# SURVEY OF RARE, THREATENED AND ENDANGERED PLANTS IN MARAI PARAI, KINABALU PARK

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## ABSTRACT

A field survey was carried out at Marai Parai, Kinabalu Park in Sabah during an expedition in October 2023 to investigate Rare, Threatened, and Endangered (RTE) plant species. The primary objective of this study was to evaluate the remaining population sizes of seven selected target species: *Elaeocarpus inopinatus* Coode, *Hedyotis protrusa* Stapf, *Melastoma maraiparaiense* K.M.Wong, *Saurauia leopoldii* K.M.Wong, *Symplocos trichomarginalis* Noot., *Timonius clementis* Merr., and *Urophyllum lineatum* Stapf. Five plots were established in areas where these target species were occuring. Among these target species, *Melastoma maraiparaiense* exhibited the highest density, while *Saurauia leopoldii* having the lowest density. It is imperative that conservation efforts prioritize *Saurauia leopoldii* due to its status as the rarest and most vulnerable target species among these plants.

Keywords: RTE plants, plant conservation, IUCN Red List, Sabah.

# **INTRODUCTION**

Rare, Threatened and Endangered (RTE) plants represent plant species that are at risk of extinction due to their limited population and restricted distribution. According to the IUCN Red List of Threatened Species, about 38% of plants in Sabah that have been assessed are considered threatened species, where they are classified under the Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) categories (Damit et al., 2023). The Marai Parai area stands out as a unique ecosystem because it lies on the ultramafic outcrop of Mount Kinabalu and is home to rich endemic flora, including several RTE plants.

Our aim in this study was to conduct field surveys targeting RTE plants in Marai Parai area and to assess the population size of the remaining individuals for each target species. The findings of this study will provide valuable insights and contribute to the analysis of the feasibility of *in situ* and *ex situ* conservation initiatives, ultimately aiding in the preservation of these threatened plant species.

# METHODOLOGY

## **Study Site**

Marai Parai is located near the south-west boundary of Kinabalu Park (Figure 1). It can be reached by trekking about 5 km from the nearest village, Kg. Kiau Nuluh, Kota Belud.



Figure 1. Location of Marai Parai within the Kinabalu Park area. (Inset: Location of Kinabalu Park in Sabah-marked in red-maroon colour).

## **Target Species**

Prior to field survey, past collection data of specimens collected from Marai Parai was extracted from the SAN Herbarium specimen BRAHMS database system. This dataset comprised 228 specimens representing approximately 150 species. Our main focus in selecting the target species was to prioritize species that are endemic to Marai Parai, particularly those classified as threatened species. The conservation status of the species in this checklist was crossreferenced to the IUCN Red List of Threatened Species. A total of 17 threatened species, consisting of four Endangered (EN) species and 13 Vulnerable (VU) species was identified. As a result, seven target species that met our criteria for selection in this expedition were selected, namely Elaeocarpus inopinatus, Hedyotis protrusa, Melastoma maraiparaiense, Saurauia leopoldii, Symplocos trichomarginalis, Timonius clementis and Urophyllum *lineatum*. They are particularly noteworthy as they are exclusively confined to the Marai Parai area, except for U. lineatum which also found in the adjacent areas (Chen et al., 2015; Coode, 1994; Noteboom, 1975; Pearce, 2004; Stapf, 1894; Wong, 2016; Wong, 2017). All selected target species are listed as VU in the IUCN Red List, except for H. protusa and S. trichomarginalis, which are yet to be evaluated (IUCN, 2023; Pereira et al., 2023). In order to enhance our understanding of the target species, comprehensive botanical information for each target species was gathered from a thorough review of all available literature sources.

## **Data Collection**

Five plots, each measuring either 20 m x 20 m ( $400 \text{ m}^2$ ) or 10 m x 10 m ( $100 \text{ m}^2$ ), were established within the Marai Parai area during the expedition (see Appendix I). Plot sites were chosen based on the presence of the target species. The size of the plots was determined based on the size of the target species. To establish the quadrat plots, four poles were fixed on each four corners. Within these demarcated areas, every individual plant of target species was identified and marked with coloured ribbons. The number of individual/clusters of the target species present in the quadrat was counted and recorded. The height of each individual was recorded. For tree species exceeding 2 meters in height and featuring distinctive trunks, the diameter at breast height (DBH) was also measured and recorded. In addition to this data collection, herbarium specimens were also collected to supplement our field data for future reference and analysis.

## **RESULTS AND DISCUSSION**

All seven target species were found during the expedition (see Appendix II). The list of target species, their respective quantities and plot description are detailed in Table 1. Each established plot covers an area of 400 m<sup>2</sup>, except for Plot No. 2 in 100 m<sup>2</sup>. This smaller plot size was due to the smaller size of *Melastoma maraiparaiense* and *Hedyotis protrusa*. Target species *H. protrusa* tends to grow in clump, complicating individual counts without disrupting its natural form. Therefore, *H. protrusa* was counted as clusters instead of individuals to minimize the disturbance to its habit.

Plot	GPS	Elevation	Plot	Target species	Number of		
No.	Coordinate	Elevation	size	Target species	individuals/clusters		
1	6.081836° N	1,679 m	$400 \text{ m}^2$	Timonius clementis	73 individuals		
	116.517500° E			Urophyllum lineatum	27 individuals		
2	6.081424° N	1,677 m	$100 \text{ m}^2$	Melastoma	25 individuals		
	116.516728° E			maraiparaiense			
				Hedyotis protrusa	6 clusters		
3	6.081832° N	1,682 m	$400 \text{ m}^2$	Symplocos	10 individuals		
	116.517407° E			trichomarginalis			
4	6.082198° N	1,637 m	$400 \text{ m}^2$	Elaeocarpus inopinatus	24 individuals		
	116.517975° E						
5	6.081467° N	1,841 m	$400 \text{ m}^2$	Saurauia leopoldii	1 individual		
	116.521597° E			_			

Table 1. Number of individuals/clusters of each target species in the established plots.

Figure 2 shows the density of each target species within the plot. *Melastoma maraiparaiense* exhibits the highest density among the target species, followed by *Timonius clementis* and *Urophyllum lineatum*. Our observations confirm that these three species are notably common and abundant throughout Marai Parai, beyond these established plots.

Conversely, *Saurauia leopoldii* displays the lowest density, with only one individual plant discovered within the plot. Despite extensive searches in the surrounding area, no additional individual of *S. leopoldii* were found. This rarity renders *S. leopoldii* particularly the most vulnerable among the target species and susceptible to any disturbances or environmental changes.



Figure 2. The density of each target species in the plot.

The height distribution of all target species is presented in Figure 3. The tallest plant among the target species is *Timonius clementis*, reaching up to 12 meters in height. However, majority of the *T. clementis* individuals are shorter, mostly measuring below 4 meters tall. This demonstrate a greater number of seedlings, which can be indicative of good regeneration that suggests successful reproduction and potential for future population growth (Dhaulkhandi et al., 2008). The smaller plants are *Melastoma maraiparaiense*, *Hedyotis protrusa* and *Saurauia leopoldii*, all considered as shrubs with the majority standing at less than 1 meter in height.



Figure 3. The distribution of height data of target species.

The diameter at breast height (DBH) data was gathered only from *Timonius clementis* and *Elaeocarpus inopinatus* (Figure 4). While most trees in their populations exhibit smaller DBH values, outliers indicate the presence of significantly larger trees within these species.



Figure 4. The distribution of DBH data of target species.

Among our expedition's herbarium collection, one notable collection is the fruiting specimen of the target species *Elaeocarpus inopinatus* (SAN 161957). When it was first described as a new species by Coode (1994), the absence of fruiting specimens left the characteristics of its fruits become unknown. The discovery of this fruiting specimen of *E. inopinatus* not only fills a crucial gap in taxonomic research of the species, but also facilitates the comparisons with other closely related species, such as *E. lawasii, E. beccarii* and *E. cordifolius*.

### RECOMMENDATION

During the survey, there were no pressing issues or threats to both the habitat at Marai Parai and to the target species observed. However, given the highly localized distribution and hyperendemism of these species within Marai Parai, we recommend formulating species-specific plant conservation plans. Priority should be given to the rarest and most vulnerable target species, specifically *Saurauia leopoldii*. The following approaches can be considered integral components of these plans:

- a. Conduct regular monitoring of the targeted species populations to assess their population trends.
- b. Undertake research to better understand the targeted species' ecology, reproductive biology, and factors contributing to their vulnerability.
- c. Establish *ex situ* collection in nursery, arboretum or botanical gardens, to safeguard genetic diversity and provide a backup in case of catastrophic events in Marai Parai.

### LIMITATIONS

Although this study has yielded important preliminary findings, this study had several potential limitations. Due to time constraint, only five plots were established and only one plot representing each target species. This small sample size may not comprehensively represent the population dynamics of each species across the entire Marai Parai area. The site selection

for plot establishment was based on the accessibility of the area and the occurrence of the multiple target species, which could introduce selection bias and potentially affecting the accuracy in capturing the abundance of the target species. Additionally, this study provided only baseline data from a single expedition. To fully understand the population trends and the impact of environmental changes on each target species, long-term monitoring and extensive data collection are necessary for further research.

#### CONCLUSION

*Melastoma maraiparaiense* exhibited the highest density at Marai Parai study area, followed by *Timonius clementis, Urophyllum lineatum, Hedyotis protrusa, Elaeocarpus inopinatus* and *Symplocos trichomarginalis.* The lowest density observed in the survey was for *Saurauia leopoldii*, with only one individual found. It is imperative that conservation efforts prioritize *Saurauia leopoldii* due to its status as the rarest and most vulnerable among all target species surveyed.

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Survey of Rare, Threatened and Endangered Plants in Marai Parai, Kinabalu Park

# APPENDIX

PLOT 3 PL

Appendix I. The location and elevation profile of all plots established at Marai Parai.

The locations of the plots along the Marai Parai ridge.

Graj	ph. Min, Avg, Max	Elevation: 1669, 1	739, 1849 m						
1849 m	Range Totals	Distance: 796 m	Elev Gain/Loss, 199 m.	-18.6 m Max Slope: 5	3.7%, -26.4% Avg Slope.	25.2%6.8%	 1.12		
1825 m							 		 PLOT 5
1800 m							 		 
1775 m								_	
1750 m		_							
1725 m		_							_
Goog	ie Eart	1							
1669 m Image @	SUES / Airbus	PLOT 1	PLOT 2	PLOT 3	PLOT	4			
G Marai Pa	rai (			225 m					750 m 796 m

Elevation profile of plot locations at Marai Parai.

Appendix II. Photo gallery of seven target species enumerated at Marai Parai, Kinabalu Park.



(Melastomataceae)

maraiparaiense



Hedyotis protrusa (Rubiaceae)



Symplocos trichomarginalis (Symplocaceae)



Flowers of Hedyotis protrusa



Flower of Symplocos trichomarginalis



Fruits and inflorescence of *Elaeocarpus inopinatus* (Elaeocarpaceae)



Close up to the flower of *Elaeocarpus inopinatus* 



Saurauia leopoldii (Actinidiaceae)



Close up to the indumentum of Saurauia leopoldii