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硕 士 学 位 论 文

红树林生态系统土壤有机碳动态及互花米草入侵
的影响

Soil Organic Carbon Dynamics in Mangrove
Forests and the Impact of *Spartina
alterniflora* Invasion

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摘要

滨海湿地具有重要的碳汇能力和向海洋输送碳的能力。红树林是重要的滨海湿地类型，关于中国红树林土壤碳动态还缺乏系统的研究。分布于东南沿海的中国红树林受到强烈的人类干扰和互花米草入侵的影响。本文以福建漳江口红树林自然保护区和广东湛江红树林自然保护区的典型红树林群落为研究对象，比较了不同类型红树林生境土壤基本理化性质、土壤有机碳库量，并系统研究漳江口红树林生态系统的土壤有机碳的来源及横向输出以及互花米草入侵对红树林土壤有机碳的影响。主要结果如下：

漳江口红树林和湛江高桥土壤有机碳库水平仅为热带红树林的四分之一。漳江口红树林土壤的有机碳含量与总碳含量没有显著差异，红树林0-60 cm深度土壤有机碳库显著高于入侵植物互花米草群落，后者显著高于光滩；高桥红树林中通量塔附近的木榄和桐花树群落0-60 cm深度土壤有机碳库显著高于靠近河流上游的无瓣海桑人工林，后者显著高于与其紧邻的桐花树林。漳江口红树林（白骨壤和秋茄）表层土壤的有机碳主要来源于红树林，互花米草群落为主要来源于红树林和互花米草，两者比例相当。0-60 cm剖面上，植物对土壤有机碳的贡献随深度增加而降低。两种红树植物对稳定态碳的贡献率高于有机碳，而互花米草相反。漳江口红树林潮沟溶解无机碳（DIC）存在净输出，但数据偏离 $\delta^{13}C$ 和 [DIC] 的逆一次线性回归方程，说明在强烈干扰的红树林，由于存在不确定的来源，使得稳定同位素的应用受到了限制。

关键词：红树林；土壤有机碳；互花米草；碳汇；稳定同位素

Abstract

Coastal wetlands serve as important carbon sink, providing significant amount of organic carbon to adjacent ocean. Mangrove forests is one of the major coastal wetlands, and those in China have not been well studied in the perspective of soil organic carbon(SOC) dynamics. China mangroves have been experincing severe disturbance from human economic activities, and now are also threatened by the invasion of exotic *Spartina alterniflora*. In this study, we quantified SOC pools within 0-60 cm from Zhangjiang Estuary Mangrove Nature Reserve in Fujian Province and Zhanjiang Estuary Mangrove Nature Reserve in Guangdong Province. In Zhangjiang estuary, Sources of SOC was partitioned, and lateral carbon export of dissolved inorganic carbon (DIC) was explored in a mangrove tidal creek. The primary results and conclusions are listed as follows:

The SOC pool of 0-60 cm in sub-tropical mangroves(Zhangjiang and Gaoqiao mangroves) were about one quarter of that in tropical mangroves. In Zhangjiang estuary, SOC pools in mangrove forests were significantly higher than in *S. alterniflora* community which was significantly higher than its nearby mudflat. In Gaoqiao estuary, SOC pools in *B. gymnorrhiza* and *A. corniculatum* around the eddy tower were significantly higher than that in *S. apetala* stand upstream which was higher than its nearby *A. corniculatum* community. In Zhangjiang estuary, SOC in mangrove forests' surface soil mainly contributed from mangrove litter while that in *S. alterniflora* was mainly contributed form mangrove and *S. alterniflora* litter. In 0-60 cm soil profile, plants' contributions to SOC decreased gradually with soil depth. Mangroves contributed more to recalcitrant organic carbon(RC) than to SOC, while *S. alterniflora* showed the opposited pattern. In a mangrove tidal creek of Zhangjiang estuary, a net export of dissolved inorganic carbon(DIC) to the creek was obeserved, DIC concentration([DIC]) and its $\delta^{13}C$ value deviated from the inverse first order regression, that indicated that in severe

disturbed mangrove ecosystem, as there was un-identified source, the application of stable isotope technique was limited.

Keywords: Mangrove; Soil organic carbon; *Spartina alterniflora*; Carbon sink; Stable isotope

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