



Original Research Article

Flora Diversity of Pulau Tekak Besar, Tasik Kenyir, Hulu Terengganu, Malaysia

G. Mohd. Norfaizal*, H. Masrom and M. Muhammad Radzali

Strategic Resources Research Centre, MARDI Headquarters, 43400 Serdang, Selangor Darul Ehsan, Malaysia

*Corresponding author.

Abstract	Keywords
<p>Tasik Kenyir which is located in the South West of Terengganu, is known as the largest man-made lake in South East Asia. The lake covers an area of 202 hectare and is surrounded by a total of 4,975 hectares of tropical forest. Tasik Kenyir is a showcase of 340 islands. The islands on Tasik Kenyir are the tips of hilltops which were not submerged during the flooding process. Realizing the potential of Tasik Kenyir as an ecotourism site, the local Authority of Terengganu has declared Tasik Kenyir as an ecotourism zone and Pulau Tekak Besar will be developed as a rare fruits park by 2012. Plant surveys were conducted to document the plant diversity in this area before the development work began. The inventorization of the flora was carried out along three nature trails in Pulau Tekak Besar. The plants then identified and tagged for our documentation. As a result, 43 species of plants from 17 families were identified and collected. Vegetation in this island was dominated by the Dipterocarpaceae family, with <i>Shorea</i> being the dominant species with a total number of 380 trees. However, the species inventorized in this area resembles the ordinary lowland dipterocarp forest characteristic and no new plant species record documented.</p>	<p>Flora diversity Pulau Tekak Besar Tasik Kenyir Hulu Terengganu Malaysia</p>

Introduction

Tree diversity is a basic and fundamental thing to the vast volume of the forest biodiversity in tropical region (Huston, 1994; Whitmore, 1998; Longman and Jenik, 1987). Tree and flora diversity varies greatly from place to place due to variation and biogeography, whether in coastal, inland, islands or montane area (Whitmore, 1998). It is important to study the variation

of flora diversity to documents their occurrence for our diversity record. One of the important water body reservoir area in Malaysia is Tasik Kenyir. Tasik Kenyir is the largest man made water body in Peninsular Malaysia. It is situated in Hulu Terengganu near the Kelantan border between 30° – 31' N and 102° 3' E in the low lying, undulating plain between

the Main Range in the West and hill ranges to the East. This 61,000 ha catchment area is the watershed for many river systems. Among the islands is Pulau Tekak Besar, which is about 200 – 500 m long and 200 m wide. The highest peak is about 160 m from sea level and the temperature here ranges from 23°C – 30.4°C. This island is located in the north of Tasik Kenyir (50° 10' 07" U and 1020° 44' 16" T) covering an area of 5 ha and will be developed into an eco-tourism and educational park based on agroforestry approach. Topographically, Pulau Tekak Besar is fairly sloping area, which represent the hilltop area before dam construction and much of other terrains are steeply sloping. Access to Tasik Kenyir is only via few several entry points, at the KETENGAH site management office at Hulu Terengganu. Tasik Kenyir has been inhabited by the indigenuous Semelai people for over 600 years. Their settlements are scattered around the edge of the swamps. The main objective of this study was to document the flora diversity of Pulau Tekak Besar so that the species diversity can be used in understanding its original diversity for future planning.

Materials and methods

Study area

The study was carried out on Pulau Tekak Besar, situated at the north parts of Tasik Kenyir, Terengganu, Malaysia (Fig. 1). This island was selected and developed as an ecotourism and educational park known as Taman Tropika Kenyir. Soil type was classified as Renggam series and the temperature ranged between 23°C to 31°C, with average evaporation rate at 5mm/day. The rainy season started usually in October and ended in January or February. The mean annual rainfall is 4200 mm of which 54% is precipitated during the months of November till January. The dry spell season is from February till September (Nor Ayshah Alia, 2013).

Field surveys

Aims and methods of the study: The main aims of this study were to conduct a plant inventory through general field collections at different times of year, as well as to include records of earlier herbarium collections of Tasik Kenyir flora and to highlight the conservation value of this habitat and the plants it harbours. This will provide baseline data on the flora of Pulau Tekak Besar, specifically in surrounding islands (Fig. 1) that can serve

as a useful tool for the authorities in-charge of protecting the site to monitor changes pattern to the flora.

Field visits: Visits were arranged to coincide with the major seasons and the major fluctuations in water levels. The preliminary visit fell within the dry months in the third half of the year (September 2008), when water levels were very low. Transects of 1000 m long and 10 width were established, depends on the trail and coverage area. A GPS (model: GARMIN GPSmap 60Csx) was used to determine the coordinates of each sampling site. One Research Assistant (recorder) and two field staff (for left and right side) is referred as a team. Trees above 15 cm DBH (diameter at breast height) of the three genera within transect were tagged with red ribbon for future assessment. Data recorded was height, DBH, GPS reading together with local and Latin name.

Collections were made of fertile vascular plants for herbarium specimens, but also of sterile specimens of major timber trees as vouchers. Plant identification and description were referred to Corner (1952), Ohash (1973), Saw (1997), Stone (1977), Turner (1995), Lee (1971), Henderson (1930) and Latiff et al. (1999). Specimens are deposited in the Malaysian Agricultural Research and Development Institute Herbarium and are recorded in the Agrobiodiversity Information System (AgroBIS) database. During the field survey, three trails were selected and botanised. Rapid assessment technique; i.e: plant listing based on trail survey was used during the survey to record the species composition and diversity. Standard collecting materials and methods and note taking were used (Bridson and Forman, 1992). Sterile materials known only at the family level are not included in the checklist, while taxa known only to the genus level e.g. *Garcinia*, *Mangifera* and *Durio* are included.

Fig. 1: Map of Taman Tropika Kenyir, Hulu Terengganu, Malaysia.



Results and discussion

Local names of plant species

The plant species recorded in the study area are provided in Table 1. Majority of the plant species surveyed during the study are locally given names by the inhabitants.

Table 1. List of species and their local names observed in Pulau Tekak Besar, Tasik Kenyir.

Local name	Scientific name
Kelat	<i>Syzygium sp.</i>
Meranti kepong	<i>Shorea ovalis</i>
Penarahan	<i>Horsfieldia sp.</i>
Penaga	<i>Mesua forrea</i>
Sesenduk	<i>Endospermum diadenum</i>
Minyak berok	<i>Xantophyllum sp.</i>
Mempening	<i>Lithocarpus sp.</i>
Meranti rambai daun	<i>Shorea acuminata</i>
Giam	<i>Hopea nutans</i>
Putat bukit	<i>Barringtonia scortechinii</i>
Penaga	<i>Mesua forrea</i>
Damar hitam pipit	<i>Shorea multiflora</i>
Nipis kulit	<i>Memecylon sp.</i>
Damar hitam katup	<i>Shorea balanocarpoides</i>
Meranti nemesu	<i>Shorea pauciflora</i>
Resak	<i>Vatica sp.</i>
Balau tembaga	<i>Shorea exelliptica</i>
Petaling	<i>Ochanostachys amentacea</i>
Ramin dara elok	<i>Gonystylus affinis</i>
Meranti melantai	<i>Shorea macroptera</i>
Mengkulang jari	<i>Heritiera javanica</i>
Tulang daing	<i>Millettia atropurpurea</i>
Rengas	<i>Gluta sp. / Semecarpus sp.</i>
Kedondong berantai bulu	<i>Santiria tomentosa</i>
Merawan bunga	<i>Hopea pubescens</i>
Nyatoh putih	<i>Palaquium obovatum</i>
Berangan	<i>Castanopsis inermis</i>
Kembang semangkuk jantung	<i>Scaphium macropodum</i>
Kayu arang	<i>Diospyros sp.</i>
Kungkor	<i>Archidendron splendens</i>
Asam kumbang	<i>Mangifera quadrifida var. quadrifida</i>
Keruing sol	<i>Dipterocarpus lowii</i>
Kedondong bulan	<i>Canarium littorale</i>
Kelat samak	<i>Syzygium sp.</i>
Mahang	<i>Macaranga triloba</i>
Meranti tembaga	<i>Shorea leprosula</i>
Jangkang	<i>Xylopiya ferruginea</i>
Kasah	<i>Pterygota alata</i>
Geronggang	<i>Cratoxylon formasum</i>
Bintangor daun panjang	<i>Calophyllum sp.</i>
Keruing mempelas	<i>Dipterocarpus crinitus</i>
Meranti pipit	<i>Shorea assamica</i>
Perah ikan	<i>Pimelodendron griffithianum</i>
Kempas	<i>Koompasia malaccencis</i>

Lowland dipterocarp forest

The area is the lowland dipterocarp forest type located some distance away from the main lake and formed a buffer zone next to the areas that have been developed for agrotourism purposes (Fig. 2). Typically, the dominant plant family in tropical lowland forests is Leguminosae and Dipterocarpaceae (Gentry, 1998). Referring to Whitmore (1998) and Richards (1952), most dominant family are Dipterocarps, and this supporting our survey in this area that was dominated from the members of *Shorea* genus. Lowland dipterocarp forest surrounding the Tasik Kenyir area is well developed and comprised typical dipterocarp – dominated lowland forest with a tall, closed canopy up to 30 - 40 m high that is often broken by emergents such as *Koompasia malaccencis* (Leguminosae), reflecting a density of 418 trees/ha. Tree communities in the study were dominated by medium sized trees, whereby the highest number of individuals with a total of 282 trees was within diameter class of 5.0- 14.9 cm. This area was dominated by *Shorea multiflora* (Dipterocarpaceae) with DBH of 55.7 cm.

Fig. 2: Site picture of the vegetation in Pulau Tekak Besar, Hulu Terengganu.



Dominant family group in this area is Dipterocarpaceae with 14 species namely *Shorea ovalis*, *S. acuminata*, *S. multiflora*, *S. balanocarpoides*, *S. pauciflora*, *S. excelliptica*, *S. macroptera*, *S. leprosula*, *S. assamica*, *Hopea nutans*, *H. pubescens*, *Dipterocarpus crinitus*, *D. lowii*, and *Vatica sp.* (Table 2). This is followed by Euphobiaceae family with 4 species, Guttiferae family with 3 species, Fagaceae family with also with 3 species and the other families with only one to two members representative. From this survey, there were seven species of rare and wild edible fruit species that are important for the plant

genetic resources for food and agriculture conservation programme and also food sources for the wild animals community here. There are *Mangifera quadrifida* var.

quadrifida, *Castanopsis inermis*, *Garcinia griffithii*, *Baccaurea parviflora*, *Barringtonia scortechnii*, *Archidendron splendens*, and *Canarium littorale*.

Table 2. List of species, scientific name and their frequency (dominant species).

Family	Scientific name	Frequency
Annonaceae	<i>Xylopi ferrugiana</i>	15
Anacardiaceae	<i>Gluta sp.</i>	3
	<i>Mangifera quadrifida</i> var. <i>quadrifida</i>	2
Dipterocarpaceae	<i>Shorea ovalis</i>	>65
	<i>S. acuminata</i>	>50
	<i>S. multiflora</i>	> 75
	<i>S. balanocarpoides</i>	53
	<i>S. pauciflora</i>	45
	<i>S. excelliptica</i>	48
	<i>S. macroptera</i>	25
	<i>S. leprosula</i>	23
	<i>S. assamina</i>	16
	<i>Hopea nutans</i>	30
	<i>H. pubescens</i>	67
	<i>Dipterocarpus crinitus</i>	34
	<i>D. lowii</i>	45
	<i>Vatica sp.</i>	30
Fagaceae	<i>Lithocarpus sp.</i>	9
	<i>Castanopsis inermis</i>	6
	<i>Koompasia malaccensis</i>	5
Guttiferae	<i>Mesua ferrea</i>	16
	<i>Callophyllum inophyllum</i>	7
	<i>Garcinia griffithii</i>	2
Euphorbiaceae	<i>Endospermum diadenum</i>	7
	<i>Macaranga triloba</i>	4
	<i>Pimelodendron griffithianum</i>	8
	<i>Baccaurea parvifolia</i>	3
Lechytidaceae	<i>Barringtonia scortechnii</i>	3
Melastomaceae	<i>Memeceylon sp.</i>	25
Myrtaceae	<i>Syzygium sp.</i>	80
Myristicaceae	<i>Horsfieldia sp.</i>	34
Leguminosae	<i>Archidendron splendens</i>	15
Thymeliaceae	<i>Gonystylus affinis</i>	2
Sterculiaceae	<i>Pterygota alata</i>	45
Burseraceae	<i>Santiria tomentosa</i>	34
	<i>Canarium littorale</i>	30
Sapotaceae	<i>Palaquium obovatum</i>	10
Ebenaceae	<i>Diospyros sp.</i>	27
Olacaceae	<i>Ochanostachys amentacea</i>	16

Conclusion

Tasik Kenyir including their neighbouring islands are sparsely populated. Most of the natural forest communities and habitats, especially those in the interior of the island were left intact. Because of its beautiful natural landscape Tasik Kenyir and its

neighbouring islands was proposed for tourism activities, especially with the establishment of rare fruits islands, bird watching activity, chalet developments and water recreation. Therefore the best possible use of the island is to leave the natural habitats in the present condition and efforts should be taken to develop more ecotourism activities, with

introduction of importance wild fruit trees in order to enhance its functionality in the future, as well as in ecosystem services. Conservation is the best form of sustainable development for Tasik Kenyir although the vegetation types found on Taman Tropika Kenyir are not much different from those found in the mainland Peninsular Malaysia.

Acknowledgements

The authors would like to express gratitude to the Unit Perancang Ekonomi Negeri (UPEN) Terengganu for funding the project. Thanks are also due to Mr Omar Yahyer, Mr. Mohd Nor Awalluddin, Mdm. Salmaniza Salleh for their technical assistance. The authors would also like to thank MARDI, Lembaga Kemajuan Terengganu Tengah (KETENGAH) and all the staff involved in the Taman Tropika Kenyir project for their support and encouragement.

References

- Bridson, A. D., Forman, L., 1992. The Herbarium Handbook. Revised Edn. Royal Botanic Gardens, Kew. 303p.
- Corner, E.J.H., 1985. The botany of some islets east of Pahang and Johore. Gardens' Bull. Sing. 38, 1-42.
- Gentry, A.H., 1988. Changes in plant community diversity and floristic composition on environmental and geographical gradients. Ann. Missouri Bot. Gard. 75, 1-34.
- Henderson, M. R., 1930. Notes on the flora of Pulau Tioman and neighbouring islands. Gardens' Bull. Sing. 5, 80-93.
- Huston, M.A., 1994. Biological Diversity: The Coexistence of Species in Changing Landscapes. Cambridge University Press, Cambridge.
- Latiff, A., Hanum, I.F., Ibrahni, A.Z., Goh, M.W.K., Loo, A.H.B., Tan H.T.W., 1999. On the vegetation and flora of Pulau Tioman, Peninsular Malaysia. Raffles Bull. Zool. 6, 11-72.
- Lee, D.W., Stone, B.C., Ratnasabapathy, M., Khoo, T.T., 1977. The Natural History of Pulau Tioman. Merlin Samudra Tioman Sdn. Bhd. 69 p.
- Longman, K.A., Jenik, J., 1987. Tropical Forest and Its Environment. 2nd Edn. Longman/Wiley, Harlow, New York.
- Nor Ayshah Alia, A.H., Tosiah, S, Norziana Z.Z., Abd. Jamil, Z., Radzali, M. M., 2013. Characterization of soil microbial functional diversity in Pulau Tekak Besar, Tasik Kenyir. J. Trop. Agric. Food Sci. 41(1), 95-108.
- Ohashi, H., 1973. The Asiatic species of *Desmodium* and its allied genera (Leguminosae). Ginkgoanal. 1-318 & 1-76.
- Richards, P.W., 1952. The Tropical Rainforests. Cambridge University Press, Cambridge.
- Saw, L.G., 1997. A revision of *Licuala* (Palmae) in the Malay Peninsula. Sandakania 10, 1-95.
- Stone, B.C., 1977. Annotated list of seed plants of Pulau Tioman. In: The Natural History of Pulau Tioman (Eds.: Lee et al.). pp.42-69.
- Turner, I.M., 1995. A catalogue of the vascular plants of Malaya. Gardens' Bull. Sing. 47, 10.
- Whitmore, T.C., 1984. Tropical Rainforests of the Far East. Clarendon Press, Oxford.
- Whitmore, T.C., 1998. An Introduction to Tropical Rainforests. 2nd Edn. Oxford University Press, New York.