

SAMPLING SPECIES DIVERSITY IN A MALAYSIAN RAIN FOREST: THE CASE OF A LOGGED-OVER FOREST

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Abstract

This study was carried out in a logged-over forest at Compartment 14, Ayer Hitam Forest, Puchong, on a randomly chosen 5-ha area (200m x 250m). The 5-ha plot contained a total of 6621 trees (for trees greater than 5cm dbh) which belonged to 319 species in 148 genera and 51 families and that is 11% species, 28% genera and 51% families of the total tree taxa found in Peninsular Malaysia. Endemism and new records were high, 33 species and 30 species respectively. A minimum contiguous area of 5-ha plot is recommended to capture species diversity in a tropical logged-over forest. The implications of the findings are herein discussed within the context of sample plot size, species diversity and conservation of logged-over forest.

Introduction

Efforts to comprehend the magnitude of richness of forest biodiversity have been mainly done through plot sampling although it can also be done at the macro level by using remote sensing (Malik & Hussain 2006a; 2006b). Besides representing the composition of the forest, the sample plot is also important in capturing the dynamics, production and regeneration capabilities in terms of number, size and species of a particular forest type. In biodiversity term, an ample sample plot size must be able to capture the diversity of a particular forest type. To date however, the sample plot size has been various and this makes sampling inconsistent. As plot setting and forest inventory are costly and time consuming activities, one is often encountered with the question 'What sample plot size is sufficient to capture forest species diversity'? Several researches in the past few years have been undertaken to know how much diversity is captured in 1-ha plot of a forest (Faridah-Hanum, 1999; Faridah-Hanum *et al.*, 1999a; Faridah-Hanum *et al.*, 1999b; Faridah-Hanum & Zamri Rosly, 2000; Mohd. Khairil, 2001). While results showed substantial species diversity in 1-ha plots, we were interested to find out if a larger sample plot size would capture greater diversity of a forest type. This paper attempts to highlight the findings of the study while trying to answer this question.

Materials and Methods

The study was conducted in a logged-over forest of Compartment 14 (279 ha), Ayer Hitam Forest, Puchong, Selangor which is about 30 minutes drive from the UPM Campus at Serdang. Logging activities had been carried out in the compartment between 1936 and 1966. The site is generally a lowland area up to 150 metres a.s.l. and is classified as a Kelat-Kedondong-Mixed Dipterocarp Lowland Forest (Faridah-Hanum, 1999).

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Five plots of 1-ha each (200 m × 50 m) were established and arranged contiguously using alphabets and numbers (Figure 1). A total of 500 quadrats each measuring 10m x 10m were also established in the 5-ha plot to give more accurate estimates of the species composition and density in less time (Wan Razali, 1980). All trees with diameter at breast height (dbh) greater than 5cm were enumerated and identified to the species, genus and family level.

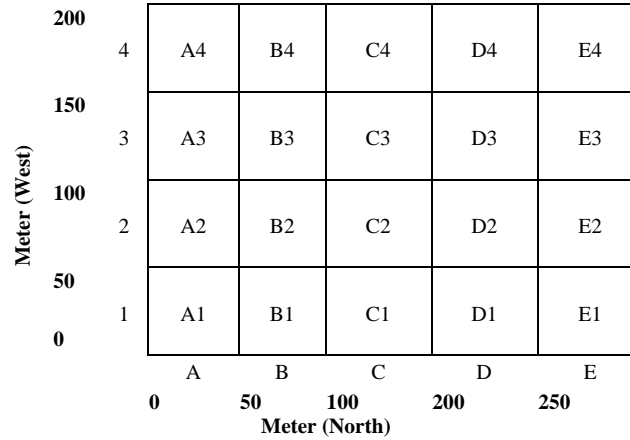


Figure 1: Detailed division of 5-ha plot

Results and Discussion

A total of 6621 trees enumerated in the 5-ha plot belonged to 319 species in 148 genera and 51 families. The individual species composition of the 1-ha plots within the 5-ha plot is shown in Figure 2. Figure 3 shows the accumulative number of species with increasing hectare within the 5-ha plot. The total number of species enumerated increased from the first to the fifth hectare with a range of 9 to 35 species. However, the incremental species number decreased with every additional hectare and was left at 9 species in the fifth hectare (Figure 4). If the size of the plot were increased to more than 5-ha, the increment of the species may probably become lower than nine and then remain constant. This assumption was based on a study conducted in the virgin 50-ha plot at Pasoh where the increment remained at 8 species if the plot size was greater than 30-ha (Manokaran & LaFrankie, 1990).

The number of genera increased from three to five with increasing hectare but did not increase anymore in the fifth hectare. In term of family, there was only one addition each in the first four hectares but none in the fifth hectare. This means that the more ideal sample plot size is a larger plot to capture greater species diversity, which is definitely not 1-ha but at least a contiguous area of 5-ha plot for a tropical lowland logged-over forest. Interestingly enough, an earlier study in a Virgin Jungle Reserve at Pasoh 50-ha plot also found a contiguous area of 5-ha sufficiently large to sample and detect tree distribution by species group and class size with 95% probability of finding trees belonging to the same species group (Wan Mohd. Shukri *et al.*, 1997).

Accumulative species composition within the sampling area

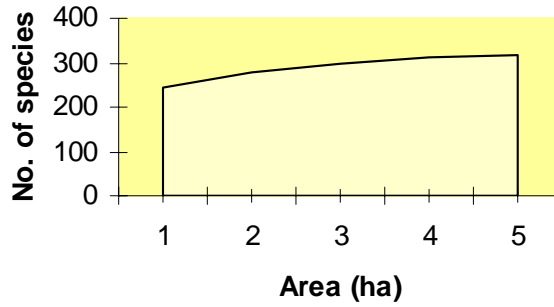


Figure 2:

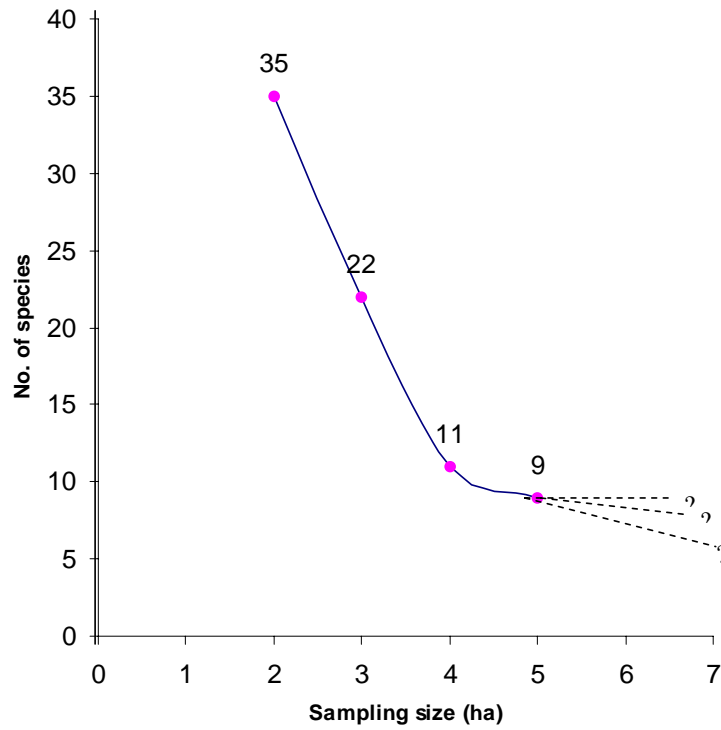


Figure 3: Species increment curve in contiguous 5-ha plot of a tropical logged-over forest at Ayer Hitam, Selangor

Results also showed the 5-ha plot to house 11% species, 28% genera and 51% families of the total tree taxa found in Peninsular Malaysia (Table 1). When compared with previous 1-ha plot studies conducted in the same area (Faridah-Hanum & Zamri Rosly, 2000; Faridah-Hanum *et al.*, 1999a; Mohd. Khairil, 2001) only about 3-6% tree species diversity of Peninsular Malaysia were captured in 1-ha which was approximately half the diversity captured in a 5-ha plot (Table 1). The 5-ha plot also recorded 33 endemic tree species for Peninsular Malaysia and 30 new records (or recorded for the first time) for the state of Selangor. Six rare tree species in Peninsular Malaysia were also found in this plot together with one uncommon species, *Artocarpus lowii* (Faridah-Hanum *et al.*, 2001a; Turner, 1995a; 1995b; Corner, 1952).

The diversity captured in a logged-over forest as exemplified by the Ayer Hitam Forest (AHFR) is sufficient in displaying arrays of plant diversity which not only constitute the green lung of the Klang Valley but also displaying patterns of distribution which are interesting from the botanical point of view. Besides housing 7% endemic tree species of the peninsula (i.e. species that grows in a specific area and has restricted distribution), AHFR also contains the montane elements, which are species known to occur on the mountains of Peninsular Malaysia; southern floristic elements, which are species occurring south of Selangor, i.e. Negeri Sembilan, Malacca and Johore; and the northern floristic elements, which are species found north of Selangor to beyond Perlis i.e. Thailand and Burma (Faridah-Hanum *et al.*, 2001a; Faridah-Hanum *et al.*, 2001b). With AHFR possessing these kind of diversity, the charisma of AHFR in garnering support for its conservation into perpetuity remains the immediate challenge.

Table 1: Comparison of various tree taxa diversity (>5cm dbh) studies in Ayer Hitam Forest, Puchong.

Category	1-ha plot		5-ha plot	Peninsular Malaysia	
	Faridah-Hanum <i>et al.</i> (1999)	Faridah-Hanum & Zamri Rosly (2000)	Mohd. Khairil (2001)	This study	Ng (1991)
Family	44	31	40	51	100
Genus	92	60	90	148	532
Species	177	80	137	319	2830

Conclusion: A plot size of 5-ha is sufficient to capture family and generic diversity of a tropical lowland logged-over forest. Until more work is done to find out at which hectare the species number stops increasing, a minimum size of a contiguous area of 5-ha is recommended to capture species diversity of the same forest type. This is supported by the richness presently captured in a 5-ha plot at Ayer Hitam, not only in the tree species recorded but also the amazing list of endemics and new records for the state of Selangor, coupled with rare and uncommon species. These findings shed light to a frequently asked question on the size of forest sampling required to capture diversity 'How much is enough?' The findings also proved the general perception of logged-over forest being poor forests misleading. The richness of logged-over are often underestimated and as a result many have given way to development. This situation is excellently exemplified by the Ayer Hitam Forest, Puchong (originally at ca. 10 000 ha) but eventually paved way for highways and housing projects. Now left at 1248 ha, it is the only larger chunk of green lung left in the Klang Valley and it houses at least 11% of the total tree species

found in Peninsular Malaysia. It is also home to about 7% endemic trees and remains the only focal point identified scientifically this far in the State of Selangor where the northern and southern floristic elements meet in the peninsula.

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