



Plastic sinks or sources: Characterizing cycling of marine debris in mangrove forests of Biscayne Bay, FL

Melinda Paduani, Florida International University
Dr. Michael Ross



Objectives

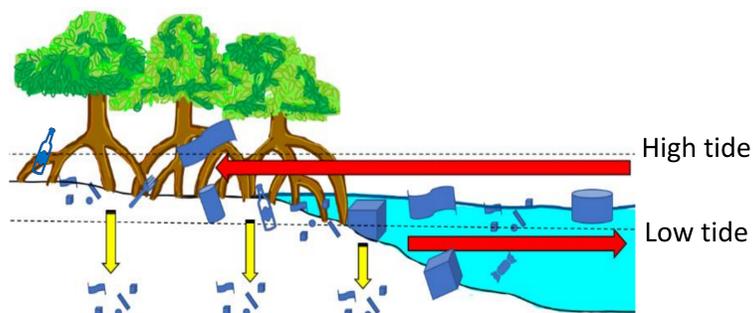


Figure 1. Diagram of import and export (red arrows) and settling (yellow arrows) of plastic debris (blue shapes) on a coastal mangrove wetland.



Figure 2. Map of sites for surficial debris surveys.

1. Determine if debris abundance varies with distance inland and ground-level vegetation structure
2. Identify patterns between plastic deposition on the surface and underground
3. Explore the potential for citizen science to facilitate long-term marine debris data and inform policy makers

Methods & Preliminary Results (Objective 1)

- Survey vegetation and debris on ground surface in 2-m plots along transects perpendicular to coastline
 - Basal area, prop root & pneumatophore cover, seeding count
 - Debris type and size class
 - Meso: 5mm-25mm
 - Macro: >25mm

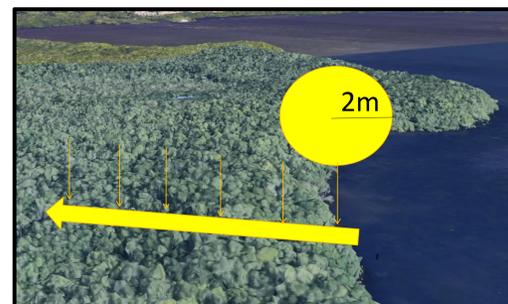


Figure 3. Diagram of debris surveys (not to scale).



Figures 4-5. Entangled debris and interactions with fauna.

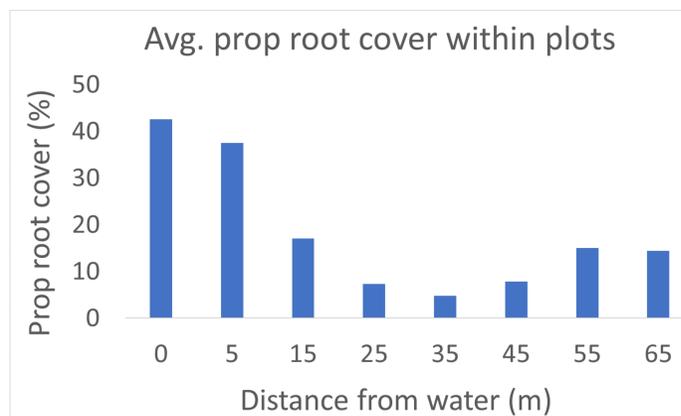


Figure 6. Distribution of average prop root cover from 4 sites.

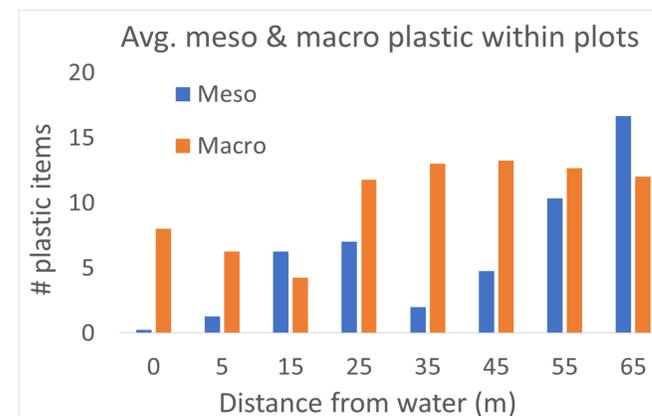


Figure 7. Distribution of average meso & macro debris from 4 sites.

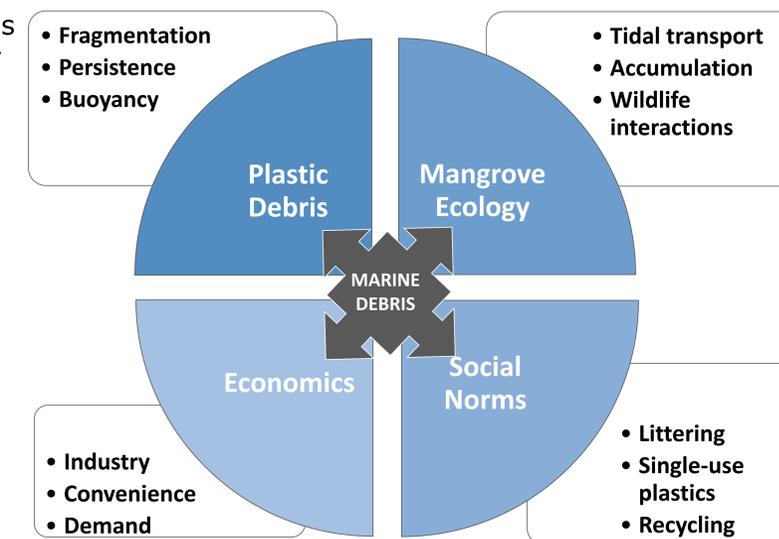
- Debris was observed at every site: over 97% plastic (fragments & food packaging most common).
- Both meso and macro plastics may get trapped in open areas further inland behind the dense prop roots of fringe mangroves.
- High tides and storm surges deliver debris far into the forest which remains until the next flood event or becomes permanently entangled in vegetation and/or buried (Figure 4).

Next Steps & Broader Impacts

- Biscayne Bay's mangrove forests are heavily polluted with plastic. Large debris items (garbage cans, crates, etc.) accumulate deep within the forest and may remain in the environment indefinitely which exposes wildlife to pollutants.
- Next steps:
 - Monitor flux of debris in and out of mangroves
 - Sieve for microplastics in sediment cores along transects
 - Separate microplastics from suspended sediment in tidal water column
 - Apply monitoring tools to citizen science initiatives & local plastic management policy-making

Figure 8 (on right). Ecological, physical, and social drivers of plastic accumulation interact to perpetuate the marine debris crisis.

- Mangroves may represent an understudied sink for plastic debris.
- Understanding the mechanisms and pathways of plastic retention in dynamic ecosystems like mangrove forests will allow land managers and clean-up organizers to address how and where plastic pollution accumulates at multiple scales.



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.