

# **Reach-Wide Geomorphology and Vegetation Monitoring**

**Science Plan Reporting Session  
2022**

**Julia Grabowski**

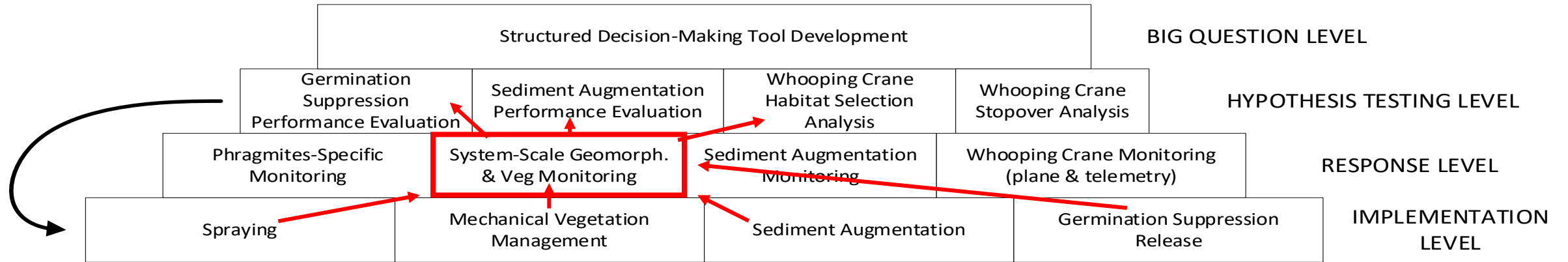
# Reach-Wide Monitoring Goals

- Document annual changes in habitat conditions
- Report sections
  - Mechanical Management
  - Hydrologic Analysis
  - Hydrodynamic Modeling
  - Land Cover Classification
  - Volume Change Analysis
  - Suitable Whooping Crane Roosting Habitat
  - Emerging Issues
- Provide data needed to answer Big Questions

**Discussion question: Anything extra needed? Anything extraneous?**



# Science Plan Strategy



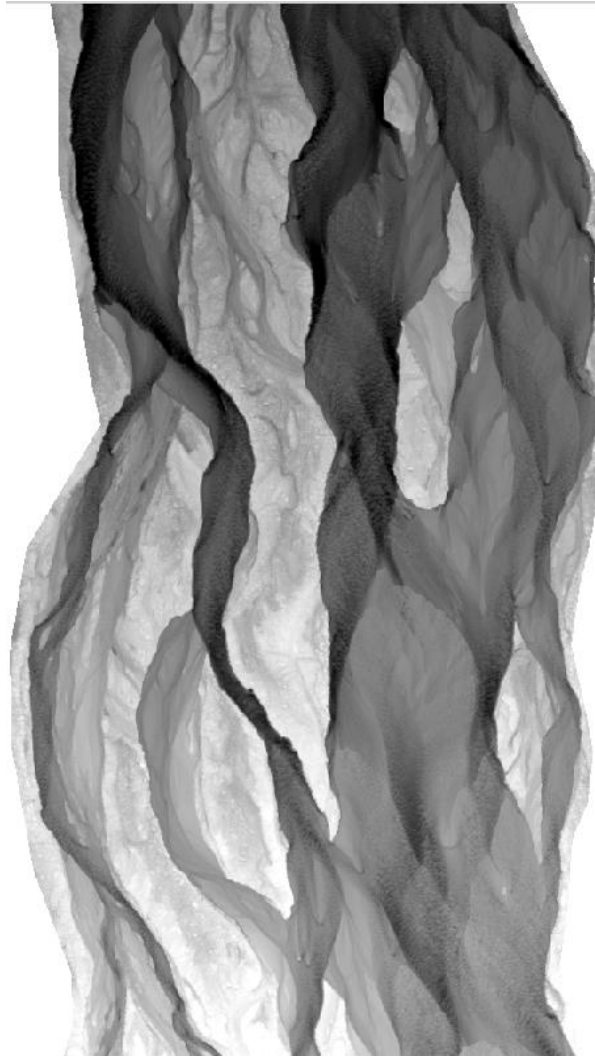
- EBQ # 1 – How effective is it to use Program water to maintain suitable whooping crane roosting habitat?
- EBQ #2 – How effective is Program management of *Phragmites* for maintaining suitable whooping crane roosting habitat?
- EBQ #3 – Is sediment augmentation necessary to create and/or maintain suitable whooping crane roosting habitat?

# Remote Sensing Methods: 2017-

Aerial imagery



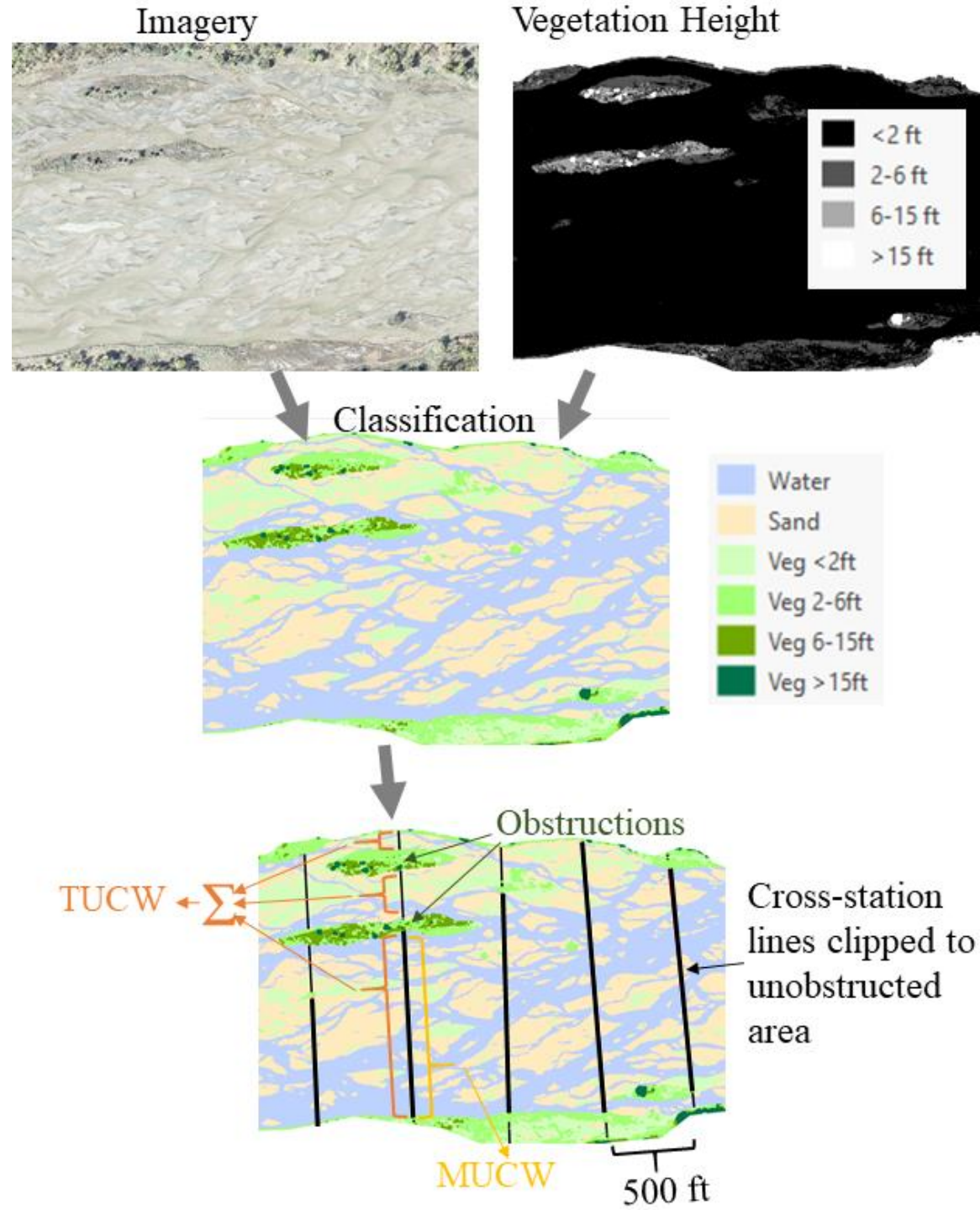
LiDAR – Bare Earth / Bathymetry



LiDAR – Vegetation Height



# Land Cover Classification



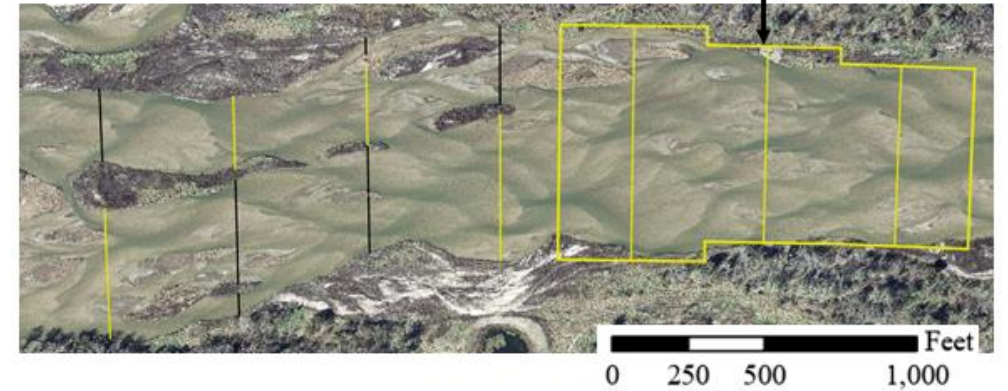


# Land Cover Classification

## Big Questions

- EBQ # 1 – How effective is it to use Program water to maintain suitable whooping crane roosting habitat?
- EBQ #2 – How effective is Program management of *Phragmites* for maintaining suitable whooping crane roosting habitat?

Unobstructed width suitable for WC roosting (>650 ft)



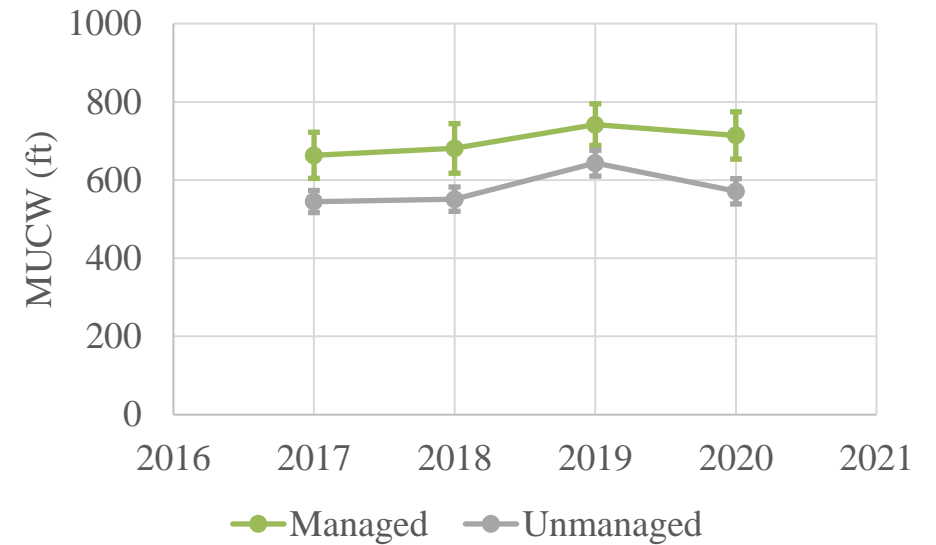
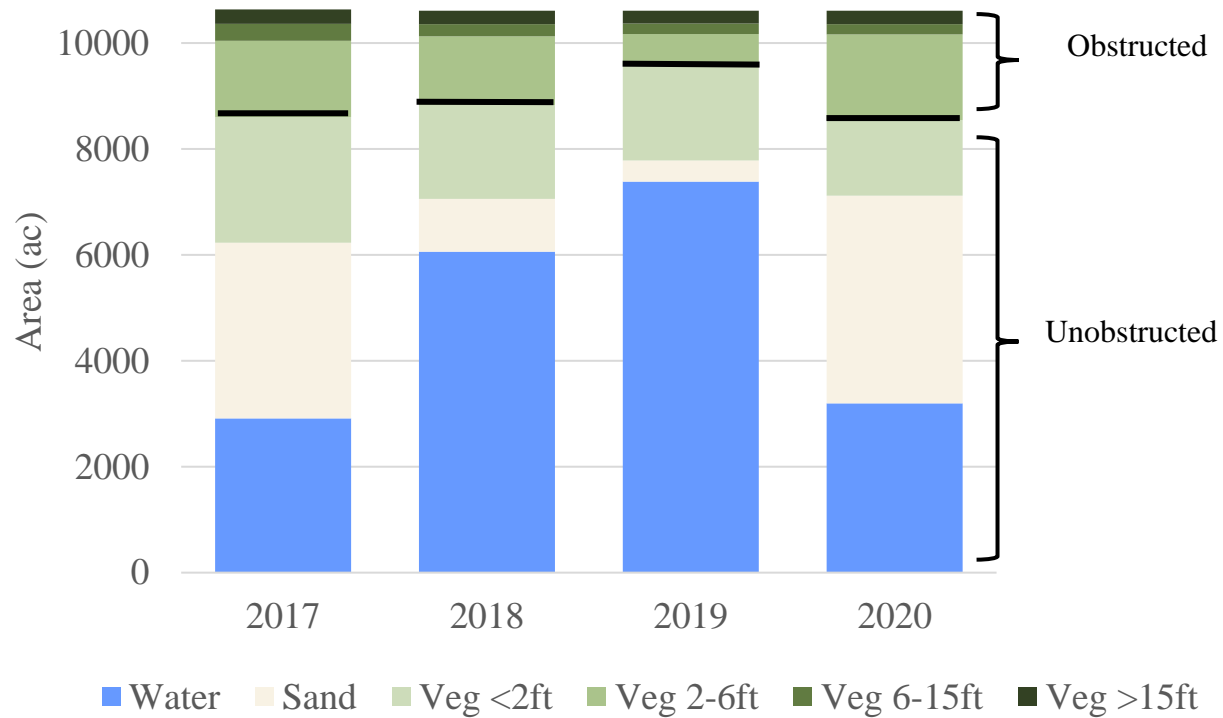
Depth suitable for WC roosting (< 1ft)



Suitable WC roosting area



# Land Cover Classification Results





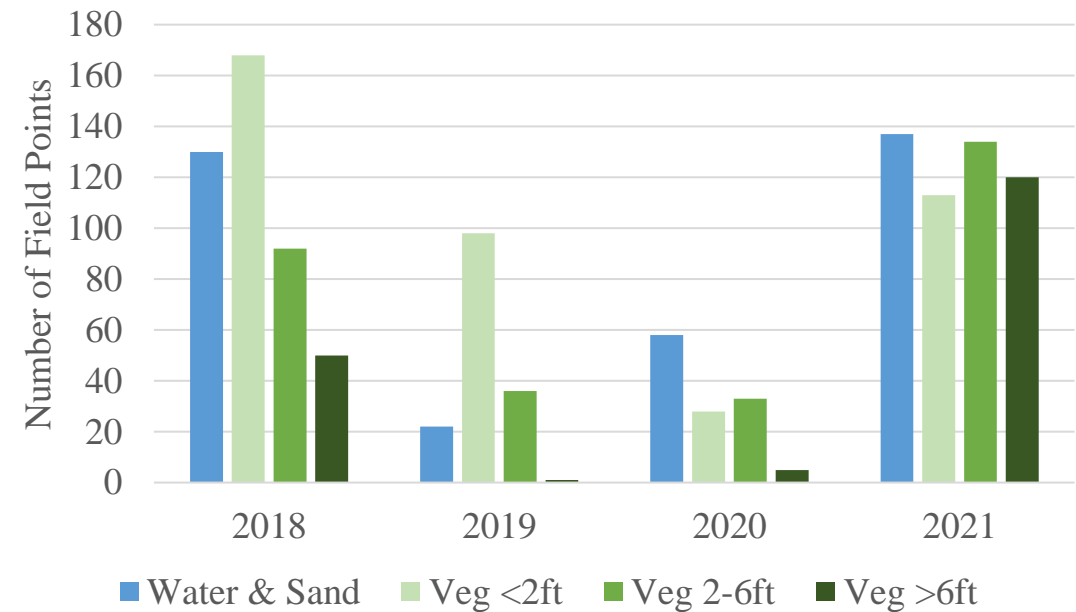
# Field Accuracy Assessment





# Field Accuracy Assessment Strategy

- 2018-2020: varying strategies
- 2021: equalized stratified sampling
  - Class
  - Geomorphic reach
  - Management type
  - Main and side channels



# Assessing accuracy from confusion matrix

2018

Class		Field Observations					
		Water/Sand	Veg <2ft	Veg 2-6ft	Veg 6-15ft	Veg >15ft	Total
E-Cognition Classification	Water/Sand	130	0	0	0	0	130
	Veg <2ft	0	167	35	4	1	207
	Veg 2-6ft	0	1	57	15	1	74
	Veg 6-15ft	0	0	0	13	4	17
	Veg >15ft	0	0	0	0	12	12
	Total	130	168	92	32	18	440

Percent correct: 86%

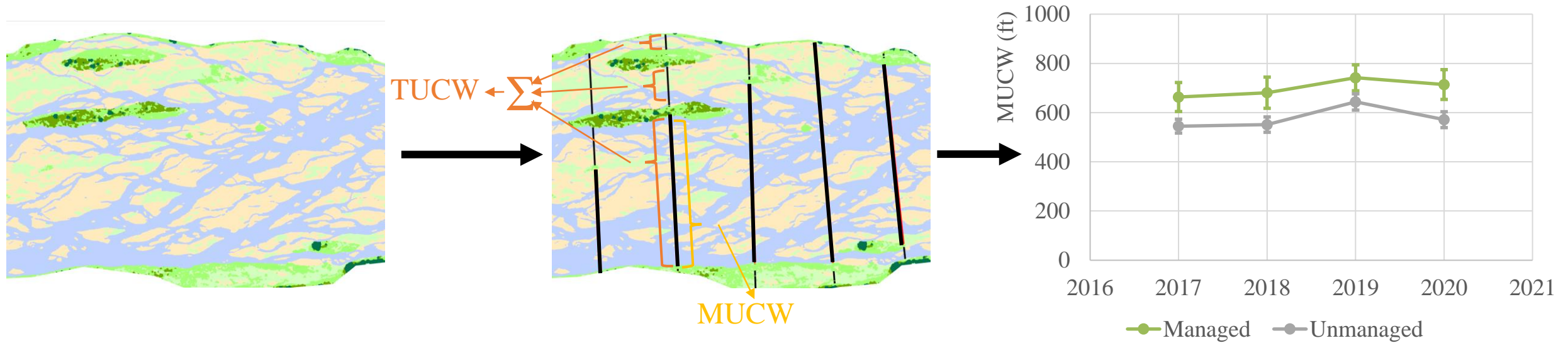
2019

Class		Field Observations					
		Water/Sand	Veg <2ft	Veg 2-6ft	Veg 6-15ft	Veg >15ft	Total
E-Cognition Classification	Water/Sand	22	0	0	0	0	22
	Veg <2ft	0	97	26	1	0	124
	Veg 2-6ft	0	1	9	0	0	10
	Veg 6-15ft	0	0	1	0	0	1
	Veg >15ft	0	0	0	0	0	0
	Total	22	98	36	1	0	157

Percent correct: 82%



# Propagation of area-based error



**Discussion question: What is the best way to estimate area-based error?**

# Volume Change Analysis

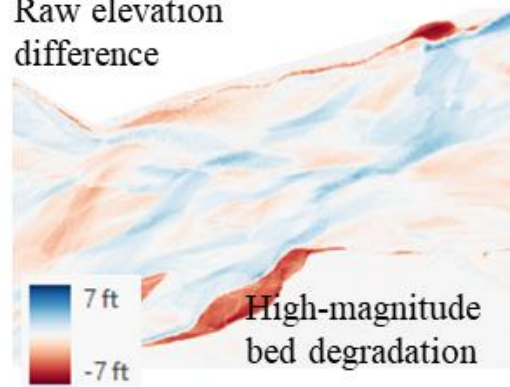
2017 Imagery



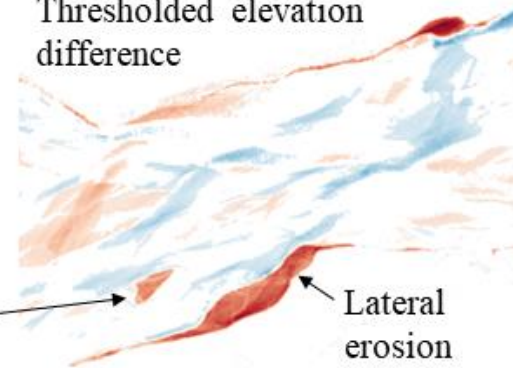
2018 Imagery



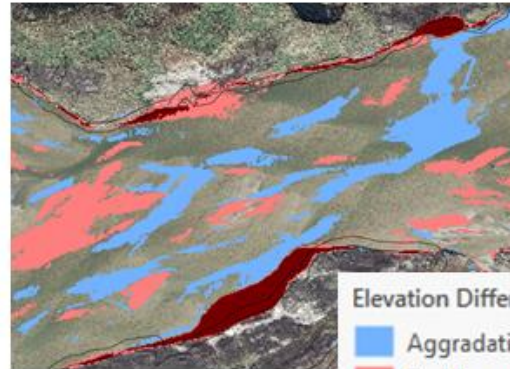
Raw elevation difference



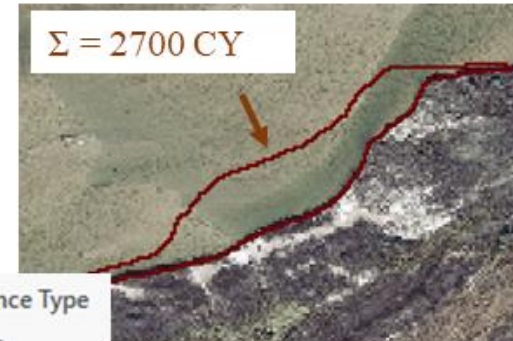
Thresholded elevation difference



Classified areas of significant elevation change



Area Statistics





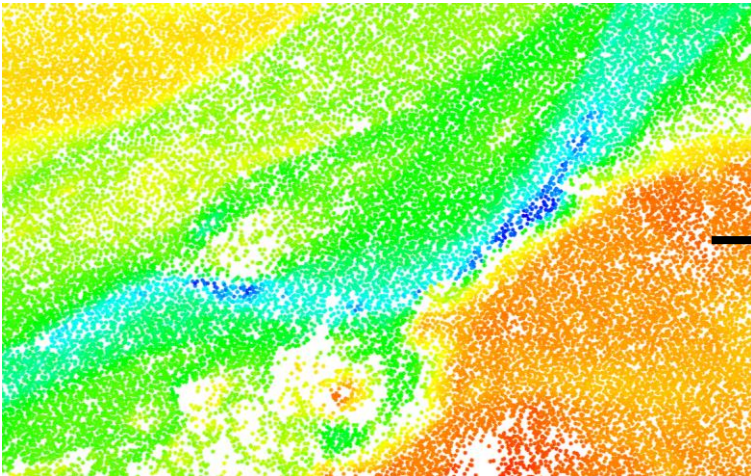
# Volume Change Analysis Big Question

- EBQ #3 – Is sediment augmentation necessary to create and/or maintain suitable whooping crane roosting habitat?



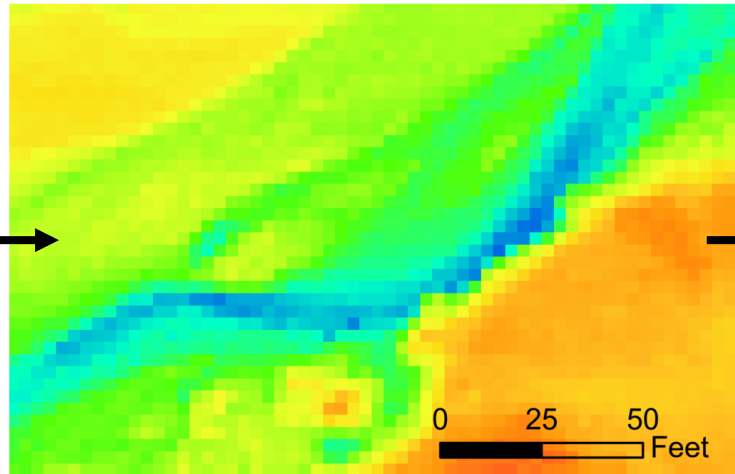
# DoD Error Propagation

LiDAR point cloud



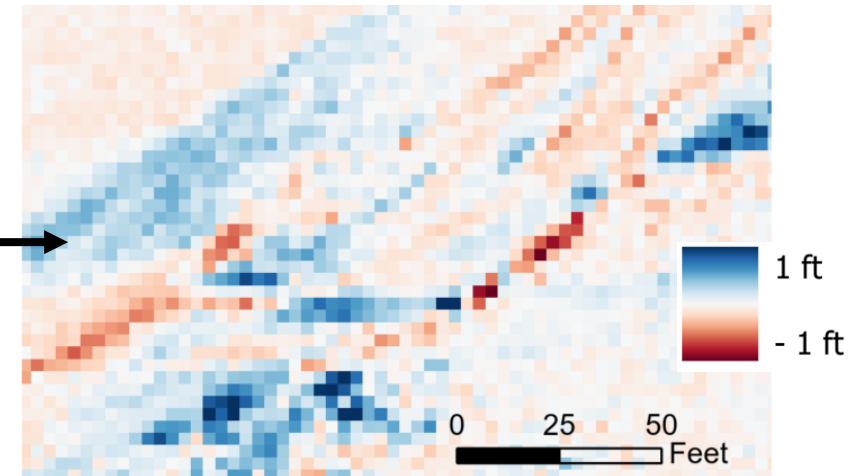
- Instrument precision
- Spatially uniform or variable?
- Spatially uniform error →  
Field-based accuracy assessment

DEM



- Interpolation

DoD



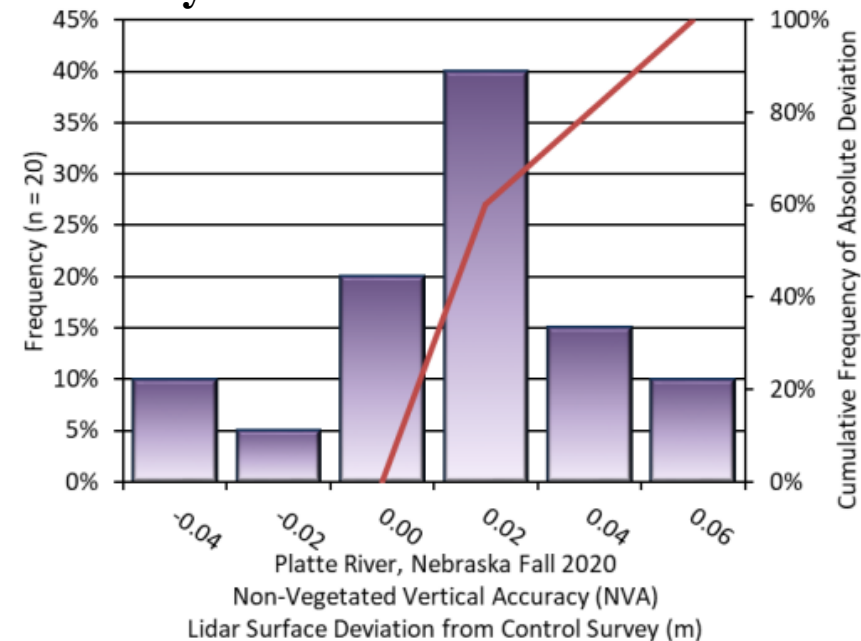
- Propagation of DEM error
- Thresholding for significance
- Linear uncertainty →  
volume uncertainty



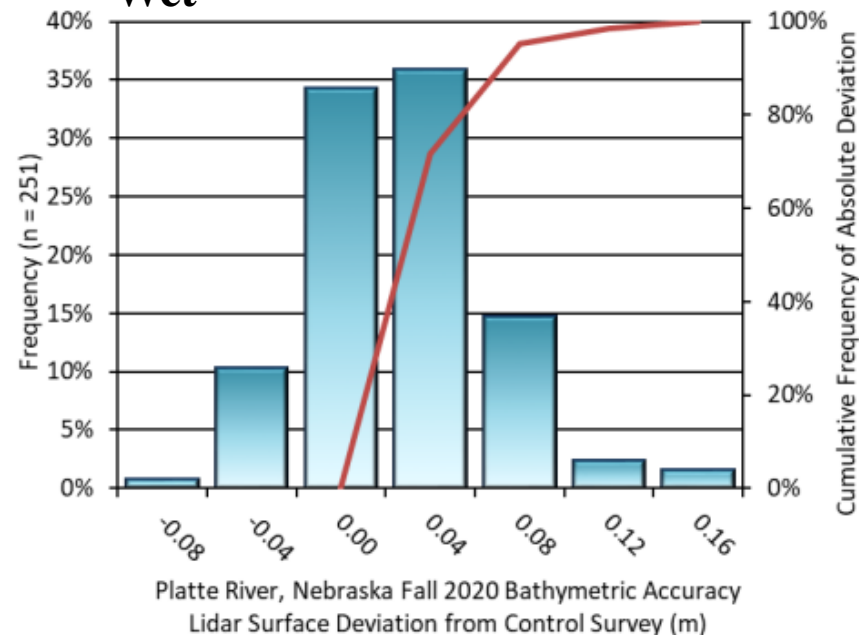
# LiDAR Accuracy Assessment

Assessed by Quantum Spatial Inc. with Ground Control Check Points

## Dry



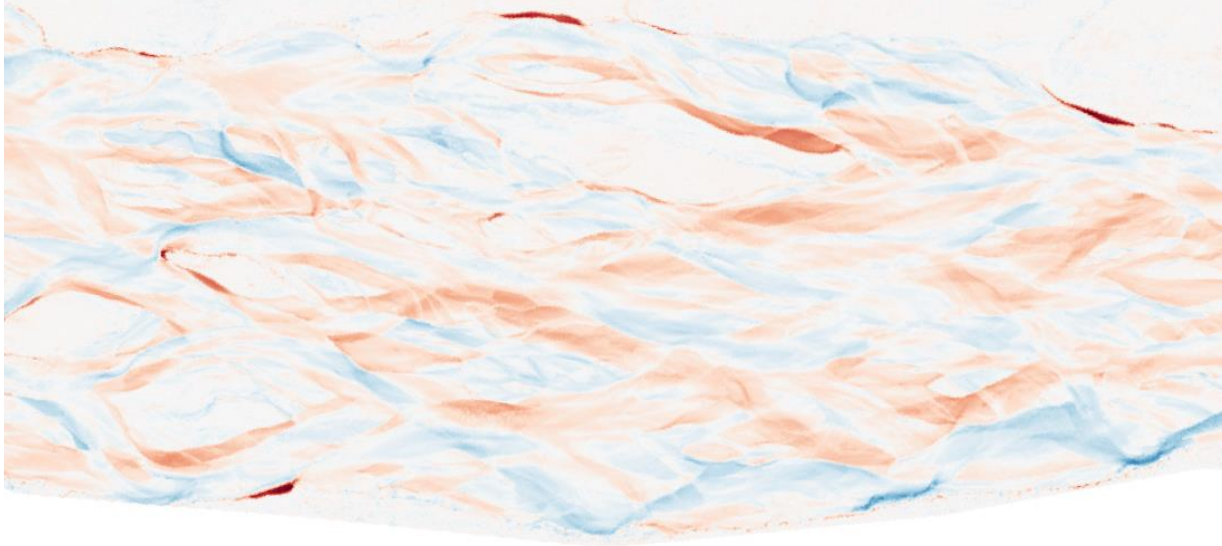
## Wet



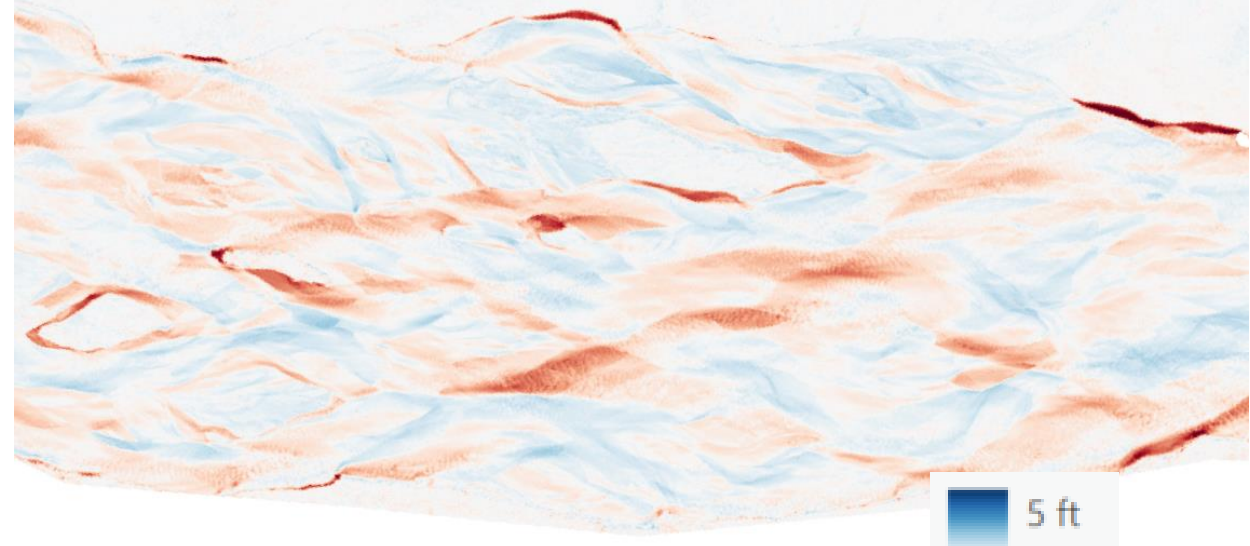
Year	Dry Accuracy (ft)	Wet Accuracy (ft)
2016	0.14	0.26
2017	0.18	0.38
2018	0.10	0.35
2019	0.10	0.75
2020	0.18	0.26

# Probabilistic DoD Thresholding

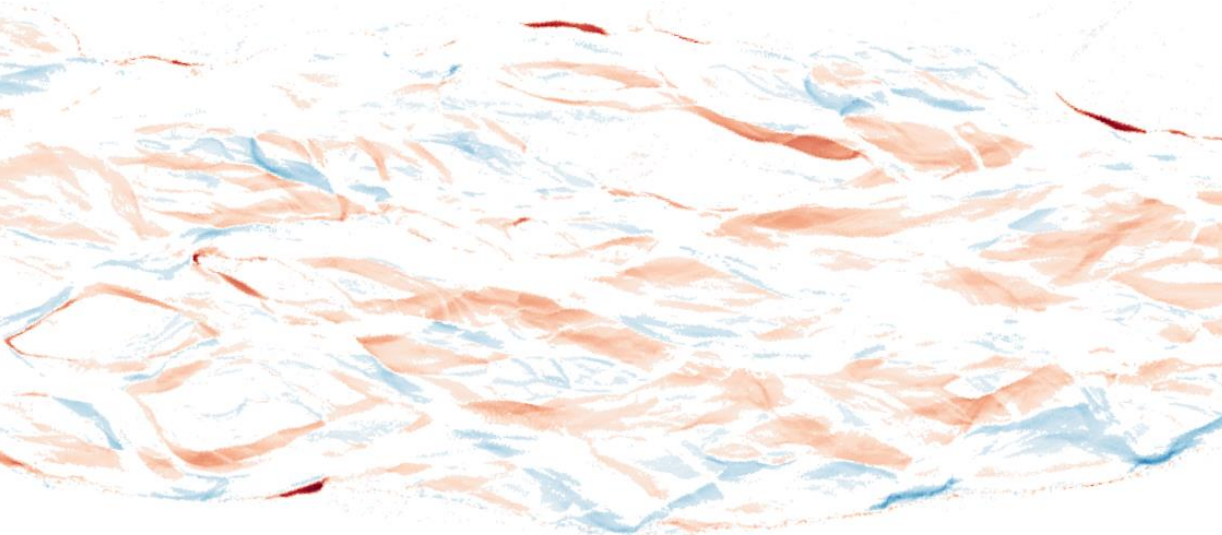
2018-2017: raw DoD



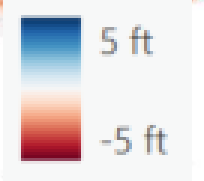
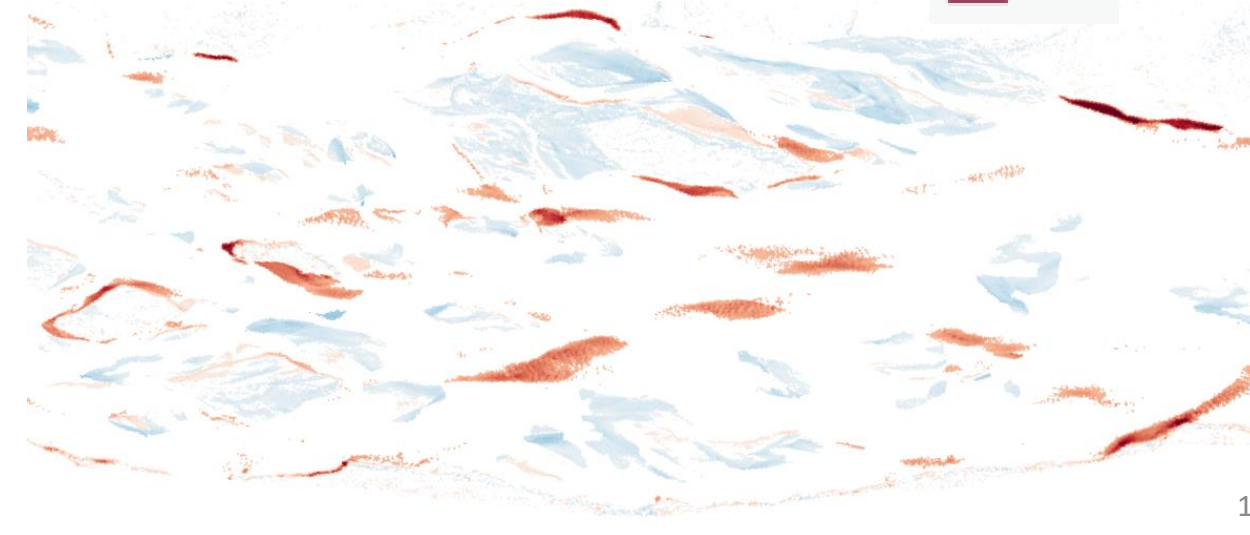
2019-2018: raw DoD



2018-2017: thresholded DoD

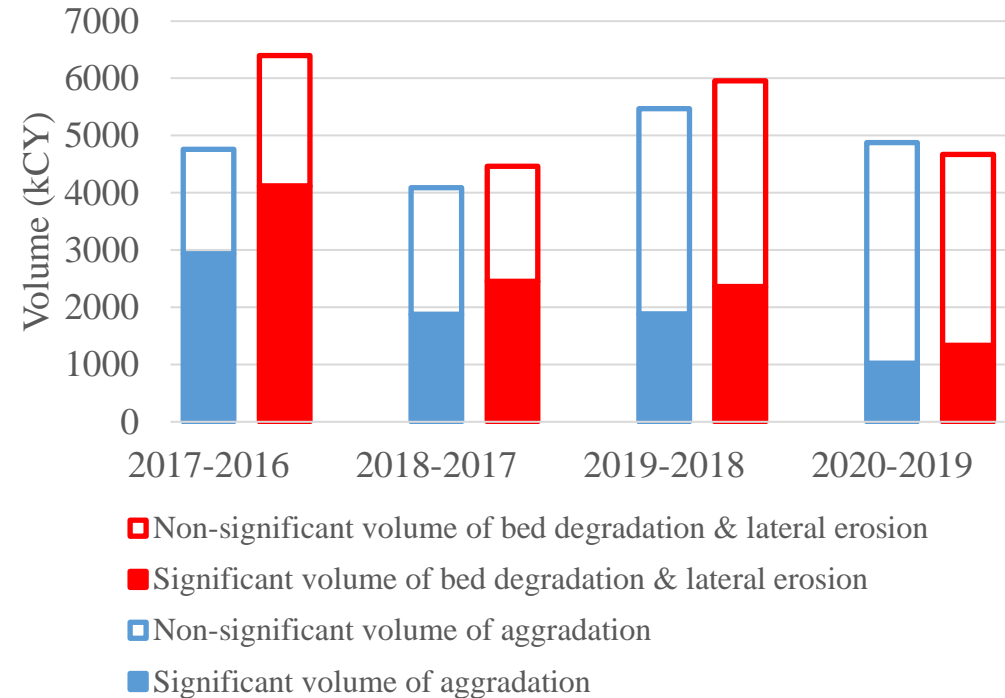
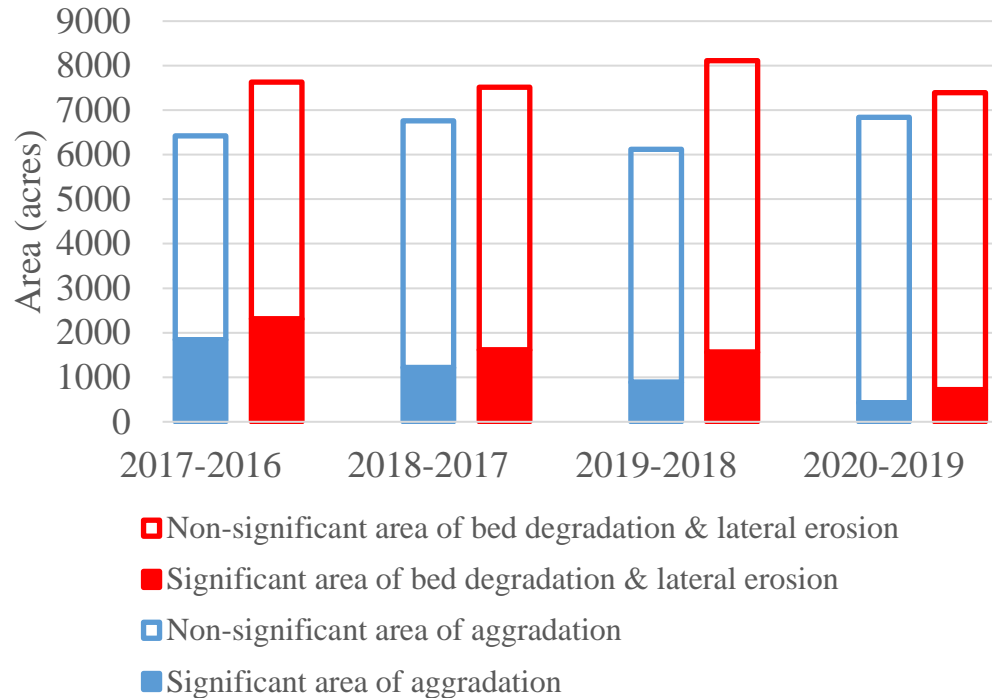


2019-2018: thresholded DoD





# Volume change, raw vs. thresholded results

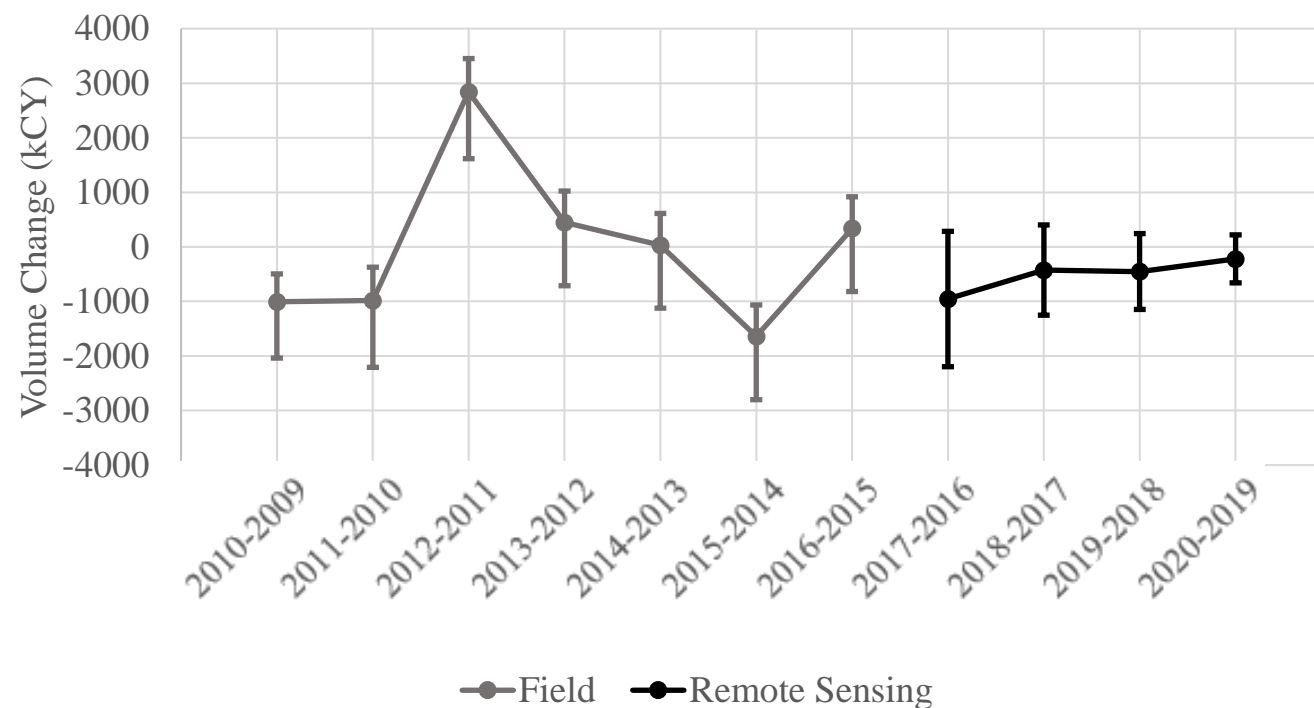


# Volume change, raw vs. thresholded results





# Net volume change results



**Discussion question: How do we compare volume change of spatially variable areas?**



# Questions?

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# References

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# Discussion Questions

- We have so far not estimated the error of area-based measurements, or classified area-derived metrics like MUCW and TUCW. What is the best way to estimate error for those measurements—taking into account both LiDAR accuracy and field vegetation data?
- The volume change error estimation process involves a probabilistic threshold based on LiDAR ground check accuracy assessments, which vary from year to year. This means that each year, a variable elevation difference magnitude is required to pass the threshold, resulting in varying total areas of significant elevation change. Does this complicate effective interannual comparisons of net volume change, and is there a way to account for that?
- Are any types of data or analyses that are needed to comprehensively capture changing channel conditions and habitat for target species missing from this report?
- Are there any types of data or analyses in this report that are extraneous to comprehensively capture changing channel conditions and habitat for target species, and should be omitted in future years?