Monitoring blue carbon ecosystem fluxes for climate mitigation and adaptation

Poulter, Benjamin, et al. (2023). Multi-scale observations of mangrove blue carbon ecosystem fluxes: The NASA Carbon Monitoring System BlueFlux field campaign. *Environmental Research Letters, 18(7), 075009. https://10.1088/1748-9326/acdae6*

NASA CMS CARBON MONITORING SYSTEM

Science Question

- What is the net exchange of carbon dioxide and methane between blue carbon ecosystems and the atmosphere?
- How does disturbance and recovery affect carbon fluxes in mangrove ecosystems?
- What is the climate mitigation potential of blue carbon ecosystems when methane emissions are included?

Analysis

- Flux measurements made in Everglades and Big Cypress National Parks across a gradient of healthy, dead and recovering mangrove stands (Fig. 1)
- Chamber measurements made to quantify water, soil and stem to air fluxes.
- Aircraft flights using NASA's CARbon Airborne Flux Experiment payload (CARAFE) to measure fluxes across the region in spring and fall of 2022 and 2023.
- Modeling to up-scale measured fluxes to gridded time series of maps for the MODIS era.

Results/Significance

- Gradients in carbon uptake and methane release were observed and explained by vegetation type, salinity, and hydroperiod. Mangrove systems were more productive and sawgrass systems released more methane.
- Accounting for methane emissions, and simply extrapolating the results from the April 2022 campaign, the region is a carbon sink of 32 $TgCO_2$-eq.
- Partnerships with tribal nations, local Universities, and non-governmental organizations have helped enable new collaborations and identify stakeholder needs for understanding the role mangrove systems can play in climate mitigation and adaptation.

Acknowledgements

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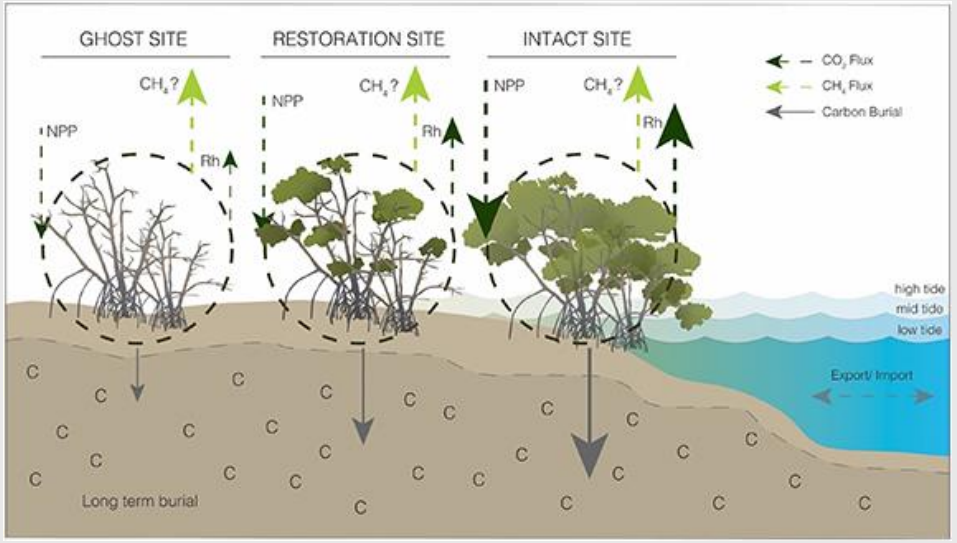

Figure 1: Mangrove ecosystems are among the most productive in the world but few measurements exist of how much CO_2 and CH_4 are exchanged and how this varies with disturbance history.

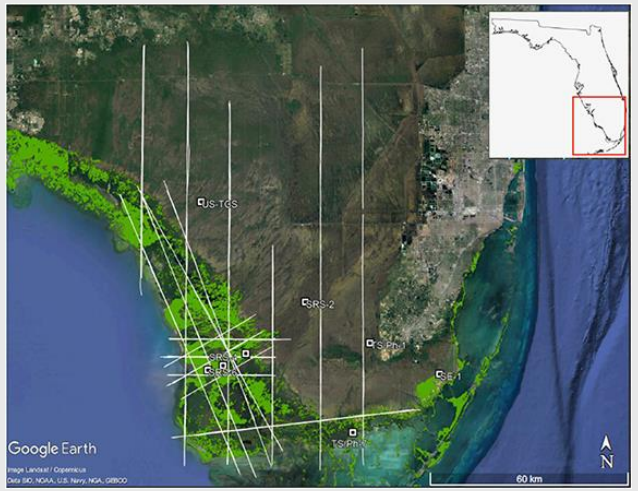

Figure 2: The CARbon Airborne Flux Experiment (CARAFE) payload was flown on a King Air B90 aircraft to measure carbon fluxes throughout the Everglades and Big Cypress National Parks in April and Oct. 2022 and Feb. and March 2023.