Invertebrate, Sediment and Blue Carbon attributes within an Estuarine System in relation to Disturbance Regime

Englishman River Estuary – Michael O'Toole

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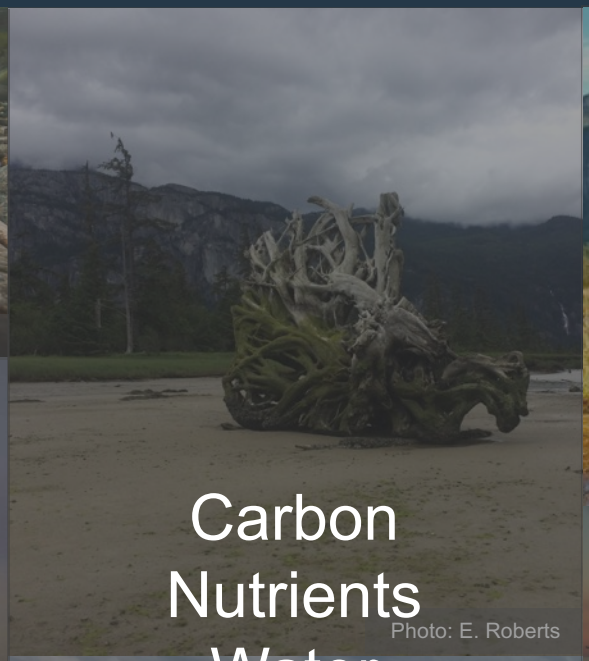
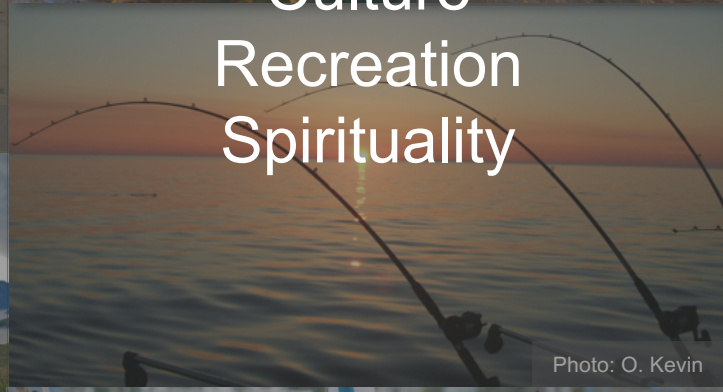
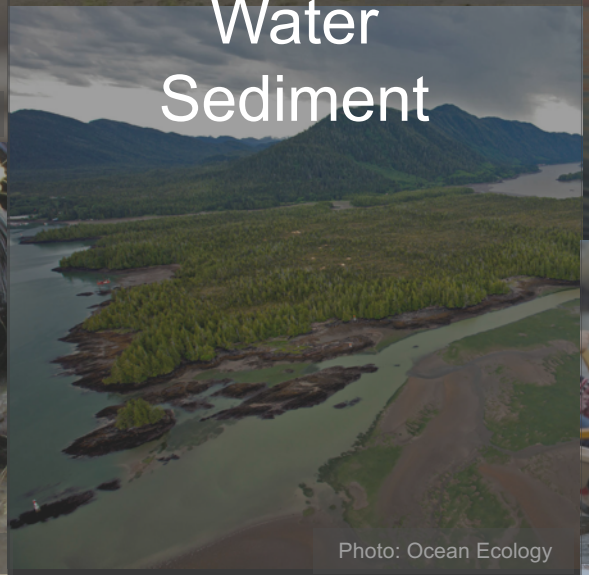
SFU BCIT

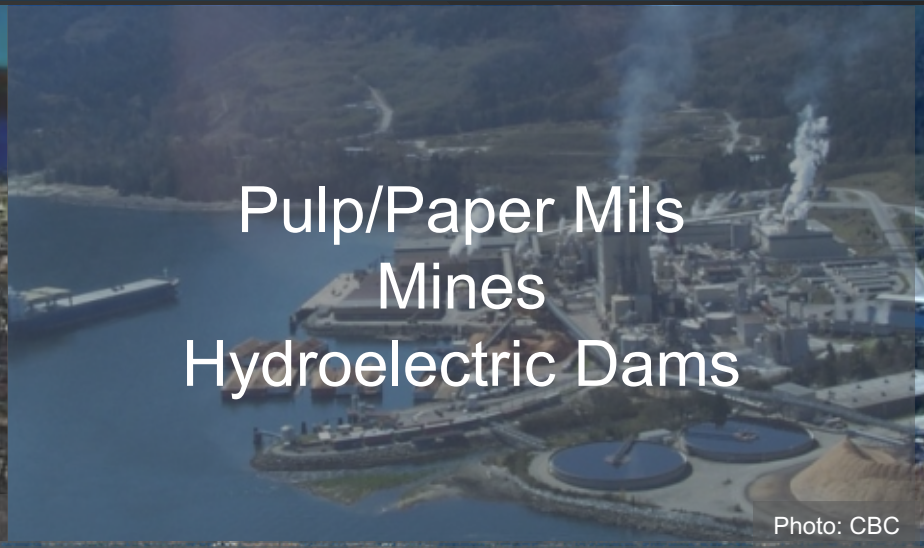
Estuaries: in Squamish and BC







Disturbance to Estuaries



Importance of Monitoring

Restoration

Photo: Nature Conversancy

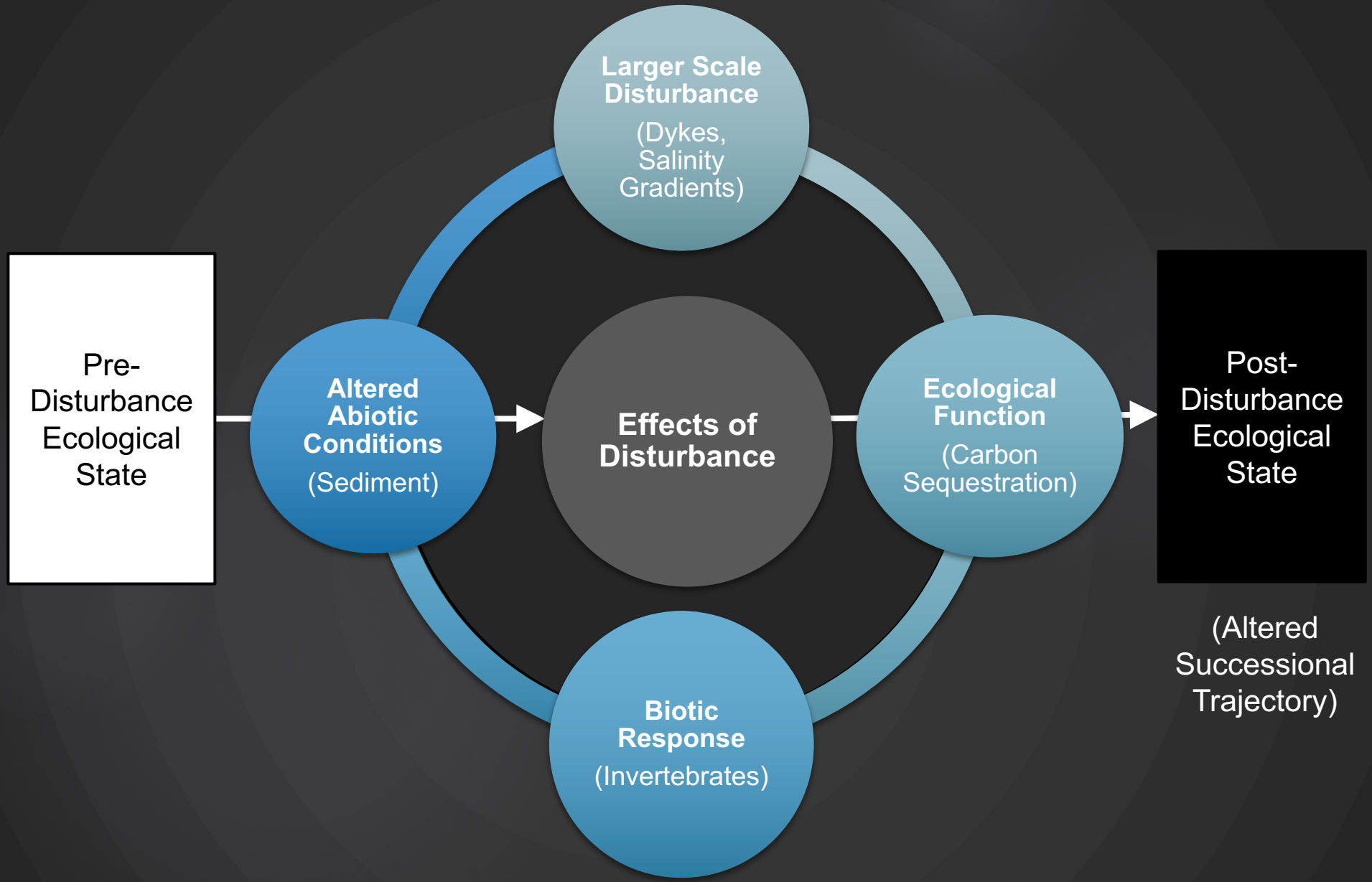
Recovery

Photo: H. Knox

Primary Research Question:
How is a mudflat estuary recovering from disturbance?
(and restoration)

Hypothesis:
A disturbed ecosystem is expected to have different characteristics than a site less impacted by anthropogenic development, due to altered successional trajectories.

Null Hypothesis:
There is no difference among sites.



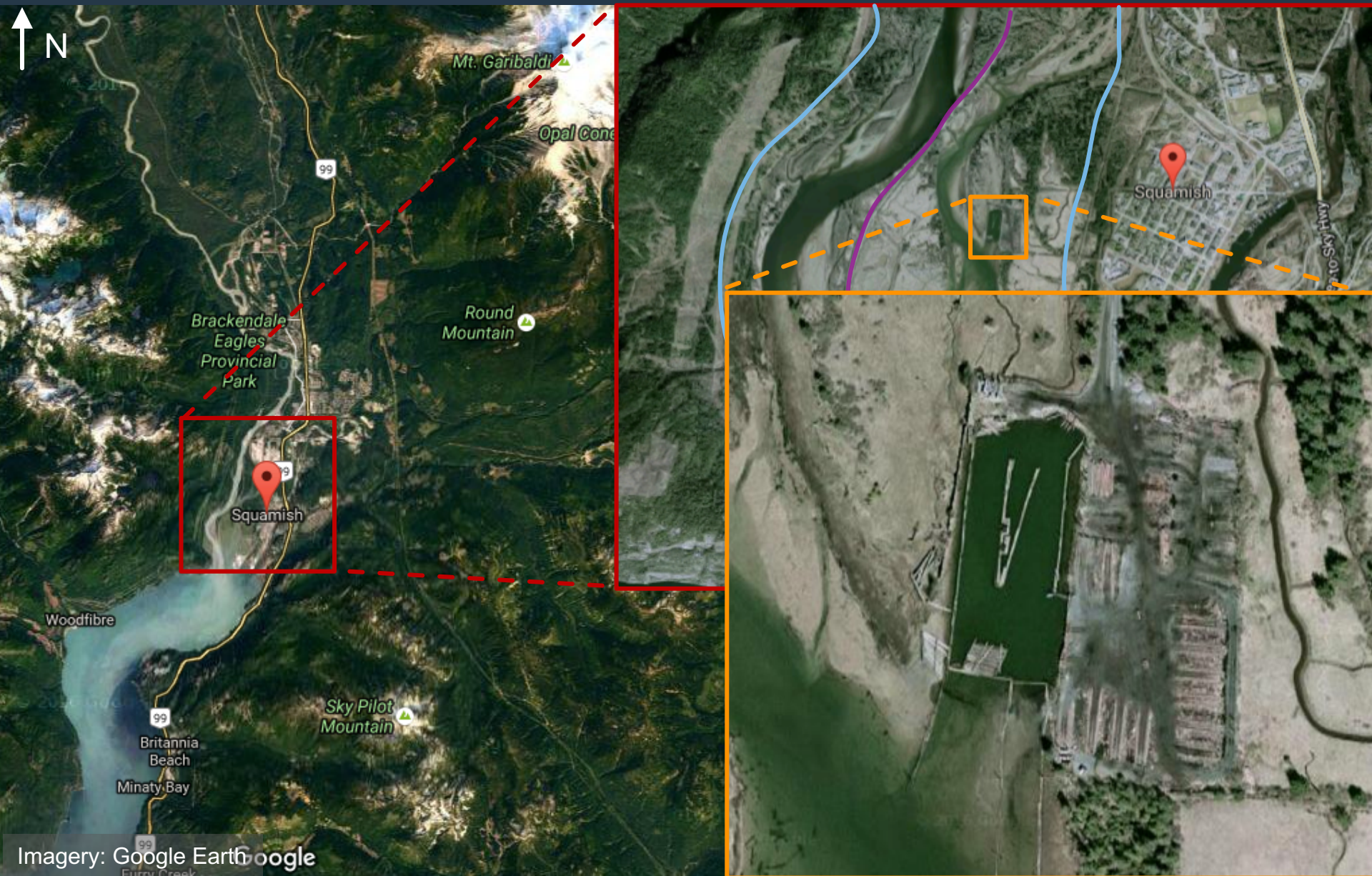
Graphical Abstract for: Roberts, E. M., Stroshein, S.D, and Bendell, L.I. (submitted for publication, 2018). Invertebrate, sediment, and blue carbon attributes within an estuarine ecosystem in relation to disturbance regime.

Outline

- Study Area – Squamish Estuary
  - History of Disturbance
  - Study Site / Sampling Design
- Variables
  (Invertebrates, Sediment, Blue Carbon)
  - Methods
  - Results
- Discussion and Implications
  - For Restoration
  - For Research

Photo: E. Tobe

Study Area – and Disturbance



Post Restoration Imagery

Study Sites

Disturbance Levels: 3

Sample Sites: 15x3

Invertebrate Variables:

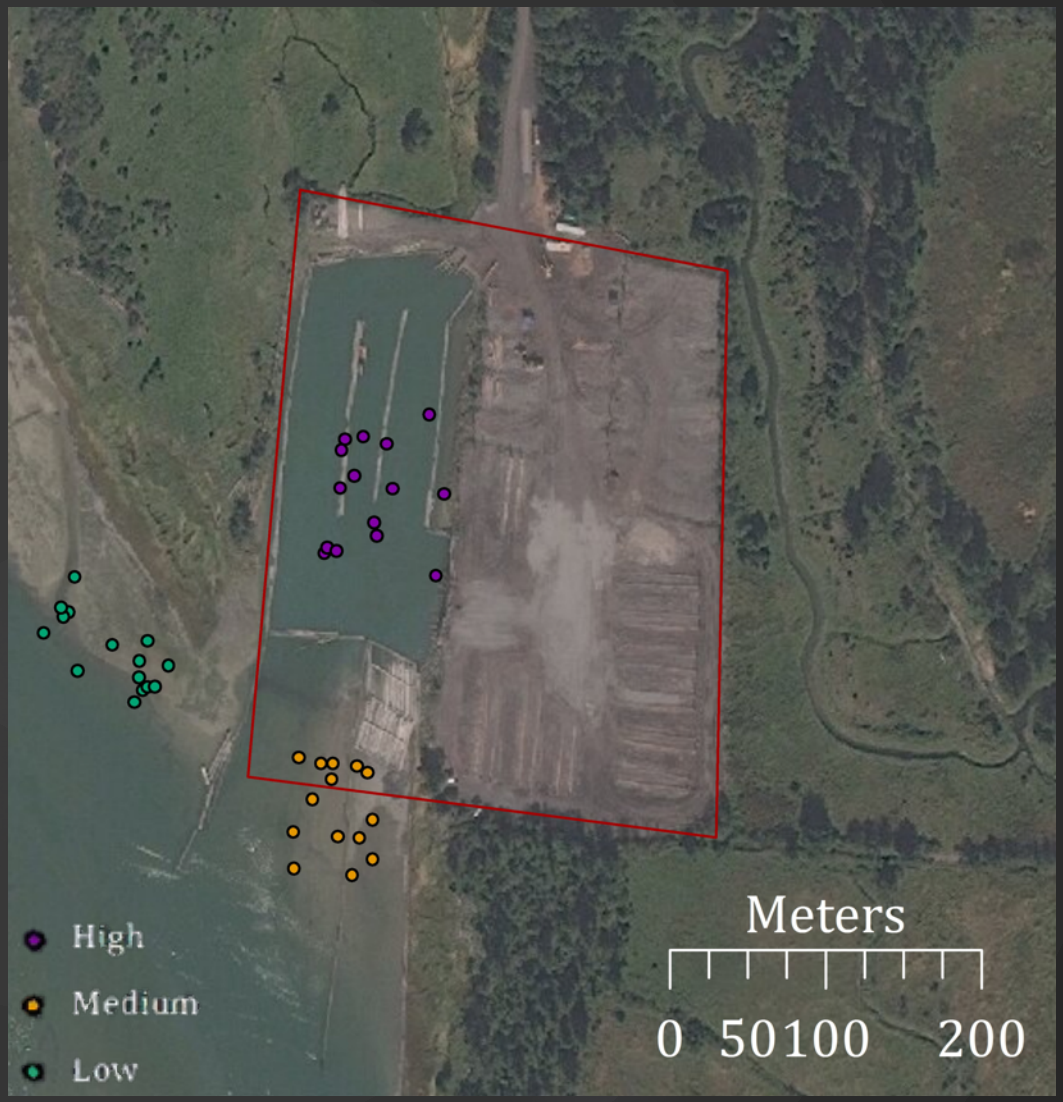
- Species Richness
- Species Diversity
- Biomass
- Count

Sediment Variables:

- Particle size
- Total organic carbon
- Water content

Blue Carbon Variables:

- Fine Woody Debris



Analysis: Statistical Approach

Goal:

- Are the sites different?
- How are they different?

Invertebrate Biomass

- Log(x+1) transformation
- Kruskal-Wallis Test

Sediment Characteristics

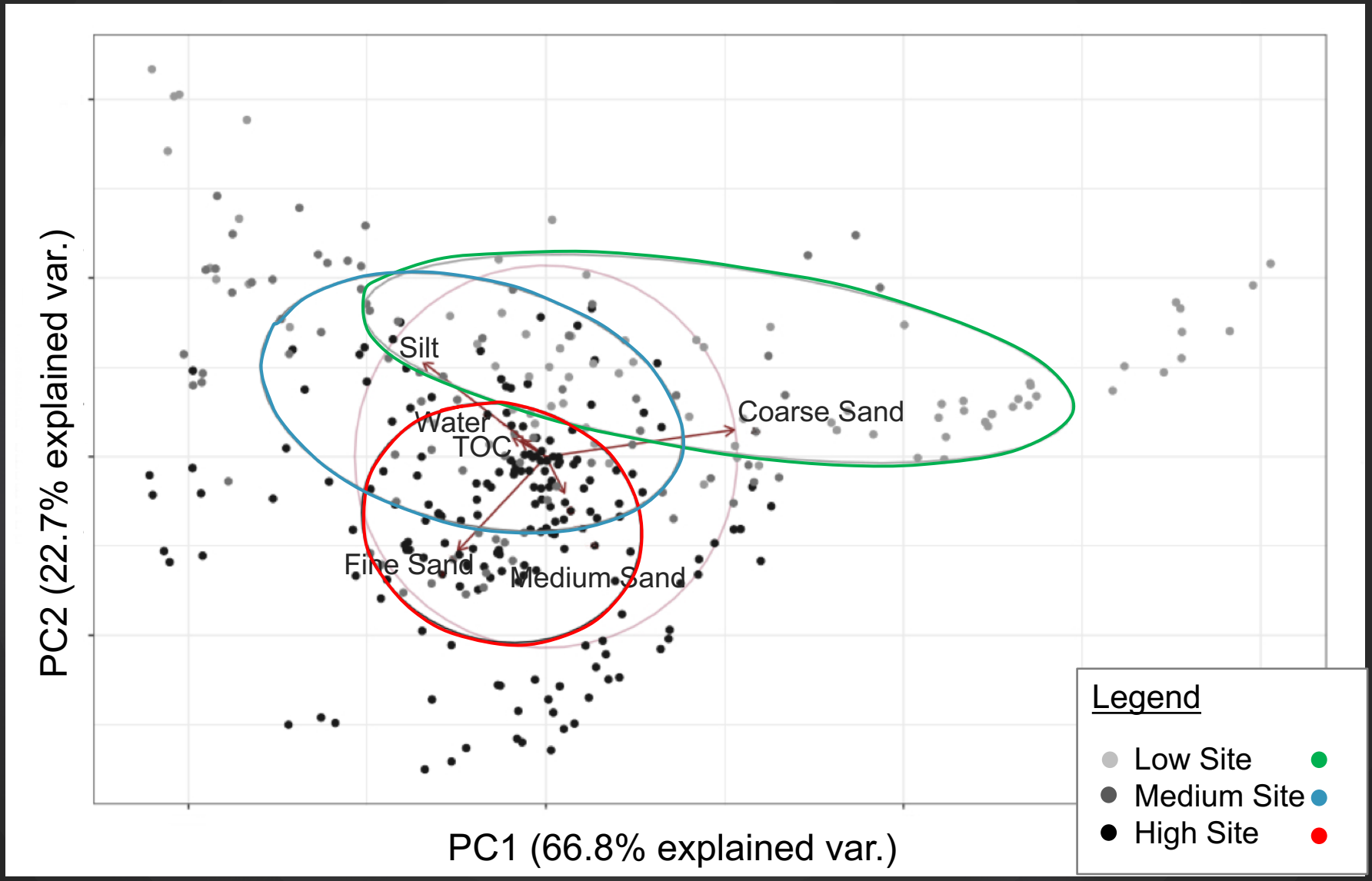
- Arcsine transformation
- Principle Component Analysis
- Analysis of Variances (ANOVA)

Blue Carbon

- Conversion factor

Photo: E. Tobe

Results: Sediment Analysis

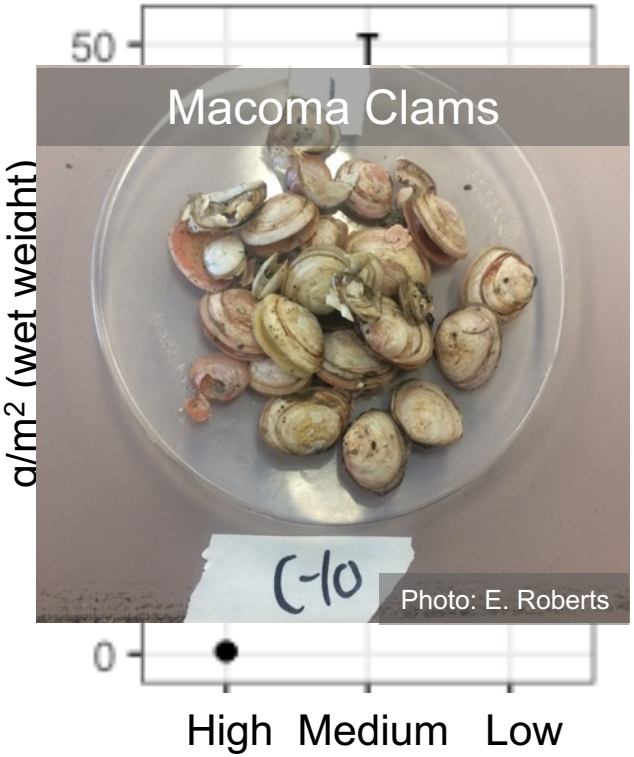


Results: Sediment Analysis

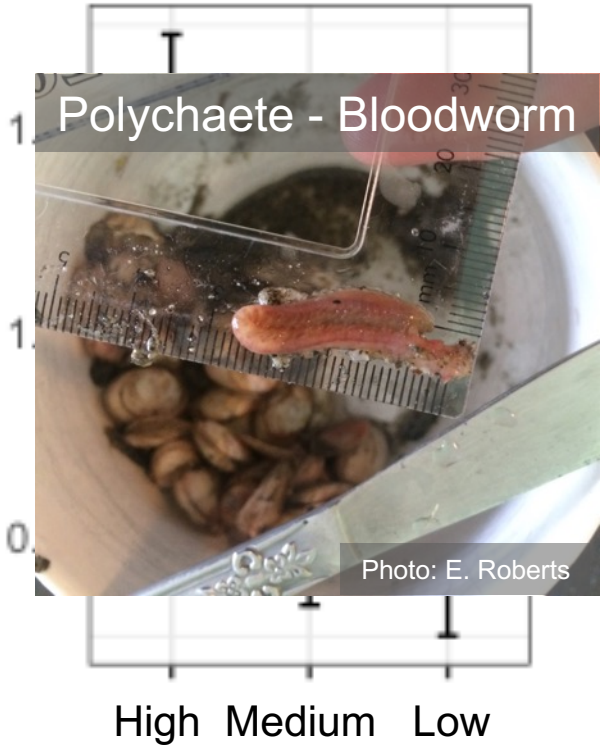
Photo: Squamish WebMap

Results: Invertebrate Biomass

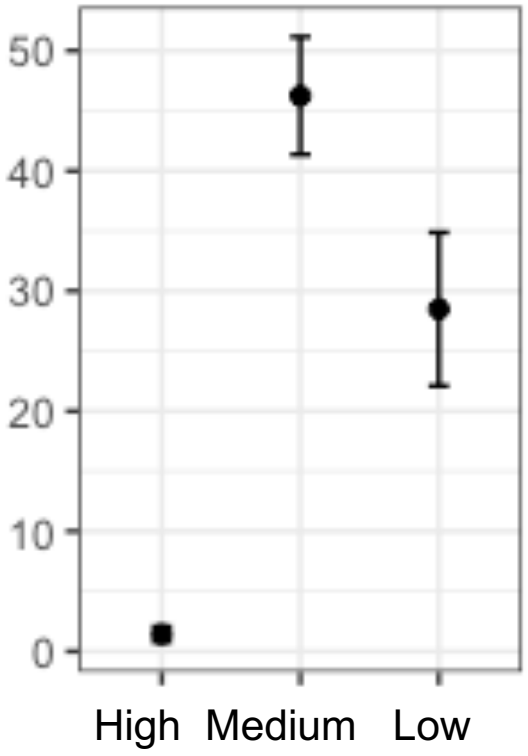
Macoma Clams
Macoma balthica
Macoma nausta



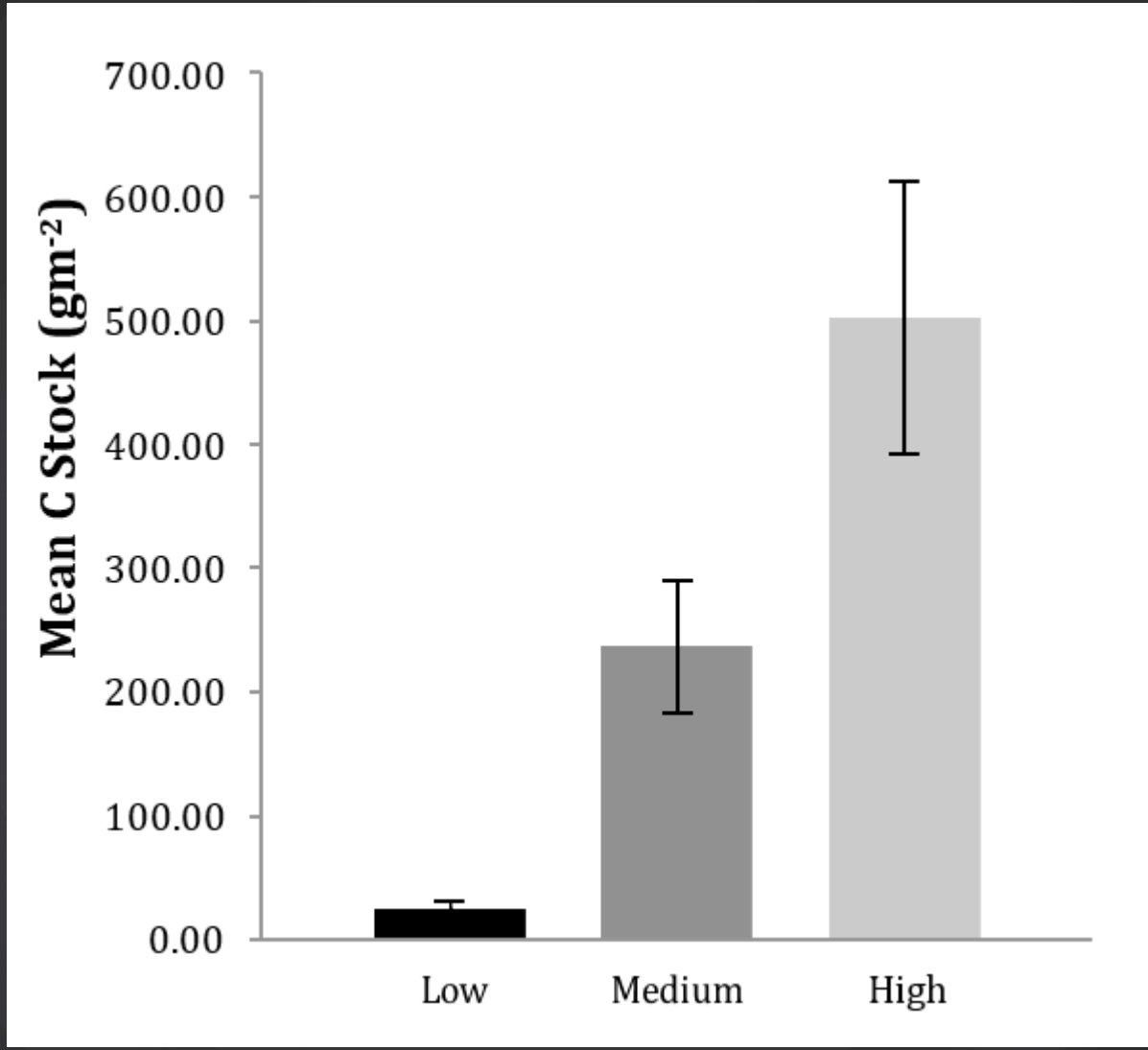
Bloodworm
Glycera americana



Total Invertebrates
Macoma balthica
Macoma nausta
Glycera americana



Results: Blue Carbon



Summary

Invertebrate

1. Delayed secondary succession response on restored site
2. Community different than historical records (post-dike installation)

Sediment

1. Gradient across sites
2. Increased proportions of fine sand on restored site

Discussion

Blue Carbon from Wood

- Fine woody debris is a potentially significant source of carbon in tidal flats
- Additional research warranted for carbon accounting initiatives

Cumulative effects

- Must consider to determine ”fit-for-purpose” restoration treatments/ monitoring


Photo: E. Roberts


Photo: E. Roberts

Looking Forward

- Additional years of monitoring
- Additional monitoring metrics
  - Salinity
  - Invertebrates (all size classes)
  - Additional ecotypes (salt marsh, tidal channel)
- Identifying a reference ecosystem (goal)

Photo: E. Tobe

Acknowledgements

Squamish River Watershed Society
- Edith Tobe

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- Olivia Gutjahr
- Margaret Yip
- Dr. Jonathan Moore

DFO
- Dr. Colin Levings

And all the volunteers in the estuary!


Photo: E. Roberts


Photo: E. Roberts

BCIT SFU


Questions?
Photo: E. Roberts