

Health status of the mangrove forest on the southeastern coast of the State of São Paulo (Brazil): From the bottom (soil salinity and vegetation biomass) to upwards (canopy)

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The Cananéia-Iguape Coastal System is located on the southeastern coast of São Paulo (Brazil) between latitudes 24°40'S and 25°20'S. The region has great landscape, biological and cultural diversity. The region has several Protected Areas (PAs) and sites recognized by UNESCO and the Ramsar Convention. Despite this, the region has undergone hydrological changes over time due to an artificial canal (AC) opened in the 19th century, which is currently 200m wide. The connection of the Ribeira River with the coastal system by the AC has led to socio-environmental changes, such as an increase in the macrophytes occurrence, reduction in salinity and in mangrove areas and impact on fishing.

The current study aims to assess the health of mangroves in different states of conservation, based on interstitial salinity, vegetation biomass and canopy condition on the southeastern coast of São Paulo (Brazil). For that purpose, mangrove forests were evaluated in 14 permanent plots of the Integrated Mangrove Monitoring research group. The plots are in three sectors. North 1 sector, in front of AC: 4 plots. North 2 sector, 10 km distant from AC: 4 plots. And south sector, 45km away from AC: 6 plots. An optical refractometer was used to evaluate interstitial salinity in sediment samples, collected at 10cm and 50cm depths. For vegetation biomass, data were obtained from Diameter at Breast Height (DBH) and height of mangrove trees, in July 2019. Posteriorly, average DBH, relative density, relative dominance of live and dead trunks were calculated. For canopy evaluation, hemispheric photographs were obtained in November 2019, with a NIKON camera, Model F-501, coupled by a NIKOR 8 mm fisheye lens with 180° angle of view. Subsequently, they were processed in the Gap Light Analyzer software to obtain the Leaf Area Indexes (LAI) and canopy opening.

Regarding interstitial salinity, the mangroves showed average values of 3ppm, 15ppm and 26ppm, in the sectors north 1, north 2 and south, respectively, indicating different influences of the waters of the River Ribeira carried to the coastal system via AC. As for vegetation biomass, in north 1 sector, mangrove forests showed high relative densities of dead trunks (40%) of individuals of intermediate diametric classes (> 2.5cm and <10cm). The north 1 sector, no seedlings or saplings were observed in the mature mangrove forests. In north 2 sector, there was less dominance of the basal area of dead trunks (<20%), confirming a better conservation status of mangrove forests. In this area, the occurrence of seedlings and saplings in mature forests were observed, indicating recruitment of individuals. In the south sector, dominance was observed in the basal area of live trunks in all the studied plots. Dead trunks (20%) in this area occur through natural thinning, especially in young forests, with trunks with a diameter class <2.5cm.

Mature mangrove forests have individuals with high values of trunk diameter and height, but also have seedlings and saplings, with less structural development. Thus, it can be said that forests with great structural development, which also had young individuals and few dead individuals, indicate good health status of the mangroves. Conserved mangrove forests showed higher LAI values compared to impacted mangrove forests. The mangroves in north 1 sector had lower LAI values, with an average of 0.23. Meanwhile, the north 2 and south sectors had higher LAI values, with averages of 0.91 and 0.88, respectively. As for the canopy opening, altered mangrove forests showed high percentages, as was registered in the north 1 sector, with an average of 80%. Conserved forests showed lower canopy opening values, as observed in the north 2 and south sectors (averages of 44% and 42%, respectively).

LAI and canopy opening data are important and complementary to the structural vegetation monitoring to analyze the health of mangroves.

The results of this study were made available to PA managers, to assist in management plans and conservation strategies of this Brazilian coastal zone.

Keywords: Leaf Area Index; Gaps; Anthropic impacts