Evaluation of potential ornamental plants in Sg. Rawog Conservation Area, Sandakan, Sabah and it's conservation status

Jesleen Linus Dani[1], Andy Russel Mojiol[1#], Nurliza Hasmat[1], Colin Goh[2], Paul Liau[2]

1 Faculty of Tropical Forestry, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, MALAYSIA.
2 KTS Plantation Sdn Bhd, Lot 32, Bandar Pasaraya Commercial Complex, Mile 4, North Road, W.D.T. 20, 90009, Sandakan, Sabah, Malaysia
#Corresponding author. E-Mail: andy@ums.edu.my; Tel: +6088-320000; Fax: +6088-320876.

ABSTRACT Wild flora with high attractiveness and has been long prized for its beauty will be planted in gardens and other recreational places to enhance the landscape beautification. Foliage arrangement, branching pattern, and the presence of fruit and flower provide interest, variety and aesthetic appeal to landscapes and even to observers. This study was carried out in Sg. Rawog Conservation Area (SRCA) within the KTS Plantation vicinity. The main objective of this study was to identify ornamental plants, and their International Union Conservation of Nature (IUCN) categories based on conservation status and endemism by using the opportunistic sampling method. The selection of the ornamental plant is based on five criterions: 1) It has a good form, shape and size of the plant, 2) It has colorful flowers and fruits, 3) It has attractive colors and arrangement of the foliage, 4) it has good branching pattern, and 5) it is easy for plant to propagate. The survey was conducted twice, in June and August 2019, in existing trails. A total of 24 species belong to 17 different families. The highest number of potential ornamental plants found in Sg Rawog Conservation Area is the Tree (29.2%) followed by the Fern (16.7%) and Shrub (20.8%), Herb (12.5%), 8.3% of which are shared by two plants habit (Pitcher and Palm), and lastly, the lowest is Climber (4.2%). Most plants are in the category Not Evaluated based on IUCN Red List except *Dryobalanops aromatic*, *Dicranopteris linearis*, *Nepenthes ampularia*, and *Nepenthes mirabilis*. The findings of this study indicate that Sg. Rawog Conservation Area is a home to a large number of plants with the potential of to become ornamental plants, and it plays an essential role in the protection of these species in Sabah. More research may be required to expand the list of plants with the potential to become ornamental plants.

KEYWORDS: Ornamental plant, Conservation Status, Sg. Rawog Conservation Area, IUCN
Received 30 May 2023 **Revised** 13 June 2023 **Accepted** 23 June 2023 **Online** 10 July 2023

Original Article

INTRODUCTION

Ornamental plants are used for many purposes such as decorative purposes in gardens, home gardens, landscape design projects, and indoor plants. People's senses and aesthetic feelings have been captivated by ornamental plants and flowers for many years, resulting in the domestication of several species (Li & Zhou, 2005). They are now a commercial success since they have become increasingly popular in numerous communities and nations throughout time.

The decorative purposes answer to aesthetic values selected by people in various cultural contexts, e.g., in Western culture usually, that are related to some plant features: flowers, fruits, leaves, foliage texture, colour, and scent (Estrada-Castillón *et al.*, 2014). Moreover, some ornamental plants provide medical uses. *Tetracera scandens*, also known as Tambar among the Dusun ethnic group of Sabah, is an example. It has medicinal properties that aid in the treatment of conditions such as cough. The useful part of the plant is the stem (Kulip, 2014).

The aesthetic values of ornamentals are closely associated with religion and involve visual, aromatic and other features (Kumar et al., 2005). A study suggested by Garber (2009) that ornamental plants can also provide habitat to animals, for instance, a community of birds. It

provides food resources such as fruits, nectars, grains and insects, and shelter. Suzana *et al.* (2019) listed the criteria for selecting a potential ornamental plant.

IUCN Red List (International Union for Conservation of Nature) is globally known as a critical indicator of biodiversity health status as it is created to monitor species that are on the verge of extinction in the wild. Aside from monitoring the status of species, it is used together with other information for setting priorities in the process of gathering all species action plans (Fitzpatrick *et al.*, 2007) reserve selection and management (Simaika & Samways, 2009), and as indicators for the condition of the environment. Mace *et al*. (1993) stated in his paper that all methods that were used to overcome the severity of threat and likelihood of extinction of species in the wild were standardized in the 1990s by adding more objectives and quantitative criteria. Consequently, the criteria were globally implemented to classify the relative risk of extinction of species.

This study was conducted to explore existing trails (Trail 1 to Trail 12) and to record the vegetation that were chosen for this study. It is also conducted to provide baseline data regarding the diversity status of plants in SRCA as it will be useful for KTS forest management, especially for conservation purposes. The objectives of this study are to identify potential ornamental plants along the selected trails and to determine their IUCN Red List based on its conservation status.

METHODOLOGY

The opportunistic sample is a type of non-probability sampling method in which the plant in this trail was selected based on easy access and within the perimeter (Saumure & Given, 2008). The selection of potential ornamental plants is based on Suzana *et al*. (2019), where there are few criterions that need to be considered to select potential ornamental plants. The ornamental plants were gathered according to the following characteristics: 1) It has a good form, shape and size of the plant, 2) It has colorful flowers and fruits, 3) It has attractive colors and arrangement of the foliage, 4) it has good branching pattern, and 5) it is easy for plant to propagate. The survey site was done on 27 – 29 March 2019. The actual data collection was done twice, which was on 25 – 29 June 2019 and 4 – 9 August 2019. Plant species along the trails were identified and classified during data collection. However, plants that were unable to be identified were brought to a botany herbarium in ITBC, UMS for further identification. The IUCN (International Union for Conservation of Nature's) Red List of Threatened Species has been employed to verify the classification of each plant species based on its criteria importance such as extinct, threatened, lower risk and other categories. The location of study area and trails chosen is shown in Figure 1.

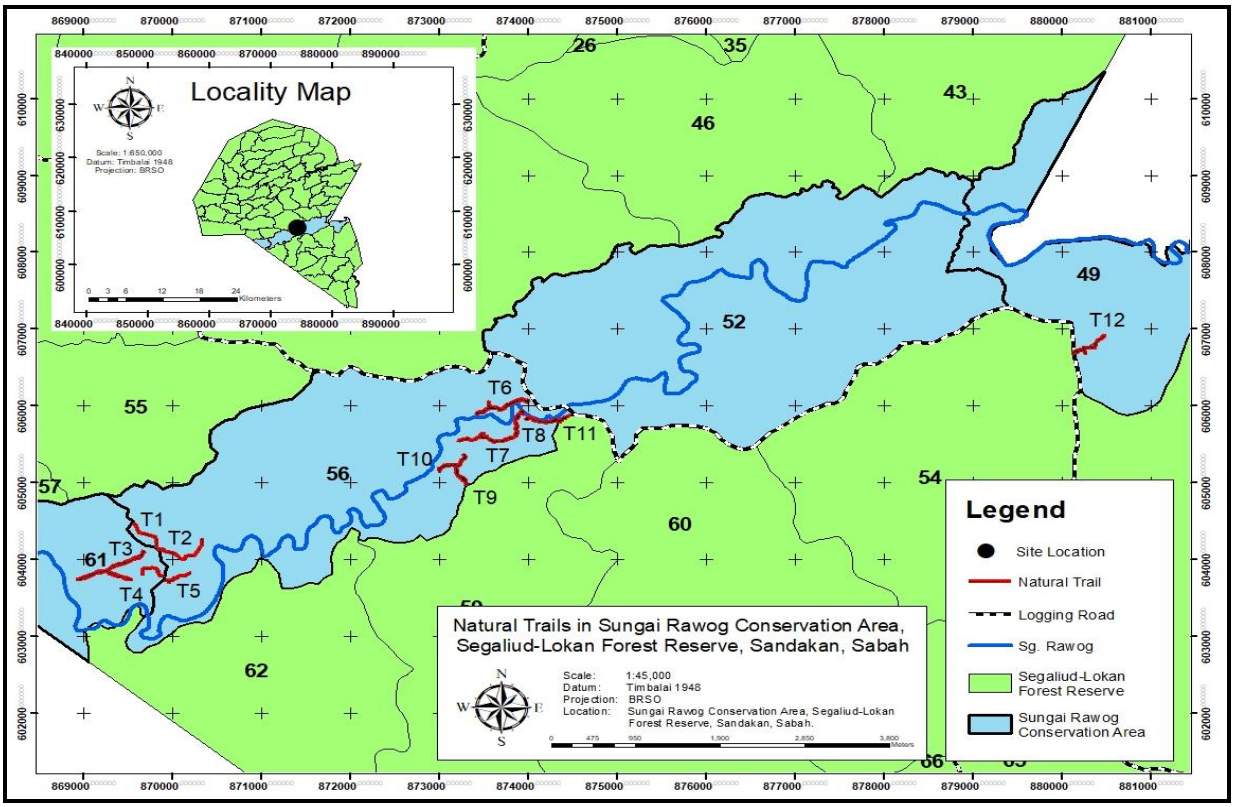

Figure 1. The location of study areas are from trail 1 (T1) to trail 12 (T12) at Sg. Rawog Conservation Area (SRCA), Sandakan

FINDING AND DISCUSSION

A total of 24 species of potential ornamental plants in 18 families had been recorded along the trails. All the potential ornamental plants in SRCA were collected in all selected trails. Five IUCN criteria were considered before collecting the plant. The following characteristics features; good form, shape and size of the plant, colourful flowers and fruits, attractive colours and arrangement of the foliage, good branching pattern, and ease of propagation of the plant (Mojiol *et al*., 2022; Suzana *et al*., 2019).

According to Table 1, plants species such as *Dillenia suffruticosa, Syzygium sp., Costus speciosus, Clidemia hirta, Melastoma malabathricum* and *Ageraratum conyzoides* that fulfil all the criteria of the ornamental plants' species selection. Whereas, *Tetracera scandens* or Mempelas is a wild plant that can be both an ornamental and medicinal plant. The locals also called it "Kertas pasir" because of its leaf's coarse surface. The plants have a medicinal value and the decoction of the plant's root helps to treat dysentery and diarrhoea, and muscle cramps (John *et al*., 2019). The plant is easy to propagate, and it has an interesting branching pattern.

Besides that, as shown in Table 2, most of the plant species that had been collected in SRCA were categorized as Not Evaluated (NE) while *Dicranopteris linearis*, *Nepenthes mirabilis* and *Nephenthes ampullaria* are under the Least Concern (LC) category. The species which is under Vulnerable (VU) category is *Dryobalanops aromatica* (Kapur) or commonly known as Borneo camphor. It is a critically endangered plant in the family Dipterocarpaceae due to the over-exploitation and forest disturbance. Besides, it has harvested because it contained oils or crystals containing borneol which is used for anti-inflammatory, analgesic, and fragrance (Aswandi & Kholibrina, 2021).

Table 1. List of ornamental plants in selected trails at SRCA

No	Family	Species name	Local Name	GH	a	b	c	d	e
1	Dilleniaceae	*Dillenia suffruticosa*	Pokok simpur	T	+	+	+	+	+
2	Dipterocapaceae	*Dryobalanops aromatica*	Kapur	T	+	-	+	+	-
3	Fabaceae	*Bauhinia diptera*	Tapak Kuda	T	+	-	+	-	+
4	Leguminosae	*Bauhinia sp.*	Bauhinia	T	+	-	+	-	+
5	Myrtaceae	*Syzygium sp.*	Jambu-jambuan	T	+	+	+	+	+
6	Pandanaceae	*Pandanus atrocarpus*	Mengkuang	T	+	-	+	-	+
7	Vitaceae	*Leea indica*	Mali-Mali	T	+	-	+	+	+
8	Apleniaceae	*Asplinium nidus*	Paku Sarang burung	F	+	-	+	-	+
9	Thelypteridaceae	*Pronephrium asperum*	Fern	F	+	-	+	+	+
10	Thelypteridaceae	*Pronephrium asperum*	Fern	F	+	-	+	+	+
11	Gleicheniaceae	*Dicranopteris linearis*	Fern	F	+	-	+	+	+
12	Araceae	*Alocasia sarawakensis*	Keladi hutan	H	+	-	+	-	+
13	Araceae	*Alocasia sp.*	Keladi hutan	H	+	-	+	+	+
14	Costaceae	*Costus speciosus*	Costus	H	+	+	+	+	+
15	Arecaceae	*Calamus sp.*	Palm	P	+	-	+	-	+
16	Arecaceae	*Licuala grandis*	Silad	P	+	-	-	+	+
17	Asparagaceae	*Dracaena sp.*	Dracaena	S	+	-	+	-	+
18	Melastomataceae	*Clidemia hirta*	Senduduk Hitam	S	+	+	+	+	+
19	Melastomataceae	*Melastoma malabathricum*	Senduduk Paksa	S	+	+	+	+	+
20	Dilleniaceae	*Tetracera scandens*	Mempelas	S	+	-	+	+	+
21	Verbenaceae	*Ageraratum conyzoides*	Rumput Tahi babi	S	+	+	+	+	+
22	Nephenthaceae	*Nepenthes ampularia*	Nepenthes sp	Pi	+	-	+	-	+
23	Nephenthaceae	*Nepenthes mirabilis*	Nepenthes sp	Pi	+	-	+	-	+
24	Piperaceae	*Piper porphyrophyllum*	Berawan	C	+	-	+	+	+

These are the list of ornamental plants found in the chosen trails. The plants were selected based on the ornamental criterions, then followed by determining the category of the IUCN status of each plant.

Note:

Habit: S – shrub; H – herb; T – Tree; C – climber; F – fern; Pi – Pitcher; P – palm

GH – Growth Habit

Criteria of ornamental plant selection (Suzana *et al*., 2019; Mojiol *et al*., 2022).

a. Good form, shape and size of the plant

b. Colorful flowers and fruits

c. Attractive colors and arrangement of the foliage

d. Good branching pattern

e. Ease of propagation of the plant.

Table 2. IUCN Red List status of ornamental plants

No	Family	Species name	Local Name	IUCN
1	Asparagaceae	*Dracaena sp.*	Dracaena	NE
2	Dilleniaceae	*Dillenia suffruticosa*	Pokok simpur	NE
3	Dipterocapaceae	*Dryobalanops aromatica*	Kapur	**VU**
4	Fabaceae	*Bauhinia diptera*	Tapak Kuda	NE
5	Leguminosae	*Bauhinia sp.*	Bauhinia	NE
6	Myrtaceae	*Syzygium sp.*	Jambu-jambuan	NE
7	Pandanaceae	*Pandanus atrocarpus*	Mengkuang	NE
8	Vitaceae	*Leea indica*	Mali-Mali	NE
9	Apleniaceae	*Asplinium nidus*	Paku Sarang burung	NE
10	Thelypteridaceae	*Pronephrium asperum*	Fern	NE
11	Thelypteridaceae	*Pronephrium asperum*	Fern	NE
12	Gleicheniaceae	*Dicranopteris linearis*	Fern	**LC**
13	Araceae	*Alocasia sarawakensis*	Keladi hutan	NE
14	Araceae	*Alocasia sp.*	Keladi hutan	NE
15	Costaceae	*Costus speciosus*	Costus	NE
16	Arecaceae	*Calamus sp.*	Palm	NE
17	Arecaceae	*Licuala grandis*	Silad	NE
18	Melastomataceae	*Clidemia hirta*	Senduduk Hitam	NE
19	Melastomataceae	*Melastoma malabathricum*	Senduduk Paksa	NE
20	Dilleniaceae	*Tetracera scandens*	Mempelas	NE
21	Verbenaceae	*Ageraratum conyzoides*	Rumput Tahi babi	NE
22	Nephenthaceae	*Nepenthes ampularia*	Nepenthes sp	**LC**
23	Nephenthaceae	*Nepenthes mirabilis*	Nepenthes sp	**LC**
24	Piperaceae	*Piper porphyrophyllum*	Berawan	NE

Note:

IUCN Category: Extinct (EX); Extinct in the Wild (EW); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threatened (NT); Conservation Dependent (CD); Least Concern (LC); Data Deficient (DD); Not Evaluated (NE) (Dublin, 2023).

CONCLUSION

In conclusion, Sg Rawog Conservation Area (SRCA) has numerous plant that can be identified as potential ornamental plants. There were 24 species of flora found in all selected trails. Most plants were assessed as Not Evaluated (NE) except for a plant species *Dryobalanops aromatica* (Kapur) This tree was assessed as Vulnerable (VU) due to over-exploitation for timber in South East Asian countries whereas *Dicranopteris linearis*, *Nepenthes mirabilis*, *Nephenthes ampullaria* are under Least Concern (LC) category. Hence, conservation efforts must continue effectively and efficiently to prevent them to go extinct in the wild. More research can be done in SRCA to collect more information whereas future studies can use a different approach which is related to flora and vegetation conservation, for example, by using the GIS approach. By doing so, this information can be used for making plans in conservation efforts and decision-making in the future. The importance of conserving plants is as crucial as animals, especially plants that are at risk of extinction.

ACKNOWLEDGEMENTS

This research was supported and funded by the Ministry of Higher Education 'FRGS/1/2020/WAB01/UMS/02/1'. The authors would also like to thank the anonymous reviewers for the invaluable suggestions to improve the accuracy and quality of the information written in this article.

REFERENCES

[1] Aswandi, A. & Kholibrina, C. R. 2021. New insights into Sumatran camphor (*Dryobalanops aromatica* Gaertn) management and conservation in western coast Sumatra, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 739(2021), 012061.

[2] Estrada-Castillón, E., Garza-López, M., Villarreal-Quintanilla, J. A., Salinas-Rodriguez, M. M., Soto-Mata, B. E., González-Rodriguez, H., González-Uribe, D. U., Cantú Silva, I., Carrillo-Parra A. & Cantú-Ayala, C. 2014. Ethnobotany in Rayones, Nuevo. León, México. *Journal of Ethnobiology and Ethnomedicine*, 10, Article number 62(2014).

[3] Dublin, H. 2023. *IUCN Red List of Threatened Species* (https://www.britannica.com/topic/IUCN-Red-List-of-Threatened-Species). Last accessed on 25 April, 2023.

[4] Fitzpatrick, U., Murray, T. E., Paxton, R. J. & Brown, M. J. 2007. Building on IUCN regional Red Lists to produce lists of species of conservation priority: a model with Irish bees. *Conservation Biology*, 21, 1324–1332.

[5] Saumure, K. & Given L. M. 2008. Convenience Sample. *In:* Given L. M. (Ed). *The SAGE Encyclopaedia of Qualitative Research Methods*. Los Angeles: SAGE Publications, Inc. pp. 124 - 125.

[6] John, S. V., Salegin, J. D., Patrick, M., Mojiol, A. R., & Lintangah, W. 2019. Medicinal plants of Sg. Rawog Conservation Area, Segaliud Lokan Forest Reserve, Sandakan, Sabah. Sabah Forestry Department and KTS Plantation Sdn. Bhd. 99-110.

[7] Kulip, J. 2014. The Ethnobotany of Dusun people in Tikolod village, Tambunan district, Sabah, Malaysia. *Reinwardtia*, 14(1), 101-121.

[8] Kumar, J. I., Soni, H., & Kumar, R. N. 2005. Aesthetic values of selected floral elements of Khatana and Waghai Forests of Dangs, Extreme Northern Part of Western Ghats, India. *Indian Journal of Traditional Knowledge*, 4(3), 275-286.

[9] Li, X. X., & Zhou, Z. K. 2005. Endemic wild ornamental plants from Northwestern Yunnan, China. *Hortscience*, 40(6), 1612–1619.

[10] Mace, G. M., Collar, N. J., Cooke, J., Gaston, K. J., Ginsberg, J., Leader-Williams, N., Maunder, M. & Milner-Gulland, E. J. 1993. The development of new criteria for listing species on the IUCN Red List. *Species*, 19, 16–22.

[11] Garber, M. 2009. *Environmental enhancement with ornamental plants: Attracting bird* (Circular 976, University of Georgia) (https://esploro.libs.uga.edu/esploro/outputs/report/Environmental-enhancement-with-ornamental-plants-attracting-birds/9949316111502959). Last accessed on 25 April, 2023.

[12] Mojiol, A. R., Lim, W. S., Chung, K. C. L., & Dani, J. L. 2022. The benefit of urban green area in Kota Kinabalu, Sabah. In IOP Conference Series: *Earth and Environmental Science*, 1053(1), 012001.

[13] Simaika, J. P. & Samways, M. J. 2009. Reserve selection using Red Listed taxa in three global biodiversity hotspots: dragonflies in South Africa. *Biological Conservation*, 142(3), 638-651.

[14] Suzana, S., Damit, A., Andi, M. A. & Sugau, J. B. 2019. *Potential Ornamental Plants of Sg. Rawog Conservation Area, Sabah.* Seminar on Sungai Rawog Conservation Area Scientific Expedition. Sabah Forestry Department and KTS Plantation Sdn. Bhd. pp. 100-110.