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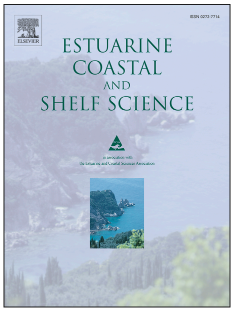

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Mapping soil carbon stocks in an oceanic mangrove ecosystem in Karimunjawa Islands, Indonesia

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Abstract

Mangrove ecosystems store large amounts of carbon in biomass and sediments. This so called 'blue carbon' that is captured by oceanic and coastal ecosystems plays an important role in climate change mitigation strategies. However, most biomass and carbon measurements have been conducted in coastal and delta mangroves, while oceanic mangroves are still insufficiently researched. In this paper we present results from our research on the Karimunjawa archipelago in the Java Sea north of Central Java, Indonesia, where we measured soil carbon stocks (soil total organic carbon – TOC) of an oceanic mangrove ecosystem. In previous research, we had already analyzed above-ground carbon (AGC) and below-ground biomass carbon (BGBC), so that we are now able to present the total ecosystem carbon stock. We took 35 soil samples along seven transects to analyze the relationship between (a) soil TOC and distance from shoreline, (b) total ecosystem carbon stock (AGC + BGBC + soil TOC) and distance from shoreline, (c) total C of living biomass (AGC + BGBC) and distance from shoreline, as well as (d) soil TOC and living biomass. We took another nine soil samples to analyze the distribution of soil TOC in the soil profile at a greater resolution. Our results show that there is a wide range of soil carbon stocks that varies from 3.3 t C ha^{-1} to 366.7 t C ha^{-1}. On average of the 35 samples soils contribute to 45.5% of the total ecosystem carbon stock. Overall there is no correlation between the analyzed variables. However, there is a correlation between distance from the shoreline and soil carbon stock for the longest transect and a strong relationship between soil depth and soil carbon stock for all samples. Carbon stock per increment decreases with a conspicuous drop at 15 cm.

Keywords: oceanic mangrove, blue carbon, soil carbon stocks, Karimunjawa

1. Introduction

Marine and coastal ecosystems, such as mangroves, seagrass beds, and salt marshes have been identified as major carbon pools (Millennium Ecosystem Assessment 2005; Kallesøe et al. 2008; Crooks et al. 2011; Alongi 2014; Howard et al. 2014). The blue carbon that is captured by living organisms and stored in biomass and sediments of the world's oceans and coastal ecosystems accounts for approx. 55% of the total carbon captured by living organisms (Nellemann et al. 2009); hence, marine and coastal ecosystems play a significant role in the global carbon cycle by sequestering (capturing and storing) carbon and redistributing it (Duarte et al. 2005; Bouillon et al. 2008; Alongi 2014; Howard et al. 2014). At the same time, we have lost coastal ecosystems at an