

Advancing Methods to Parameterize Emergent Vegetation Variables for Coastal Impact Models

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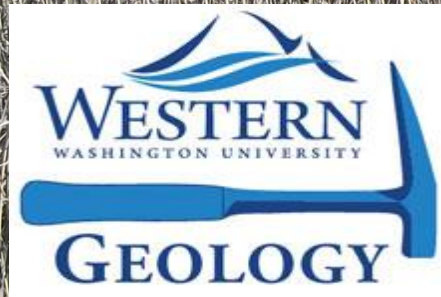
WWU and USGS

Dr. Scott Linneman

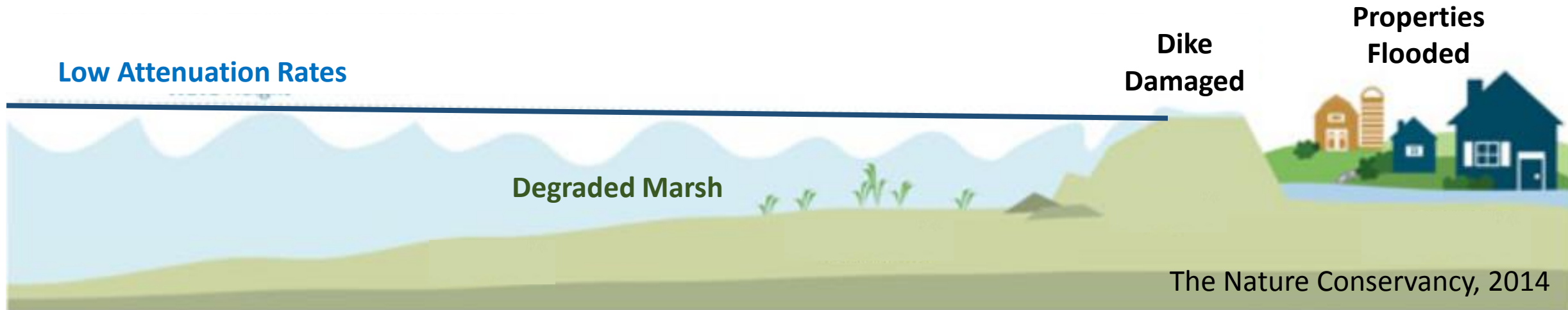
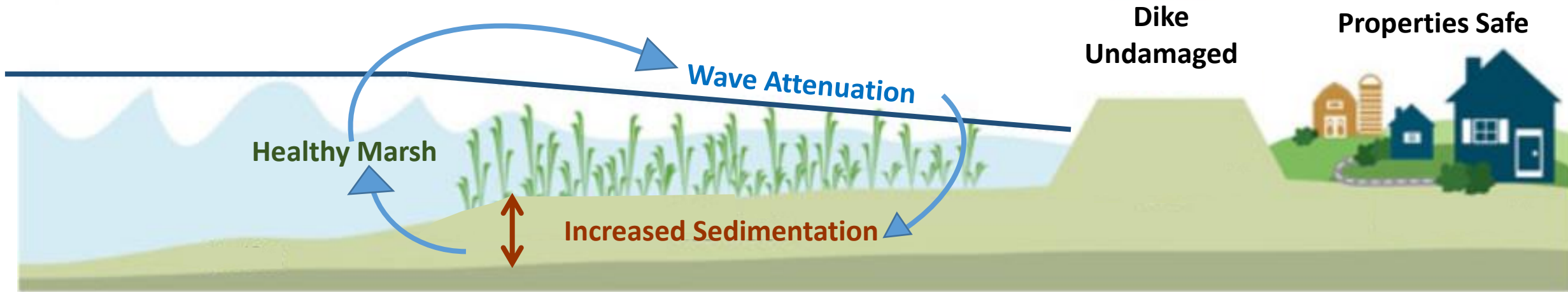
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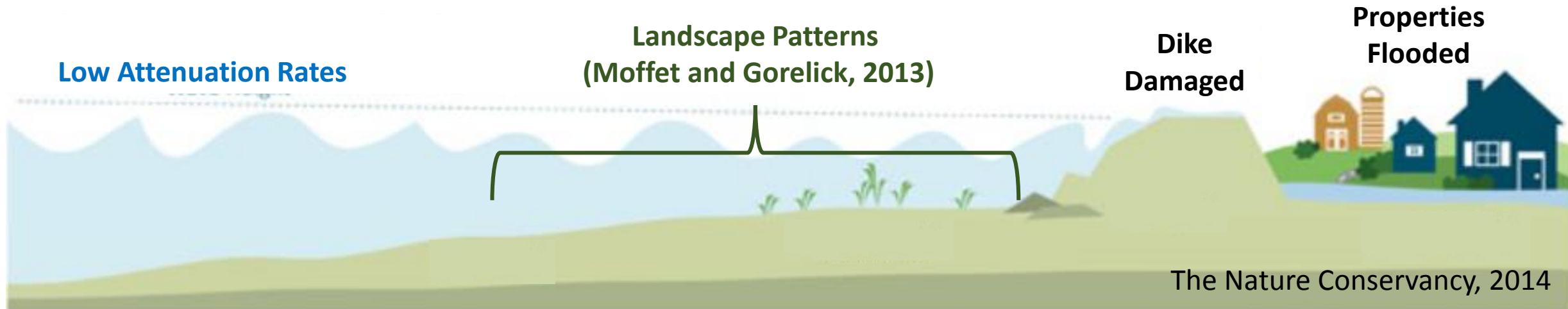
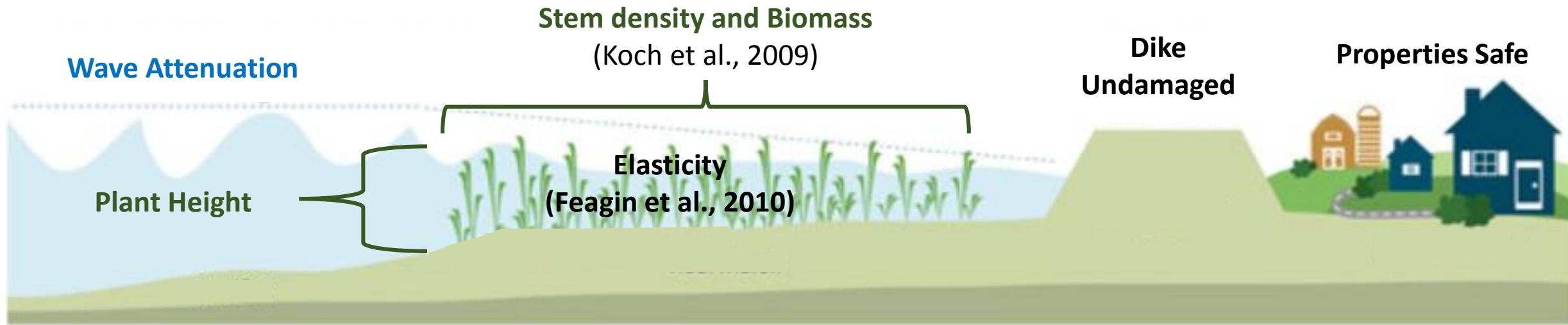
Introduction : Coastal Resilience of Lowlands



The Problem:

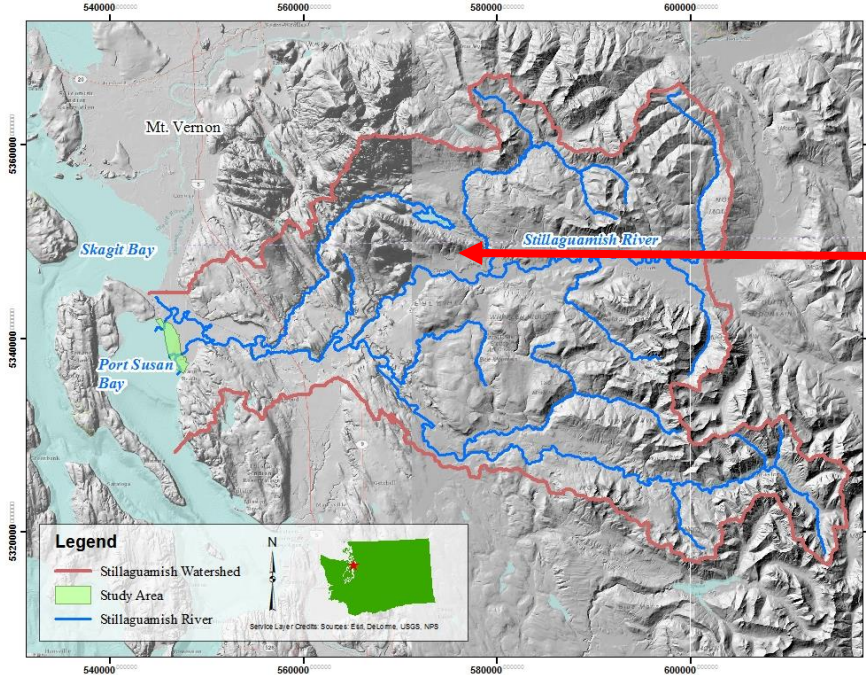
- Science has not fully quantified the biophysical characteristics of wetland vegetation and their effect on wave energy/sedimentation.
- Most wave models use wave sensor data or idealized flume experiments to estimate a friction coefficient for vegetation. These may not account for the high spatial and temporal variability of wetland vegetation structure.

Purpose : Quantify Vegetation Variables

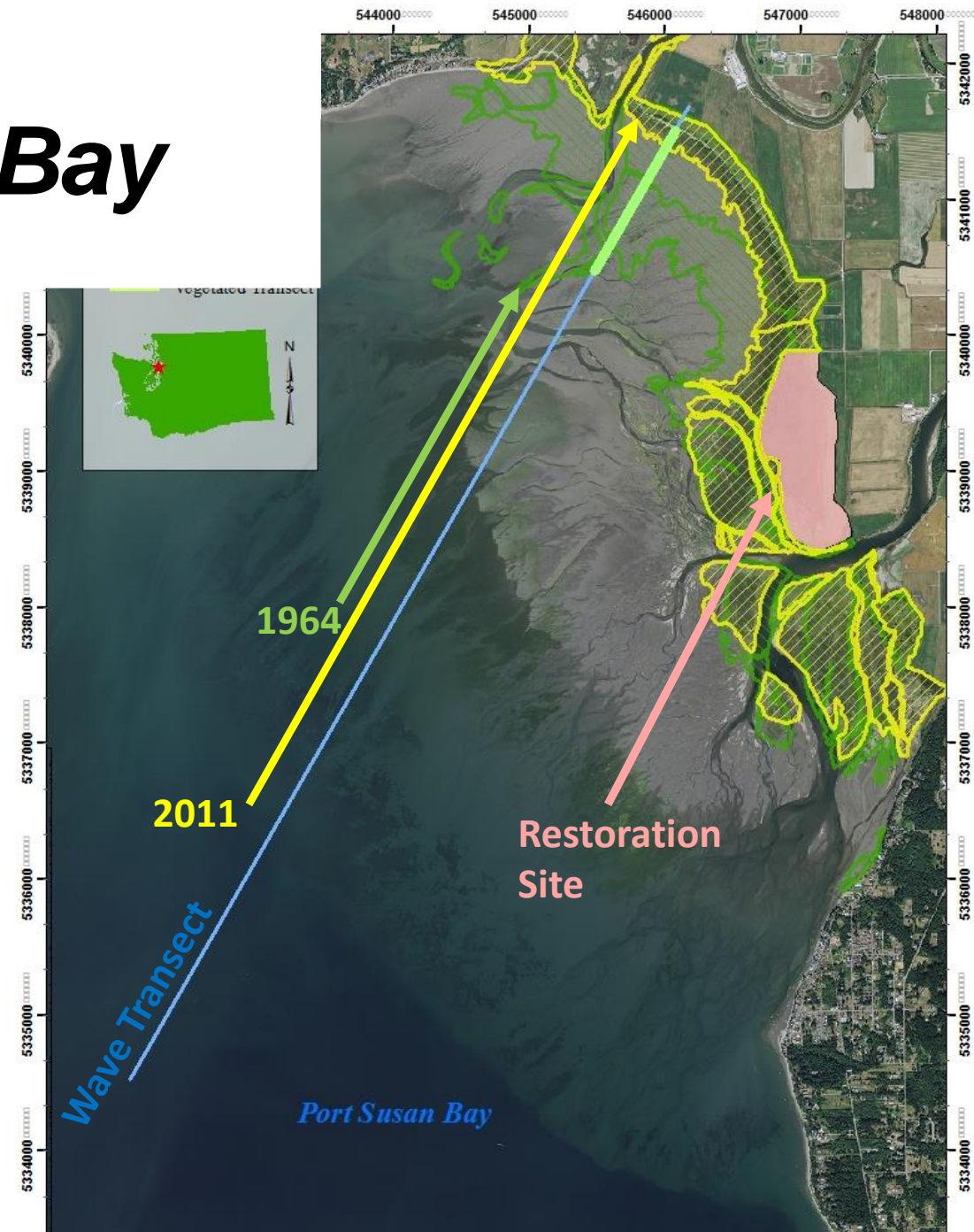


Study Area: Port Susan Bay

- Rapid historical marsh loss.
 - Up to a kilometer since the 1960s.
- On-going restoration and monitoring.
- Large scientific community.
- Oso landslide.



Oso, WA



Methods: Overview

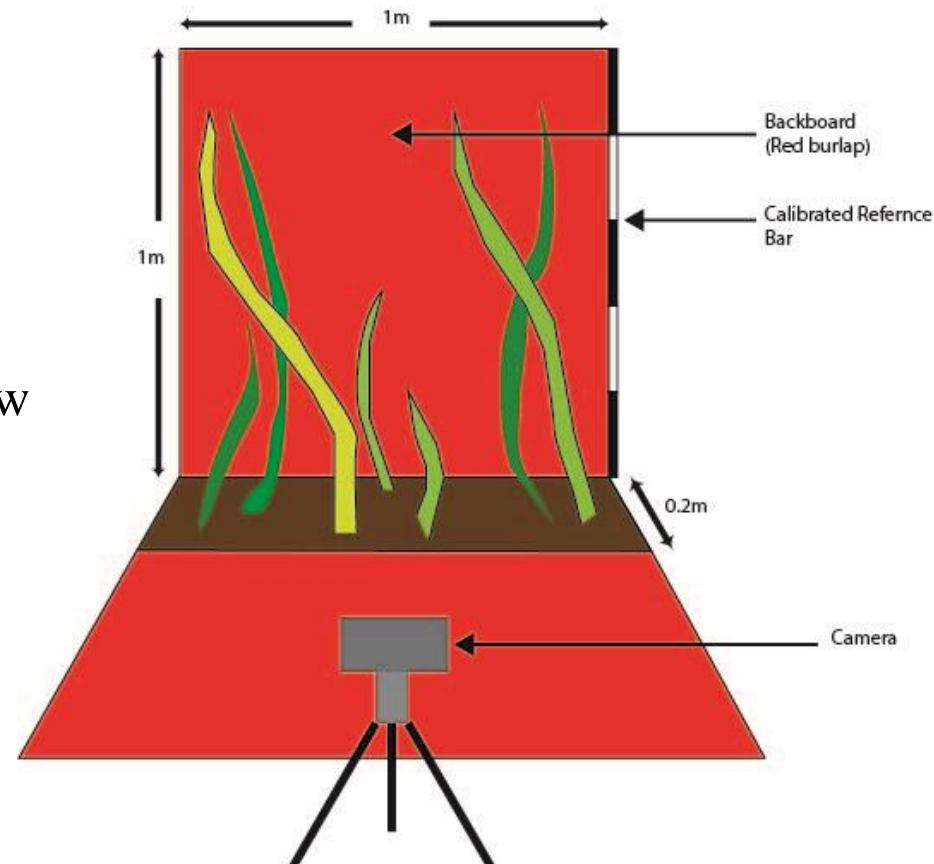
1. Quantify biophysical characteristics that effect wave energy through direct field measurements and semi-automated side-on image analysis.
2. Extrapolate using landcover maps derived from hyperspectral imagery.
3. Use extrapolated vegetation data to parameterize and compare x-shore wave models.

Methods: Vegetation Measurements

- Collect side-on photographs for vertical vegetation analysis.

- Biomass
- Stem density
- Height
- Diameter
- Area available for flow

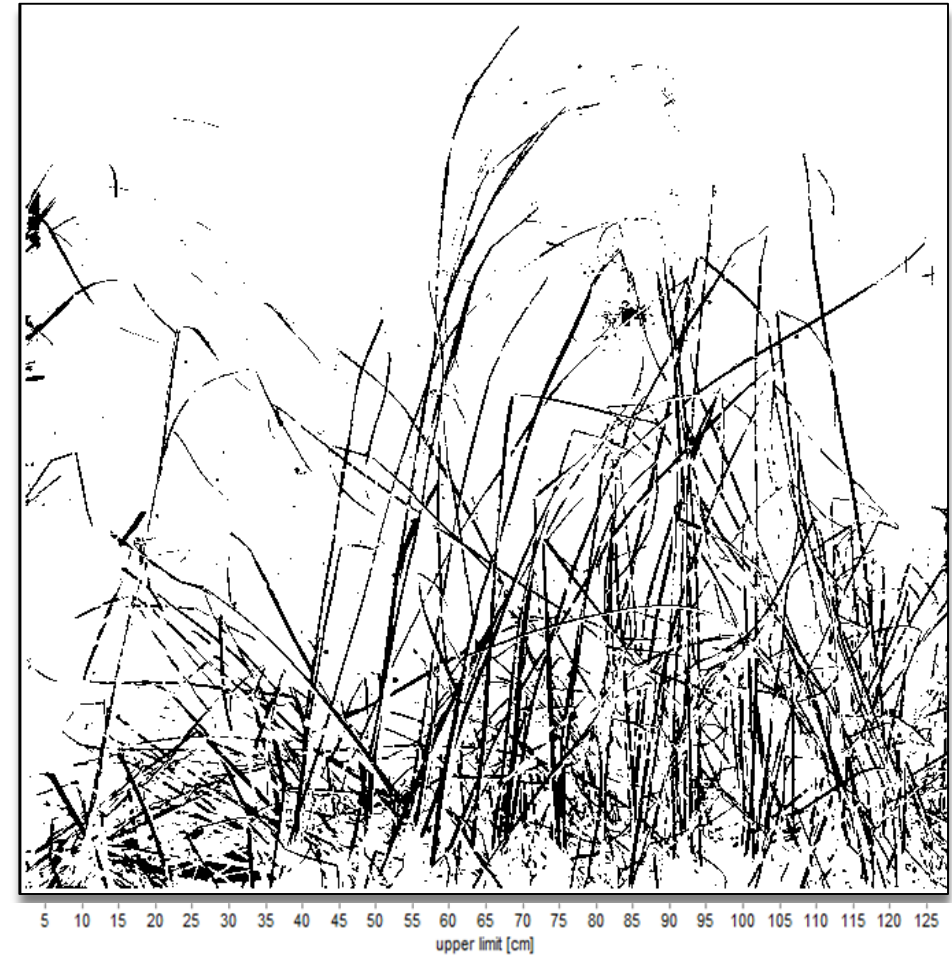
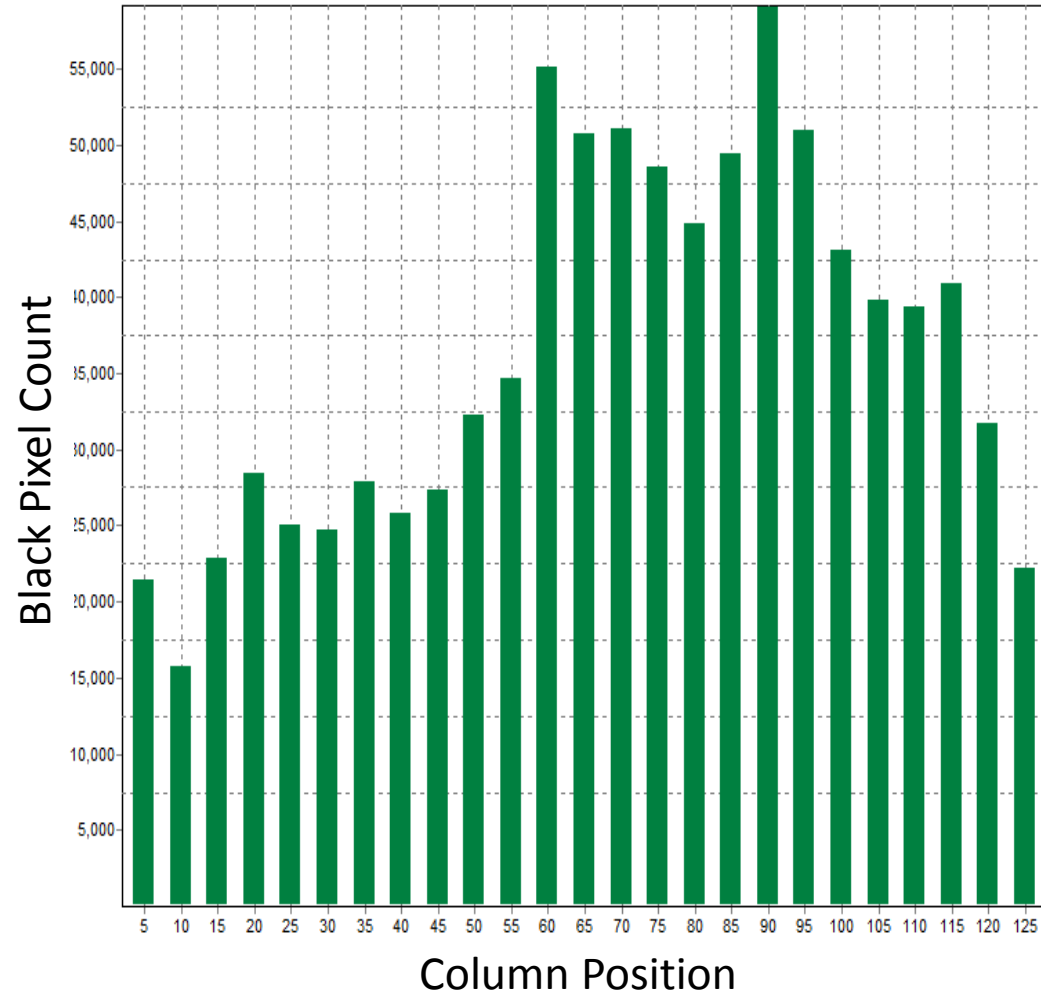
Based off work from
Moller (2006)



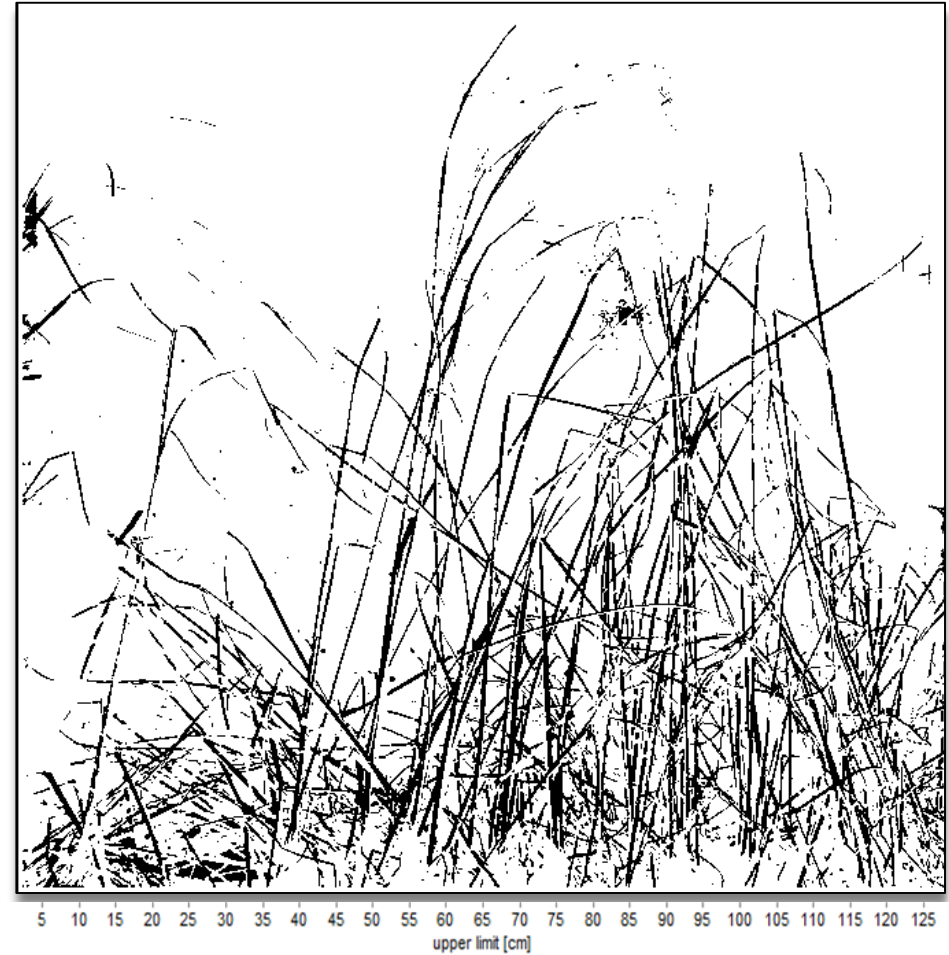
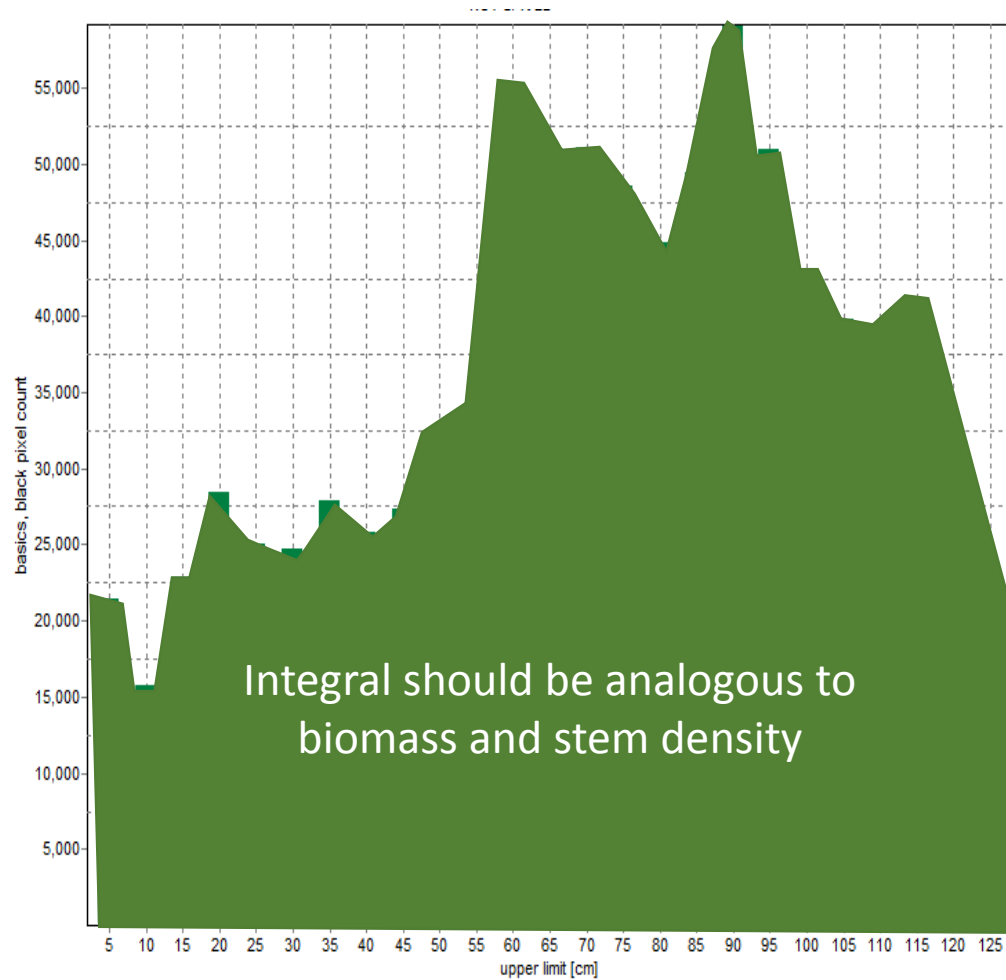
Lab Methods: Side-On Photos



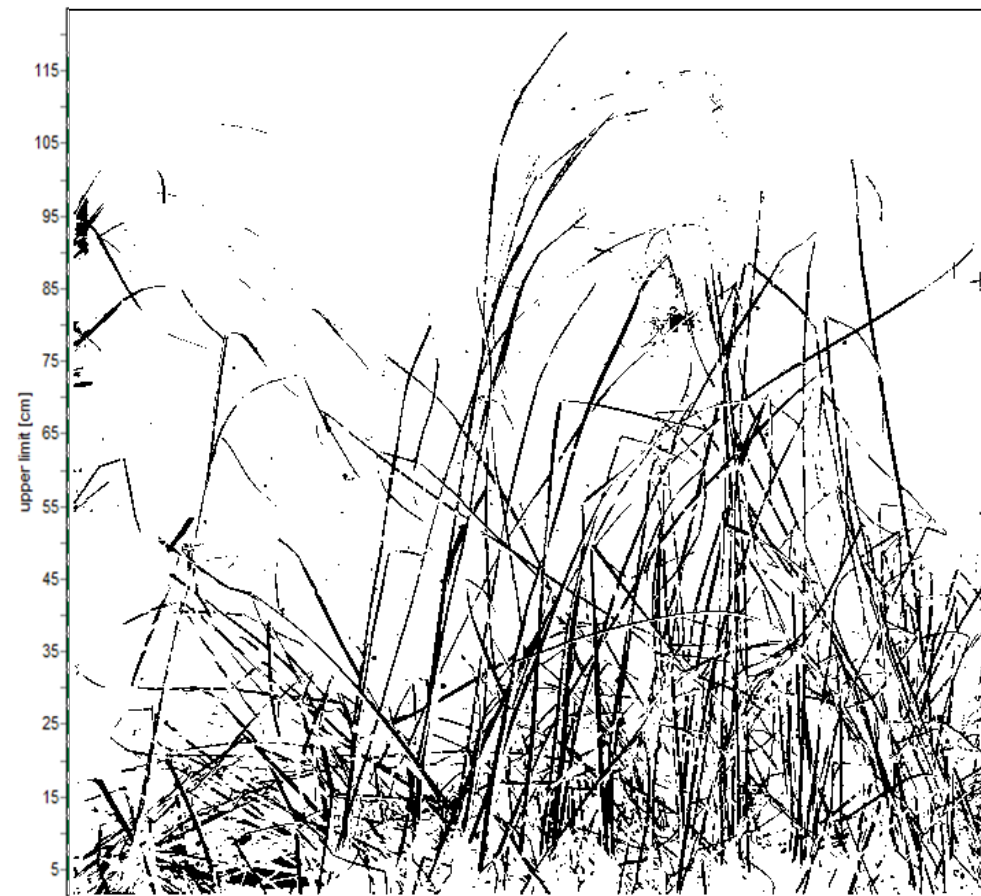
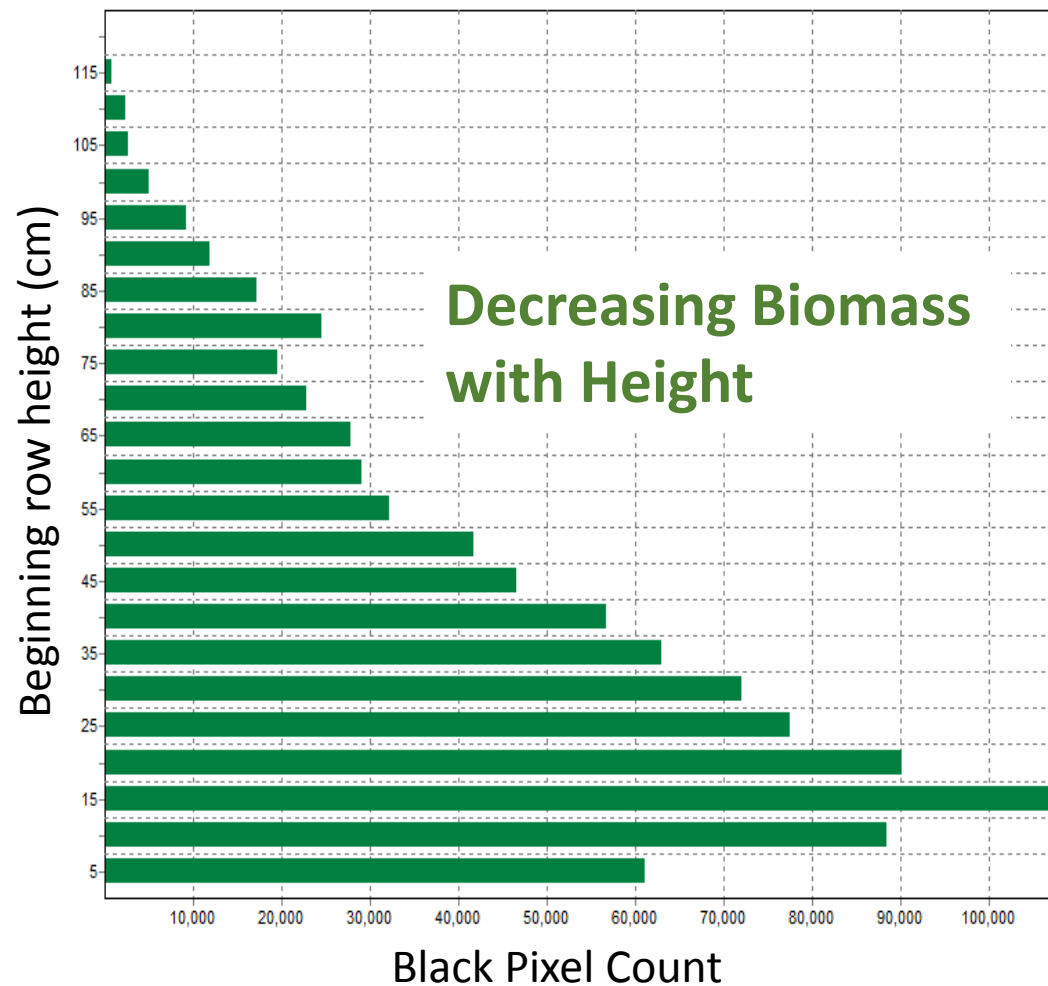
Results: Vegetated Pixels By Column



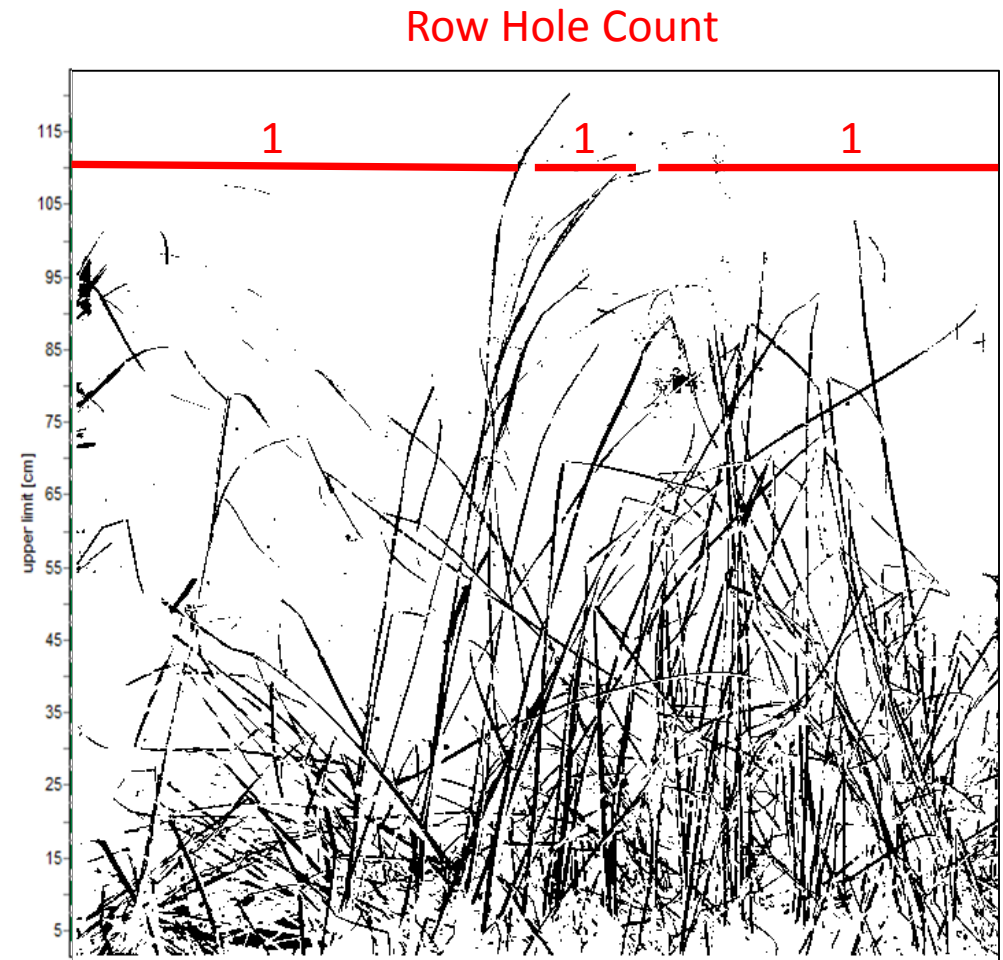
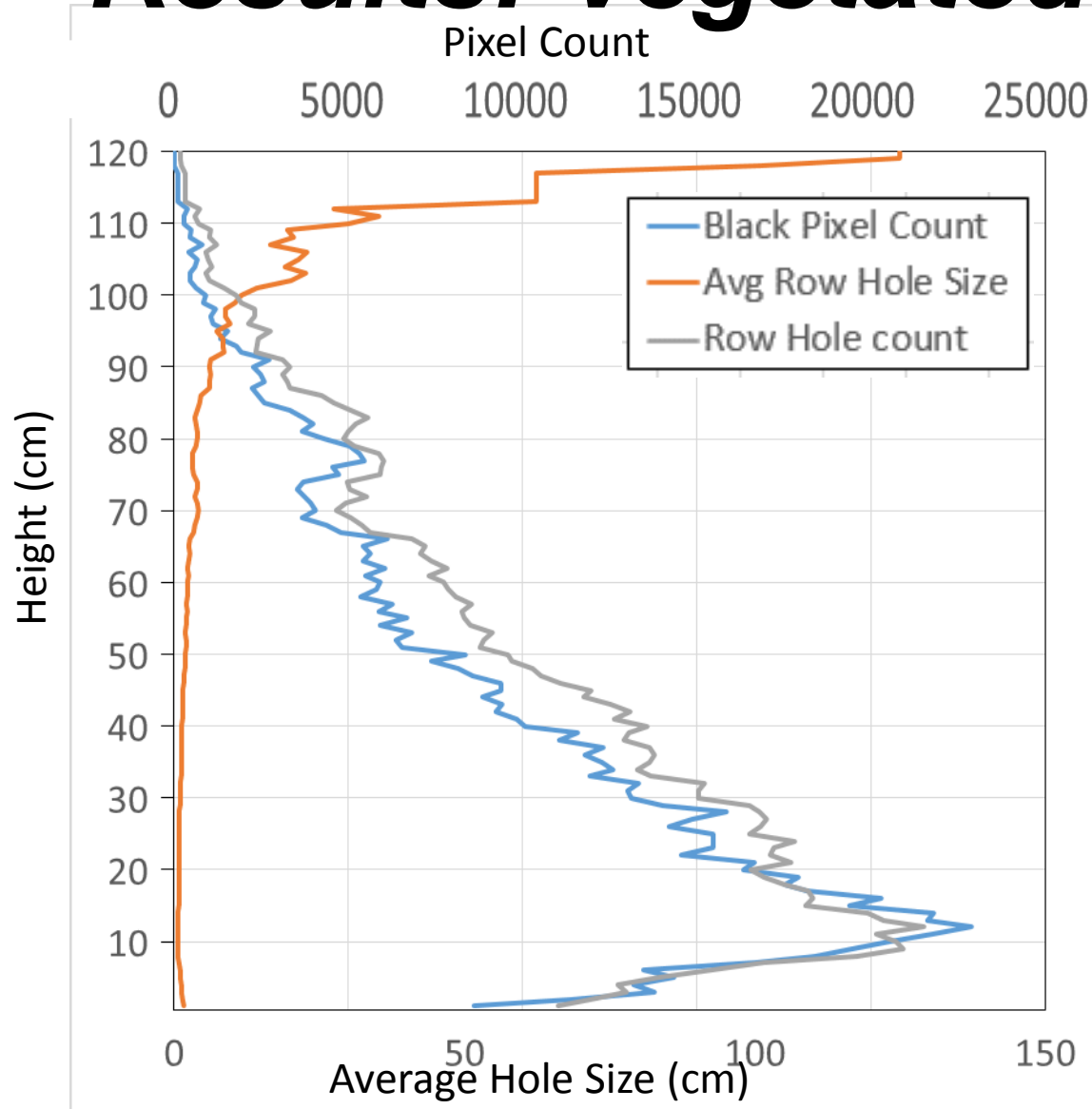
Results: Vegetated Pixels By Column



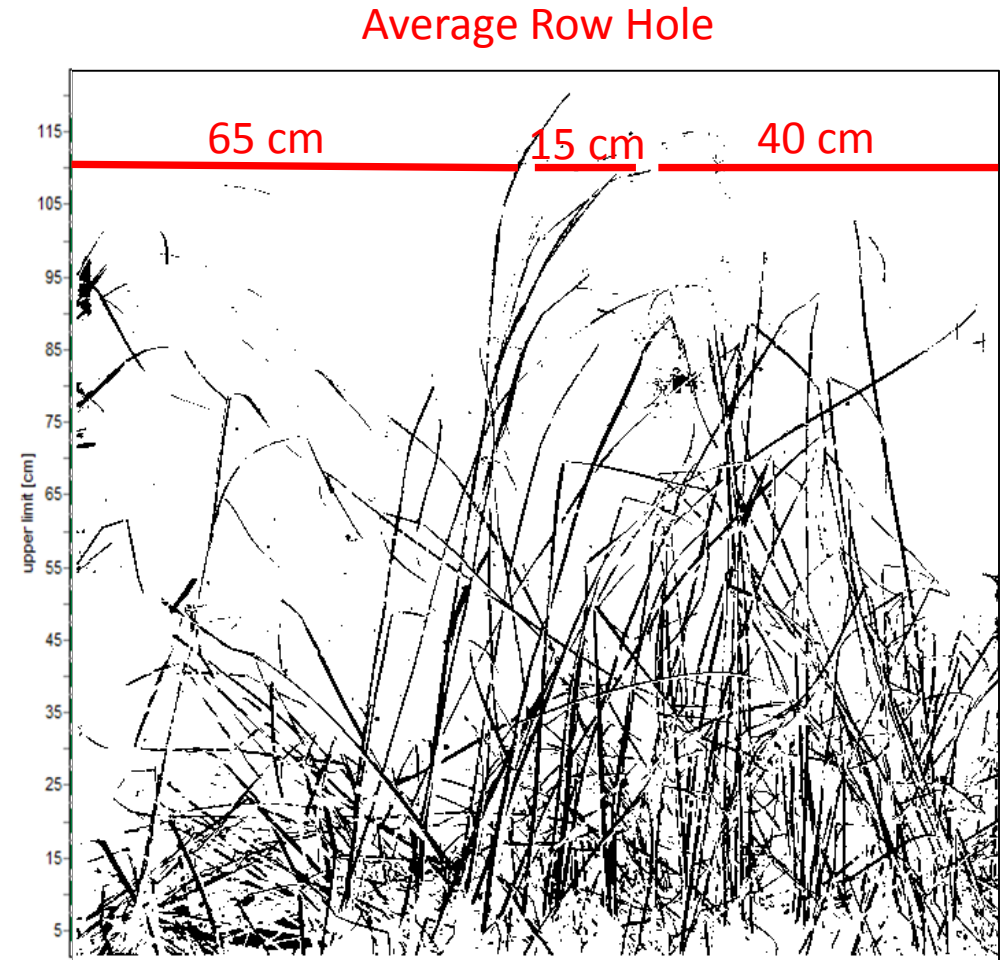
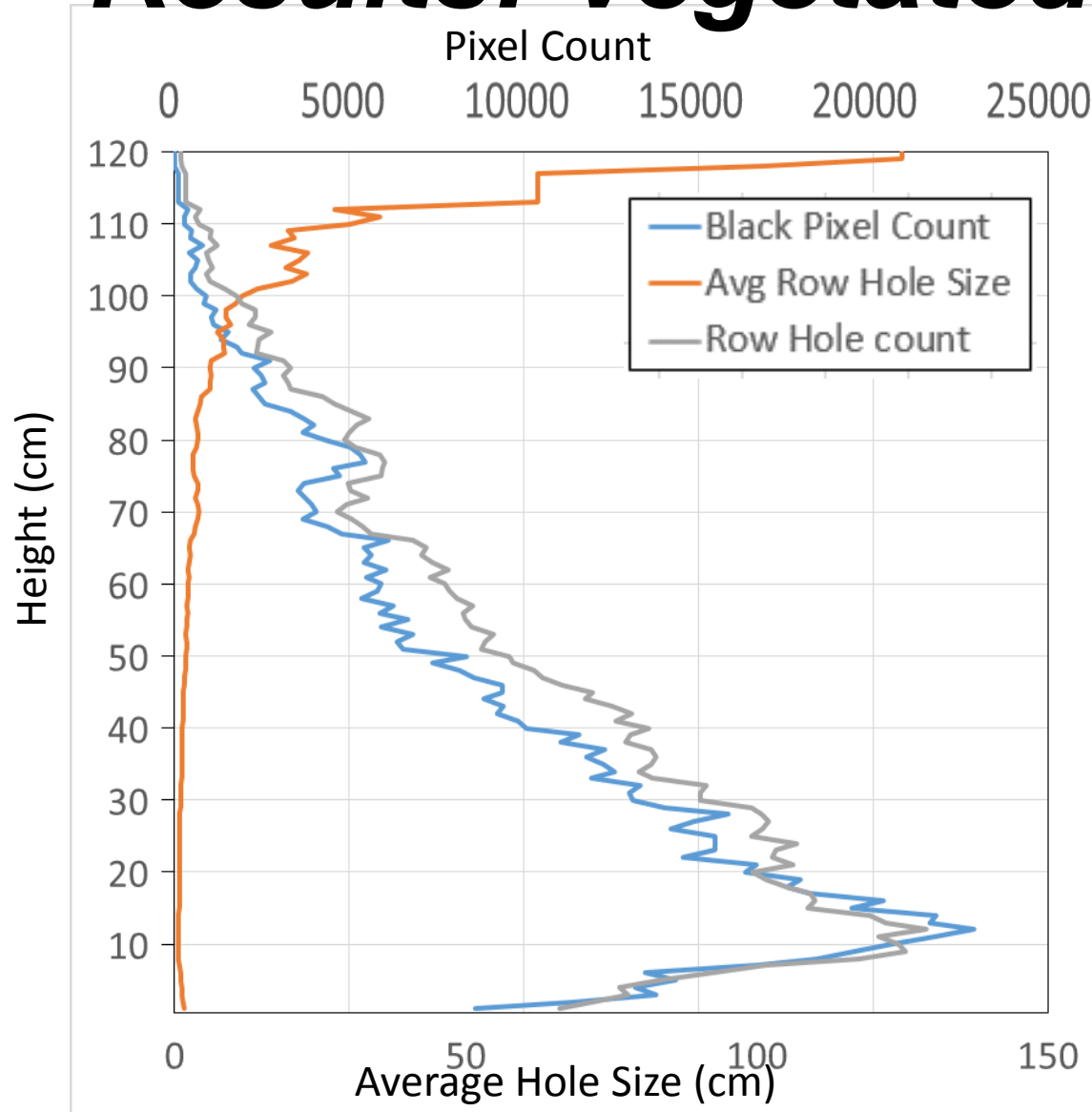
Results: Vegetated Pixels by Row



Results: Vegetated Pixels by Row



Results: Vegetated Pixels by Row



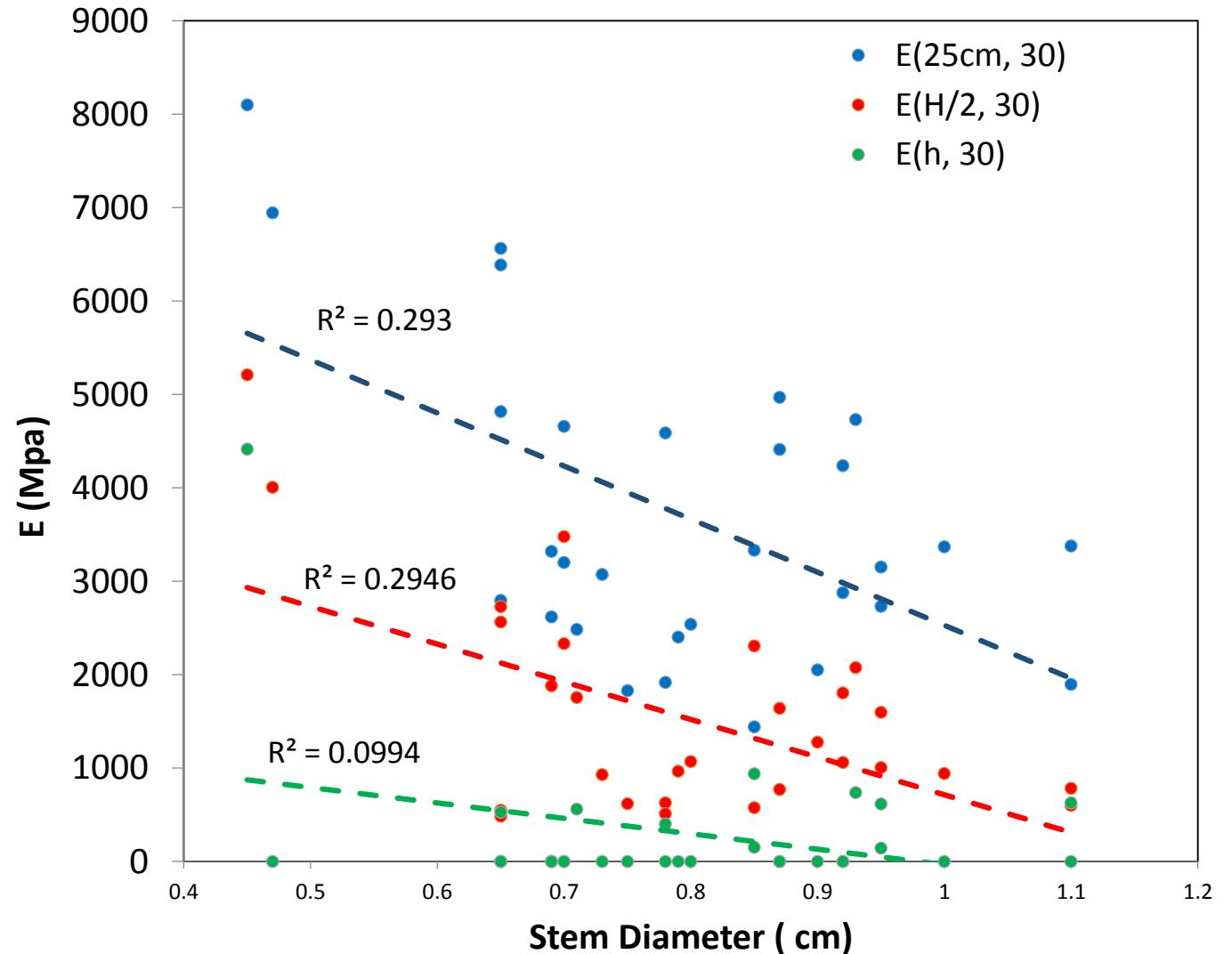
Methods: Vegetation Measurements

- Elasticity
 - Measurements of priority vegetation throughout the summer, fall and winter.



Results: Plant Elasticity

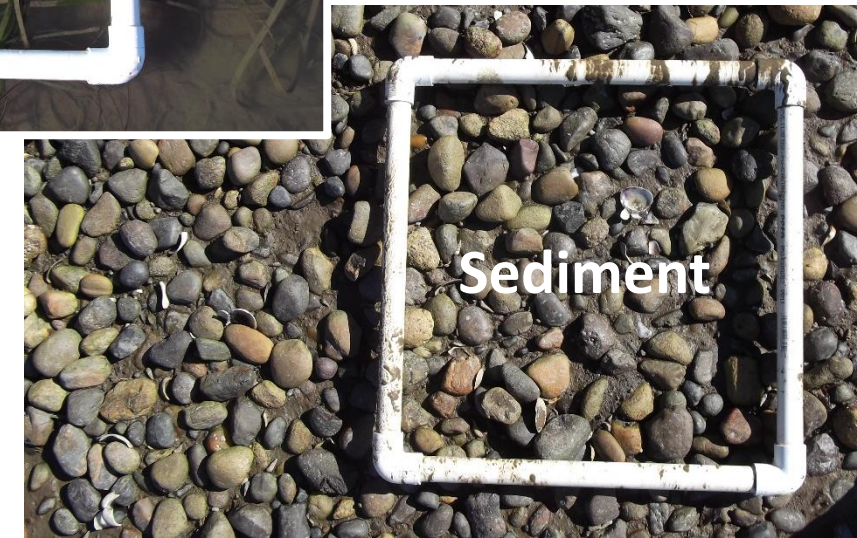
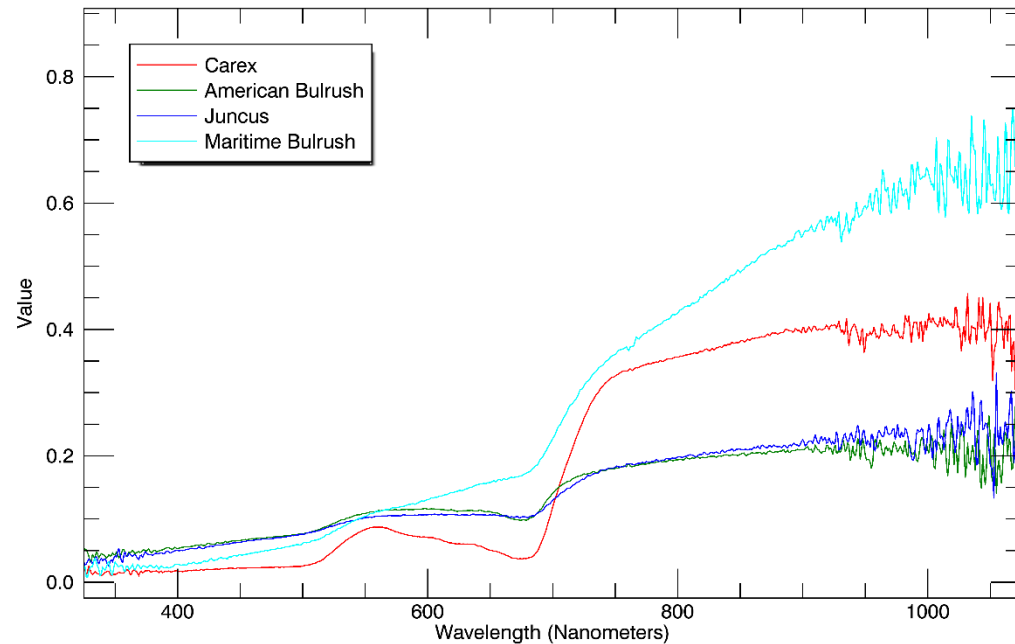
- Young's Modulus
 - Ratio Stress and Strain
- Easier to bend plants with a higher measuring point.



Methods: Spectral Surveys

- Ground-truthing
 - Hand-held spectrometer.

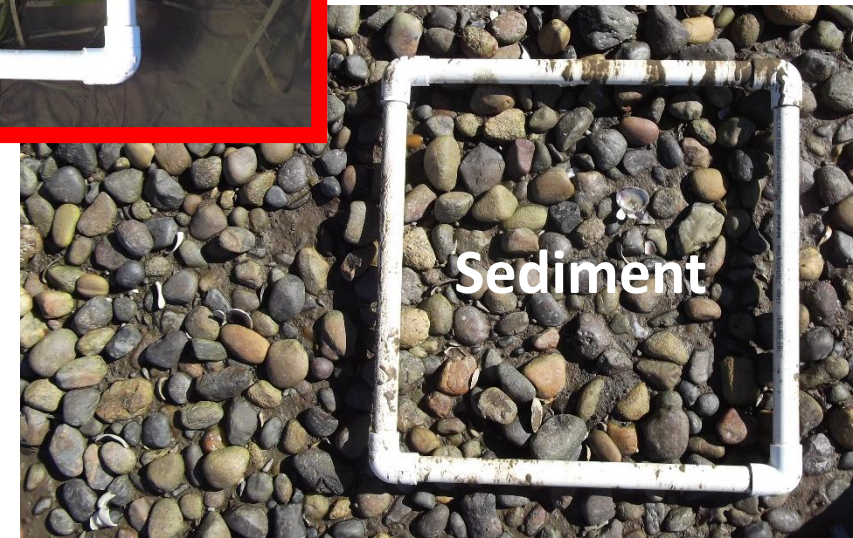
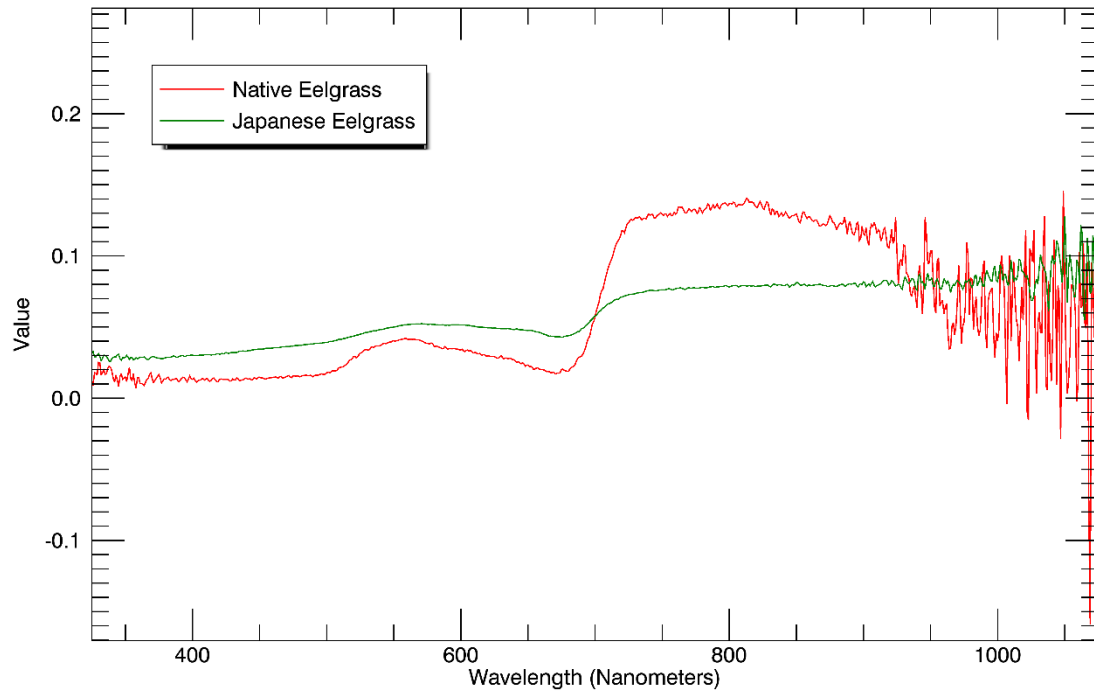
Emergent Vegetation Signatures



Methods: Field Data

- Ground-truthing
 - Hand-held spectrometer.

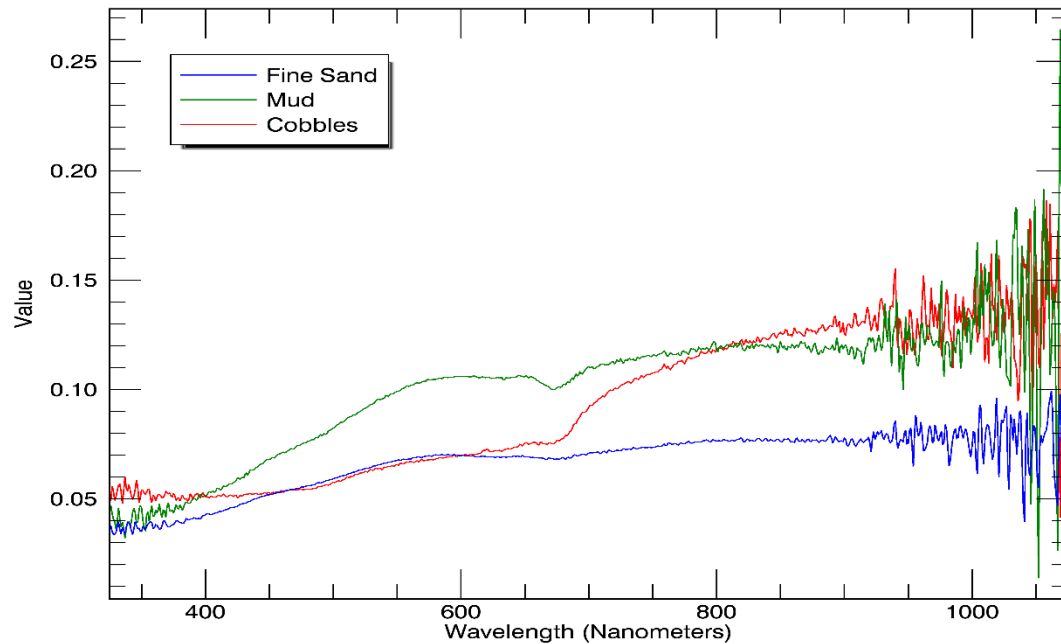
Eelgrass Signatures



Methods: Field Data

- Ground-truthing using digital images and a hand-held spectrometer.

Sediment Signatures



Next Steps:

Vegetation Calibration

- Finalize biophysical metric measurements through digital imagery analysis.
 - Stem density, stem diameter, biomass through Matlab scripting
- Measure vegetation samples to calibrate and validate image analysis.

Remote Sensing

- Classify vegetation assemblages or species using CASI hyperspectral imagery.
 - Object-based image analysis, unsupervised classification, further ground-truthing
- Extrapolate vegetation structural data based on classification.

Wave Modeling

- Sensitivity analysis of x-shore wave transformation model outputs relative to vegetation biophysical metrics.

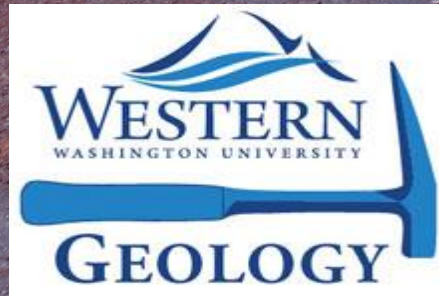
The End. And Thanks!

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Acknowledgements

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- Grace Sutherland



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