Drone the SWMP

assessing the utility of drones for wetland monitoring

Drones can revolutionize **research** and **monitoring**…can't they?

Photo by Bertrand Bouchez on Unsplash

Project team

Brandon Puckett
Project lead
NC NERR

Whitney Jenkins
Collaborative lead
NC NERR

Justin Ridge
Technical lead
Duke University

Erik Smith
Pilot, End User
NI-WB NERR

Denise Sanger
End User
ACE Basin NERR

Rachel Guy
Pilot, End User
Sapelo NERR

Scott Eastman
Pilot, End User
GTM NERR

Milton Munoz
Pilot, End User
Jobos Bay NERR

Angel Dieppa
End User
Jobos Bay NERR

John McCombs
Technical Advisor
NOAA OCM

Bryon Toothman
End User
NC NERR

Hope Sutton
End User
NC NERR

Ernesto Olivares
End User
Jobos Bay NERR

Benefits of using drones for wetland monitoring?

- Drones *may* improve wetland monitoring by providing **high** spatial **resolution** and coverage, with **customizable sensors**, at **user-defined intervals**.
- Ground surveys along permanent **transects** and **plots** can **miss features** (e.g., marsh die-offs; Fig. A) and **leave 'scars'** from trampling (Fig. B).
- **Satellites** can provide **insufficient** resolution to detect **species composition** (Fig. C right panel) or delineate **ecotones**, whereas drones provide cm-scale resolution (Fig C left panel).

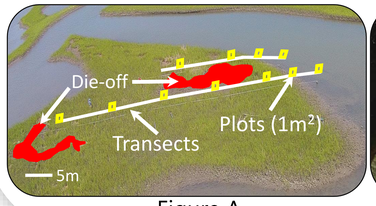

Figure A

Figure B

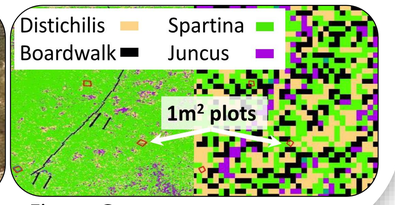

Figure C (from [1]Bickford and Spurrier 2016)

Can drones be used for wetland monitoring?

- In **salt marshes** and **mangroves** located within the six **NERRs of the Southeast and Caribbean**, we will conduct drone surveys and image analysis to:
  - Estimate species-specific percent **cover** (Fig. D) and **canopy height** (Fig. E)
  - Delineate **ecotones** (e.g., low to high marsh)
  - Generate digital **elevation models** (Fig E.)
  - Estimate species-specific **biomass**
- Ground-based **field surveys** (largely following SWMP biomonitoring protocols) will be used to **validate** drone-derived estimates.

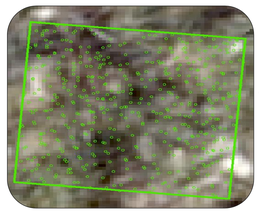

Figure D. Drone image (underlay) with green dots representing pixels with vegetation (overlay) to estimate percent cover (from [2]DiGiacomo et al. 2020).

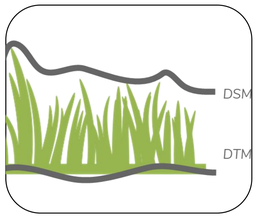

Figure E. Two elevation models from drone imagery—digital surface model (DSM) and digital terrain model (DTM). Their difference represents canopy height (from [2]DiGiacomo et al. 2020).

Project timeline, outputs and outcomes?

- Project timeline and workflow

Oct 20	May-Aug 21	June-Nov 21	Oct-Nov 21	Nov 21-Feb 22	Mar 22
Start!	Drone and ground-based surveys	Analyze imagery	Archive imagery	Final image acquisition, analysis, and data management protocol	Next steps

- Outputs: Protocol for drone-based wetland SWMP toolkit, monitoring products (e.g., Fig D-E), archive of high-resolution imagery of reserve sentinel sites
- Outcomes: A path to operationalize the use of drones for wetland monitoring in the NERRS—complimenting existing SWMP (vegetation and habitat mapping) and sentinel site monitoring efforts
- Funding: NERRS Science Collaborative Catalyst Grant
- References: [1]Bickford, Susan, and Lindsay Spurrier. 2016. The Way Forward: Unmanned Aerial Systems for the National Estuarine Research Reserves. NERRS Technical Report. 64pp. [2]Digiacamo, AE et al. 2020. Modeling salt marsh vegetation height using unoccupied aircraft systems and structure from motion. Remote Sensing, 12: 2333.