Marine Pollution Bulletin 200 (2024) 116064

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Storage and dynamics of soil organic carbon in allochthonous-dominated and nitrogen-limited natural and planted mangrove forests in southern Thailand

Jianxiong Hu [a], Siriporn Pradit [b,*], Pei Sun Loh [a,*], Zengxuan Chen [a], Chuanyi Guo [a], Thi Phuong Quynh Le [c], Chantha Oeurng [d], Ty Sok [d], Che Abd Rahim Mohamed [e], Choon Weng Lee [f,g], Chui Wei Bong [f,g], Xixi Lu [h], Gusti Z. Anshari [i], Selvaraj Kandasamy [j], Jianjun Wang [k,l]

[a] Institute of Marine Geology and Resources, Ocean College, Zhejiang University, Zhoushan 316021, China
[b] Coastal Oceanography and Climate Change Research Center, Faculty of Environmental Management, Prince of Songkla University, Songkhla 90110, Thailand
[c] Institute of Natural Product Chemistry, Vietnam Academy of Science and Technology, Hanoi 11307, Viet Nam
[d] Faculty of Hydrology and Water Resources Engineering, Institute of Technology of Cambodia, Phnom Penh 12156, Cambodia
[e] Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia
[f] Faculty of Science, Universiti Malaya, Kuala Lumpur 50603, Malaysia
[g] Institute of Ocean and Earth Sciences, Universiti Malaya, Kuala Lumpur 50603, Malaysia
[h] Department of Geography, National University of Singapore, Singapore 119260, Singapore
[i] Soil Science Department, Faculty of Agriculture, Tanjungpura University, Pontianak 78124, Indonesia
[j] Department of Geology, School of Earth Sciences, Central University of Tamil Nadu, Neelakudi, Thiruvarur 610005, India
[k] Jiangsu Key Laboratory of Crop Genetics and Physiology/Jiangsu Key Laboratory of Crop Cultivation and Physiology, Agricultural College of Yangzhou University, Yangzhou 225009, China
[l] Jiangsu Co-Innovation Centre for Modern Production Technology of Grain Crops, Yangzhou University, Yangzhou 225009, China

ARTICLE INFO

Keywords:
Blue carbon ecosystem
Soil organic carbon
Environmental gradients
Climate change

ABSTRACT

Mangrove forests can help to mitigate climate change by storing a significant amount of carbon (C) in soils. Planted mangrove forests have been established to combat anthropogenic threats posed by climate change. However, the efficiency of planted forests in terms of soil organic carbon (SOC) storage and dynamics relative to that of natural forests is unclear. We assessed SOC and nutrient storage, SOC sources and drivers in a natural and a planted forest in southern Thailand. Although the planted forest stored more C and nutrients than the natural forest, the early-stage planted forest was not a strong sink relative to mudflat. Both forests were predominated by allochthonous organic C and nitrogen limited, with total nitrogen being a major driver of SOC in both cases. SOC showed a significant decline along land-to-sea and depth gradients as a result of soil texture, nutrient availability, and pH in the natural forest.

1. Introduction

Mangrove forests (MFs), located in the transitional zone between land and ocean, are blue carbon (C) ecosystems, along with saltmarshes and seagrass meadows. MFs have attracted significant attention due to their exceptional capacity for C sequestration relative to their size and other ecosystem functions, such as habitat provision (Lovelock and Duarte, 2019). The ability of MFs to capture and store C is particularly important to mitigate the effects of global warming and increased levels of atmospheric carbon dioxide (Macreadie et al., 2019). Extensive anthropogenic activities (e.g., land use conversion for aquaculture or agriculture), particularly in Southeast Asia where most MFs are found, have resulted in severe degradation and loss of MFs over the past few decades (Friess et al., 2020). Degraded MFs can no longer function as C sinks to offset greenhouse gas emissions (Adame et al., 2021). Fortunately, extensive management measures, such as afforestation and conversion, including REDD+, have been implemented to mitigate MFs loss (Romañach et al., 2018). Studies have demonstrated that planted

* Corresponding authors.
E-mail addresses: siriporn.pra@psu.ac.th (S. Pradit), psloh@zju.edu.cn (P.S. Loh).

https://doi.org/10.1016/j.marpolbul.2024.116064
Received 9 August 2023; Received in revised form 15 December 2023; Accepted 18 January 2024