Mangroves in Unexpected Places: Identifying and Characterizing Mangroves in Miami-Dade County, Florida

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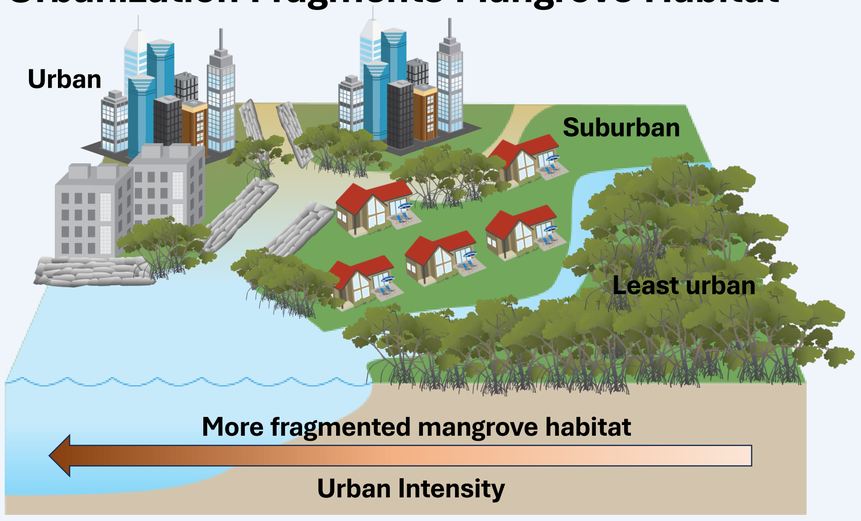
Urbanization Fragments Mangrove Habitat



- Urban development can leave behind small patches of fragmented mangrove habitat, which may be missed by current mapping efforts.
- Degree of urban intensity may also have consequences on mangrove structure and distribution within a landscape.
- Accurate habitat maps of mangrove spatial attributes and configurations (fragmentation and shape complexity) are essential to understanding their role within coastal landscapes.

Hypothesis 1: Current mapping efforts lack the resolution needed to capture small mangrove fragments in highly urbanized areas.
Hypothesis 2: More urbanized mangrove patches are smaller in size, further apart, and composed of more edges.

Objective 1: Locate Mangroves in Miami-Dade County and Compare Results with Current Habitat Maps

ArcMap →

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Compared results with FWC's current mangrove habitat inventory.

Method identified all mangroves inventoried by the FWC and additional mangrove area (Fig 2)

Our process for identifying mangrove area.

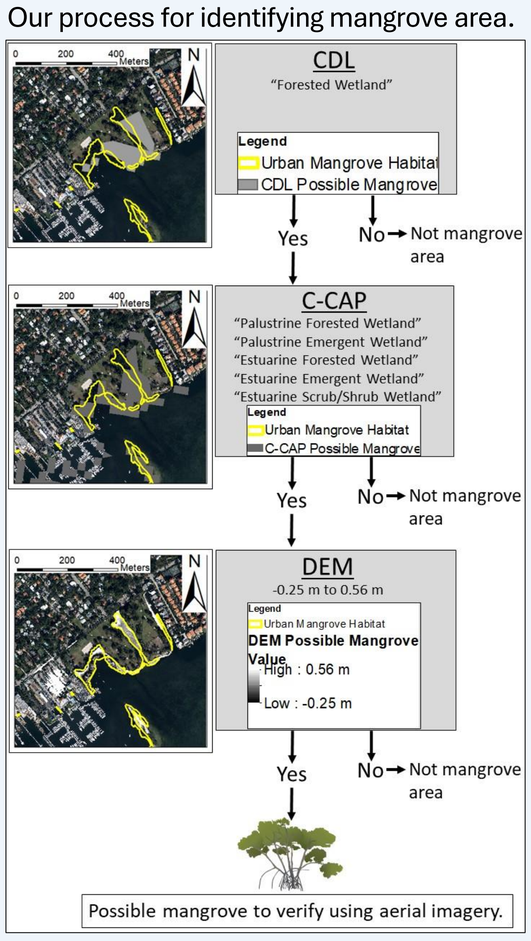

Fig 1. Possible mangrove habitat isolated from the Cropland Data Layer (CDL), Coastal Change Analysis Program (C-CAP), and 1.5 m resolution digital elevation model (DEM). Final mangrove polygons verified using with high resolution aerial imagery (7.6 cm) and ground-truthing.

Objective 2: Describe Mangrove Landscape Configurations Along a Gradient of Urbanization

- Divided Miami-Dade County's urban extent and mangrove habitat by three urban regions: North, Central, and South based on documented patterns in Biscayne Bay water quality (Fig 3)

North — Central — South

Urban Intensity

- Quantified mangrove habitat area, fragmentation, and shape complexity using newly generated map and FRAGSTATS (Fig 4)
- Compared FRAGSTATS results for average mangrove stand size, distance between patches, and perimeter to area ratios between newly generated map and FWC datasets (Fig 5)

We identified 65% more mangrove area and generated 386 more mangrove patches in Miami-Dade County compared to FWC.

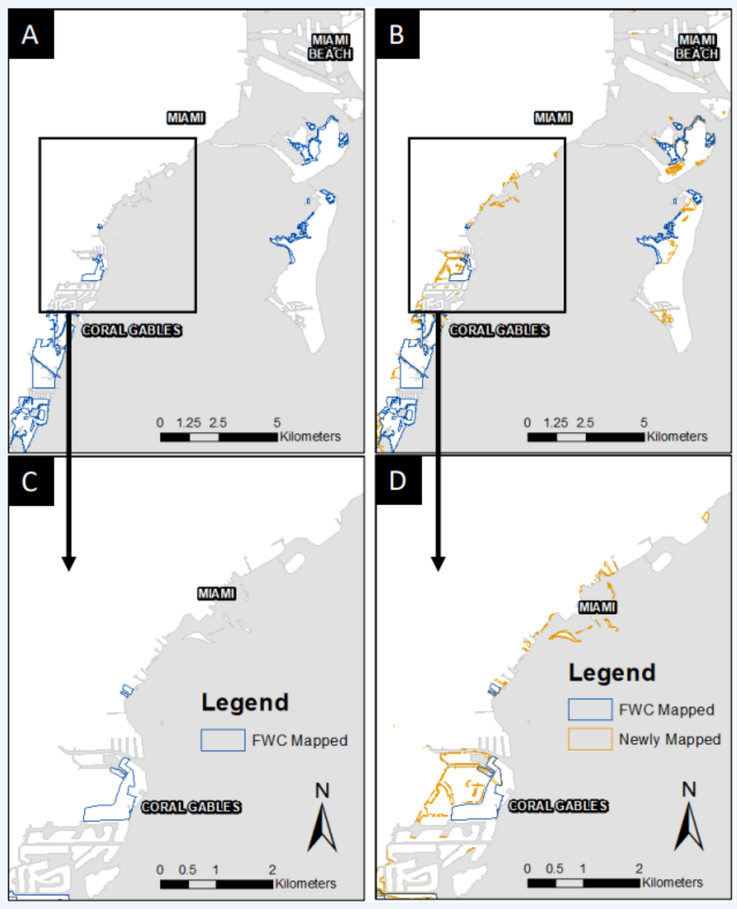

Fig 2. More mangroves area was found than what is recorded by the FWC. A subset of the total area we mapped in Miami-Dade County, Florida, USA. Left, A and C, show the FWC mangrove data only (blue). Right, B and D, illustrate our mangrove mapping methods found all mangroves identified by the FWC and new mangrove area (orange).

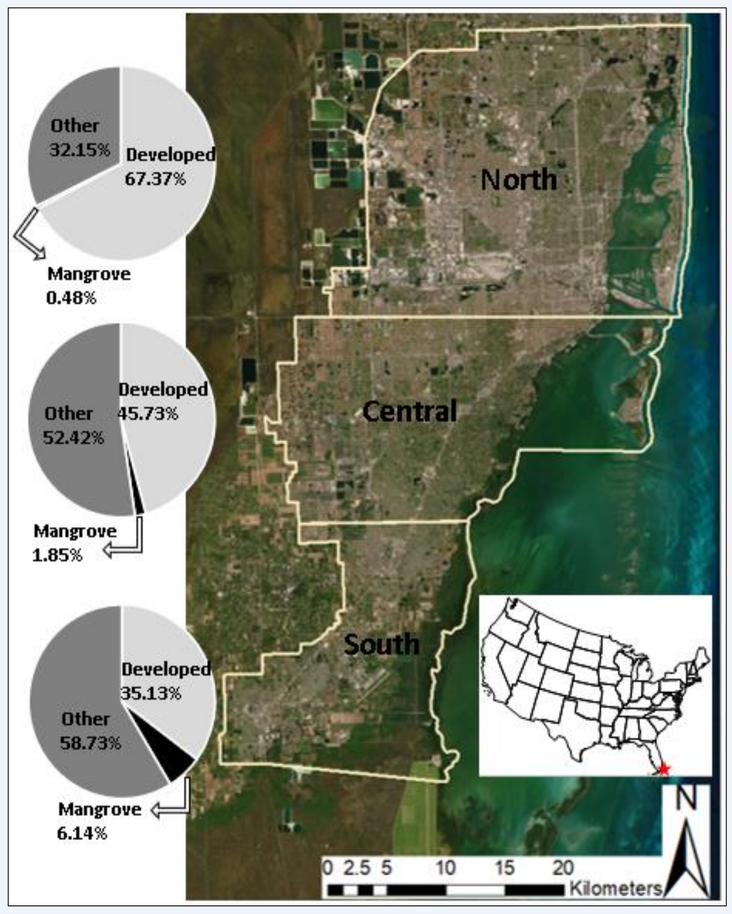

Fig 3. North Biscayne Bay is composed of more developed area Three Biscayne Bay regions, within Miami-Dade County's (Florida, USA) urban boundary layer, used to compare mangrove spatial attributes and configurations. Pie charts illustrate percentage landscape cover of mangrove, developed land, and other landcover land use types (e.g., golf courses) within each region.

Mangroves are smaller, patchier, and further apart in more urbanized areas.

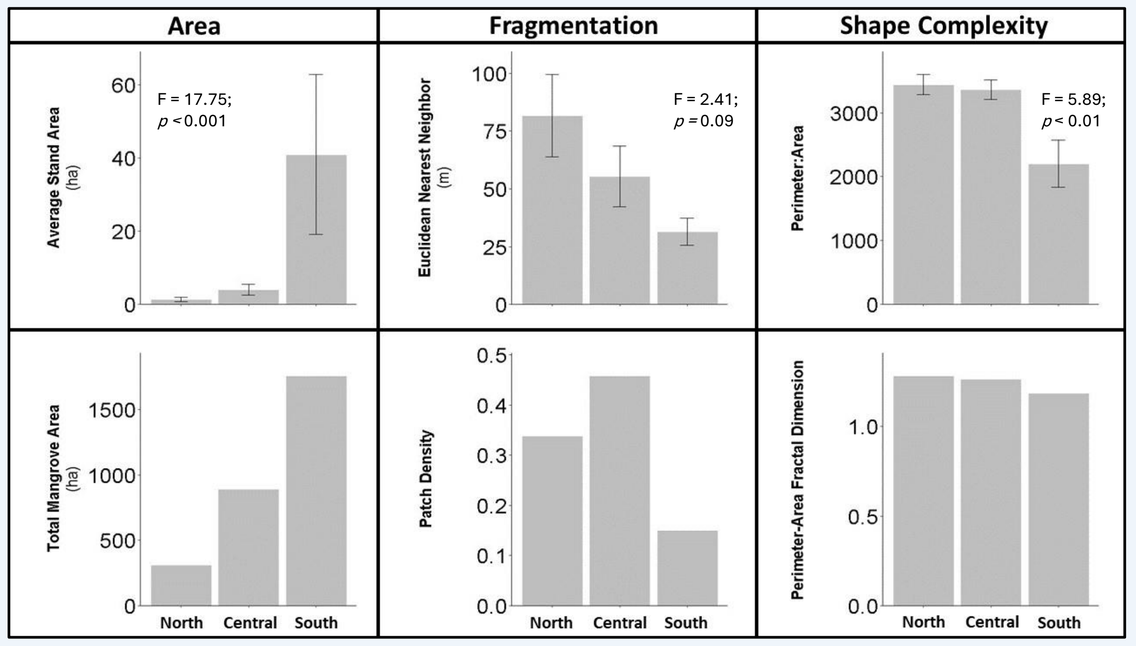

Fig 4. Mangroves in the north are smaller and more fragmented than mangroves in the central and south regions. Bar graphs of mangrove spatial attributes and configurations per Biscayne Bay region (North, Central, and South). Error bars are the standard errors. Patch Density and Perimeter-Area Fractal Dimension are standardized by the areal extent of each region, and therefore do not have standard error bars.

FWC dataset provides important habitat area estimations but misses key fragmentation patterns at the scale needed for urbanized areas.

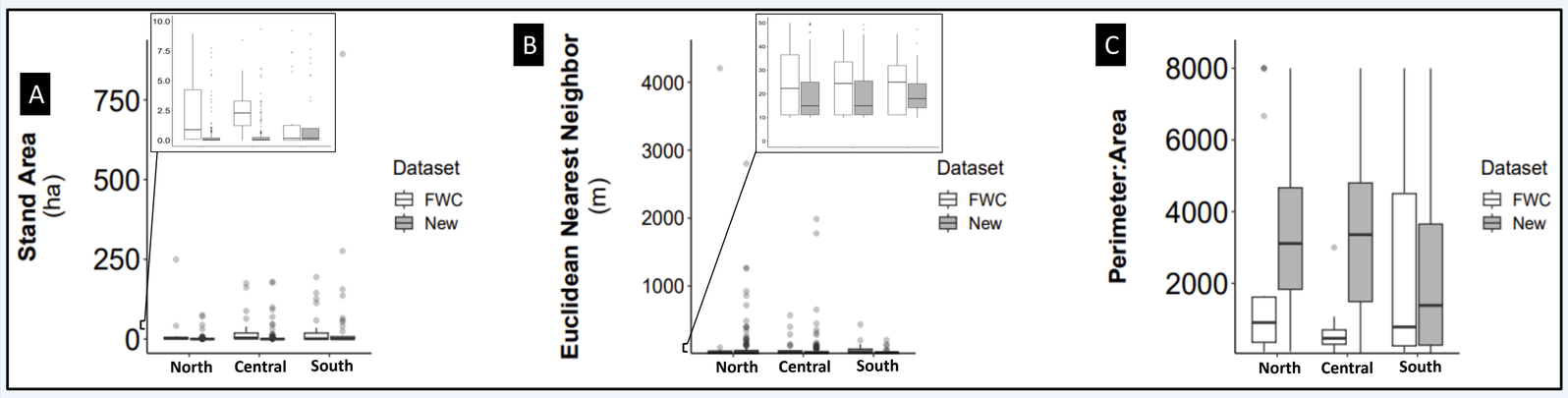

Fig 5. The effect of urban intensity on individual stand size and shape complexity depended on the dataset used. Box plots comparing landscape metrics between the FWC and newly mapped datasets and Biscayne Bay region: A) displays differences in mangrove stand size between the two datasets (Dataset: F = 8.74; p < 0.01, Region: F = 10.46; p < 0.001, Interaction: F = 3.55; p < 0.05), B) shows Euclidean nearest neighbor comparison (Dataset: F = 2.08; p = 0.15; Region: F = 2.62; p = 0.74, Interaction: F = 2.24; p = 0.11), and C) shows a comparison of perimeter to area ratios (Dataset: F = 34.70; p < 0.001, Region: F = 1.60; p = 0.20, Interaction: F = 11.05; p < 0.001).

There are significantly more, smaller patches of mangrove habitat in highly urbanized areas than what is currently reported in habitat inventories.

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