

**COMPARISON OF SOIL FEATURES AND
COMMUNITIES OF BACTERIA AND
ARTHROPOD BETWEEN OLD GROWTH AND
LOGGED FOREST IN SABAH**

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ABSTRACT

A key driver of land-use change in the tropics is commercial selective logging, which often results in changes to soil biological, chemical and physical properties. Understanding the changes in these properties is essential to evaluate the ecosystem functions of forests after a disturbance. The objectives of this research was 1) to investigate the abiotic (physicochemical) difference between old growth forest soil and logged forest soil; 2) to determine the biotic difference (microbial biomass, leaf-litter arthropod abundance and bacterial community) of soils in old growth and logged forest; and 3) to investigate the relationship between soil abiotic and biotic properties of old growth and logged forest. Soil and arthropod litter samples were collected from old growth forest (OG) and logged forest (LF) in the Stability of Altered Rainforest Ecosystem (SAFE) Project, Sabah. Soils were separated into three parts based on the layer depth. It was found that the organic layer of the logged forest had the highest phenolic content (8.08 ± 4.72 ug/ml) compared to old growth forest (4.63 ± 1.92 ug/ml). Dissolved organic carbon was also found to be higher in logged forest (0.64 ± 0.16 ppm/g) than old growth forest (0.30 ± 0.11 ppm/g). Meanwhile, old growth forest had soils, which have a higher pH, organic matter and moisture content. Discriminant analysis showed that old growth and logged forest organic layer (O) were discriminated from organic mineral (OM) and mineral layer (M). The dominant parameter for OG-O was organic matter while total phenols was associated with LF-O. The trend continued with microbial biomass carbon being higher in logged forest (1.75 ± 1.10 mg/g) than old growth forest (0.79 ± 0.57 mg/g) indicating logged forest having an active decomposition by microbial community *Proteobacteria* (30.3%) and *Planctomycetes* (15.0%) dominated organic layer of old growth forest while *Actinobacteria* (30.5%), *Proteobacteria* (23.1%) and *Firmicutes* (14.7%) are found to be dominant in logged forests. An average of 123.73 ± 70.1 (17 taxa) arthropod individuals from old growth forest and 45.59 ± 26.7 (15 taxa) individuals from logged forest were found. While the abundance was significantly different between forest types, the community composition did not significantly change. Multivariate analysis revealed that soil properties are potential regulators of the arthropod community composition based on its functional group. We conclude that both old growth and logged forest gave significant difference based on selected physical and chemical properties and affects the faunal communities. Based on the results from this investigation, there are sufficient evidence to proof that logging practices to have a reducing impact on the ecosystem function of the tropical rainforest. However, further data is needed to give a more detailed description of the effected ecosystem functions.

ABSTRAK

PERBANDINGAN SIFAT-SIFAT TANAH DAN KOMUNITI BAKTERIA DAN ATROPODA ANTARA HUTAN DARA DAN HUTAN DIBALAK DI SABAH

Penyebab utama perubahan penggunaan tanah di kawasan tropika adalah pembalakan komersil yang sering menyebabkan perubahan sifat-sifat biologi, kimia dan fizikal tanah. Memahami perubahan dalam sifat-sifat ini adalah penting untuk menilai fungsi ekosistem hutan selepas sesuatu gangguan. Objektif kajian ini adalah 1) untuk mengkaji perbezaan abiotik (fizikal dan kimia) antara tanah hutan dara dan hutan dibalak; 2) untuk mengkaji perbezaan biotik (biomas mikrobial, atropoda dan komuniti bakteria) antara tanah hutan dara dan hutan dibalak; dan 3) untuk mengkaji hubungan antara ciri-ciri abiotik dan biotik tanah di hutan dara dan hutan dibalak. Sampel diambil dari hutan dara (OG) dan hutan dibalak (LF) di SAFE, Sabah. Tanah telah dipisahkan kepada tiga bahagian berdasarkan lapisan. Ia didapati bahawa lapisan organik OG mempunyai kandungan fenolik tertinggi (8.08 ± 4.72 ug/ ml) berbanding LF (4.63 ± 1.92 ug / ml). Karbon organik terlarut juga didapati lebih tinggi dalam hutan dibalak (0.64 ± 0.16 ppm / g) berbanding dengan hutan dara (0.30 ± 0.11 ppm / g). Sementara itu, LF mempunyai mempunyai pH, bahan organik dan kandungan lembapan tanah yang lebih tinggi. Analisis diskriminan menunjukkan bahawa lapisan organik (O) tanah daripada hutan dara dan hutan dibalak berbeza daripada lapisan organik mineral (OM) dan lapisan mineral (M). Parameter dominan untuk OG-O adalah bahan organik manakala jumlah fenol dikaitkan dengan LF-O. Trend ini berterusan dengan biomas mikrobial karbon yang lebih tinggi di hutan dibalak (1.75 ± 1.10 mg / g) daripada hutan dara (0.79 ± 0.57 mg/g) yang menunjukkan hutan dibalak mempunyai aktiviti aktif dalam penguraian oleh komuniti mikrobial. Proteobacteria (30.3%) dan Planctomycetes (15.0%) mendominasi lapisan organik hutan lama, manakala Actinobacteria (30.5%), Proteobacteria (23.1%) dan Firmicutes (14.7%) didapati dominan dalam hutan yang dibalak. Purata individu arthropoda dijumpai di hutan dara adalah 123.73 ± 70.1 (17 order) dan 45.59 ± 26.7 (15 order) individu daripada hutan dibalak. Walaupun jumlah individu berbeza dengan jenis hutan, komposisi komuniti artropoda tidak banyak berubah. Analisa mendedahkan bahawa sifat tanah berpotensi mengawal komposisi komuniti atropoda berdasarkan kumpulan fungsinya. Kesimpulannya, kedua-dua hutan dara dan hutan dibalak memberi perbezaan yang signifikan berdasarkan sifat-sifat fizikal dan kimia terpilih dan memberi kesan kepada komuniti fauna. Berdasarkan hasil penyelidikan ini, terdapat bukti yang mencukupi untuk membuktikan bahawa amalan pembalakan mempunyai kesan penurunan fungsi ekosistem hutan hujan tropika. Walau bagaimanapun, maklumat selanjutnya diperlukan untuk memberikan gambaran yang lebih terperinci tentang fungsi ekosistem yang dilaksanakan.