Blue Carbon from seaweeds:

Carbon sequestration by marine primary producers - seaweeds do matter!

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C-sequestration and acknowledged Blue-C sinks

Blue-C defined:

The sequestration of C from marine organisms that takes place when burial rates exceed long-term rates of erosion and decomposition

Key issue: Incomplete decomposition and burial of detrital C

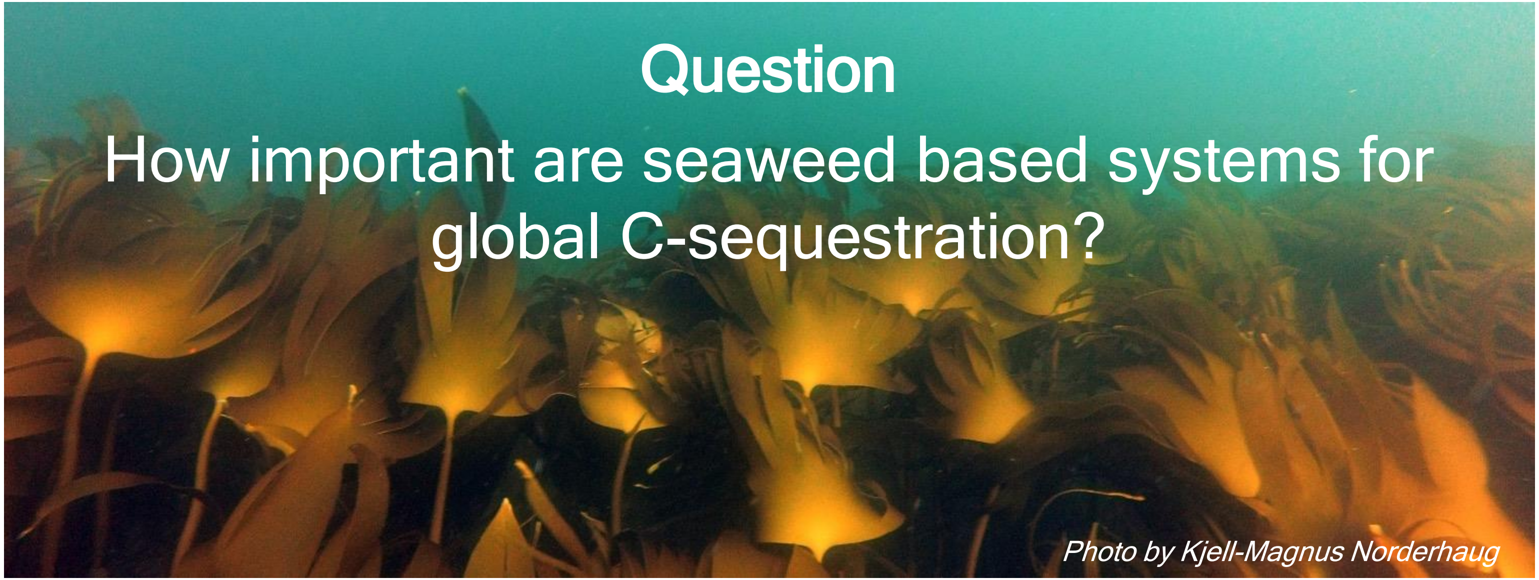
Acknowledged Blue-C sinks:

- Seagrass meadows
- Mangrove forests
- Saltmarsh systems

However -

Seaweed-based systems remain unrecognized as major C-sinks by many people (and ICCP)

C-sequestration and acknowledged Blue-C sinks



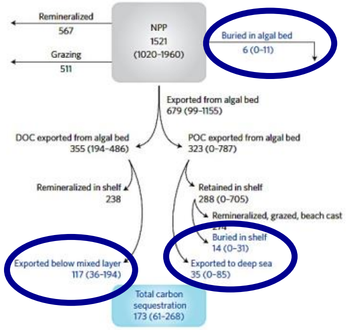
Quantifying Blue-C - usual approaches

1. Core sampling, aging and chemical analysis of sediments

Challenges:

- Aging often impossible due to mixing in shallow waters
- Cores often difficult to collect in deep waters
- Separation of terrestrial and marine C not easy

2. Mass-balance calculations



Challenges:

- Requires detailed quantification of many variables
- Export estimates often biased (difficult to obtain)

An alternative approach may be to look at the amount of non-decomposable detritus produced in systems:

C-sequestration = detrital C produced − mineralization (through decomposition)

Comparing the significance of Blue-C habitats:

The global significance of any habitat to C-sequestration must depend on:

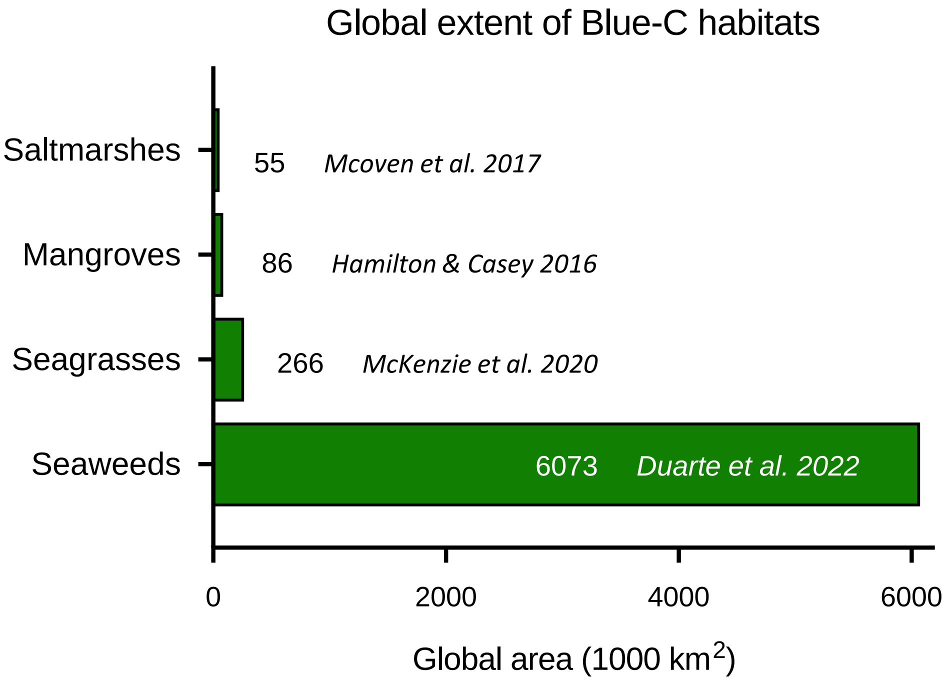
- Range distribution (areal cover)
- Detritus production (DP) per unit area and time
- Decomposition (rate and extent) of the detritus




Method:

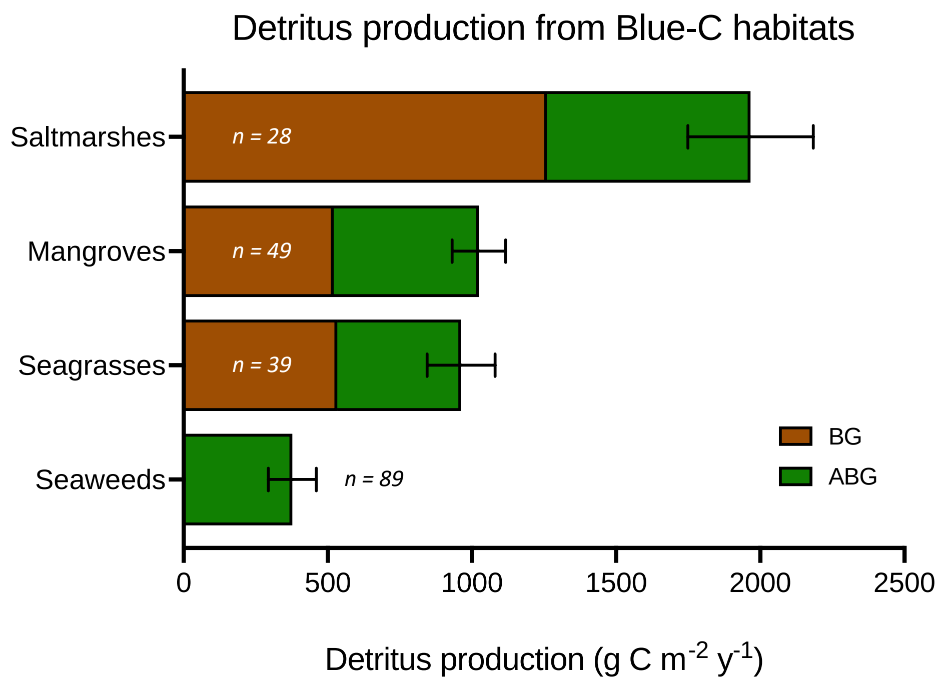
- Collation and analysis of data from the literature

1. Global extent of potential Blue-C habitats:



Seaweeds cover 15 times more area than the other Blue-C habitats together

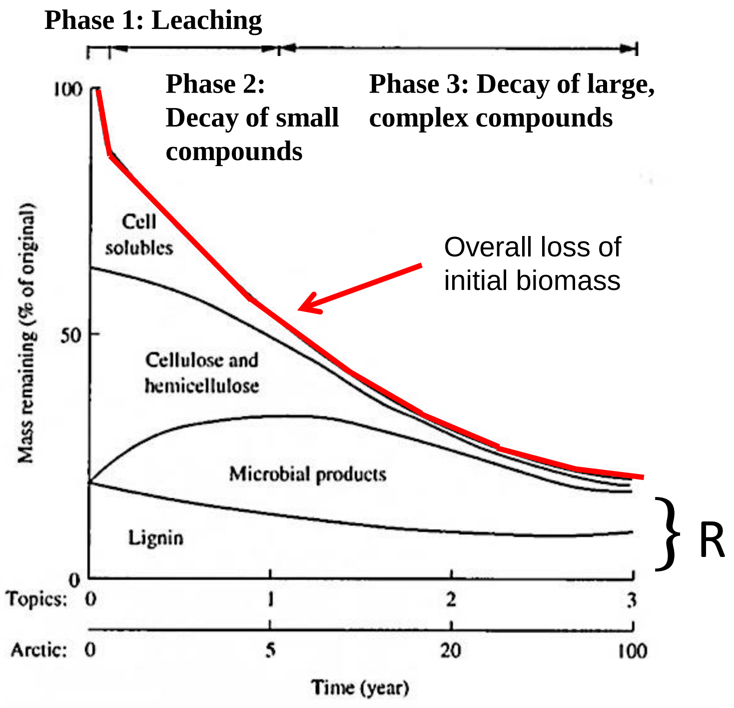
2. Detritus production from Blue-C habitats:



The production of detritus-bound C varies 5-fold among habitats - seaweeds produce less detrital C than other Blue-C habitats

3. Decomposition rates and extent among Blue-C sinks:

Decomposition involves several steps:



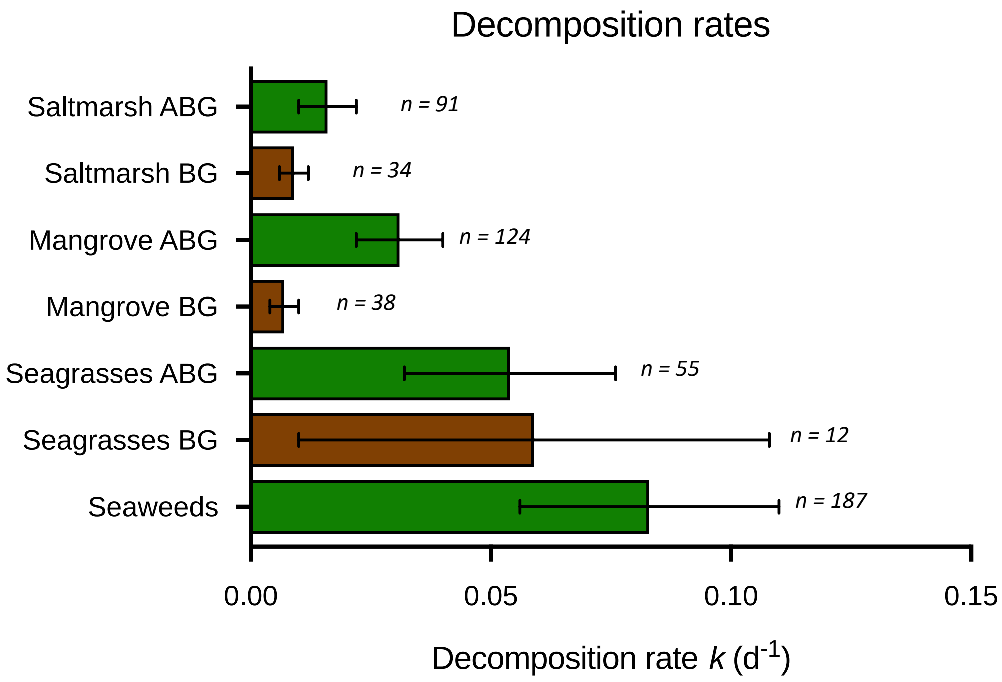
Decomposition often modeled by:

$$B_t = B_0 \times e^{-k \times t} + R$$

Decay rate (k) is important as it determines standing stock size of C at steady state

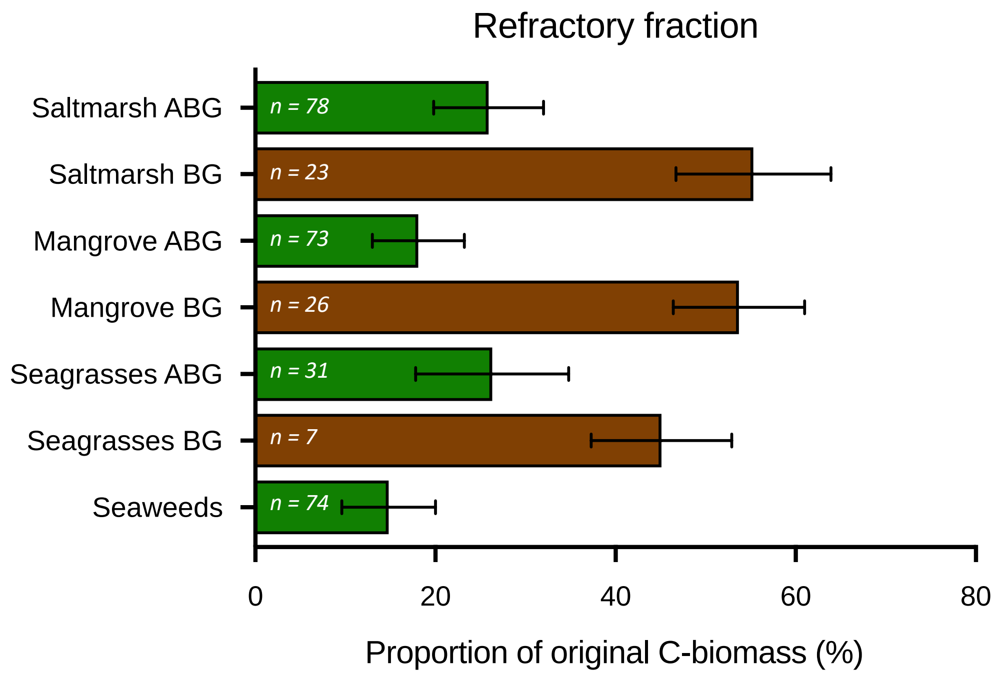
The refractory (R) component is important as is represents detrital C that may be stored for decades to millennia

3. Decomposition rates and extent among Blue-C sinks:



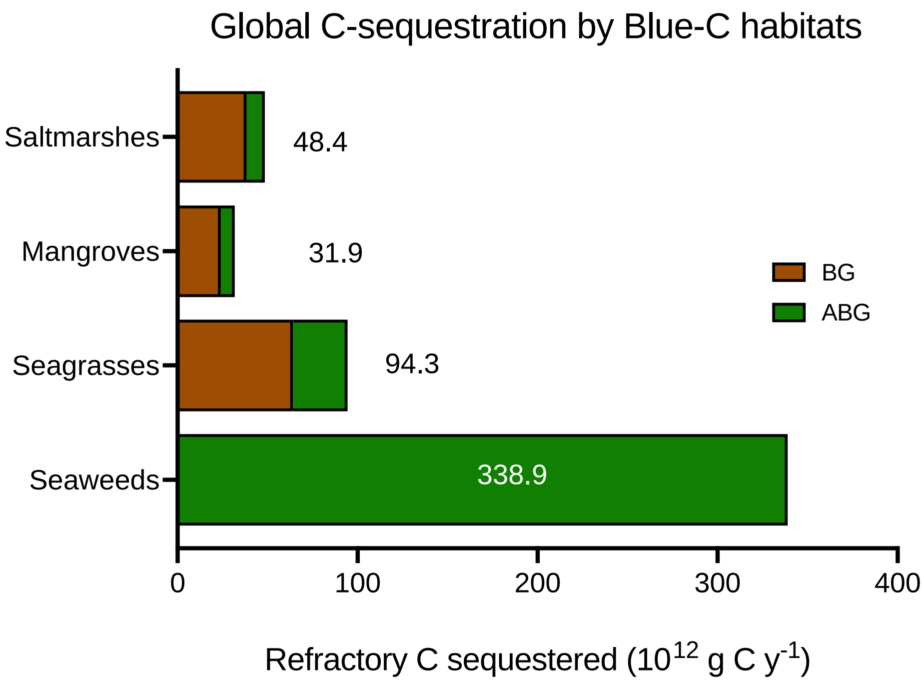
Seaweed detritus is broken down 2 - 5 times faster than that from seagrass, mangrove and saltmarsh plants

3. Decomposition rates and extent among Blue-C sinks:



R in seaweed detritus is slightly less than that in above-ground seagrass, mangrove & saltmarsh matter, but much lower than in below-ground material

The global perspective - contribution by Blue-C habitats:



Seaweeds sequester at least twice as much C as the presently acknowledged Blue-C habitats together at the global scale

Conclusion

and thanks to my co-authors:

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