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COMMUNICATION II

The Rate of Litter Production in Mangrove Forest at Siar Beach, Lundu, Sarawak

ABSTRAK

Penyelidikan kadar pengeluaran sesampah hutan bakau telah dilakukan di Pantai Siar, Lundu, Sarawak. Hutan ini mempunyai sembilan spesies pohon; spesies pohon yang dominan ialah Rhizophora mucronata, sementara R, apiculata sebagai spesies kodominan. Kadar pengeluaran sesampah ialah 5.72 t/ha/tahun, dan dari jumlah ini 4.49 t/ha/tahun (78.5%) adalah serasah daun. Corak kadar pengeluaran sesampah dan serasah daun berubah antara satu bulan dengan lainnya. Pengeluaran sesampah antara bulan April hingga Jun dan Disember hingga Februari lebih banyak berbanding dengan bulan-bulan lain.

ABSTRACT

A study of litter production was conducted at Siar Beach, mangrove forest, near Lundu, Sarawak. There are nine species of trees in this forest of which Rhizophora mucronata is the dominant and R. apiculata is the co-dominant species. The rate of litter production was 5.72 t/ha/year, and of this 4.49 t/ha/year (78.5%) was leaf litter. The production of litter fluctuates being higher during April to June and December to February compared to other months.

INTRODUCTION

Mangrove trees serve many functions. The ecological functions of mangrove as a land builder and coastline stabilizer have been described by McNae (1974) and de la Cruz (1979). Heald and Odum (1970) described mangrove as a spawning and nursery area for fishes and prawn. These functions, are closely related to the primary productivity of the mangrove. Several authors have conducted studies on the relationship of primary productivity of mangroves and its ecological and economic functions (e.g. Golley *et al.* 1962; Heald and Odum 1970; Odum 1971). They found that most of the organic debris that enriched the estuary were derived from adjacent mangrove forest. Thus, litter production plays an important role in maintaining the fertility of the mangrove ecosystem and supply of food material to the faunal life (Srivastava 1980). However, the rate of litter production varies from place to place, and between species dominating the site (Mathias 1974). Such differences can be seen from the work of Heald (1971) in Florida, Christensen (1978) in Thailand and Gong *et al.* (1984) in Matang mangrove forest, West Malaysia.

The production of litter of the mangrove forest at Siar Beach, near Lundu was studied in order to understand more about the productivity of mangrove ecosystems in Sarawak.

Study Area

The study area is located at Siar River Estuary, between latitudes 109° 52' E to 109° 53' E and longitudes 1° 44' to 1° 45' N (Wolfenden and Haile 1963). The estuary is about 12 km N - E of Lundu (*Fig. 1*). The river is about 2 m wide at low tide and 4 m wide at high tide.

The area is dominated by *Rhizophora mucronata* and *R. apiculata* is co-dominant (Saberi 1984). The other species that can be found in the area are *Bruguiera gymnorrhiza, B. parviflora, B. cylindrica, Avicennia alba, Lumnitzera sp., Nypa fruticans, Oncosperma sp.* and a fern *Acrosticum sp.*

The soils of the area derived from biotite adamellite rocks. The climate is reasonably wet, highest precipitation occurring in January, and lowest in March. The total precipitation is 4260 mm per year. The temperature varies between

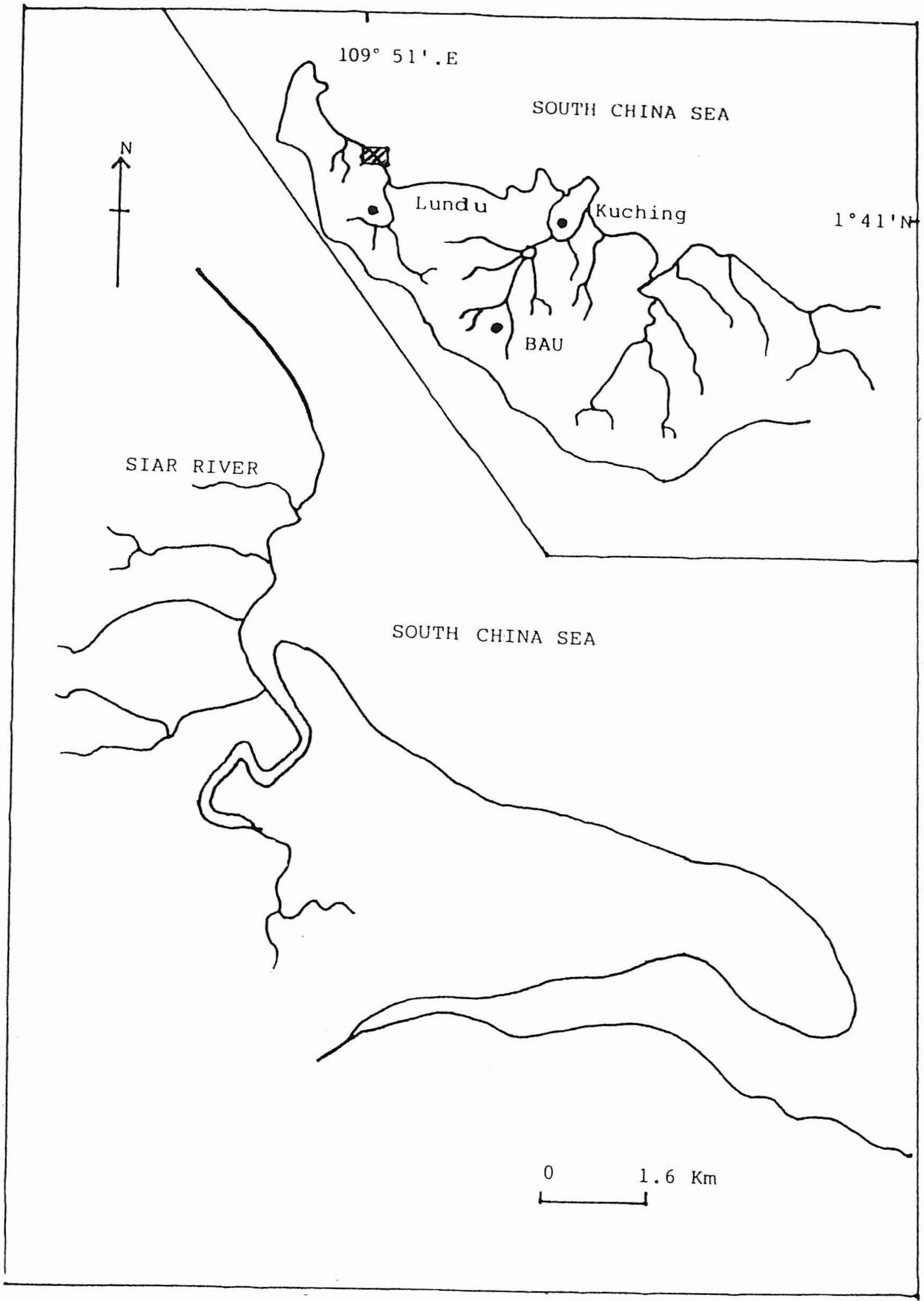

Fig. 1. Siar beach of Lundu, Sarawak.

25° - 28°C, the lowest being in January and higher in May *(Fig. 2)*.

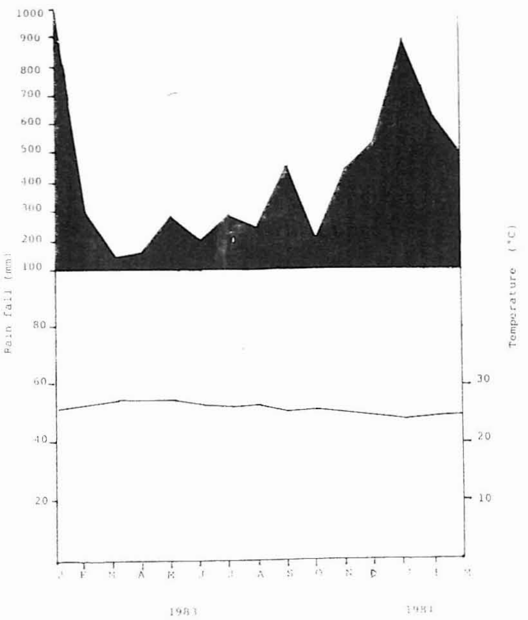

Fig. 2. The climatic diagram for Kuching, Sarawak.

MATERIALS AND METHODS

Plant litter was collected in a trap made of sail-cloth, with a square wooden-frame opening measuring 50 x 50 cm. The trap was placed 1m above the ground. Fifteen such litter traps were sited randomly beneath the trees, and their contents were emptied at the beginning of each month. The litter was sorted into leaves and a miscellaneous component. The litter was washed and oven-dried at 105°C to constant weight.

RESULTS AND DISCUSSION

The suitable size and form of litter-trap for sampling litter-fall in a tropical rain forest is not known. A study of previous work shows that a varied size of litter-traps were used. The smallest was 45 x 45 cm (Woodroffe 1982) and the largest was 200 x 200 cm (Duke et al. 1981). The form of the trap also shows variation. Mason (1970) had used round shaped traps instead of square, and Kira et al. (1967) used a long belt of plastic net as the trap. In this study a trap with a square opening measuring 50 x 50 cm was used. This size is within the range of the trap used by previous workers, and easy to handle while in the forest.

The total small litter and leaf litter production varies between forest and climatic regions. Generally leaf litter accounts for more than 50% of the total litter produced. However, the amounts of this litter may vary depending on the size of the traps used. For some forests, particularly mangrove, leaf litter could reach as high as 80%. A similar high percentage (78.5%) of leaf litter was detected in the mangrove forest at Siar Beach *(Fig. 3)*.

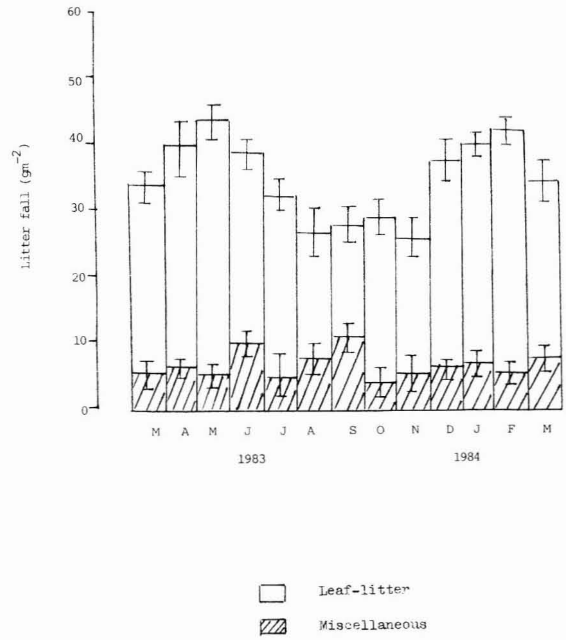

Fig. 3. The pattern of litter fall for 1983 and 1984 in a stand of Mangrove forest, Siar Beach, Lundu, Sarawak.

The mean values obtained for the mixed mangrove forest at Siar Beach are 5.74 and 4.49 t/ha/year for total small litter and leaf litter respectively. These values are significantly lower than those obtained for many tropical rain forest (e.g. Nye 1961; Bullock 1973; Gong et al. 1984). The leaf litter of this forest is about 40% lower compared to the values obtained for other mangrove forests. This could be due to the fact that the mangrove forest at Siar Beach is not as dense compared to other forests. Such situations have been highlighted by Gong et al (1984) for Matang mangrove forest, and Woodroffe (1982) for Tuff Crater, mangrove forest, Auckland New Zealand. The density of trees at Siar Beach is 166/ha (Saberi, 1984), and this value is about four times lower compared to other forests such as at Banyu Asin, Sumatera (Soekardjo and Kartawinata 1979), Sabah, Malaysia (Liew 1977) and in Florida, U.S.A. (Pool et al. 1977). However, there is no data available for comparison on the relationship between density and litter production in mangrove forests.

Litter production increased in March and April and reached its highest rate in May. It subsequently dropped in June, July and August and remained constant till November. It then increased again in December and reached its second peak in February. A similar pattern in litter fall has been reported for Pasoh (Lim 1978), Matang mangrove forest (Gong et al. 1984) and R. apiculata in Phuket, Thailand (Christensen and Wium-Anderson, 1977). The high production in May coincide with high temperature and draught. Gill and Tomlinson (1969 & 1971) in their studies of the red mangrove in South Florida, report peak rates of leaf fall and growth during summer months when air temperature and incident light were at their annual peaks. Similar results have been reported by Heald (1971). Snedaker and Lugo (1973) found indications that leaf fall increases during dry periods. According to Lugo and Snedaker (1975) the timing of these events has a significant interaction with the hydrologic budget and primary productivity of the forest community. The higher production in February cannot be explained in terms of biological processes. However, its does coincide with heavy winds of the South China Monsson and rainfall. Occasional storms have been reported to coincide with increased litter fall (e.g. Pool et al. 1975; Goulter and Allaway 1979).

Production of litter is relatively continuous, thus supplying the detritus food chain. The fraction exported to adjacent sea areas is not known, but many leaves are carried away by tides, especially at spring tides, before any degradation takes place.

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