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Factors influencing mangrove carbon storage and its response to environmental stress

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Mangrove forests serve as significant carbon sinks and play a crucial role in mitigating climate change. Currently, the response of mangroves to intensified climate change and human activities, and the factors that influence the magnitude of carbon storage in their sediments remain uncertain. To address these questions, two sediment cores were collected from the mangrove reserve in Pearl Bay, Guangxi, China. The activity of ²¹⁰Pb in the sediment, grain size, bulk elemental composition, stable carbon isotopes, lignin, and different sediment organic matter (OM) fractions were investigated to determine the local mangrove's response to climate change and human activities, as well as the factors influencing its carbon storage. The results showed mangrove forests with lower tidal ranges, slower sedimentation rates, and where OM predominantly originated locally tend to have larger carbon stocks. The mangrove OM (MOM) decreased progressively from the bottom to the top of the cores, indicating that the mangroves in Pearl Bay have possibly undergone degradation, which was further substantiated by the decrease in lignin content. Based on these results, the entire cores were divided into two stages: stable stage 1 (1963–2001) and degradation stage 2 (2001–2020). The cause of the mangrove degradation is likely due to the impact of human activities; however, these impacts are anticipated to gradually lessen in the future due to mangrove protection policies. Our results indicate that lignin can track and predict mangrove growth trends and provide guidance for the sustainable management of mangrove ecosystems.

KEYWORDS

blue carbon ecosystem, sediment carbon storage, lignin biomarker, sea level rise, human disturbance