Journal of Environmental Science and Management 20-2: 77-87 (December 2017) ISSN 0119-1144

Carbon Stock Evaluation of Selected Mangrove Forests in Peninsular Malaysia and its Potential Market Value

ABSTRACT

Mangrove forest has a big potential to become a new market for carbon trading. The purpose of this study was to estimate the amount of carbon stored and its potential carbon market value in undisturbed mangrove forest; Kuala Selangor Nature Park (KSNP) and degrading mangrove forest; Sungai Haji Dorani (SHD) thereby create awareness on how preserving the natural mangrove forest in Malaysia really pays. The carbon content of seasonally-sampled selected mangrove living vegetation and soil was determined using the LOI furnace method followed by a conversion factor. The carbon content for the soil and above-ground biomass in the undisturbed forest was greater than in the degrading forest; while the carbon stored below-ground surprisingly showed a reversed pattern. The total ecosystem carbon stock in undisturbed KSNP was estimated at 246.21 t ha^{-1} C which is relatively higher than that in the degrading forest in SHD with 151.40 t ha^{-1} C. It was also estimated that the minimum carbon credit value for the mangrove forest in the SHD and KSNP was USD 3,314.23 ha^{-1} and USD 5,89.83 ha^{-1} respectively, based on the market price in the voluntary market. The undisturbed mangrove forests have a higher potential for economic return in carbon credits.

Key words: *mangroves, biomass, carbon sink, carbon market*

Liu Chai Hong[1]
Zhila Hemati[2]
Rozainah M. Zakaria[3*]

[1] Institute of Biological Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia
[2] Key Laboratory of Tropical Forest Ecology, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Mengla, Yunnan 666303, China
[3] Institute of Ocean & Earth Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia

*Corresponding author: rozainah@um.edu.my

INTRODUCTION

According to the *WWF-Australia Blue Carbon Report* (*2012*), coastal ecosystems, including sea grass, mangrove and salt marsh, are known as the blue carbon sinks. Mangrove forests are effective in storing organic carbon 3-5 times higher than terrestrial forests (*Donato et al. 2011*). In fact, this storage of Blue Carbon can potentially occur for millennia. The two main carbon pools in the forest ecosystem are: the living vegetation and the soil (*Kauffman et al. 2011; Chen et al. 2012*). The soil ecosystem is often the largest pool in the mangrove ecosystem, and measuring it is important for determining the long-term dynamics associated with climate change and/or land management. The soil carbon pools usually constitute over 50%, and sometimes over 90%, of the total ecosystem carbon stock of mangroves (*Donato et al. 2011; Kauffman et al. 2011*). Among the main sources of organic carbon for soil are litter production and dead wood debris from the plant. The decomposition and decay of organic material caused by bacteria increases the accumulation of organic matter in the soil sediment. This process usually takes place in the soil surface layer, which is known as the organic-rich layer. It is also important to highlight that mangrove forests can be carbon sinks but, if the ecosystem is disturbed, they can become a carbon source as well. The clearing of mangrove forests causes the drying up of mangrove sediments, which increase the microbial activity following the loss of anaerobic environment. This in turn causes an oxidation for the soil and leads to the release of stored carbon into the atmosphere. Thus, it is essential to acknowledge the importance of the mangrove forests and to value their conservation.

Malaysia ranks as the third country in the world to hold largest mangrove forest at 469,100 ha in 2014 after Indonesia and Brazil, but sadly subjected to a reduction in 0.19% since 2000 (*Hamilton and Casey 2016*). In larger view, Southeast Asia is a region of concern with mangrove deforestation rates between 3.58 – 8.08%, while across the globe, mangrove reduction was estimated between 0.16 – 0.39% (*Hamilton and Casey 2016*).

Several publications have acknowledged that mangrove forests are a globally important source of carbon storage due to their high carbon assimilation and flux rate (*Bouillon et al. 2008; Komiyama et al. 2008;*