Factors influencing carbon storage capacity in eelgrass meadows of New England

Alyssa Novak[1], Phil Colarusso[2], Marguerite Pelletier[3], Julie Simpson[4], Mary Nicole Gutierrez [5] , Ariane Arias Ortiz[6], Pere Masqué[6], Prasseda Vella[7]

[1]Boston University, Earth and Environment, Boston, MA, USA, [2]US EPA, Region 1, Boston, MA, USA, [3]US EPA, ORD, NHEERL-AED, Narragansett, RI, USA, USA, [4] MIT Sea Grant, Cambridge, MA, USA, [5] SSC to US EPA, Narragansett, RI, USA, [6] Autonomous University of Barcelona, Barcelona, Spain, [7] Mass CZM, Boston, MA, USA

Multimodel Inference

- Alternative to null hypothesis testing
- Multiple models generated using different combinations of variables
- Information criteria (AIC) used to rank models
- Relative importance of each variable in model is determined from AICw value summed across models

Multimodel Inference

- Alternative to null hypothesis testing
- Multiple models generated using different combinations of variables
- Information criteria (AIC) used to rank models
- Relative importance of each variable in model is determined from AICw value summed across models

Multimodel Inference Conceptual model

Variables

- Environmental Conditions
  - Latitude (temperature)
  - Fetch
  - Precipitation
- Sediment Characteristics
  - % Silt Clay
  - Percent %N
  - Trap weight
- Plant Parameters
  - Leaf Area
  - Growth Rate (cm)
  - Shoot Density

Multimodel Inference Conceptual model

Variables

- Environmental Conditions
  - Latitude (temperature)
  - Fetch
  - Precipitation
- Sediment Characteristics
  - % Silt Clay
  - Percent %N
  - Trap weight
- Plant Parameters
  - Leaf Area
  - Growth Rate (cm)
  - Shoot Density

Multimodel Inference Conceptual model

Variables

- Environmental Conditions
  - Latitude (temperature)
  - Fetch
  - Precipitation
- Sediment Characteristics
  - % Silt Clay
  - Percent %N
  - Trap weight
- Plant Parameters
  - Leaf Area
  - Growth Rate (cm)
  - Shoot Density

Multimodel Inference Conceptual model

Variables

- Environmental Conditions
  - Latitude (temperature)
  - Fetch
  - Precipitation
- Sediment Characteristics
  - % Silt Clay
  - Percent %N
  - Trap weight
- Plant Parameters
  - Leaf Area
  - Growth Rate (cm)
  - Shoot Density

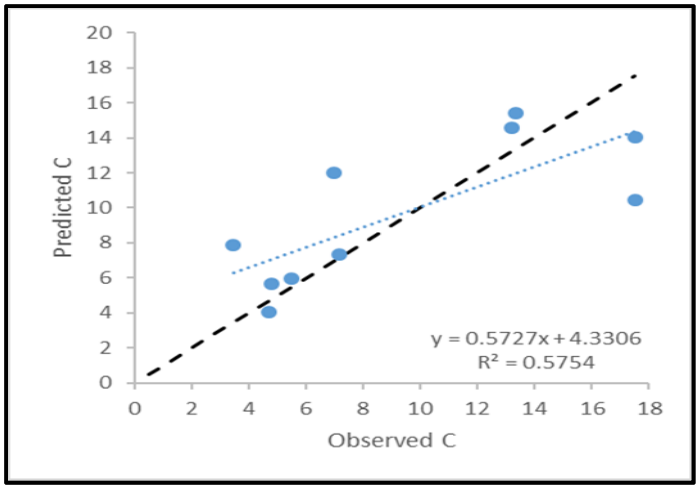
Multimodel Inference Conceptual model

Top 5 cm- Eelgrass

- % silt-clay= high importance
- Latitude & %N trap = low to moderate importance
- Remaining variables= low importance

Model has moderate predictive ability

Variable	Sum AICw
% silt-clay	**0.86**
Latitude	**0.29**
Sed trap %N	**0.27**
Leaf area	**0.18**
Avg growth	**0.14**
Total spring/summer ppt	**0.13**
Avg shoot density	**0.11**
sed trap wt	**0.11**
Median fetch	**0.10**



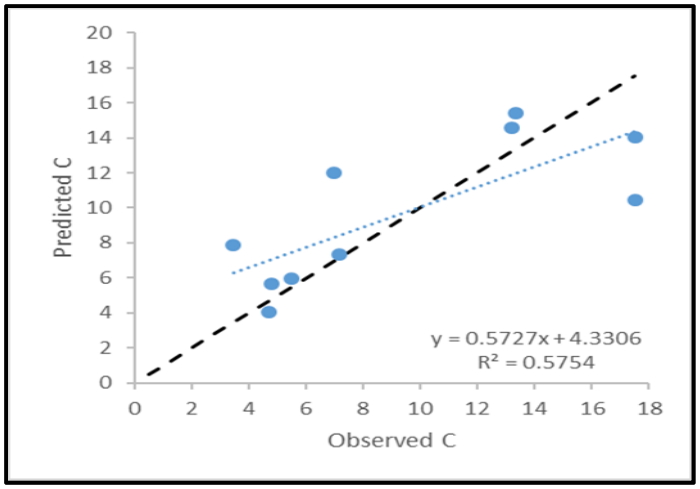
Multimodel Inference Conceptual model

Top 5 cm- Eelgrass

- % silt-clay= high importance
- Latitude & %N trap = low to moderate importance
- Remaining variables= low importance

Model has moderate predictive ability

Variable	Sum AICw
% silt-clay	**0.86**
Latitude	**0.29**
Sed trap %N	**0.27**
Leaf area	**0.18**
Avg growth	**0.14**
Total spring/summer ppt	**0.13**
Avg shoot density	**0.11**
sed trap wt	**0.11**
Median fetch	**0.10**



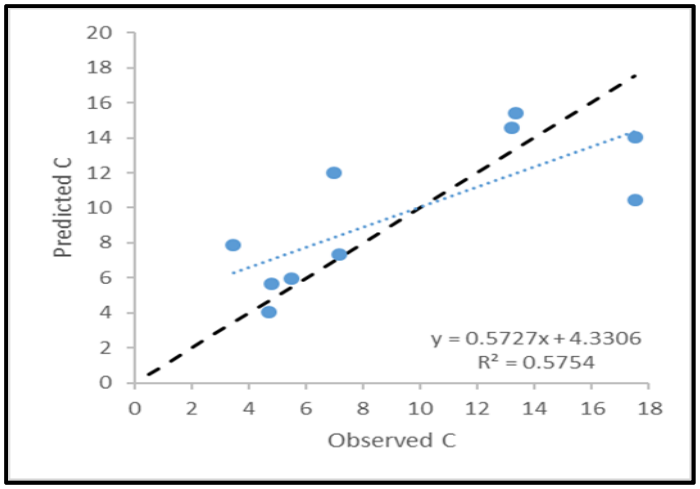
Multimodel Inference Conceptual model

Top 5 cm- Eelgrass

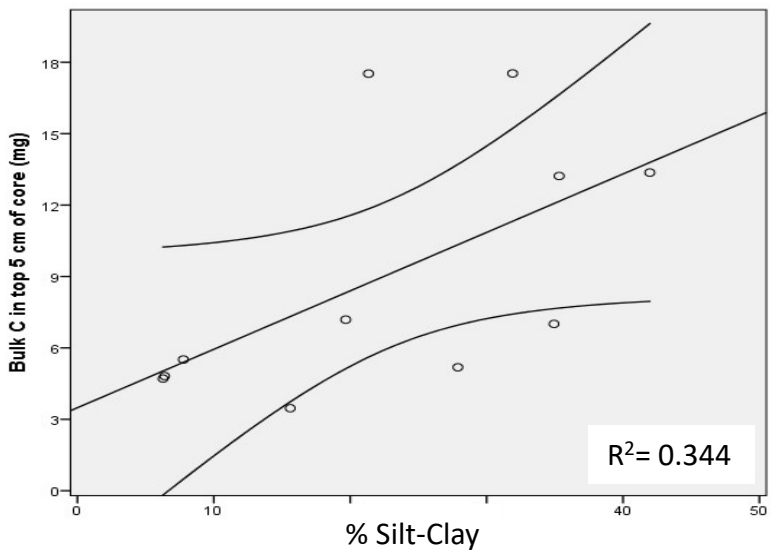
- % silt-clay= high importance
- Latitude & %N trap = low to moderate importance
- Remaining variables= low importance

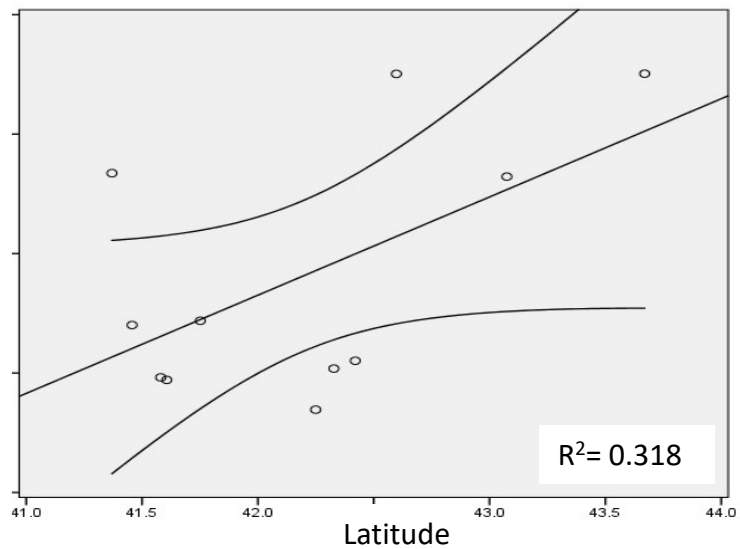
Model has moderate predictive ability

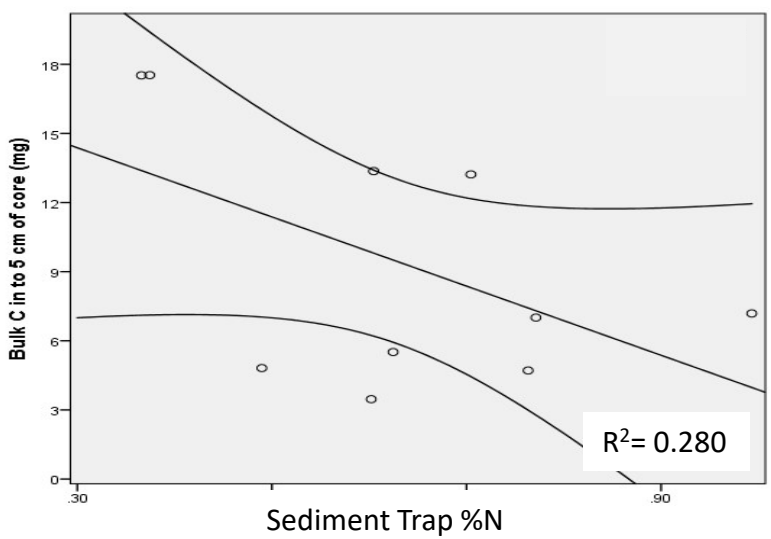
Variable	Sum AICw
% silt-clay	**0.86**
Latitude	**0.29**
Sed trap %N	**0.27**
Leaf area	**0.18**
Avg growth	**0.14**
Total spring/summer ppt	**0.13**
Avg shoot density	**0.11**
sed trap wt	**0.11**
Median fetch	**0.10**



Multimodel Inference Conceptual model

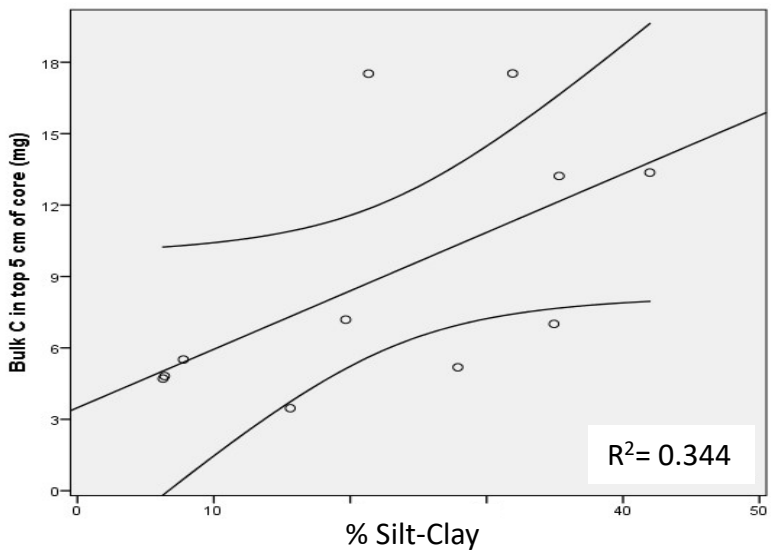


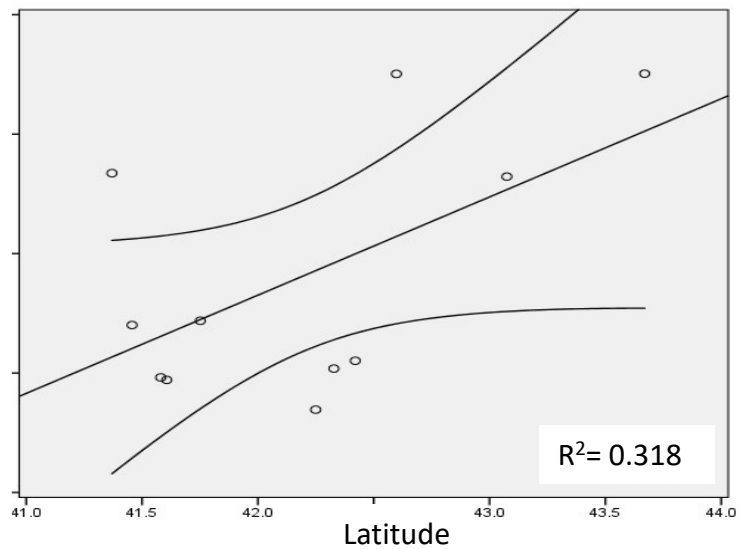


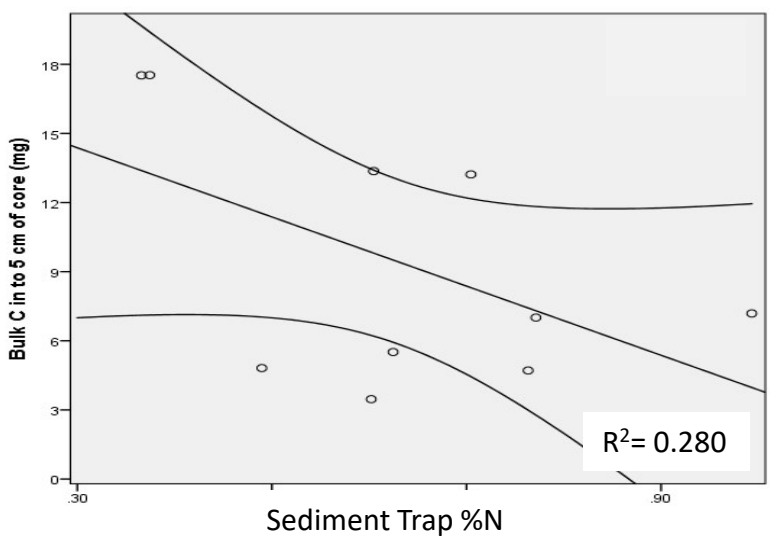


Top 5 cm- Eelgrass

Multimodel Inference Conceptual model







Top 5 cm- Eelgrass

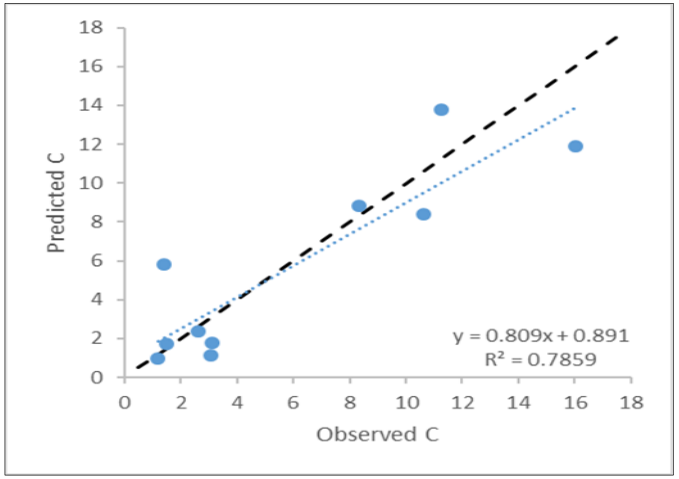
Multimodel Inference Conceptual model

Top 5 cm- Reference

- % silt-clay= high importance
- Latitude & Precipitation= low to moderate importance
- Remaining variables= low importance

Model has good predictive ability

Variable	Sum AICw
% silt-clay	**0.96**
Latitude	**0.25**
Total spring/summer ppt	**0.23**
Median fetch	**0.16**
sed trap wt	**0.16**
Sed trap %N	**0.14**



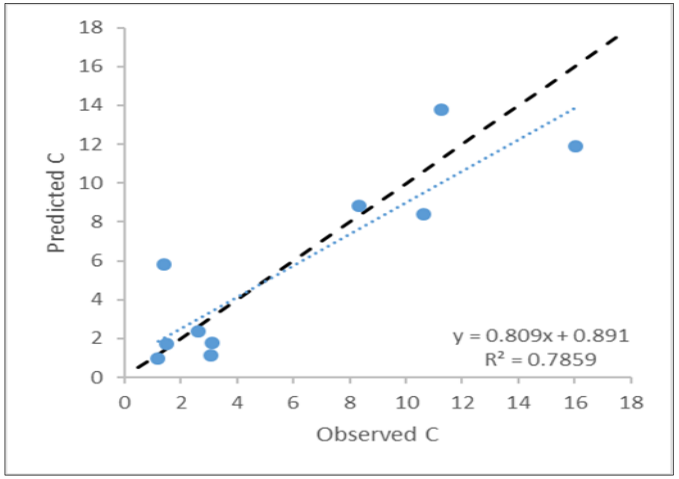
Multimodel Inference Conceptual model

Top 5 cm- Reference

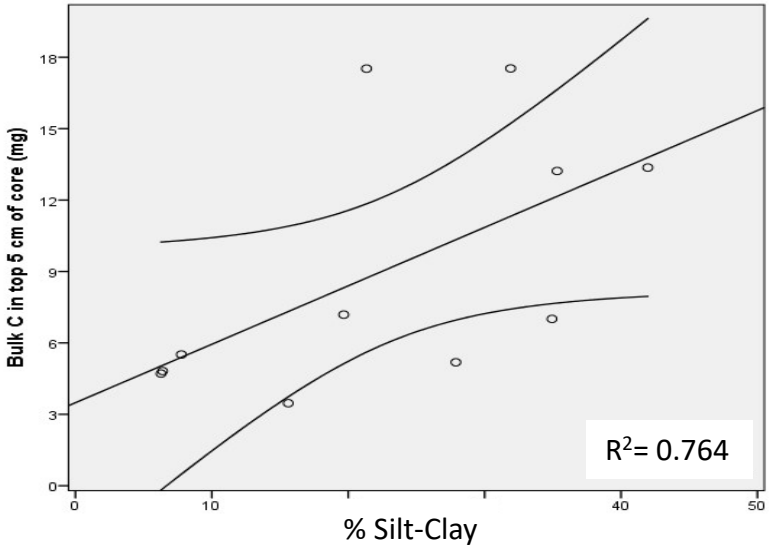
- % silt-clay= high importance
- Latitude & Precipitation= low to moderate importance
- Remaining variables= low importance

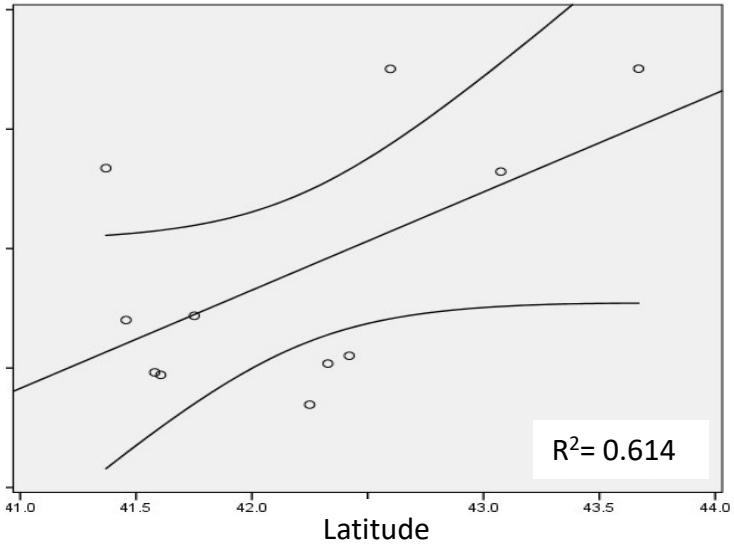
Model has good predictive ability

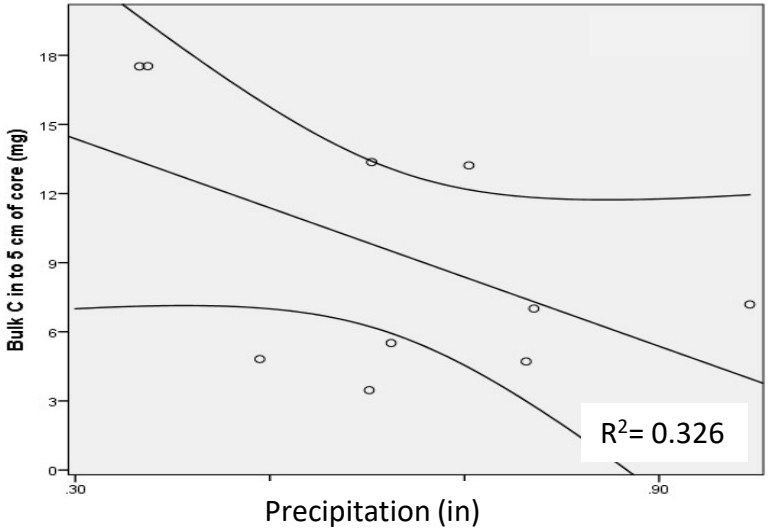
Variable	Sum AICw
% silt-clay	**0.96**
Latitude	**0.25**
Total spring/summer ppt	**0.23**
Median fetch	**0.16**
sed trap wt	**0.16**
Sed trap %N	**0.14**



Multimodel Inference Conceptual model





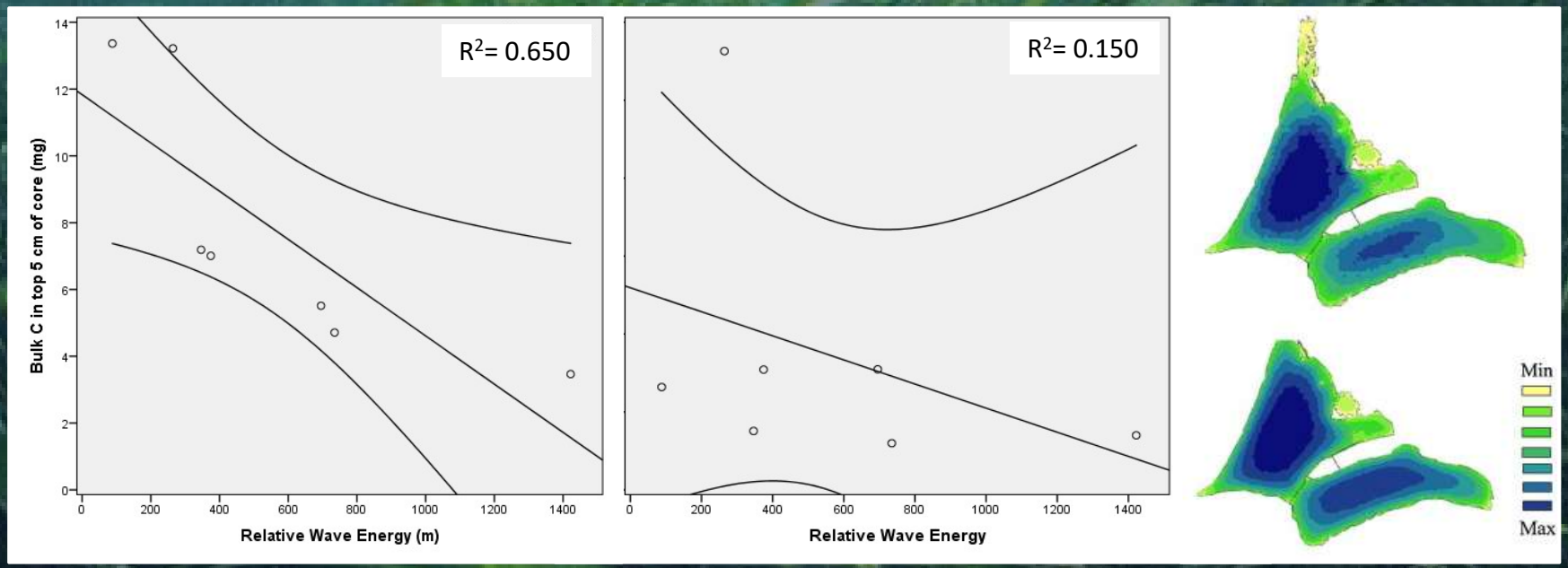


Top 5 cm- Reference

Future: Relative Wave Exposure

- WEMo- NCCOS: uses linear wave theory to calculate wave height and wave energy
  - wind generation
  - water depth

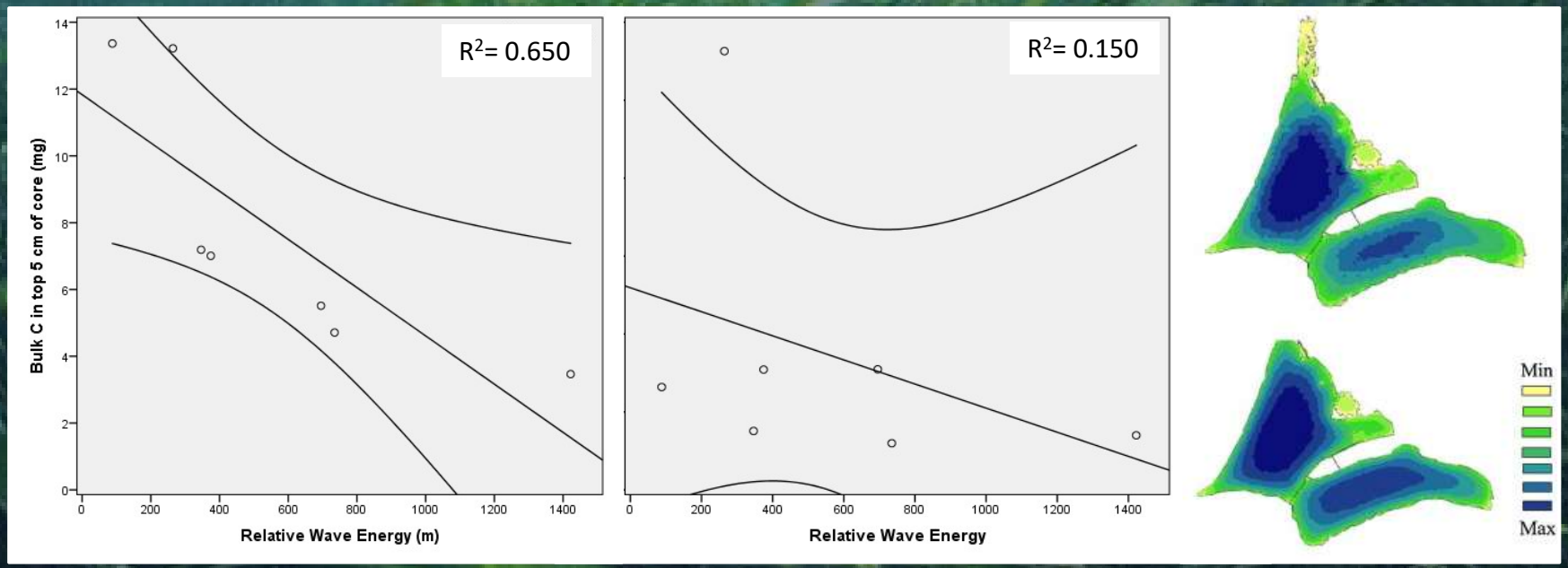
Eelgrass **Reference**



Future: Relative Wave Exposure

- WEMo- NCCOS: uses linear wave theory to calculate wave height and wave energy
  - wind generation
  - water depth

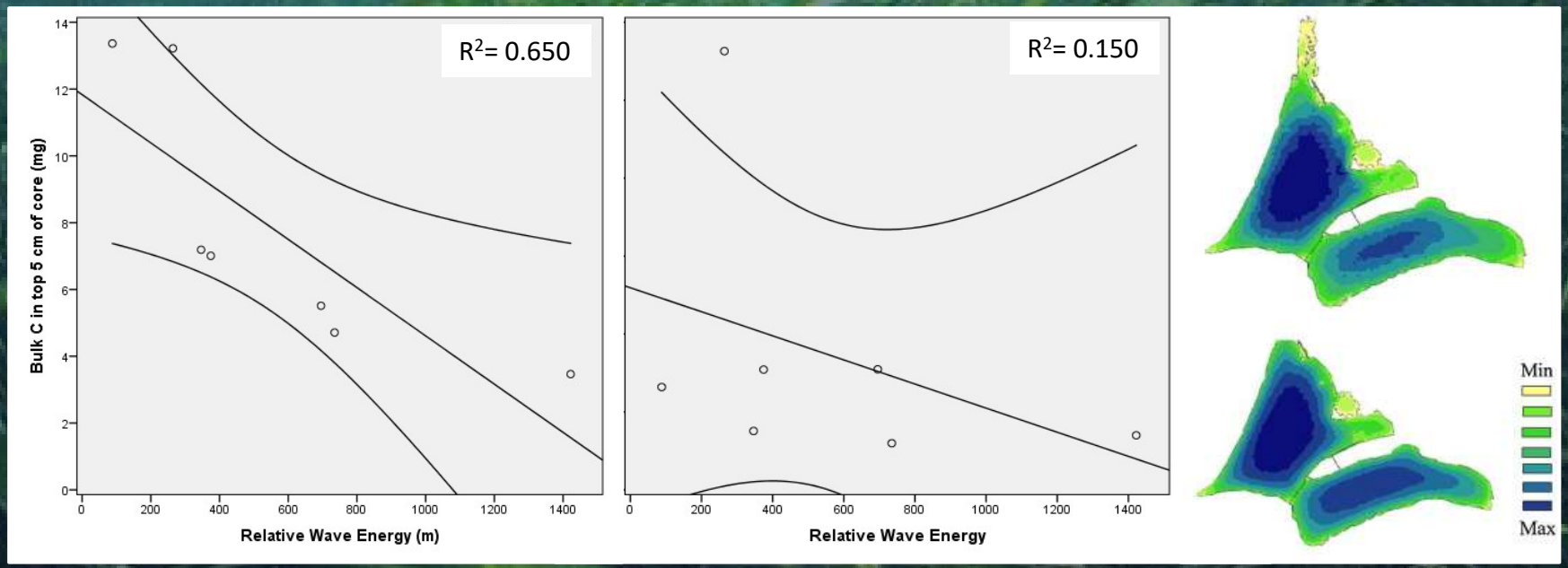
Eelgrass **Reference**



Future: Relative Wave Exposure

- WEMo- NCCOS: uses linear wave theory to calculate wave height and wave energy
  - wind generation
  - water depth

Eelgrass **Reference**



Conclusions

- We have developed reasonable models with moderate-good predictive ability with collected variables.
- Sediment grain size is an important predictor while latitude is a moderate predictor of bulk carbon at eelgrass and reference sites.
- Future models will substitute fetch with relative wave exposure.

Acknowledgements

Fred Short, Eric Nelson, Dan Arsenault, Jean Brochi, Chuck Protzmann, Tim Bridges, Holly Plaisted, Agnes Mittermayr, Jill Carr, Tay Evans, Jack Buckley, Dani Ewart, Dave Grunden, Hanna Mogensen, Juliette Williams, Lindsay Peter, Audrey Michniak, Molly Sullivan, Ivy Mlsna, Kathryn Baltes, Bill Osbahr, Don Cobb

- .