UNIVERSITI PUTRA MALAYSIA

COMPARISON OF SOIL RESPIRATION AND CARBON DYNAMICS UNDER DIFFERENT SITE CHARACTERISTICS OF SHOREA PELTATA AT TENGGAROH FOREST RESERVE IN JOHOR, MALAYSIA

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By

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October 2010

Chairman: **Associate Professor Mohamad Azani Alias, PhD**

Faculty: **Forestry**

Soil respiration is an indicator of biological activity of soil life. This activity is important to the soil system as healthy lungs are to use. A field experiment was conducted in Tenggaroh Forest Reserve, Johor to compare soil respiration and carbon dynamic of natural forest reserve under different density of *Shorea peltata*. The objectives of this study were: to investigate soil respiration under different site characteristics of *Shorea peltata*, to understand the factors that influence the occurrence of soil respiration in relation to vegetation association and to determine the relationship between soil respiration and soil physical properties under different density of *Shorea peltata*. Twenty observational plots 50 x 50 m with different density of *Shorea peltata* namely, rare (E1), low (E2), moderate (E3) and high (E4) were established in compartments 135 and 136. Each plot was divided into 25 subplots, and five subplots were selected at random for soil sampling. Soil samples consisting of topsoil 0 – 10 cm and 10 – 30 cm were taken to determine the physical and chemical properties. Environmental factors such as light intensity, wind speed, relative humidity, and air temperature were recorded in the study site using

environmental meter. For the lab analysis, the soil physical and chemical properties such as soil moisture content, soil texture, bulk density, particle density, porosity, pH, soil organic matter, total carbon, total nitrogen, and available of sulphur were analyzed. Soil respiration characteristics were also recorded at all sites of the study area with used LCpro+ instrument at 0 to 6 cm depth.

Results show that there are three layers of *Shorea peltata* species namely (1) dominant, (2) understorey and (3) shrubs. It was also observed that in certain localities, the abundance of this species were not very high. The results of soil respiration and carbon dynamic under different sites showed significant differences at $P<0.05$ among groups. Analysis for the relationship between soil respiration and environmental variables (correlation) showed that the light intensity, air temperature, soil moisture content, pH, texture, C, N, and sulphur were the important factors in the distribution of vegetation in Tenggaroh Forest Reserve. This implies that the site preferences and density of *Shorea peltata* were also influenced by these factors. The results of soil analysis showed that the soil physical properties were significantly different at ($P<0.05$) among groups. Certain physical properties such as moisture content and soil texture were significantly influenced the distribution of *Shorea peltata*. The environmental factors also showed a strong relationship with the distribution of *Shorea peltata.* Soil chemical properties were not significantly different among groups at ($P<0.05$). The degrees of acidity were extremely high in the study area. The overall status of the entire soil samples were relatively lower which showed that plants in the present study seem to be adapted to a relatively poor supply of N, S and acidic soil pH.

PERBANDINGAN PERNAFASAN TANAH DAN KARBON DINAMIK DENGAN CIRI BERBEZA DARI PLOT *Shorea peltata* DI HUTAN SIMPAN TENGGAROH DI JOHOR, MALAYSIA

Oleh

MUSALAM MOHAMMED ABDALMOULA

Oktober 2010

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Fakulti: **Perhutanan**

Respirasi tanah merupakan petunjuk aktiviti biologi kehidupan tanah. Kegiatan ini sangat penting untuk sistem tanah yang mempunyai pernafasan yang sihat. Percubaan lapangan dilaksanakan di Hutan Simpan Tenggaroh, Johor untuk membandingkan respirasi tanah dan dinamik karbon hutan di bawah kepadatan berbeza *Shorea peltata*. Tujuan kajian ini adalah untuk mengetahui ciri-ciri respirasi tanah yang berbeza dari pelbagai dirian *Shorea peltata* bagi memahami faktor-faktor yang mempengaruhi terjadinya respirasi tanah dan hubungannya dengan kesatuan vegetasi serta menentukan hubungan antara respirasi tanah dan sifat fizikal tanah dengan kepadatan berbeza dirian *Shorea peltata*. Dua puluh plot 50 x 50 m dengan kepadatan dirian *Shorea peltata* berbeza iaitu, jarang (E1), rendah (E2), sederhana (E3) dan tinggi (E4) dibentuk di kompartmen 135 dan 136. Setiap plot dibahagikan menjadi 25 anak petak masing-masing, lima anak petak kemudiannya dipilih secara rawak bagi persampelan tanah. Sampel tanah terdiri dari tanah lapisan atas (0 - 10 cm) dan pada kedalaman 10 - 30 cm diambil untuk menentukan sifat fizikal dan kimia tanah. Faktor persekitaran seperti keamatan cahaya, kelajuan angin,

kelembapan relatif, dan suhu udara turut direkodkan di kawasan kajian menggunakan alata "meter persekitaran". Bagi analisis makmal, sifat fizikal dan kimia tanah, kadar air, tekstur tanah, kepdatan pukal, ketumpatan zarah, porositi, pH, bahan organik tanah, jumlah keseluruhan karbon, jumlah keseluruhanl nitrogen, dan sulfur tersedia dianalisis. Ciri-ciri respirasi tanah juga dicatat menggunakan Radas LCpro+, diukur dari tanah lapisan atas iaitu pada kedalaman 0 hingga 6 cm.

Kajian ini mendapati terdapat tiga lapisan spesies *Shorea peltata* iaitu (1) dominan, (2) bawah naungan dan (3) syrub. Hasil juga mendapati bahawa di kawasan tertentu, taburan spesies ini tidak terlalu tinggi. Hasil dari respirasi tanah dan dinamik karbon menunjukkan perbezaan yang signifikan pada aras $P<0.05$ di antara kumpulan. Analisis untuk respirasi tanah dan pembolehubah persekitaran (korelasi) menunjukkan bahawa keamatan cahaya, suhu udara, kadar kelembapan tanah, pH, tekstur, C, N, dan belerang adalah faktor penting dalam taburan vegetasi di Hutan Simpan Tenggaroh. Ini bermakna bahawa kepadatan dan taburan *Shorea peltata* juga dipengaruhi oleh faktor-faktor tersebut. Keputusan analisis tanah juga menunjukkan bahawa sebahagian besar sifat fizikal tanah adalah berbeza dengan signifikan($P<0.05$) di antara kumpulan. Sifat fizikal seperti kadar air dan tekstur tanah mempunyai pengaruh yang signifikan terhadap taburan *Shorea peltata*.. Kimia tanah secara dasarnya tidak ketara menunjukkan perbezaan antara kumpulan pada aras $P<0.05$. Darjah pula keasidan sangat tinggi di kawasan kajian. Status semua sampel tanah yang relatif lebih rendah menunjukkan bahawa vegetasi di kawasan kajian ini boleh menyeseuaikan diri dengan bekalan N, S and pH tanah yang amat miskin.

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I certify that an Examination Committee has met on 22 October 2010 to conduct the final examination of Musalam Mohammed Abdalmoula on his Master of Science thesis entitled "Comparison of Soil Respiration and Carbon Dynamics Under Different Site Characteristics of *Shorea peltata* at Tenggaroh Forest Reserve in Johor, Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the student be awarded the relevant degree.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master science. The members of the Supervisory Committee were as follows:

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Date: February 2011

DECLARATION

I declare that the thesis is my original work except for quotations and citation which have been duly acknowledged. I also declare that it has not been previously and is not concurrently submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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Musalam Mohammed Abdalmoula

Date: 22 October 2010

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