

Development of Fire Management Programme For Peat Swamp Forest

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Introduction

Malaysia has about 2.4 million hectares of peatland which constitutes 7 % of the total land surface (Joseph et al., 1974). Lately, incidences of forest fire in Malaysia are on the increase. This is due to drought that occurred as a result of change in climatic pattern in the region due to El Nino effect. Fire suppression activities were difficult since the area was inaccessible and the fire was mostly below ground. As opposed to ordinary alluvial or lateritic forest soil which are compact and low in organic matter, peat soil has numerous air tunnels and woody substance of different sizes entangled in the ground. When there is fire, the dry fibres and oxygen availability in the ground enable not only for burning to take place but also for easy spread. It develops into natural kilns that keep the fire or amber alive for weeks even after intermittent rains.

The objectives of this study were to determine the meteorological factors that influence moisture in peat swamp forest, to determine the influence of moisture and inorganic in the combustibility of peat soil and to study the effect of fire on the vegetation and peat soil physical and chemical properties

Materials and Methods

This project was divided into two parts; field and lab study. The study was conducted in compartment 127 of Tanjong Karang Forest Reserves during two periods, namely: October 1999 to January 2000 and May 2000 to October 2000, while, the study on forest fire effects was conducted in compartment 132 from October 1999 to January 2000. The field study focused on the effects of forest fire to the vegetation and peat soil chemical and physical properties and the seasonal variability of water level and the moisture regime of peat swamp forest. Climatic water balance, drought occurrences analysis and drought index using Keetch-Byram Drought Index (KBDI) were used to describe climatic variations. Investigation on peat swamp forest condition included peat characteristics such as moisture content, pH, organic content, ash content, calcium, potassium, magnesium, sodium and water level. The laboratory study was conducted to investigate how moisture regime and inorganic component affect the smoldering combustion of peat soil. Heat content and combustion rate were measured to determine peat combustibility. All data obtained were analyzed statistically by using multivariate cluster analysis, univariate and multiple regression.

Results and Discussion

The study defined dry season and wet season as a period when monthly rainfall is similar or less than 125 mm and more than 125 mm respectively. The area has two drought periods, namely: January, February, and March as the first period and May to August as the second period. Statistically, the season affected moisture content, bulk density, potassium, magnesium, sodium and water level. By using weekly rainfall prediction, the critical peat moisture content to fire is 355 %.

Heat content is influenced by several factors in different manner. Among them are moisture content, bulk density or compactness of the fuel and chemical component of the fuels. The study revealed that heat content highly fluctuated with the moisture contents, it appeared to decrease with moisture content (Figure 4.33). The peat in the study area had high value of heat content, ranging from 7.133 KJ/g to 22.688 KJ/g (Table 4.29). This means that the peat soil is a good fuel and highly flammable. The minimum heat content was observed at the moisture content of 303 % and the maximum one was found at the moisture content of 11 %. Statistical analysis observed a direct relationship with relatively high correlation (79 %) between heat content and moisture content.

Study on peat combustibility suggested that peat in the study area is a good fuel in which has a high calorific value. This characteristic may have significant consequence to fire behaviour. The peat swamp forest has the potential to produce high combustion heat when it burned. Therefore, it may increase the air temperature and the flammability of the forest fuel. Combustion test suggested that peat combustion rate responses vary with moisture content, inorganic content and fuel texture. The high stages of KBDI in 1999/2000 were observed twice, namely on 25 and 26 April 2000. KBDI can be used in predicting moisture content and water level in the study area.

Conclusions

Peat characteristics varied with depths. Moisture contents, hydraulic conductivity, organic and sodium content increases with depths. On the other hand, pH, bulk density, ash content, calcium and potassium content decreases with depths. Regression model with heat content (Y) as a dependent variable and moisture content (X) as a predictor may be used to estimate the heat content of peat ($R^2 = 0.628$).

Water level in peat swamp forest is an important indicator of hydrological condition of the forest and peat moisture content. The study suggested the equations to predict water level by KBDI is as follows: $WL = -52.05 - 0.057 \text{ KBDI}$ ($R^2 = 0.472$)

Benefits from the study

Modelling the relationship between meteorological factors and peat soil moisture
Using the moisture regimes of peat soil as a basis for predicting the combustability of peat soil
Fire danger index which relates meteorological factors and fire risk

Patent(s), if applicable:

Nil

Stage of Commercialization, if applicable:

Nil

Project Publications in Refereed Journals:

1. Lailan, S and Ainuddin, A.N. 2000. Forest fire in peat forest: An overview. *J. Manajemen Hutan Tropika*. 6(1):75-83.

Project Publications in Conference Proceedings

1. Ainuddin, N.A. and Saidy, M. 2001. Keetch-Byram Drought Index Calculator (KBDIC) – A Windows-based Software for Forest Fire Risk Assessment. Abstract. In Symposium Programme and Abstract Malaysian Science Technology Congress 2001. 24-26 September 2001. Sabah. pp. 65
2. Ainuddin, N.A. , Kelvin G. and Jamaluddin B., 2001. Effect of forest fire on vegetation in Raja Musa Forest Reserve. Abstract in Symposium Programme and Abstracts Asian Wetland Symposium. 27-30 Ogos, 2001. Penang. pp. 36.
3. Lailan, S, Ainuddin, N.A. and Jamaluddin ,B. 2001. The effects of climatic factors on peat swamp forest condition: A case study in Sungai Karang Forest Reserve, Selangor. Abstract in Symposium Programme and Abstracts Asian Wetland Symposium. 27-30 Ogos, 2001. Penang. pp. 131
4. Lailan, S, Ainuddin, N.A. and Jamaluddin ,B. 2001. Fire effects on physical and chemical peat properties in Sungai Karang Forest Reserve, Selangor. . Abstract in Symposium Programme and Abstracts Asian Wetland Symposium. 27-30 Ogos, 2001. Penang. pp. 229
5. Fauzi, A.I, Lailan, S. and Ainuddin, N.A. 2000. Morphological study of fire affected peat soil in Sungai Karang Forest Reserve, Selangor. Proceedings SOILS 2000: Soil Science Conference of Malaysia. pp .129-131

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Lailan Syaufina	The effects of climatic variations on peat swamp forest condition and peat combustibility	Forest Fire	PhD	2002

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