Salt marshes provide many critical services (e.g., carbon sequestration), though these habitats are in decline globally. Traditional monitoring methods are often in soil compaction, root death, and habitat destruction. Unoccupied aircraft systems (UAS, AKA drones) enable non-invasive, remote monitoring of marshes while reducing many traditional monitoring costs. Researchers manually collected stem height, density, and ground elevation for comparison to UAS point data. All images were processed in Pix4D and additional UAS point cloud processing was completed in ArcGIS Pro. This high-resolution imagery was most reliable for creating a digital terrain and digital surface models. The difference between the DSM and DTM is the points using ArcGIS LAS tools and then generate a digital surface model (DSM). The difference between the DSM and DTM is the physical impact to the environment.

**ABSTRACT**

Salt marshes provide many critical services (e.g., carbon sequestration), though these habitats are in decline globally. Traditional monitoring methods are often in soil compaction, root death, and habitat destruction. Unoccupied aircraft systems (UAS, AKA drones) enable non-invasive, remote monitoring of marshes while reducing many traditional monitoring costs. Researchers manually collected stem height, density, and ground elevation for comparison to UAS point data. All images were processed in Pix4D and additional UAS point cloud processing was completed in ArcGIS Pro. This high-resolution imagery was most reliable for creating a digital terrain and digital surface models. The difference between the DSM and DTM is the points using ArcGIS LAS tools and then generate a digital surface model (DSM). The difference between the DSM and DTM is the physical impact to the environment.

**IMAGE PROCESSING**

- Photos imported into Pix4D
- Top squares
- GCPs imported
- Green and Alw targets
- Follow necessary steps differ for multispectral and RGB imagery
- Multispectral imagery (false color, overlaid) includes NDVI bands
- Calculations NDI
- Calculations from chips
- Red + no plants
- Multispectral imagery can be used to determine habitat health and extent

**HABITAT CLASSIFICATION**

- Mosaic (left) created using Pix4D and ArcGIS Pro
- Multispectral bands combined to create one composite
- Classification scheme created using Arc Classification Wizard
- Object-based classification used to create a clearer classification scheme
- Can provide more reliable data than satellites (e.g., avoids cloud cover)
- Enables managers to calculate wetland area with reduced physical impact to the environment

**CANOPY HEIGHT MODEL: DIGITAL TERRAIN & SURFACE MODELS**

- Digital terrain model and ground point comparison
- Generating canopy height
- Canopy height determination from UAS data (in LAS form) compared to groundtruthed plant heights
- Comparison of mean height manually collected and calculated based on plant reflections in mirror
- Canopy height determination from UAS data (in LAS form) compared to groundtruthed plant heights
- Mean height plotted across range of values

**PLANT DENSITY**

- DRY WEIGHT AT UAS POINTS PER PLANT
- UAS Points per 2.52m2 Plot
- Relationship between UAS (false color) point cloud density and above ground biomass (AGB)
- Calculations determined with regional and national datasets

**DISCUSSION**

Declining salt marshes are now primarily lost due to wave action from increased storms and sea level rise (SLR). Rapid monitoring is needed to assess whether individual marshes recover from storms and accrete sediment to outpace SLR. The developed workflow for extracting canopy height, marsh bed elevation, classification, and habitat extent provide a means for managers to calculate wetland area with reduced physical impact to the environment. The developed workflow for extracting canopy height, marsh bed elevation, classification, and habitat extent provide a means for managers to calculate wetland area with reduced physical impact to the environment. The developed workflow for extracting canopy height, marsh bed elevation, classification, and habitat extent provide a means for managers to calculate wetland area with reduced physical impact to the environment.

**REFERENCES**