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DETERMINATION OF CARBON AND NITROGEN IN LITTER FALL OF MANGROVE ECOSYSTEM IN PENINSULAR MALAYSIA

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Abstract

Mangroves in Peninsular Malaysia are typical of tropical forest setting. Nevertheless, the state of the mangrove forests has led to various classifications; natural and degraded mangroves. The study aimed to utilize litter fall (production and standing crop) potential as a means of evaluating the degree of productivity of the mangrove types across seasons, in addition to determining the abundance of carbon and nitrogen in the Peninsular mangrove forest. Leaf litter accounted for more than 70% of the total litter production in both natural and degraded mangroves, and the peak month for such production was December; 82.7% and 82.2%, for Sungai Haji Dorani and Kuala Selangor Nature Park, respectively. The degraded mangrove recorded higher concentration of total N (6.16 mg/g) than the natural mangrove forest (5.60 mg/g) at significant level. However, the organic carbon (CO) content across the litter parts varied with the three seasons. The CO of leaf litter was at the peak during the dry season, however, analysis on the branch and fruit revealed that during the intermediate and wet seasons CO level could be higher than the concentration observed at dry season. Though, the study concluded that both mangrove types in Peninsular Malaysia showed high similarity in the degree of litter production, yet the identified differences suggest that counter measures need to be adopted in order to protect mangroves from degradation and possible productivity loss.

Key words: Mangrove; Carbon; Nitrogen; Litter production; Litter standing crop.

Introduction

Litter fall (production and standing crop) is fundamental to ecosystem process due to its importance in for organic matter production and decomposition cycle. From a global point of view, mangrove is a highly productive ecosystem that is not only known for its primary productivity, but also recognized for export of organic matter and support for variety of aquatic life (Woodroffe, 1982). Litter fall is highly required in energy and nutrients cycle in the woodland ecosystem (Guo *et al.,* 2006). Through tree harvesting, litter fall adds nutrient to the soil, thereby encouraging land use sustainability. In as much as it is technically difficult to obtain direct methods of measuring primary productivity in mangrove forests, Bunt *et al*. (1979) utilized the extrapolation of litter production data for the generation of net primary production.

This is to infer that litter from mangrove swamps potentially represents a significant organic input to the sea, especially where the swamps are extensive, such as on the west coast of the Peninsular Malaysia (Sasekumar & Loi, 1983). Geographical location is found to influence mangrove productivity. This is because litter production and breakdown rate do not only vary with species but also geographically (Guo *et al.,* 2002). In fact in the tropics, mangrove swamps achieve their highest structural and floristic diversity; hence litter production rates in the temperate region are less than in the tropical setting (Woodroffe, 1982). Estimates of litter production have been reported for some mangrove forests around the globe. Leaf litter production in Florida and Central America was 2 g m^{-2} day^{-1} (dry weight), (Lugo & Snedaker, 1974), Heald, 1971 reported a total litter of 2.4 g m^{-2} day^{-1} (Heald, 1971); in Queensland it ranged from 1.04 to 5.26 g m^{-2} day^{-1} (Duke*et al.,* 1981); and Sasekumar & Loi (1983) recorded from 3.5 g m^{-2} day^{-1} to 6.72 g m^{-2} day^{-1} in mangrove forest zones of Peninsular Malaysia. Despite the importance of mangrove forests, much attention has not been given to litter production. Similarly, none of the literature has viewed litter fall from the angle of evaluating both natural and degraded mangroves. Mangrove forests significantly play a key role in the storage of atmospheric carbon mainly by storing organic C in living and dead biomass, thereby reducing effects brought about by greenhouse gases (Khan *et al.,* 2007). However, it is worthy to note that the level of C storage in soil is about two or three times more than that of atmospheric C that is found as CO_2 (Davidson *et al.,* 2000). Similarly,nitrogen uniquely influences mangrove productivity, and it is the major source in below-ground biomass (Alongi *et al.,* 2003). Hence, it is deduced that mangrove forests constitutes efficient sinks for organic C and N, and even essential nutrients that ensure increased rate of plant growth (Holguin *et al.,* 2001). While some mangrove forests are pristine, some have experienced degradation due to anthropogenic activities like building resorts, fishing etc., thereby making them degraded mangrove forests. The study was designed to utilize litter fall (production and standing crop) potential as a means of evaluating the degree of productivity of the mangrove types across seasons, in addition to determining the abundance of carbon and nitrogen in the Peninsular mangrove forests.