Eelgrass: A Climate Hero

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Climate Change Stewardship Education Program

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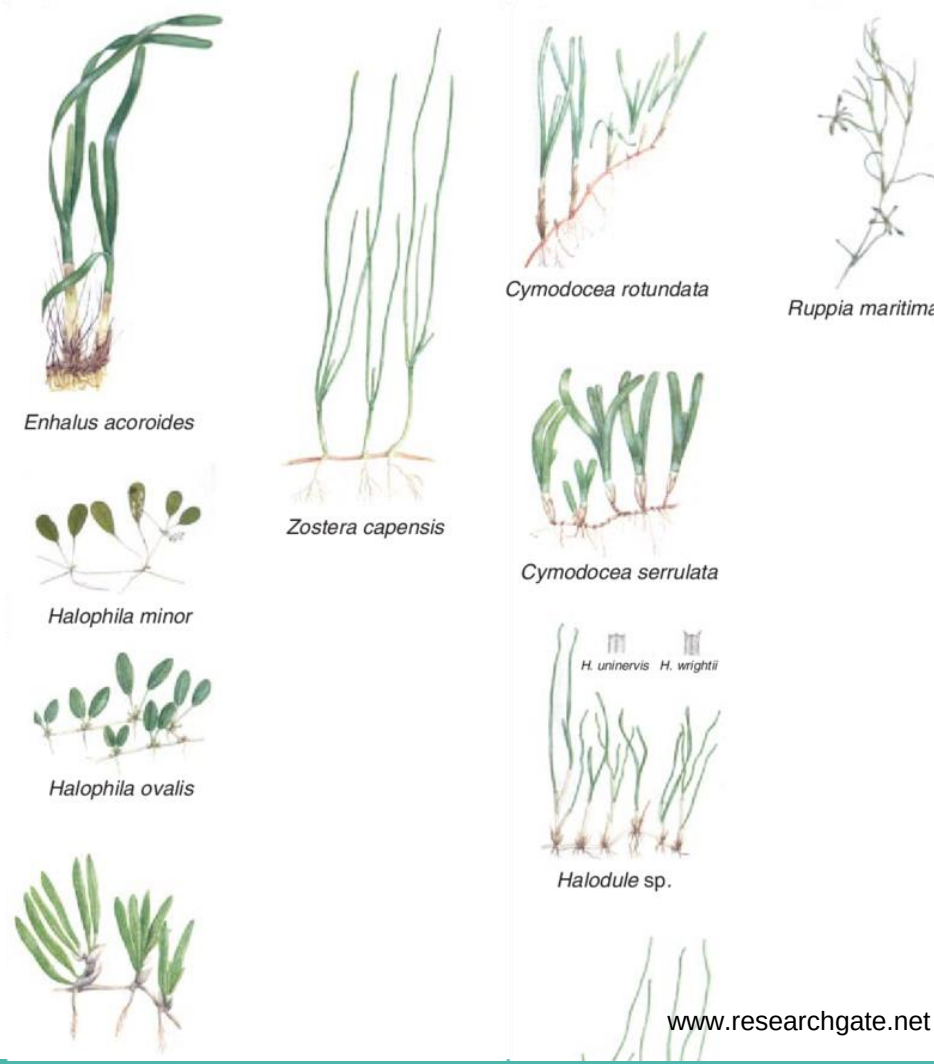
Outline

1. Why is Eelgrass important?
2. What is Blue Carbon?
3. Eelgrass on the Pacific Coast of Canada
4. Researching Blue Carbon in Clayoquot Sound
5. Protecting Blue Carbon in the Trust Area

Seagrass

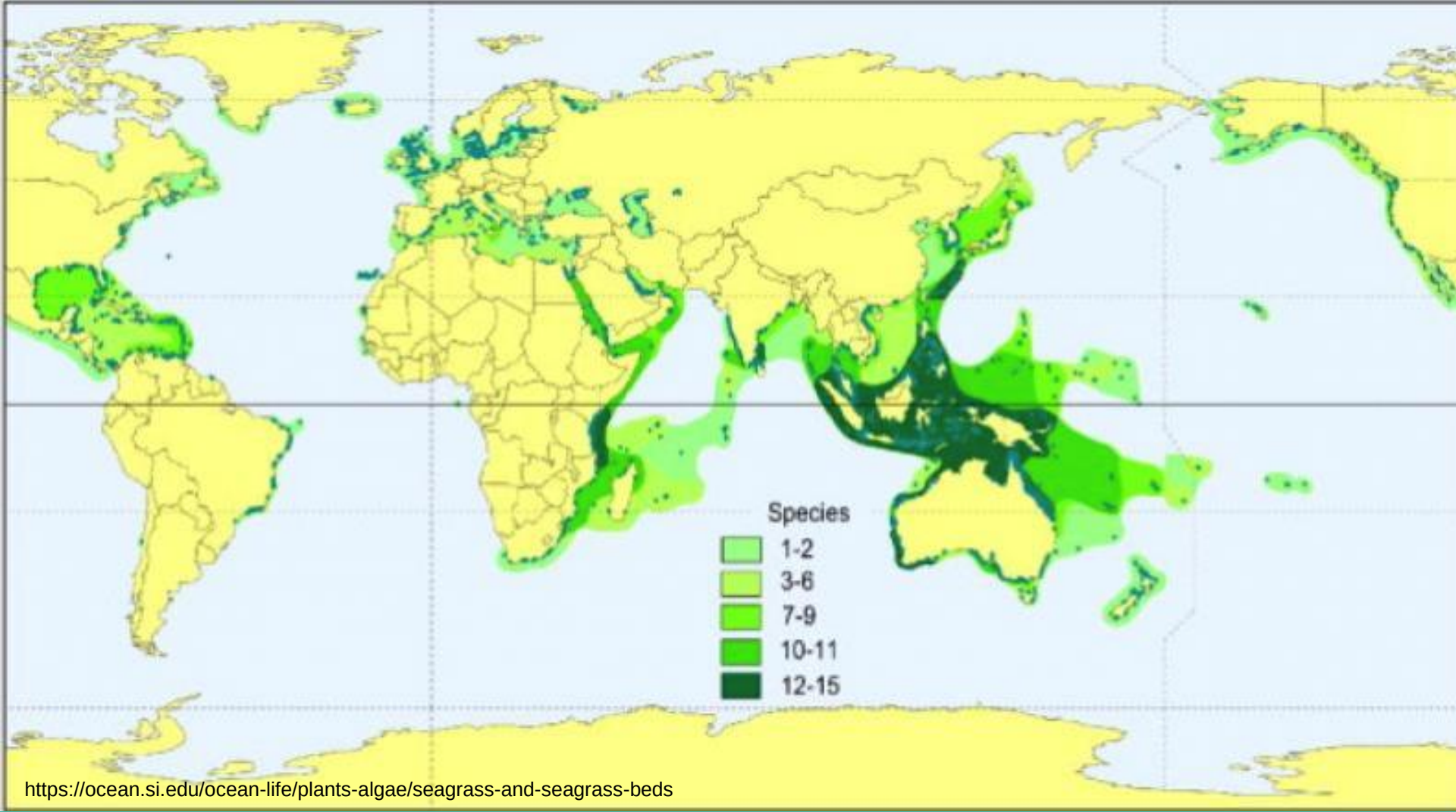
- A flowering plant that grows in marine environments
- Are so-named because most species have long green, grass-like leaves
- Commonly found in depths of 1 to 3 meters, but some found at depths of 58 meters![1]



www.researchgate.net

Seagrass

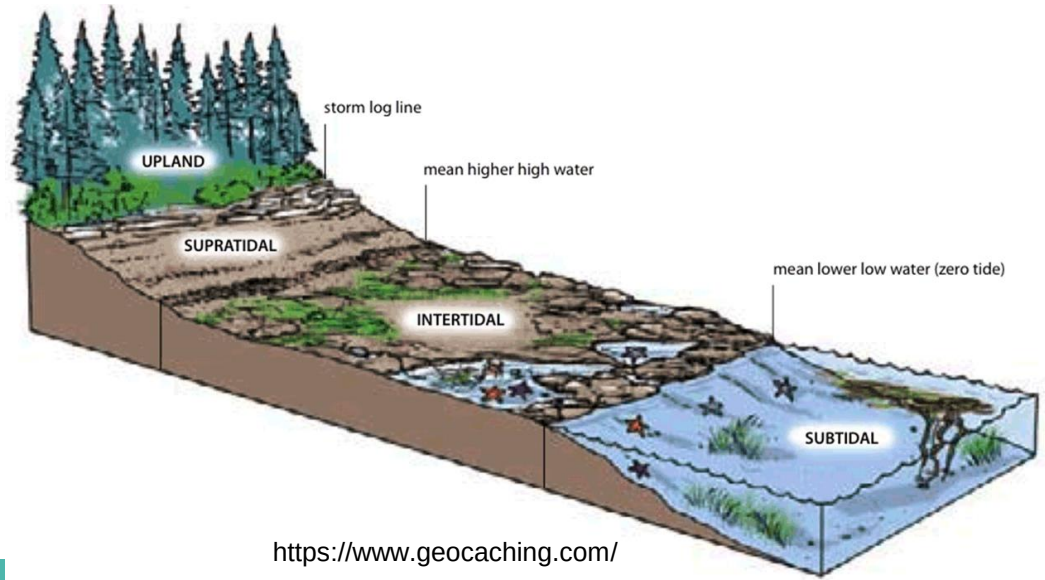
- Known as the "**lungs of the sea**"
- Seagrasses are believed to be one of the most valuable ecosystem in the world!
- There are about 70 different species worldwide[1]



https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds

Eelgrass

- *Zostera marina* is commonly distributed in the shallows areas of temperate estuaries
- Eelgrasses form dense underwater meadows
- Intertidal zone: the part of a shore between the high water and the low water
- Subtidal zone: below the level of the tide



https://www.geocaching.com/

Eelgrass Meadow

Eelgrass Meadow: Intertidal

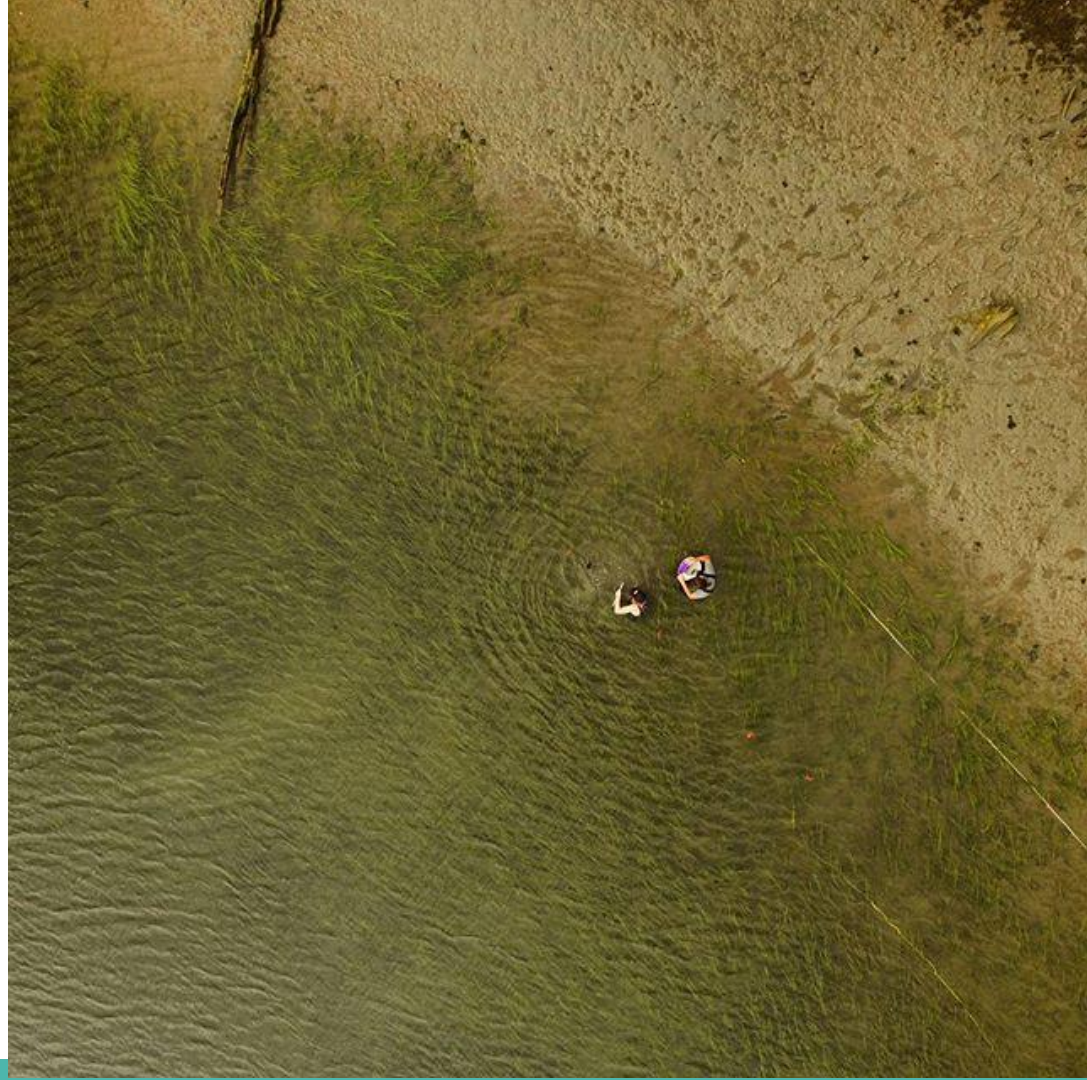
Eelgrass Meadow: Subtidal

Eelgrass

- Recognized for the myriad of ecosystem services it provides:
  - regulates water quality
  - stabilizes shorelines
  - provides shelter and food to a diverse community of species
  - shallow nursery habitat for fish and other marine species

Blue Carbon

- Capture and store organic carbon from the atmosphere in their leaves, roots, and sediments
- Carbon stored is known as '**blue carbon**'
- Carbon stored in the eelgrass' roots and sediments can be stored over centuries or millenia



Blue Carbon Systems

- Seagrass meadows cover <0.2% of the global ocean, yet account for ~10% of the yearly total carbon stored in the ocean
- Some species are known to store carbon up to 12x faster than terrestrial forests!
- Increased recognition of the potential these ecosystems have for climate change mitigation → increases interest in quantifying the amount of organic carbon that they can store

Blue Carbon Systems

- ~ 25-50% of the world's coastal wetlands lost due to land-use changes
- ~0.4–2.6% of seagrass area is being lost globally
- >29% of seagrass area has been lost since 1879
- At current rates, 30–40% of seagrasses and tidal marshes could be lost in the next 100 years!

Blue Carbon Systems

- Upon destruction, the carbon stored in blue carbon systems is released back into the ocean

- Shifting them from carbon **sinks** to carbon **sources**

http://wetlandscoralreefsseagrass.blogspot.com/2015/10/wondering-what-is-coastal-development.html

Seagrass on the Pacific Coast of North America

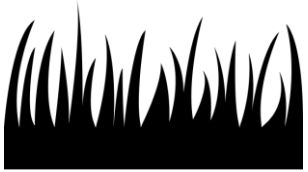
- Only 3% of seagrass meadows in Canada have been mapped
- The lack of data hinders their inclusion in coastal habitat and blue carbon conservation planning
- To improve assessments of the blue carbon storage potential of seagrasses along coastal BC, a more thorough understanding of the **variability** between seagrass meadows and the **environmental factors** that influence carbon storage is required

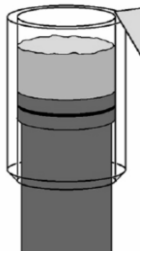
http://www.cec.org/

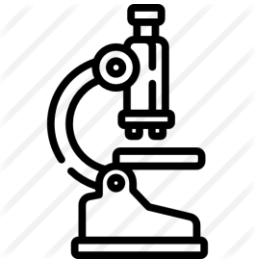
Seagrass on the Pacific Coast of North America

- In 2015, the Commission for Environmental Cooperation, a trinational organization that is funded by the governments of Canada, the US and Mexico, identified the Pacific Coast of North America as a high-priority area for seagrass mapping and carbon storage research

Extent, Density, and Biomass Carbon of Eelgrass







Mapping

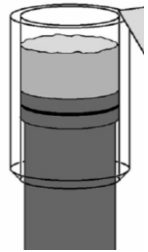
Biomass Collecting

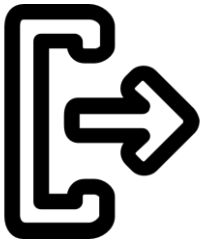
Coring

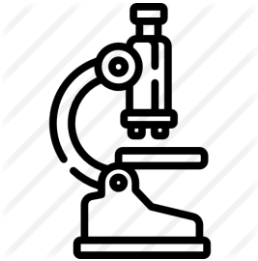
Measure Carbon

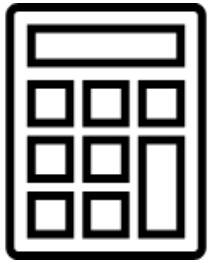
https://www.flaticon.com/

Sediment Carbon of Eelgrass









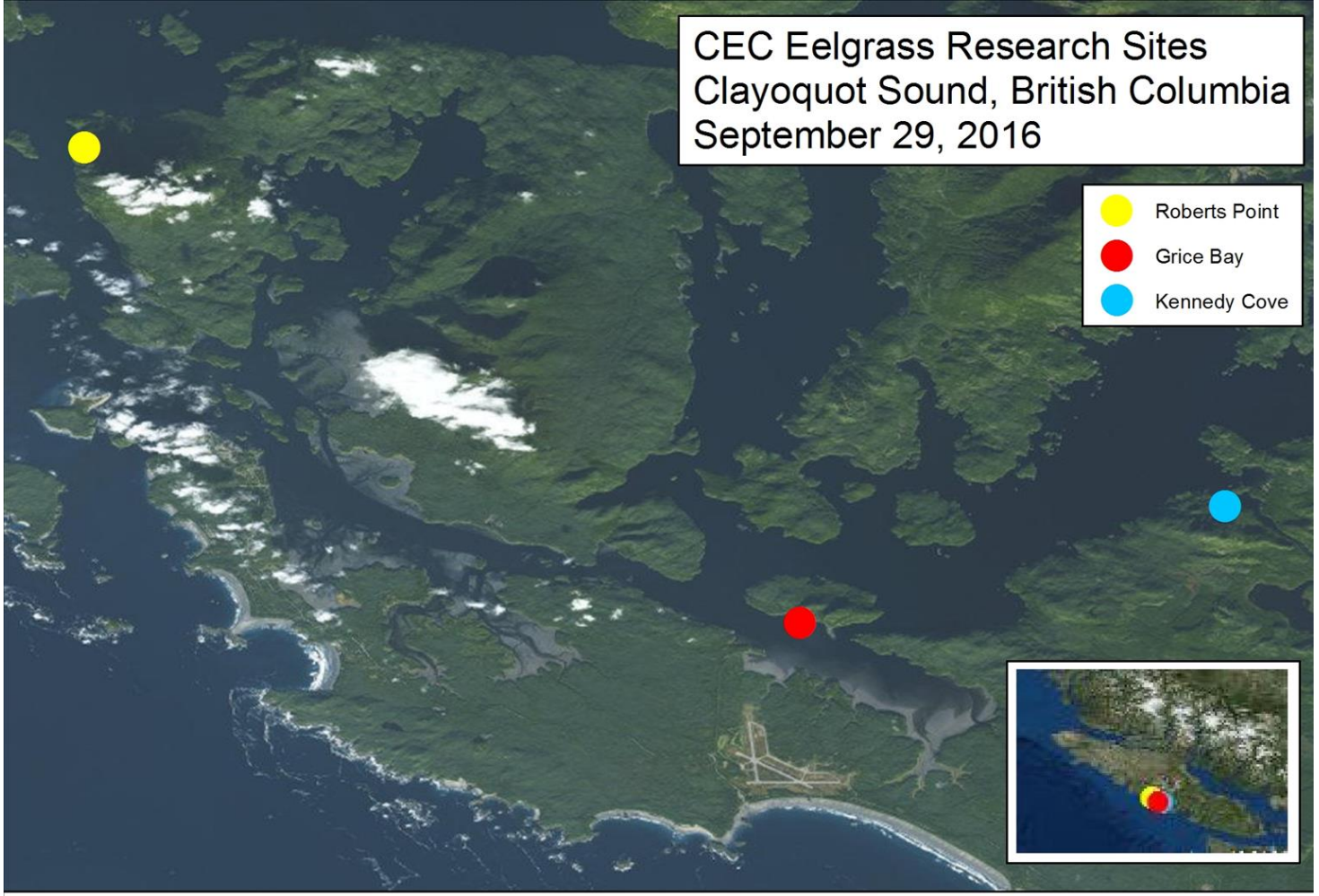
Coring

Core Extraction

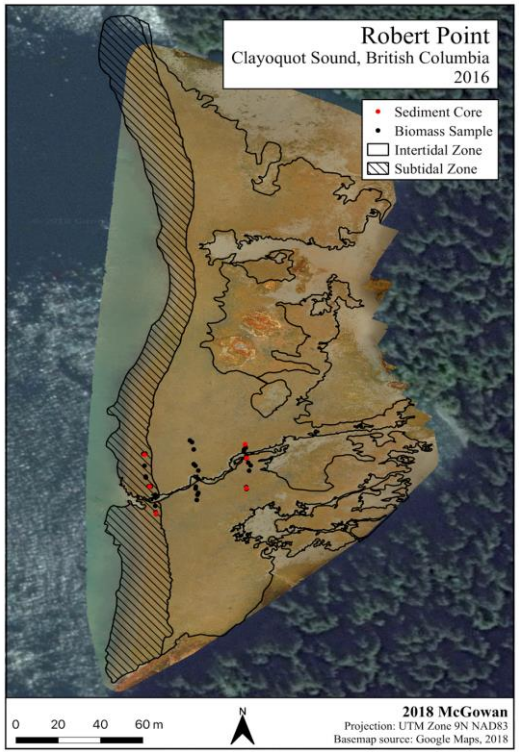
Measure Density

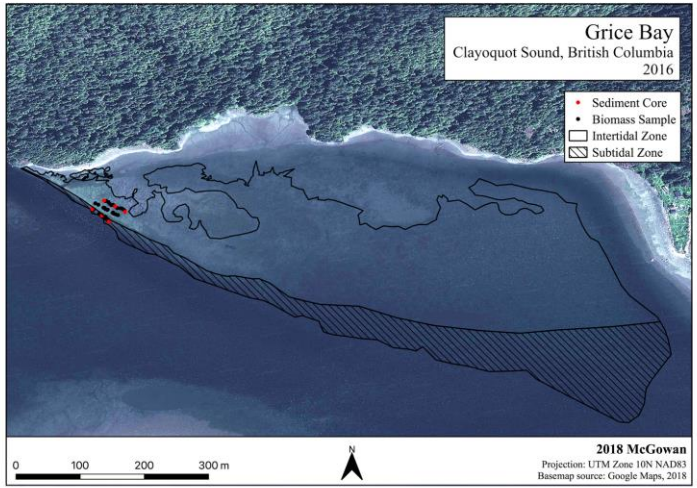
Measure Carbon

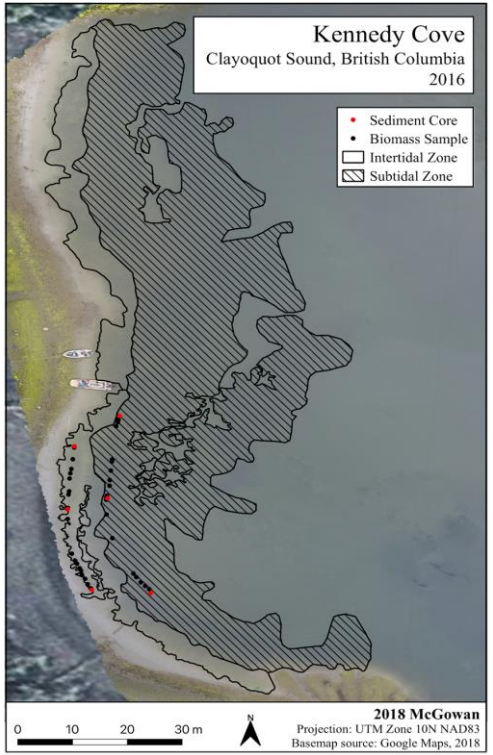
https://www.flaticon.com/


CEC Eelgrass Research Sites
Clayoquot Sound, British Columbia
September 29, 2016
Roberts Point
Grice Bay
Kennedy Cove
N
km
0
2.5
5
7.5
10
Projection Zone: GCS WGS 1984, UTM Zone 9-10 N
Basemap Source: Google Maps, 2016
McGowan, Aimee

Eelgrass Meadows in Clayoquot Sound

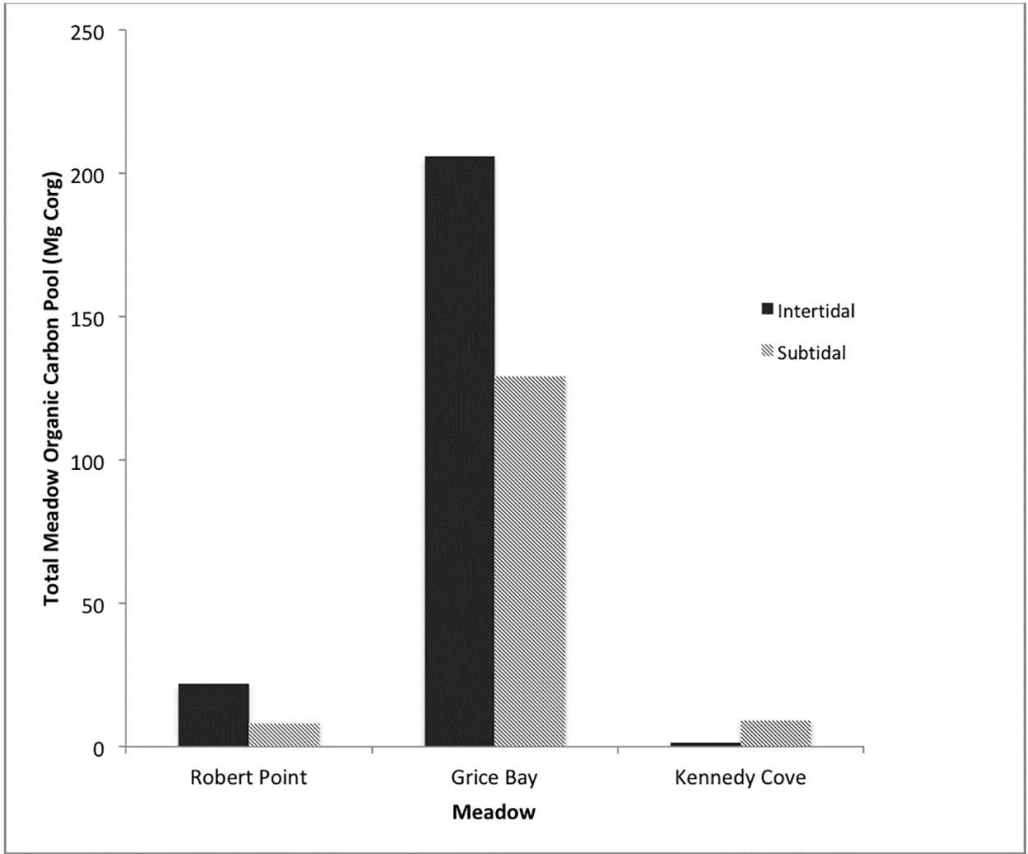






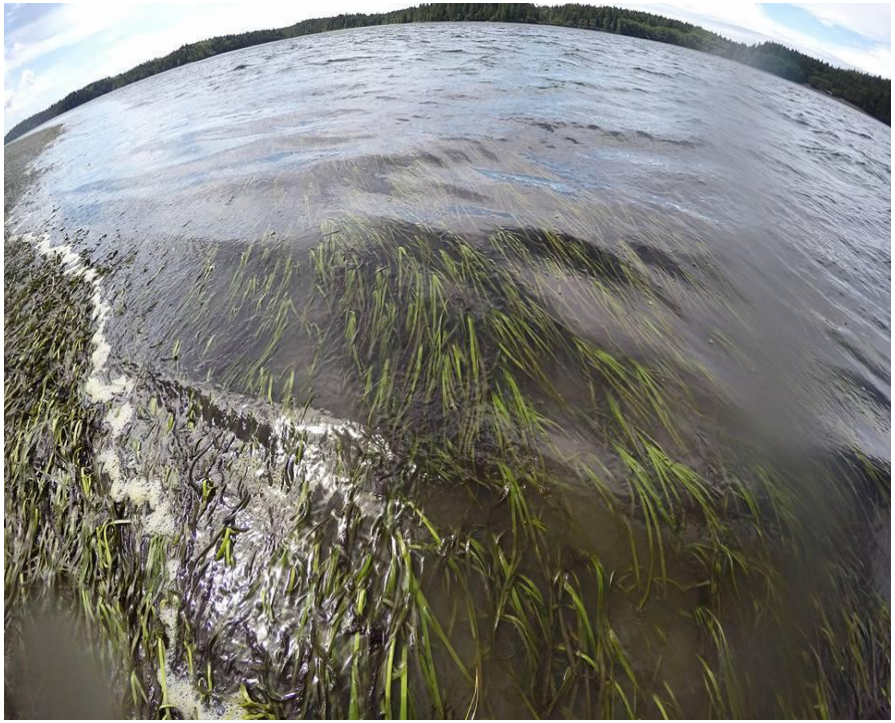
What We Found: Carbon Storage

- The majority of carbon stored in these ecosystems is stored in the sediment
- Carbon storage in these meadows is significant, but not as high as in more tropical seagrasses
- Strong patterns between sites



What We Found: Water Temperature

- *Zostera marina* are healthiest in water temperatures ranging between 5-8°C[2]
- They exhibit symptoms of stress at temperatures above 15°C[2]
- Our worst-performing site had an early summer water temperature of 18°C



What We Found: Salinity

- Low salinities can lead to decreased eelgrass health[3]
- Signs of stress have been seen at salinities <9[3]
- Our worst performing site had an early summer salinity of 6.3

What We Found: Stressors

- Human or environmental stress can affect eelgrass growth and disturb the sediment, resulting in decreased carbon storage or even release of previously buried carbon back into the air

https://floridakeys.noaa.gov/plants/msthreats.html

Assessing Seagrass' Potential for Blue Carbon Storage

- The natural **variability** of seagrass meadows, along with any **stress** they experience, have important implications for their total carbon storage capacity:

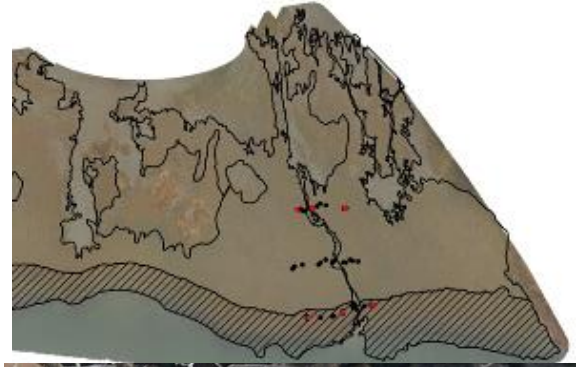
  - Area/Extent
  - Water temperature
  - Salinity level
  - Nutrients
  - Light availability
  - Environmental stress
  - **Human-induced stress**

Regulation and Conservation of Eelgrass Habitats

- Global estimates are available but we need **locally specific** estimates of carbon storage and emissions values
- **Understanding blue carbon habitats** will be important for incorporating them into conservation planning on the Pacific Coast of Canada
- While carbon markets could incorporate eelgrass meadows into climate change mitigation strategies, protection through law is the most important step.

Next Steps?

- More **detailed maps** of seagrass meadows
- **More research** on how these ecosystems respond to change and what influences their carbon storage
- **Transfer lessons learned** from research into conservation planning and climate change mitigation strategies



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1. Reynolds, Pamela L. 2018. “Seagrass and Seagrass Beds.” Smithsonian Ocean. December 18, 2018. https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds.
2. Thom, Ronald M., Amy B. Borde, Steven Rumrill, Dana L. Woodruff, Gregory D. Williams, John A. Southard, and Susan L. Sargeant. 2003. “Factors Influencing Spatial and Annual Variability in Eelgrass (Zostera Marina L.) Meadows in Willapa Bay, Washington, and Coos Bay, Oregon, Estuaries.” *Estuaries* 26 (4): 1117–29. https://doi.org/10.1007/bf02803368.
- Kaldy, James E. 2014. “Effect of Temperature and Nutrient Manipulations on Eelgrass Zostera Marina L. from the Pacific Northwest, USA.” *Journal of Experimental Marine Biology and Ecology* 453 (April): 108–115. https://doi.org/10.1016/j.jembe.2013.12.020.