

## PLANT DIVERSITY OF QUANG TRUC FOREST IN DAK NONG PROVINCE, VIETNAM

Pham Thanh Trang<sup>1</sup>, Nguyen Thi Thu<sup>2</sup>, Hoang Thanh Luong<sup>3</sup>

<sup>1,2</sup>*Vietnam National University of Forestry*

<sup>3</sup>*Dak Nong Department of Forest Protection*

### SUMMARY

Quang Truc forest (QTF) is a remote area in the South-West of Dak Nong province, Vietnam, which is well known for valuable timber species representative for central highland of Vietnam with different globally and nationally threatened species. However, the general understanding of plant diversity of QTF has been still poorly known. The objectives of this paper are to figure out the plant diversity of QTF and compare that with other protected forest areas in Dak Nong province, in order to provide scientific evidences for conservation and sustainable development. The desk study, field work on transect sampling and PRA surveys were conducted to assess plant diversity in QTF in comparison with Ta Dung and Nam Nung Nature Reserves, Dak Nong province. A total of 654 plant species belonging to 132 families and five phylas were found for QTF from our current investigation. Also, there are up to 34 threatened species presented in QTF, 17 of which are listed in IUCN Red List, and 26 species listed in Viet Nam Red Book (2007). The finding of our research also indicated that number of plant families and species in QTF is lower than that of Ta Dung, but it is still significant compared to Nam Nung Nature Reserve.

**Keywords:** Biodiversity conservation, Dak Nong, endangered, plant diversity, Quang Truc forest.

### I. INTRODUCTION

Quang Truc forest (QTF) is a remote area in the South-West of Dak Nong province, which is well known for valuable timber species representative for central highland of Vietnam with different globally and nationally threatened species (Trinh et al., 2015). Also, it is an important habitat for some of Asia's rarest and most threatened mammal species. QTF shares borders with two rich biodiversity areas of Vietnam and Cambodia so it plays an important role in biodiversity connectivity and it is expected to harbor a significant number of rare and endemic species (Nguyen and Le, 2013).

Quang Truc forest contains one of very few areas with primary forest in central highlands of Vietnam (Nguyen and Le, 2013). This area is adjacent to other rich biodiversity areas and is an integral part of the large forest areas between Vietnam and Cambodia, and located on the exchange point of the exodus of plants from the north, namely, Tonkin, Yunnan–Guizhou, India–Myanmar floristic elements, with their representations belong to Fabaceae,

Magnoliaceae, Lauraceae, Fagaceae, Euphorbiaceae, Moraceae and gymnosperms; and migration flows from the south including Indo–Malaysia floristic element with representation belongs to Dipterocarpaceae. The plant resource of this area is expected to be high diversity and have endemic species representative for the southwest of Dak Nong province as well as for the whole Central Highlands (Nguyen and Hoang 2013). The recent study, Nguyen et al., (2014) mentioned some globally and nationally important plant species occurring in QTF which listed in IUCN Red List and Vietnam Red Book, e.g. (1) timber group such as *Azelia xylocarpa*, *Dalbergia oliveri*, *D. cochinchinensis*, *Pterocarpus macrocarpus*; (2) medicinal group such as *Drynaria roosii*; and (3) *Phalaenopsis* orchid group that has been found and used by local people for a long time. These above-mentioned timber species have been well known in QTF because they are very rare, precious, high demand and slowly growing species. The wood of these species was used to produce high-grade furniture for noble families

in Vietnam and China. With current over exploitation, it is predicted that these species will be disappeared from this area or even be extinct in the wild unless timely and appropriate conservation actions are taken. It is expected that there are more threatened species will be found in QTF if more field work in remote area is conducted.

Despite of biodiversity importance, the conservation effort from the government for QTF is still limited in comparison to two Nature Reserves of Dak Nong (Trinh et al., 2015). However, the general understanding of plant diversity of QTF has been still poorly known. Also, there has not been research carried out to determine its biodiversity yet. From ecological and conservation points of view, assessment of biodiversity of any habitat or locality has been regarded as one of the vital issue for careful preservation, promotion and management of the variety of life-forms (Alam and Masum, 2005). The objectives of this study are to figure out the plant diversity of QTF and compare that with other protected forest areas in Dak Nong province, in order to provide scientific evidences for conservation and sustainable development. With the finding from this research, it is expected to have timely intervention from the government for better conservation plan and further scientific research about flora of QTF.

## II. METHODOLOGY

### *Secondary data collection*

We used desk study method for secondary data collection of plant diversity data in Ta Dung and Nam Nung Nature Reserves from the previous studies, which were carefully assessed.

### *Field work*

Numerous field work were conducted to assess plant diversity in QTF. We used the current vegetation types map to identify the distribution of all the vegetation types in this area and then decide the transect locations. Six

transects were established around and from the base to the top of the hills so that they sample all six vegetation types on different slopes and reliefs. On each transect, there are systematically-spaced 15 plots of 20 m x 50 m size or 25 m x 40 m size depending on the slope. Timber species were recorded in the 1000 m<sup>2</sup> plots and herbal plants in 10 m x 10 m (100 m<sup>2</sup>) plots which are located within the 1000 m<sup>2</sup> plots. At each plot, a GPS reference is recorded for longitude, latitude and altitude. All plants are listed and annotated.

### *Identification of specimens and conservation assessment*

Identification of plant specimens were made based on the major literatures such as Pham Hoang Ho (1993, 2000, 2003), Nguyen Tien Ban (2000, 2003), and recent reports. These specimens were deposited in herbarium of Centre for Biodiversity, Vietnam National University of Forestry. Conservation assessment of the threatened species were followed IUCN Red List, the Vietnam Red Data Book, and the Degree No 32 issued by Vietnamese government about list of threatened species need to be conserved.

## III. RESULTS

### 3. 1. Plant diversity of Quang Truc forest area

#### *a. Diversity of plant species*

Although QTF is none of the forest protected area in Dak Nong province, there are up to 654 species belonging to 132 families and five phylas found in this forest area. The most species diversity phylum in QTF as well as two nature reserves is Magnoliophyta with 89% total species in QTF and 90%, 88% in Nam Nung and Ta Dung nature reserve respectively. By contrast, the phylum with smallest number of species is Psilotphyta which QTF is not presented by any species. The number of species and families, though, is lower than Ta Dung Nature Reserve, it is still significant in comparison to Nam Nung Nature Reserve (table 1).

**Table 1. Diversity of plant species in Quang Truc and comparison with Ta Dung and Nam Nung Nature Reserves**

No.	Taxa	Quang Truc forest		Nam Nung Nature Reserve		Ta Dung Nature Reserve	
		Number of species	%	Number of species	%	Number of species	%
1	Psilotophyta	-	-	1	0.11	1	0.07
2	Lycopodiophyta	5	0.76	4	0.45	10	0.71
3	Equisetophyta	1	0.15	1	0.11	2	0.14
4	Polypodiophyta	54	8.26	66	7.49	134	9.53
5	Pinophyta	9	1.38	10	1.14	8	0.57
6	Magnoliophyta	585	89.45	799	90.69	1251	88.98
<i>a</i>	<i>Magnoliopsida</i>	485	74.16	645	73.21	1004	71.41
<i>b</i>	<i>Liliopsida</i>	100	15.29	154	17.48	247	17.57
<b>Total</b>		<b>654</b>	<b>100</b>	<b>881</b>	<b>100</b>	<b>1406</b>	<b>100</b>

**b. Diversity of plant families**

A total of 132 plant families were recorded for the flora of Quang Truc. In which, Magnoliophyta is most diverse, followed by Polypodiophyta, Pinophyta, Lycopodiophyta, and Equisetophyta, but none of Psilotophyta

was recorded (table 2). The table 2 also showed that Ta Dung Nature Reserve is the most diversity area of plant families in Dak Nong, followed by Nam Nung Nature Reserve and QTF.

**Table 2. Diversity of plant families in Quang Truc and comparison with Ta Dung and Nam Nung Nature Reserves**

No.	Taxa	Quang Truc forest		Nam Nung Nature Reserve		Ta Dung Nature Reserve	
		Number of family	%	Number of family	%	Number of family	%
1	Psilotophyta	-	-	1	0.57	1	0.53
2	Lycopodiophyta	2	1.52	2	1.14	2	1.05
3	Equisetophyta	1	0.76	1	0.57	1	0.53
4	Polypodiophyta	18	13.64	22	12.57	24	12.63
5	Pinophyta	4	3.03	4	2.29	4	2.11
6	Magnoliophyta	107	81.06	145	82.86	158	83.16
<i>a</i>	<i>Magnoliopsida</i>	89	67.42	121	69.14	135	71.05
<i>b</i>	<i>Liliopsida</i>	18	13.64	24	13.71	23	12.11
<b>Total</b>		<b>132</b>	<b>100</b>	<b>175</b>	<b>100</b>	<b>190</b>	<b>100</b>

\* *Top 10 families with highest diversity of species*

The ten dominant families in Quang Truc forest (table 3) include 225 species (34.4% of the total). The most species rich family is

Euphorbiaceae. Others with significant species (more than 20) are Rubiaceae, Fabaceae, Poaceae, Moraceae. In contrast to the ten dominant families, 122 other families in QTF are presented by only 429 species (table 1).

**Table 3. Top 10 families ranked according to number of species**

TT	Scientific name	Species	% of total species
1	Euphorbiaceae	37	5.66
2	Rubiaceae	29	4.43
3	Fabaceae	28	4.28
4	Poaceae	27	4.13
5	Lauraceae	24	3.67
6	Moraceae	20	3.06
7	Asteraceae	16	2.45
8	Mimosaceae	15	2.29
9	Cyperaceae	15	2.29
10	Verbenaceae	14	2.14
<b>Total</b>		<b>225</b>	<b>34.4</b>

*\* Top 10 highest diversity genus*

The 10 most diversity genus are listed in the table 4 which include 71 species. The most species rich genus is *Ficus* belonging to

Moraceae. This is followed by *Dalbergia* (Fabaceae) and *Syzygium* (Myrtaceae) with 8 species. Others include from 5 to 6 species.

**Table 4. Top ten genus ranked according to number of species**

No.	Genus	Species
1	<i>Ficus</i>	16
2	<i>Dalbergia</i>	8
3	<i>Syzygium</i>	8
4	<i>Terminalia</i>	6
5	<i>Litsea</i>	6
6	<i>Lagerstroemia</i>	6
7	<i>Albizia</i>	6
8	<i>Dipterocarpus</i>	5
9	<i>Diospyros</i>	5
10	<i>Elaeocarpus</i>	5
<b>Total</b>		<b>71</b>

*c. Threatened species*

Besides the analysis of family and species diversity, this study primarily assessed the conservation status of threatened species in QFT, and compared to Nam Nung and Ta Dung Nature Reserves. The results are presented in the table 3.

There are up to 34 threatened species in QTF. 17 of which were listed in the IUCN Red

List (2016), 26 species were in the Vietnam Red Book (2007) and 6 species were listed in Degree 32/NĐ-CP/2006 issued by Vietnamese Government about threatened species need to be prioritized for conservation. Moreover, 17 out of 34 threatened species were found only in QTF and Ta Dung Nature Reserve, but not occur in Nam Nung Nature Reserve.

**Table 3. Threatened plant species in Quang Truc and comparison with Ta Dung and Nam Nung Nature Reserves**

No.	Family	Scientific Name	Vietnamese Name	IUCN	Degree No. 32	Vietnam Red Book (2007)	Ta Dung Nature Reserve	Nam Nung Nature Reserve	Quang Truc Forest
1	Polypodiaceae	<i>Drynaria bonii</i> C. Chr.	Tắc kè đá			VU	✓	✓	✓
2	Polypodiaceae	<i>Drynaria roosii</i> Nakaike	Cốt toái bổ			EN	✓	✓	✓
3	Cycadaceae	<i>Cycas micholitzii</i> Dyer	Tuế lá xê	VU	IIA	VU	✓	✓	✓
4	Cycadaceae	<i>Cycas siamensis</i> Miq.	Thiên tuế xiêm	VU	IIA		✓	✗	✓
5	Podocarpaceae	<i>Dacrycarpus imbricatus</i> (Blume) de Laub.	Thông nàng	LC			✓	✗	✓
6	Podocarpaceae	<i>Podocarpus neriifolius</i> D. Don	Thông tre	LC			✓	✗	✓
7	Annonaceae	<i>Goniothalamus vietnamensis</i> Bân	Bồ bèo đen			VU	✓	✓	✓
8	Apocynaceae	<i>Rauwolfia verticillata</i> (Lour.) Baill.	Ba gác lá vòng			VU	✓	✗	✓
9	Sapindaceae	<i>Amesiodendron chinensis</i> (Merr.)Hu	Trường sâng	CR			✓	✓	✓
10	Asclepiadaceae	<i>Dischidia beniganensis</i> Colebr.	Song ly ben gan			VU	✓	✗	✓
11	Caesalpiniaceae	<i>Azelia xylocarpa</i> (Kurz.) Craib	Gỗ đỏ, Cà te	EN	IIA	EN	✓	✓	✓
12	Caesalpiniaceae	<i>Sindora siamensis</i> Miq.	Gụ mật	LR	IIA	EN	✓	✓	✓
13	Dipterocarpaceae	<i>Anisoptera costata</i> Korth.	Vên vên	EN		EN	✓	✗	✓
14	Dipterocarpaceae	<i>Dipterocarpus alatus</i> Roxb. ex G.Don.	Dầu rái	EN			✓	✓	✓
15	Dipterocarpaceae	<i>Dipterocarpus costatus</i> C.F.Gaertn.	Dầu mít			EN	✓	✗	✓
16	Dipterocarpaceae	<i>Hopea ferrea</i> Pierre	Săng đào, Sao xanh	EN		EN	✓	✗	✓
17	Dipterocarpaceae	<i>Hopea odorata</i> Roxb	Sao đen	VU			✓	✓	✓
18	Dipterocarpaceae	<i>Hopea pierrei</i> Hance	Kiền kiền phú quốc	EN		EN	✓	✗	✓
19	Dipterocarpaceae	<i>Shorea hypochra</i> Hance	Sao cát	EN			✓	✗	✓
20	Fabaceae	<i>Dalbergia balansae</i> Prain	Trắc vàng	VU			✓	✗	✓
21	Fabaceae	<i>Dalbergia oliveri</i> Prain	Cắm lai	EN	IIA	EN	✓	✓	✓
22	Fabaceae	<i>Pterocarpus macrocarpus</i> Kurz	Giáng hương		IIA	EN	✓	✗	✓

No.	Family	Scientific Name	Vietnamese Name	IUCN	Degree No. 32	Vietnam Red Book (2007)	Ta Dung Nature Reserve	Nam Nung Nature Reserve	Quang Truc Forest
23	Fagaceae	<i>Lithocarpus corneus</i> var. <i>zonatus</i> C .C.Huang & Y.T.Chang	Sồi bán cầu			VU	✓	✓	✓
24	Fagaceae	<i>Lithocarpus truncatus</i> (King ex Hook. f.) Rehd.	Dẻ quả vát, Dẻ phần			VU	✓	✗	✓
25	Magnoliaceae	<i>Magnolia balansae</i> A.DC.	Giổi bà			VU	✓	✗	✓
26	Magnoliaceae	<i>Magnolia baillonii</i> Pierre	Giổi xương			VU	✓	✓	✓
27	Magnoliaceae	<i>Magnolia braianensis</i> (Gagnep.) Figlar	Giổi găng, Lông hung			EN	✓	✓	✓
28	Meliaceae	<i>Amoora gigantea</i> Pierre	Gội nếp			VU	✓	✗	✓
29	Menispermaceae	<i>Coscinium fenestratum</i> (Gaertn.) Colebr.	Vàng đắng			VU	✓	✓	✓
30	Sterculiaceae	<i>Scaphium macropodium</i> (Miq.) Beumée ex K. Heyne	Lười ươi			VU	✓	✓	✓
31	Thymelaeaceae	<i>Aquilaria crassna</i> Pierre ex Lecomte	Trầm hương	EN		EN	✓	✓	✓
32	Verbenaceae	<i>Vitex ajugaeflora</i> Dop	Bình linh nghệ	VU		VU	✓	✓	✓
33	Orchidaceae	<i>Dendrobium farmeri</i> Paxton	Ngọc điểm			VU	✓	✗	✓
34	Stemonaceae	<i>Stemona cochinchinensis</i> Gagnep.	Bách bộ nam			VU	✓	✗	✓

Note: ✗ = Absence; ✓ = Presence

#### IV. DISCUSSION

Plant communities are differentiated from region to region based on indicator species in combination with a distinctive floristic composition. There are various factors effects the diversification such as climate, soil conditions, elevation, and human factor. In the scale of Dak Nong province, our comparison of Ta Dung nature reserve, Nam Nung nature reserve and QTF shows that the diversity and composition of plant communities in these study sites are different. Although QTF is the forest outside protected area, there are up to 654 species belonging to 132 families presenting in this forest area. 34 of which are threatened species. The number of plant species and families, though, is lower than Ta Dung Nature Reserve, it is still significant in comparison to Nam Nung Nature Reserve.

Additionally, QTF is located in the South-West area of Dak Nong province comprising of many high mountain ranges which are connecting with the delta area belonging to Binh Phuoc province, considered as one of the most important factors effecting to the plant diversity of QTF.

Recently, most of conservation activities in Vietnam have focused on protected area network. In Dak Nong province, the conservation effort from the government for QTF is limited in comparison to two above-mentioned Nature Reserves (Trinh et al., 2015). Based on our finding on plant diversity of the site study, QTF should be raised to be a new protected area in Dak Nong province for better conservation plan.

#### V. CONCLUSION

QTF is the outside protected areas which has the high number of plant families and species. A total of 654 species belonging to 132 families were recorded in this forest area. The number of species and families, though, is lower than Ta Dung Nature Reserve, it is still

significant in comparison to Nam Nung Nature Reserve. Moreover, there are up to 34 threatened species found in QTF. Of these, 17 species were listed in IUCN Red List (2016), 26 species listed in Viet Nam Red Book (2007), and 6 species were listed in Degree 32/NĐ-CP/2006. However, up to 17 threatened species occurred either in QTF, Ta Dung Nature Reserve or Nam Nung Nature Reserve only. This indicates that forest plant in QTF is of high diversity. With its biodiversity importance, QTF should be considered to raise a new protected area in Dak Nong for better conservation strategy.

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## **ĐA DẠNG THỰC VẬT Ở KHU VỰC RỪNG QUẢNG TRỰC TẠI TỈNH ĐẮK NÔNG**

**Phạm Thành Trang<sup>1</sup>, Nguyễn Thị Thu<sup>2</sup>, Hoàng Thanh Lương<sup>3</sup>**

<sup>1,2</sup>*Trường Đại học Lâm nghiệp*

<sup>3</sup>*Cục Bảo vệ rừng Đắk Nông*

### **TÓM TẮT**

Rừng Quảng Trực là khu vực hẻo lánh nằm ở phía Tây Nam của tỉnh Đắk Nông. Khu rừng này được đặc trưng bởi các loài cây gỗ có giá trị cao của vùng Tây nguyên, trong đó có nhiều loài nguy cấp ở mức độ quốc gia và quốc tế. Tuy nhiên, cho đến nay vẫn còn thiếu các nghiên cứu về đa dạng thực vật ở khu vực này. Nghiên cứu này được thực hiện nhằm đánh giá tính đa dạng thực vật của rừng Quảng Trực và so sánh với hai Khu Bảo tồn Thiên nhiên Tà Đùng và Nam Nung ở tỉnh Đắk Nông, cung cấp luận chứng khoa học về tầm quan trọng của đa dạng sinh học ở khu vực rừng Quảng Trực. Kết quả nghiên cứu cho thấy mặc dù số lượng loài và họ thực vật ở rừng Quảng Trực thấp hơn so với khu bảo tồn thiên nhiên Tà Đùng nhưng số lượng này cũng khá cao so với khu bảo tồn thiên nhiên Nam Nung. Khu vực rừng Quảng Trực có sự hiện diện của 654 loài thực vật thuộc 132 họ của 5 ngành thực vật. Bên cạnh đó, nghiên cứu cũng chỉ ra rằng có tới 34 loài thực vật nguy cấp, quý hiếm ở khu vực này trong đó có 17 loài thuộc danh lục đỏ của IUCN (2016), 26 loài có trong sách đỏ Việt Nam (2007) và 6 loài trong NĐ23/NĐ-CP (2006). Với mức độ quan trọng về mặt đa dạng sinh học ở Quảng Trực, nghiên cứu của chúng tôi khuyến nghị rằng khu vực này nên được thiết lập trở thành Khu Bảo tồn Thiên nhiên thuộc tỉnh Đắk Nông để có kế hoạch bảo tồn đa dạng sinh học hiệu quả xứng tầm với mức độ đa dạng sinh học của khu vực này.

**Từ khóa:** Bảo tồn đa dạng sinh học, đa dạng thực vật, Đắk Nông, nguy cấp, rừng Quảng Trực.

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