Sediment accumulation rates of organic matter, nutrients, and trace metals vary across mangrove forests on the island of Puerto Rico

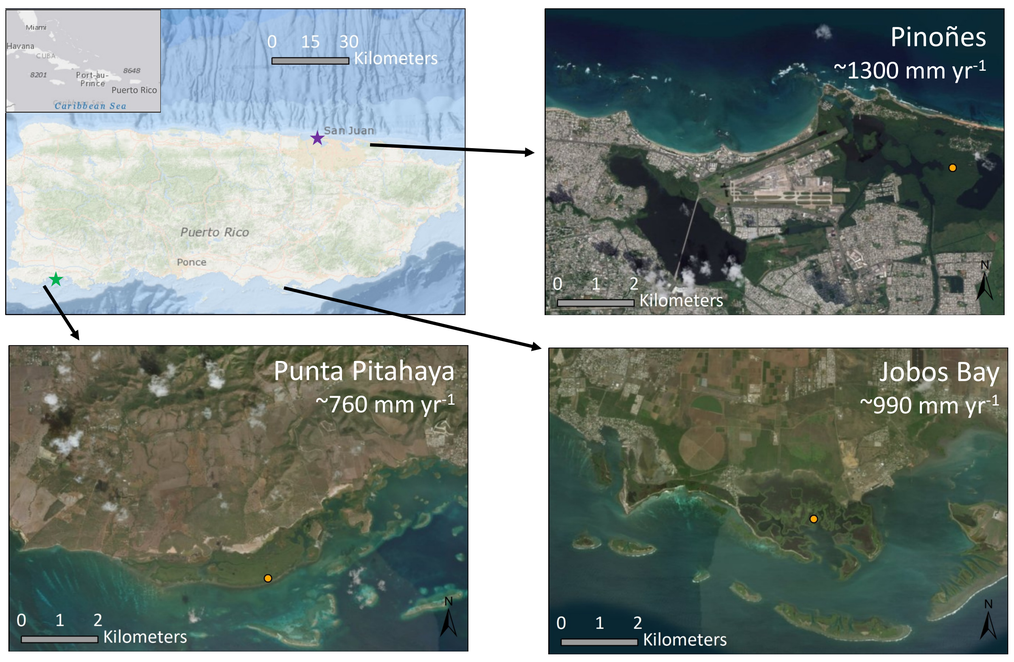
Danielle Ogurcak[1*], Todd Crowl[1], Michael Ross[1], John Meeder[1], Joseph Smoak[2], John Kominoski[1], James Fourqurean[1], Piero Gardinali[1], Amanda Chappel[2], Natalia Soares Quinete[1], Jennie Rivera[1], Marla Santos[1], and Tatiana Barreto[1]

[1]Institute of Environment, Florida International University, Miami, FL, USA, [2]University of South Florida, St. Petersburg, FL, USA, *dogurcak@fiu.edu

Objective: To assess the capacity of mangrove forests to accrete sediments and sequester nutrients and metals across climatic, physiographic, and land-use gradients on the island of Puerto Rico over the past ~100 years of sea level rise (SLR)

1. Study Sites

We selected core sites in 3 basin mangrove forests in Puerto Rico, located across a gradient of low to high rainfall (mm yr^{-1}) and varying physiography and surrounding land-use histories. Locations of cores and tide gauges are marked with orange dots and stars, respectively.



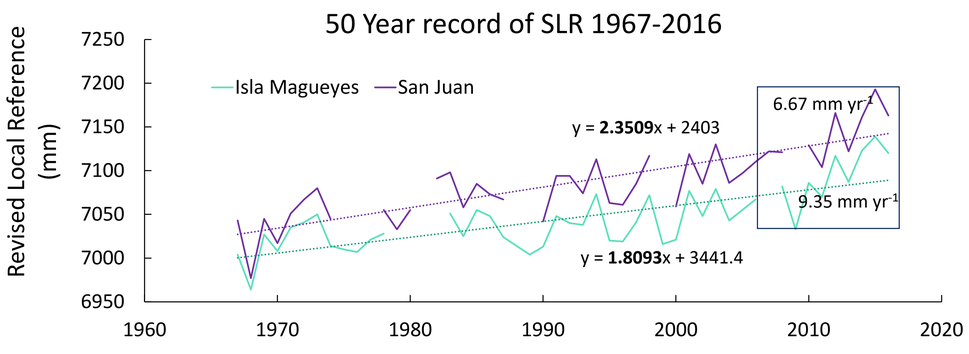
2. Methods

For this pilot study, we collected a single 40-cm deep core from each basin mangrove forest in June 2017. 1-cm sections (2-cm for top 10 cm) were analyzed for % organic matter (OM) from LOI, inorganic & organic carbon (IC & OC), nitrogen (N), phosphorus (P), & dry bulk density (DBD). ^{210}Pb isotopic dating generated sediment accumulation rates (mm yr^{-1}). Trace metal analysis was conducted on every third interval using inductively coupled plasma mass spectrometry (ICP-MS).

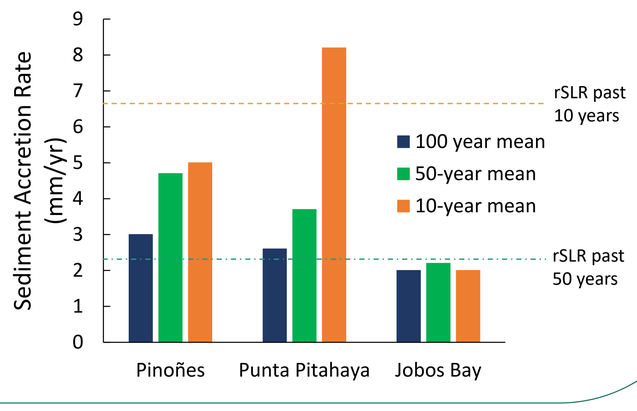
Above: Punta Pitahaya core interval 16-17 cm showing highly organic sediment with roots.

Above Left: Core collection in a forest of *Rhizophora mangle*.
Above Center: Tatiana Barreto sections a core in the lab in PR.

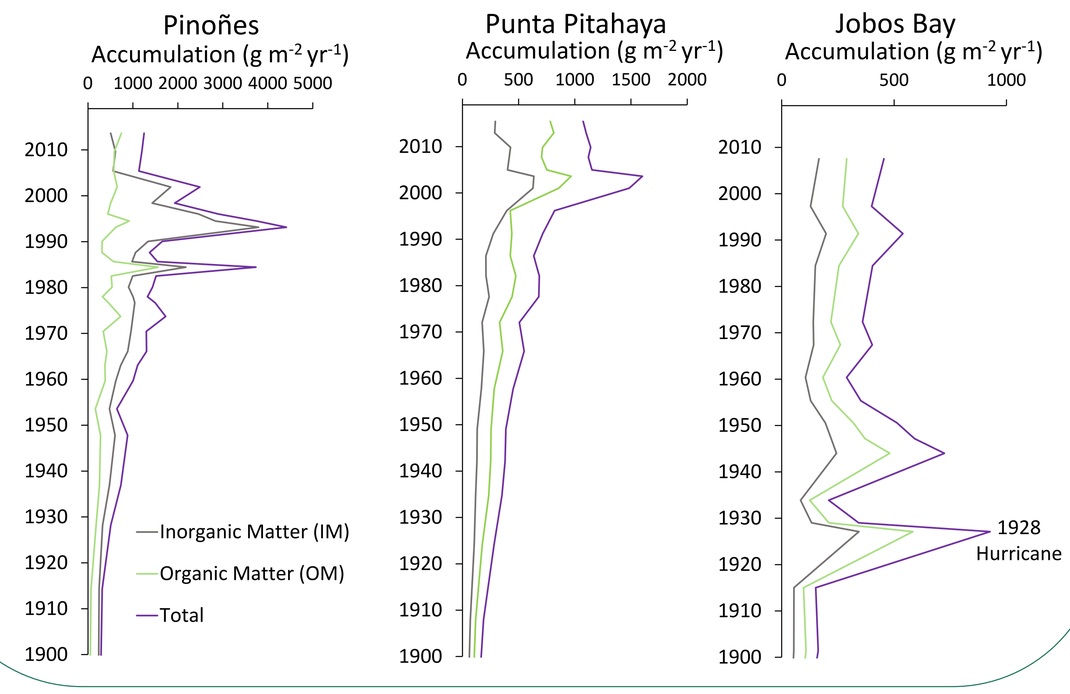
3. Results: Sediment accretion rates keep pace with SLR at Punta Pitahaya, but not at Jobos Bay.



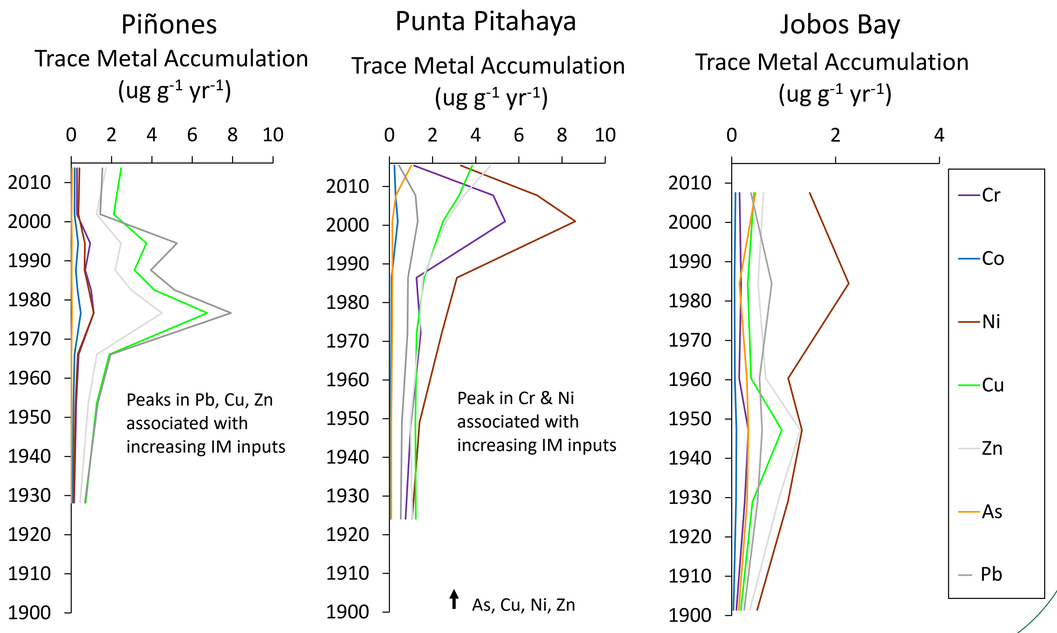
Above: Rate of sea level rise (SLR) from PR tide gauges (www.psmsl.org). Rates have increased in past 10 years (inset). Right: Mean sediment accretion rates at each site with rate of SLR (rSLR) from San Juan tide gauge for comparison (dashed lines).



4. Results: Mass accumulation rates are driven by IM at Pinoñes and are generally 2-4x that of the other sites, which are dominated by OM. Peaks are associated with tropical cyclone activity & possible upslope erosion events.

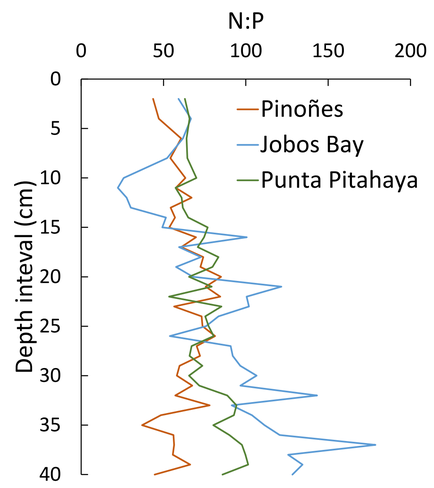


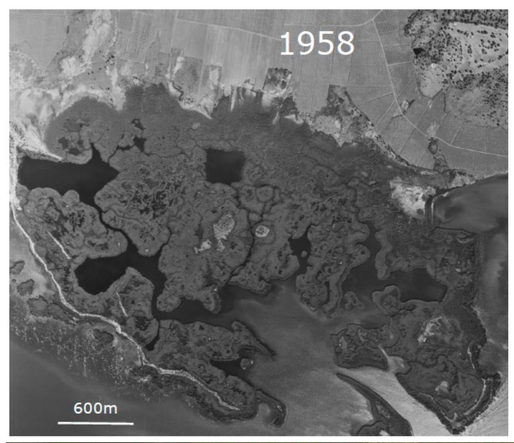
5. Results: Trace metal accumulation rates are comparatively low for Jobos Bay. Peaks in some metals are associated with higher IM inputs (see Box 4). Increase in accumulation rates for As, Cu, Ni, and Zn occur in the last couple decades for Punta Pitahaya and perhaps Jobos Bay.

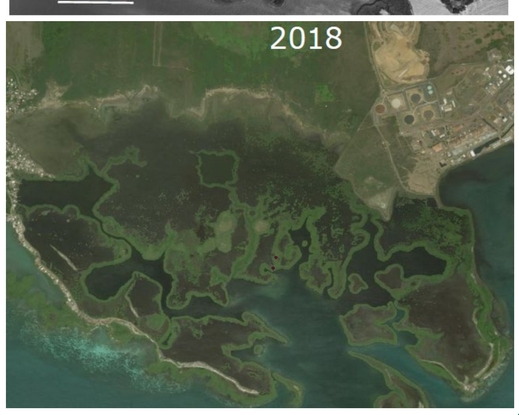


6. Results & Discussion:

Low sediment accretion rates compared to SLR could be explained by declines in forest cover at Jobos Bay (right). Increases in P (↓N:P) are likely attributable to the history of intensive agriculture upslope of Jobos Bay (below).







Imagery of Jobos Bay: earthexplorer.usgs.gov

This material is based upon work supported by the National Science Foundation under Grant No. HRD-1547798. This NSF Grant was awarded to Florida International University as part of the Centers of Research Excellence in Science and Technology (CREST) Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.