

Research Article

Assessment of the Water and Sediment Quality of Tropical Forest Streams in Upper Reaches of the Baleh River, Sarawak, Malaysia, Subjected to Logging Activities

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The study of the impact of logging activities on water and sediment quality of Sarawak forest streams is still scarce despite Sarawak being the largest exporter of timber in Malaysia. This study was aimed at determining the water and sediment quality of forest streams in Sarawak and the potential impact of logging activities. *In situ* parameters were measured, and water and sediment samples were collected at six stations before rain. Additionally, water quality was investigated at three stations after rain. The results showed that canopy removal resulted in large temperature variation and sedimentation in the forest streams. Lower suspended solids were found at stations with inactive logging (<2 mg/L) compared to active logging (10–16 mg/L) activities. The highest concentration of total nitrogen and total phosphorus in water and sediment was 4.4 mg/L, 77.6 µg/L, 0.17%, and 0.01%, respectively. Besides, significantly negative correlation of sediment nitrogen and water total ammonia nitrogen indicated the loss of nitrogen from sediment to water. Water quality of the streams deteriorated after rain, in particular, suspended solids which increased from 8.3 mg/L to 104.1 mg/L. This study reveals that logging activities have an impact on the water quality of Sarawak forest streams particularly in rainfall events.

1. Introduction

Sarawak is the largest state in Malaysia with about 70% of the state categorized as forested land. Sarawak's forestry plays a significant role in its socioeconomic development. In 2012, the export earnings from timber and timber products in Sarawak were 2.4 billion USD [1]. The majority of Sarawak forests are subjected to logging which has been a major contributor to the Malaysian economy. It has been reported that Sarawak exported a total of 1,388,894 m³ of logs worth 244 million USD from January to June 2015, contributing 88.7% compared to Sabah's 10.5% and West Malaysia's 0.8% [2]. The high production of timber renders deforestation problems in

Sarawak. Deforestation and degradation of forests in Sarawak are occurring at a rate of 0.64% annually [3]. Nearly 80% of the land surface of Sarawak was impacted by previously undocumented, high-impact logging or clearing operations from 1990 to 2009 [4].

Deforestation often results in the degradation of water quality which includes an increase in temperature, sedimentation, and nutrient enrichment [5–9]. In Malaysia, soil loss from logging activities had been predicted to highlight the potential risk posed by logging within water catchment areas [10]. Besides, the amounts of sediment, wood, and detritus accumulations were examined in four headwater tributaries after timber harvesting in the Bukit Tarek Experimental