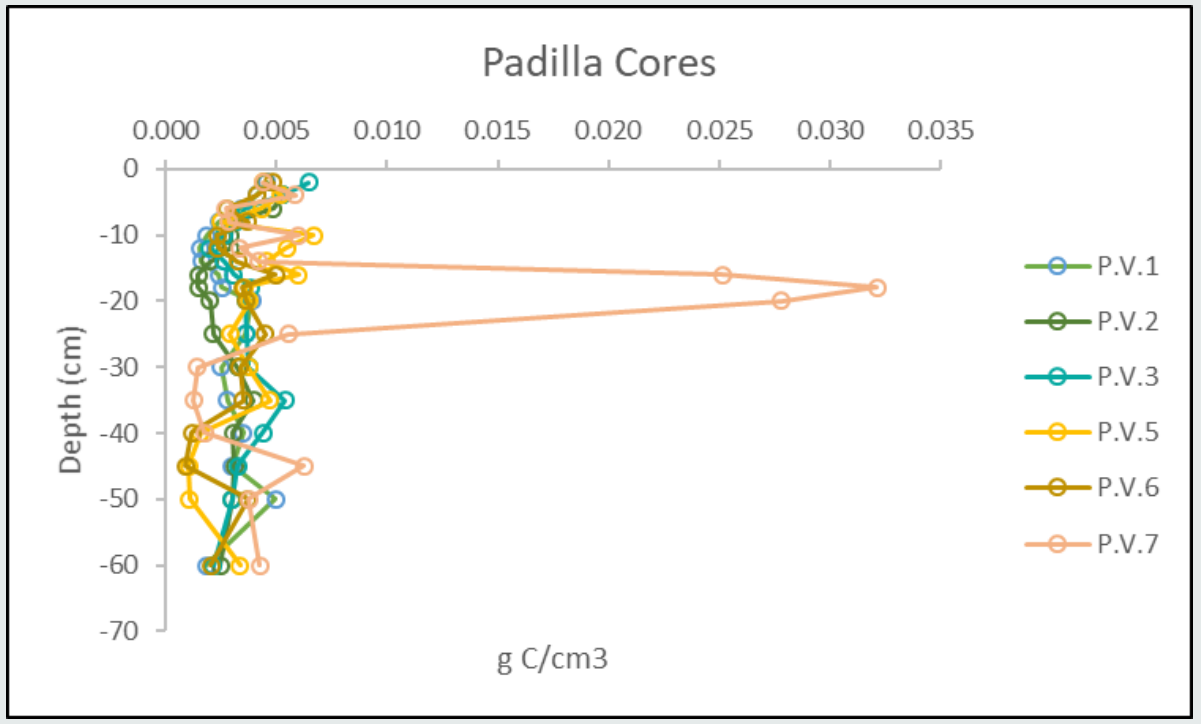
140 metric tons C/ ha





Results: Carbon Density

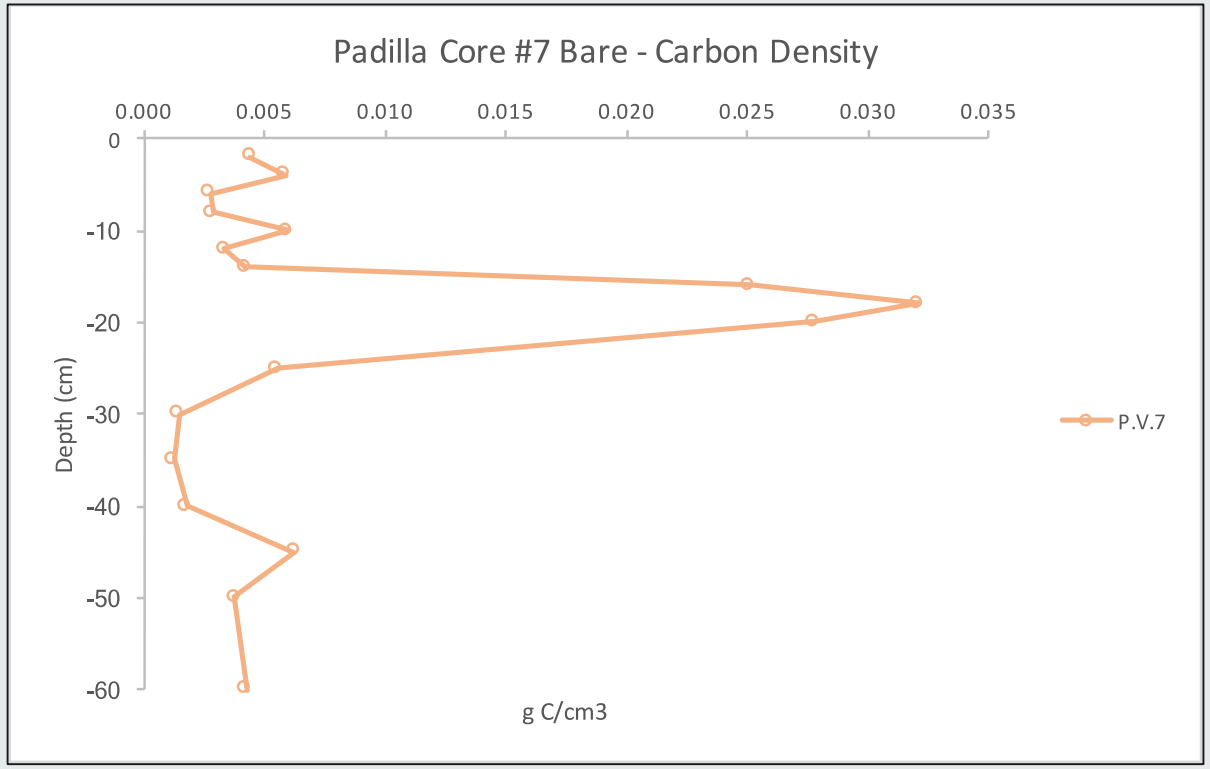


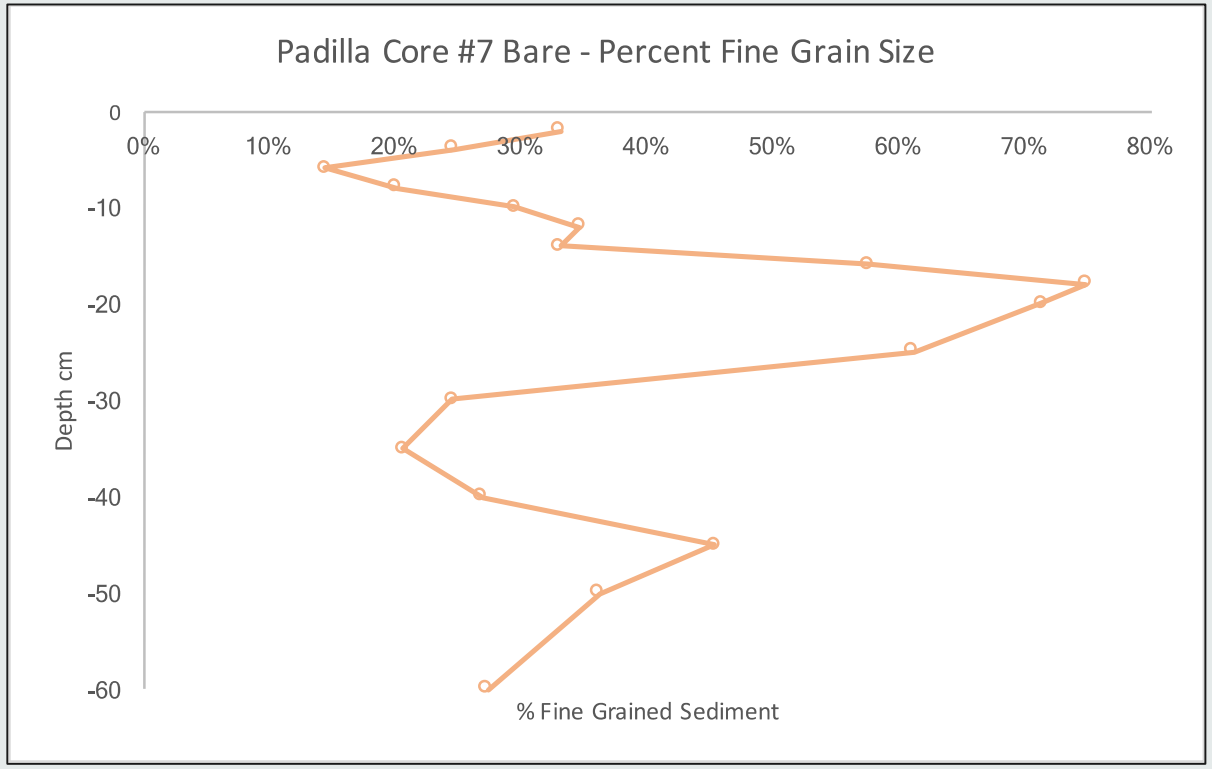


- No detectable difference between Skagit & Padilla
- No detectable difference between Vegetated & Bare

Fine Grained Sediment was the most explanatory factor

Results: Fine Grained Sediment & Carbon Density

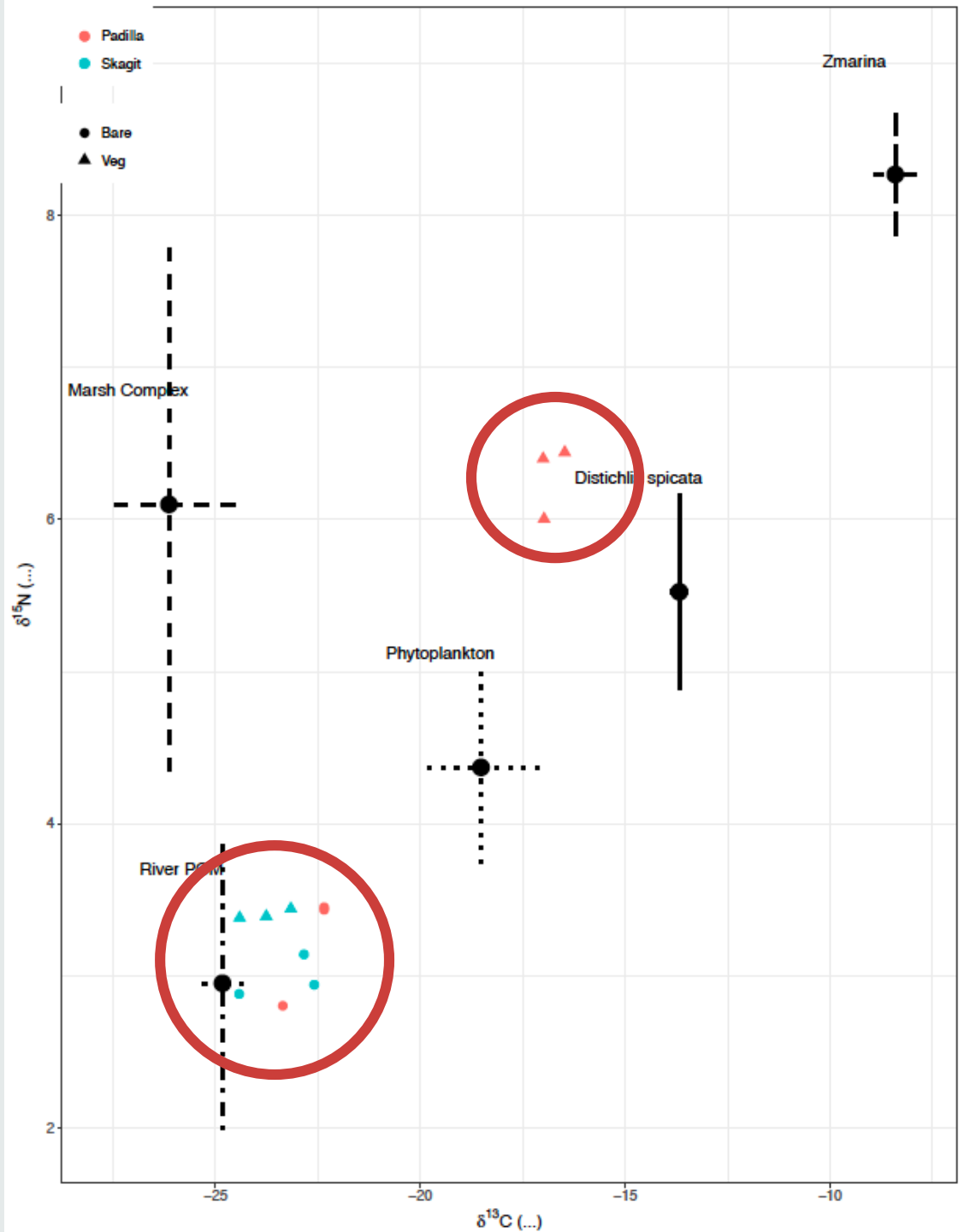




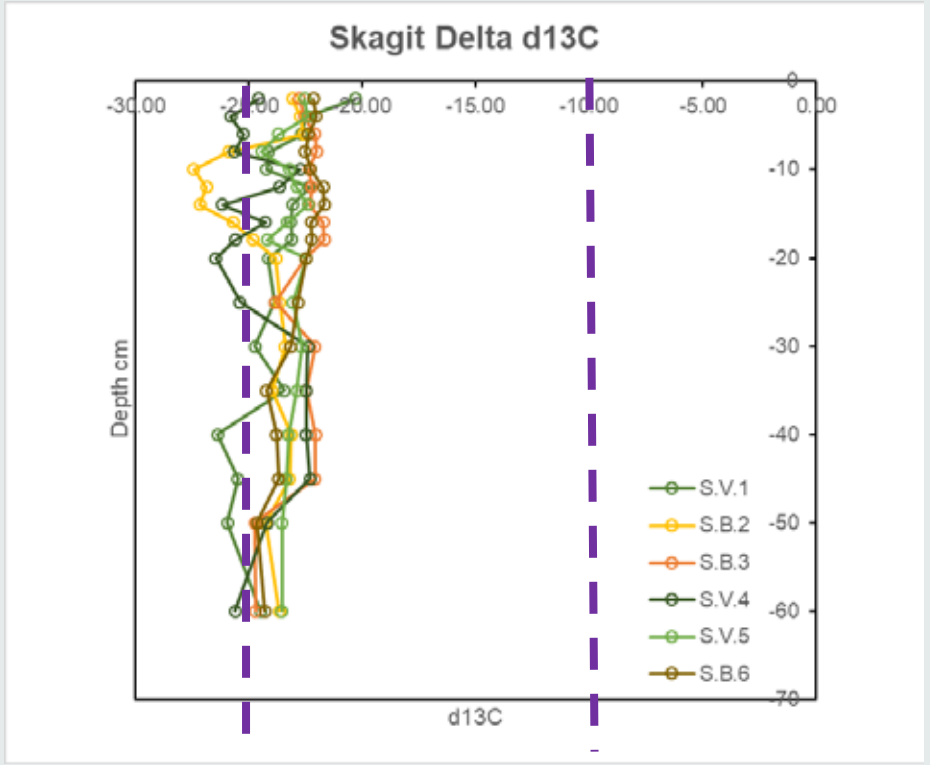
Results: Stable Isotopes

$$Heavy\ Isotope = \frac{(R_{sample} - R_{standard})}{R_{standard}}\ x1000$$

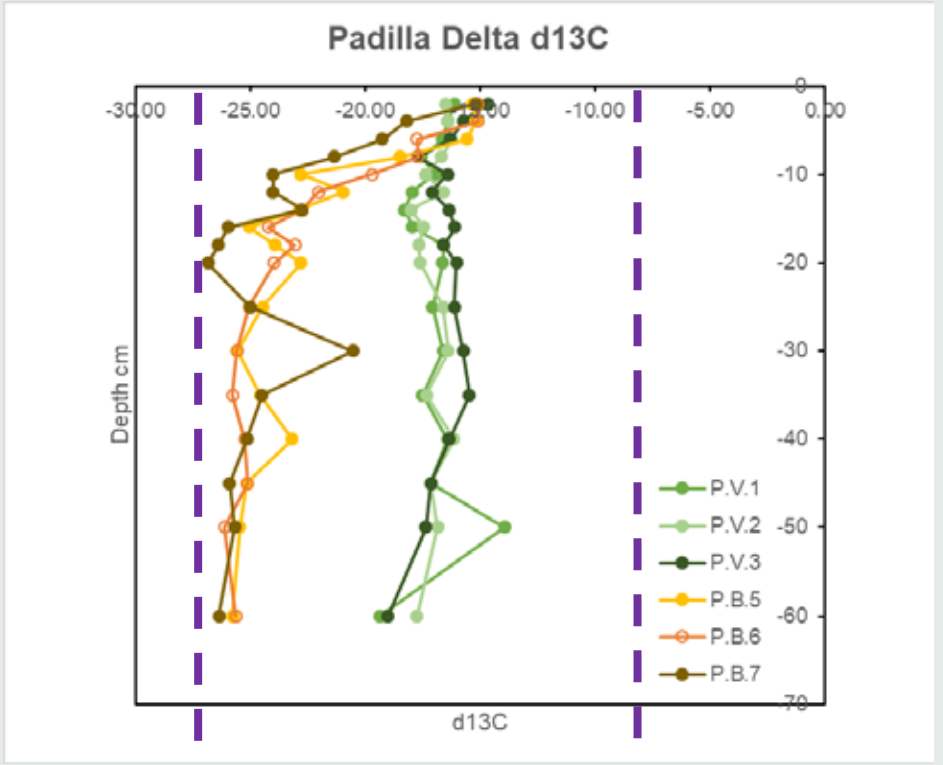
R is the ratio between ^{14}C:^{13}C or ^{15}N:^{14}N:



^{13}C Isotope Results



River POM Z. marina



River POM Z. marina

- Significant difference between Skagit & Padilla
- Significant difference between Vegetated & Bare habitat in Skagit and Padilla

Fine Grained Sediment was the most explanatory factor

Summary of Results

Is the eelgrass ecosystem service of carbon sequestration in the Salish Sea robust enough to be included in coastal management plans or carbon budgets?

Not really

Does carbon stock differ between a natural estuary to a diked shoreline?

Not really

If there is carbon storage in these habitats, what its source?

Digging into this further, but so far does not look like it is coming seagrass

Padilla

Skagit

http://www.padillabay.gov/brant/sites/padilla.html

Acknowledgements

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Questions?