COMPARISION OF STAND STRUCTURE AND TREE SPECIES DIVERSITY BETWEEN MEDIUM AND RICH FORESTS OF TRUONG SON FORESTRY COMPANY, QUANG BINH PROVINCE

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SUMMARY

Results from this study showed several characteristics of structure, composition and tree species diversity of the medium and rich forests in the tropical moist evergreen forests of the Truong Son Forestry Company, Quang Binh province. A total of 4 plots of 100m × 100m each placed in two forest states were surveyed and all stems ≥ 6 cm DBH were measured. 3661 live stems ≥ 6 cm DBH were encountered, representing 40 families and 70 tree species. The density, mean DBH, mean height and total basal area of the medium forest ranged 809 trees/ha - 839 trees/ha, 14.55 cm – 15.05 cm, 10.80 m – 11.06 m and 19.35 m^2/ha – 22.42 m^2/ha, while these numbers in the rich forest were 1003 trees/ha - 1010 trees/ha, 15.55 cm – 15.64 cm, 11.79 m – 12.60 m and 28.22 m^2/ha – 29.00 m^2/ha, respectively. These key characteristics were significant difference between two forest states. The Exponential and Weibull distributions could provide good fit for the tree diameter and height data. The most dominant families in both two forest states were Fabaceae, Burseraceae, Lauraceae and Meliaceae, and the most important species found in both two forest states were *Garuga pierrei*, *Ormosia balansae* and *Litsea glutinosa*. Based on the diversity profile, there is no intrinsic diversity ordering between the medium and the rich forests.

Keywords: Diversity indices, diversity profile, forest structure, species composition, tree species diversity.

1. INTRODUCTION

Geographically, tropical rain forests are currently found in Southeast Asia, Central and South America, and Central and West Africa (Richards, 1996; Whitemore, 1998), with Southeast Asia containing the second largest tropical rain forest with an area of about 2.5 million km^2 (Whitemore, 1998). Globally, around 52% of the total forests are in tropical regions and they are known to be the most important areas in terms of biodiversity (Lewis et al., 2009).

Tropical forests play a crucial role in three respects regarding the well-being of mankind. Tropical forests provide many goods and ecosystem services, such as prevention of soil erosion and preservation of habitats for plants and animals (Anbarashan M. and Parthasarathy N., 2013). Socially, millions of people who are living in or around tropical forests depend on them for the many forest products and environmental services gained (Naughton-Treves and Weber, 2001). Economically, they possess a main source of energy in the form of fuel wood, wood, and traditional medicines; they also provide timber and non-timber forest products. It is therefore essential to understand the structures and species diversity of tropical forests in order to find a way to maintain, protect, and develop those ecosystems.

However, the majority of researching tropical forests in developing countries are still limited, consequently, the stand structures and species diversity of those forests are often insufficient for management. Sustainable management of these forests requires a good knowledge of all the natural forest resource; this knowledge could be reliable only through studies of the forest environment.

In this study, the forest structures, composition and tree species diversity of the tropical moist evergreen forests of Truong Son Forestry Company, Quang Binh Province were analyzed. The specific objectives of this research paper are to (1) analyze stand structure, (2) identify tree species composition and (3) assess tree species diversity between the medium forest and rich forest in terms of timber volume in the tropical moist evergreen forests.

2. RESEARCH METHODOLOGY

2.1. Study site

The study was carried out within the tropical moist evergreen forests belonging to the Truong Son Forestry Company. The zone of study covers a total of 26,490.13 ha natural forest. It lies between $17^0 10'00''$ and $17^0 40'00''$N of northern latitude and between $106^0 00'00''$ and $107^0 00'00''$E of longitude.

The annual climate is divided into 2 distinct seasons: dry season from March to August, rainy season from September to February. The average temperature is about 23^0C - 24^0C. Annual rainfall is between 2,500 and 3,000 mm. Rainfall is distributed unevenly in the year, mainly in October and November, accounting for 60 - 70% of the total annual rainfall. Average humidity is 86%. In the study area, soil can be divided into two main groups: The lowland ferralite soils develop on granite, sandstone, Shale, and limestone; The mountainous humus soils develop on granite, limestone.

Flora of Truong Son company has 663 species of 131 families and 408 genera of 4 vascular plant phylum: *Lycopodiophyta*, *Polypodiophyta*, *Pinophyta* (*Gymnospermae*), *Magnoliophyta* (*Angiospermae*) (Source: Report on Flora Survey of Truong Son Forestry Company in Quang Binh by Vu Anh Tai, Ho Van Cu). The most abundant species is *Magnoliophyta* and the poorest of the species is *Pinophyta*. There are 27 plant species in the Forestry Company are endangered species.

2.2. Plot set-up and censuses

The tree sampling for the data collection was performed in four plots of 100 × 100 m each randomly placed in two different forest states of the study area: medium forest and rich forest.

Forests in these four plots have less human disturbances and are representatives of tropical moist evergreen forests in Truong Son Forestry Company according to field surveys. Each plot was divided into 100 contiguous 10 × 10 m subplots as workable units. All free-standing woody plants in the plot with diameter at breast height (DBH) ≥ 6 cm were investigated. The species names, dbh and total tree height within each subplot were recorded. All tree species were assigned to species.

2.3. Data analysis

2.3.1. Forest structure

- Several general information on forest structure were computed for each sample plot, including: Number of trees per plot, mean diameter at breast height (DBH), mean total tree height, total basal area, number of tree species, number of families.

- Frequency distributions: In the present study, the Exponential and Weibull functions (two parameters) were used to model absolute frequency distributions of the dbh and total tree height.

- Comparison of key characteristics between medium forest and rich forest: We used Z test to determine differences in diameter, height, basal area, and density of trees between two forest states. To combine two plots in each forest state into one larger plots, Kolmogorov–Smirnov test was used. The frequency distribution of stem density in various size classes in two forest states was compared using Kolmogorov–Smirnov one-sample test (Zar, 1999).

2.3.2. Tree species composition

Family relative diversity, relative density, relative dominance and family importance values (FIV) were calculated according to the formulae of Mori et al. (1983):

$$Relative\ diversity\ (Sp.\%) = \frac{no.of\ species\ in\ family}{total\ no.of\ species}.100 \quad (1)$$

$$Relative\ density\ (\%) = \frac{no.of\ trees\ in\ family}{total\ no.of\ trees}.100 \quad (2)$$

$$Relative\ dominance\ (G\%) = \frac{basal\ area\ of\ family}{total\ basal\ area}.100 \quad (3)$$

$$FIV = \frac{(2.1) + (2.2) + (2.3)}{3} \quad (4)$$

In addition, we quantified basal area, relative density, relative frequency, relative dominance and importance value indices (IVI) following Curtis and Cottam (1956):

$$Relative\ density\ (N\%) = \frac{Number\ of\ individuals\ of\ the\ species}{Number\ of\ individuals\ of\ all\ the\ species} 100\% \quad (5)$$

$$Relative\ frequency\ (F\%) = \frac{Number\ of\ subplots\ where\ the\ species\ occurs}{Total\ number\ of\ subplots} 100\% \quad (6)$$

$$Relative\ dominance\ (G\%) = \frac{Total\ basal\ area\ of\ the\ species}{Total\ basal\ area\ of\ all\ species} 100\% \quad (7)$$

$$IVI = \frac{(2.5)+(2.6)+(2.7)}{3} \quad (8)$$

The IVI varies from 0% to 100%; the larger the importance value, the more important a species is within that particular community.

The families and species with FIV% and IVI% are equal or higher than 5% in our study were listed.

2.3.3. Measuring biodiversity

a) Diversity indices

The following diversity indices were used in this study.

- Species richness (S): is the total number of species.

- Shannon diversity index (H'): as a measure of species abundance and richness to quantify diversity of the tree species. This index takes both species abundance and species richness into account:

$$H' = -\sum_{i=1}^{s} p_i . lnp_i \quad (9)$$

Where: s equals the number of species and pi equals the ratio of individuals of species i divided by all individuals N of all species. The Shannon diversity index ranges typically from 1.5 to 3.5 and rarely reaches 4.5 (W.L. Gaines et al., 1999).

- Species evenness (J'): refers to how close in numbers each species in an environment is. Mathematically it is defined as a diversity index, a measure of biodiversity which quantifies how equal the community is numerically. In this paper, we used Pielou's evenness index (Magurran, 1988):

$$J' = \frac{H'}{H'_{max}} \quad (10)$$

Where H' is the number derived from the Shannon diversity index and H'_{max} is the maximum possible value of (if every species was equally likely), equal to:

$$H'_{max} = -\sum_{i=1}^{s} \frac{1}{S} . ln\frac{1}{S} = lnS \quad (11)$$

$\boldsymbol{J'}$ is constrained between 0 and 1. The less evenness in communities between the species (and the presence of a dominant species), the lower $\boldsymbol{J'}$ is. And vice versa.

- Simpson index (D): a measure of species dominance. The Simpson index is defined as (Magurran, 1988):

$$D = 1 - \sum_{i=1}^{s} p_i^2 \quad (12)$$

Where p_i is the is the proportion of importance value of the i^{th} species.

$$p_i = \frac{n_i}{N} \quad (13)$$

n_i is the number of tree of i^{th} species and N is the number of trees of all species.

As biodiversity increases, the Simpson index decreases.

b) Diversity profile

Diversity profiles have been used to assess tree species diversity in uneven-aged forest stands. Patil and Taillie (1979, 1982) discuss two kinds of rarity measures, the dichotomous type and the rank type, which lead to two different diversity profiles. Examined more closely, these types are defined as follows:

- Dichotomous type:

$$\Delta_\beta = \sum_{i=1}^{s} \frac{1-\pi_i^\beta}{\beta} \pi_i = \frac{1-\sum_{i=1}^{s} \pi_i^{\beta+1}}{\beta}, \beta \geq -1 \quad (14)$$

where for β = -1, Δ_{-1} is the species richness, for β = 0, Δ_0 is the Shannon-Wiener index and for β = 1, Δ_1 is the Simpson index.

- Rank type

The intrinsic diversity profile of a community is given by the pairs (T_j):

$$T_j = \sum_{i=j+1}^{s} \pi_i^{\neq} \quad j = 1, \ldots, s\text{-}1 \quad (15)$$

where: $T_s = 0$ and $T_0 = 1$. Species rarity relies only on its rank, because $\pi_i^{\#}$ is the *i-th* component in the ranked relative abundance vector $\pi^{\#} = (\pi^{\#}_1,\ldots, \pi^{\#}_s)$ with $\pi^{\#}_1 \geq \pi^{\#}_2 \ldots \geq \pi^{\#}_s$. T_j is called the right tail-sum of the ranked relative abundance vector $\pi^{\#}$.

If community C' is intrinsically more diverse than community C, in short $C' \overset{imd}{>} C$, then the Δ_β-profiles preserve that ordering; the reverse is not true. However, ordered T_j-profiles, i.e. without intersections, are equivalent to intrinsic diversity ordering.

3. RESULTS

3.1. Forest structure

3.1.1. Overview of key characteristics of individual plots in two forest states

Stand characteristics of four plots in the study area are shown in Table 1.

Table 1. Stand characteristics of four plots in the study area

Forest states	Plot	Density (N/ha)	Mean dbh (cm)	Mean height (m)	Total basal area (m^2/ha)	No. species	No. families
Medium	1	809	14.55	10.80	19.35	52	34
forest	2	839	15.05	11.06	22.42	43	35
Rich	1	1010	15.64	11.79	29.00	43	30
forest	2	1003	15.55	12.60	28.22	43	32
Total		3661				70	40

A total of 3661 individual trees representing 70 species and 40 families were identified from the total area (4 ha) (Table 1). Density of the medium forest were from 809 trees/ha to 839 trees/ha, while the density of the rich forest ranged from 1003 trees/ha to 1010 trees/ha. The mean diameter and height of the medium forest were 14.55 cm – 15.05 cm, 10.80 m – 11.06 m, respectively, and these values for the rich forest were 15.55 cm – 15.64 cm, 11.79 m – 12.60 m, respectively. The total basal area of the former was 19.35 m^2/ha – 22.42 m^2/ha, whereas these numbers of the latter were 28.22 m^2/ha – 29.00 m^2/ha. The number of tree species and families of the medium forest varied from 43 species to 52 species, 34 – 35 families, and these numbers of the rich forest was 43 species and 30 – 32 families.

3.1.2. Frequency distributions

The Exponential and Weibull functions were used to fit distribution of diameter and height frequency.

Table 2. Estimated parameters and Chi - square test for diameter and height distributions of 4 plots in two forest states

Forest states	Plot	Variables	λ	α	β	$\chi^2_{computed}$	$\chi^2_{critical}$	Conclusion
Medium forest	1	DBH		418.56	0.091	13.7	16.9	Accepted
	2			339.60	0.082	13.3	16.9	Accepted
Rich forest	1			341.68	0.075	18.2	19.7	Accepted
	2			382.62	0.078	17.3	16.9	Accepted
Medium forest	1	H	0.006	2.13		12.5	16.9	Accepted
	2		0.004	2.24		14.9	16.9	Accepted
Rich forest	1		0.006	2.04		16.3	19.7	Accepted
	2		0.002	2.43		11.9	18.3	Accepted

The four distributions were further tested with Chi-square test. The Chi-square test indicate that the Exponential and Weibull distributions can provide good fit for the diameter and height data, because its calculated Chi-square values was lower than critical Chi-square values in 4 plots (Table 2). This implies the null hypothesis was accepted for the Exponential and Weibull distributions, meaning the data followed the specified distribution. Figure 1 and Figure 2 showed the diameter and height size class distribution of 4 plots in two forest states in the study area.

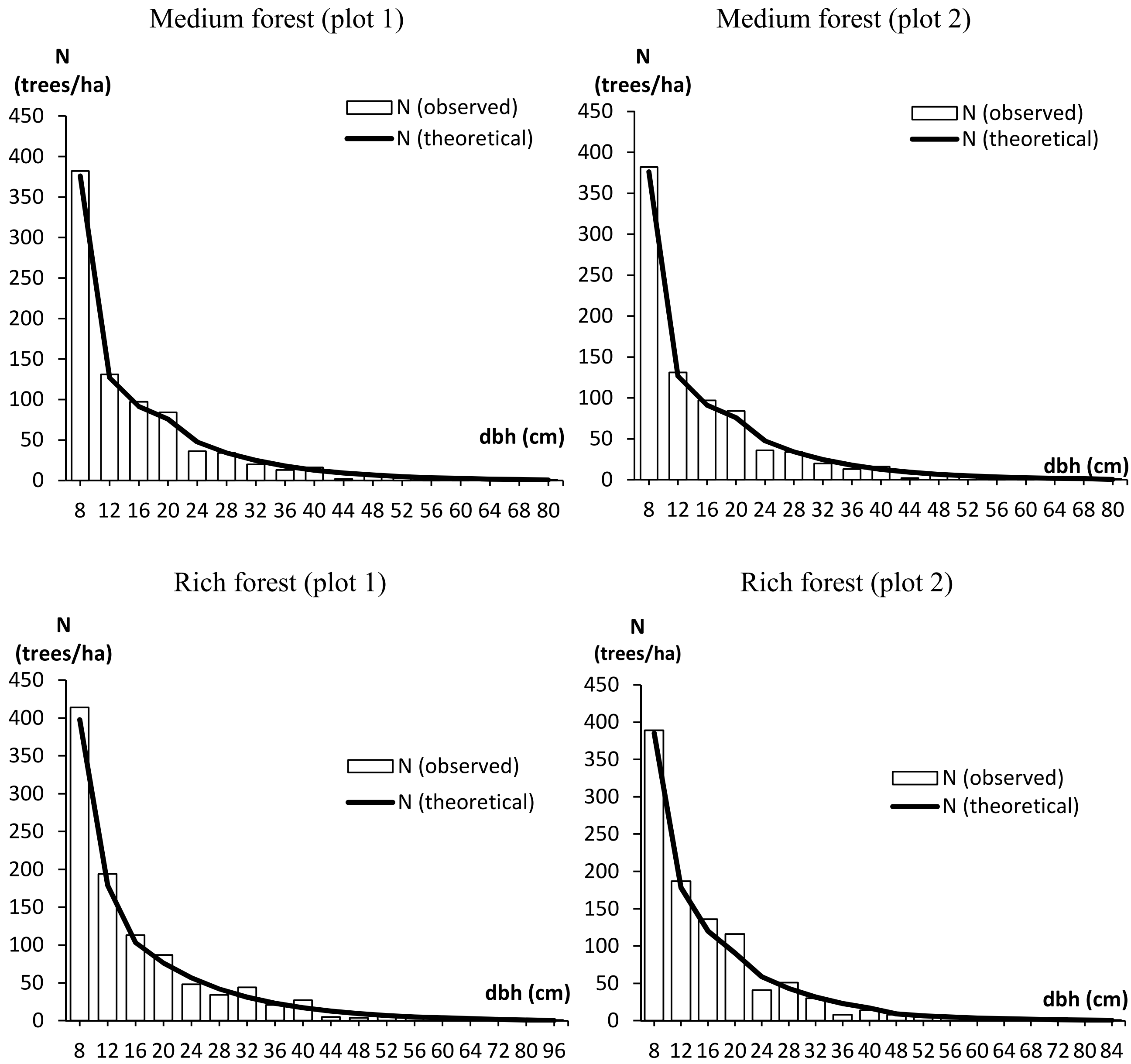

Figure 1. Frequency distributions of diameter for 4 plots in two forest states as fitted by Exponential distribution

The frequency distributions of the tree diameter of the two forest stands was reverse J-shaped (Figure 1). There was virtually no difference in the frequency distributions of the diameter between two forest states (Figure 1). In both two forest states, the majority of stems were concentrated in the first DBH class (8 cm), which accounted for 380 - 400 stems in one hectare. Trees with a DBH greater than 80 cm were only found in the rich forest.

In general, those distributions were all skewed to the left of the graph, with the total number of stems dramatically declining with the ascending DBH classes, suggesting that small-size trees dominate the stand (which in turn indicates good regeneration).

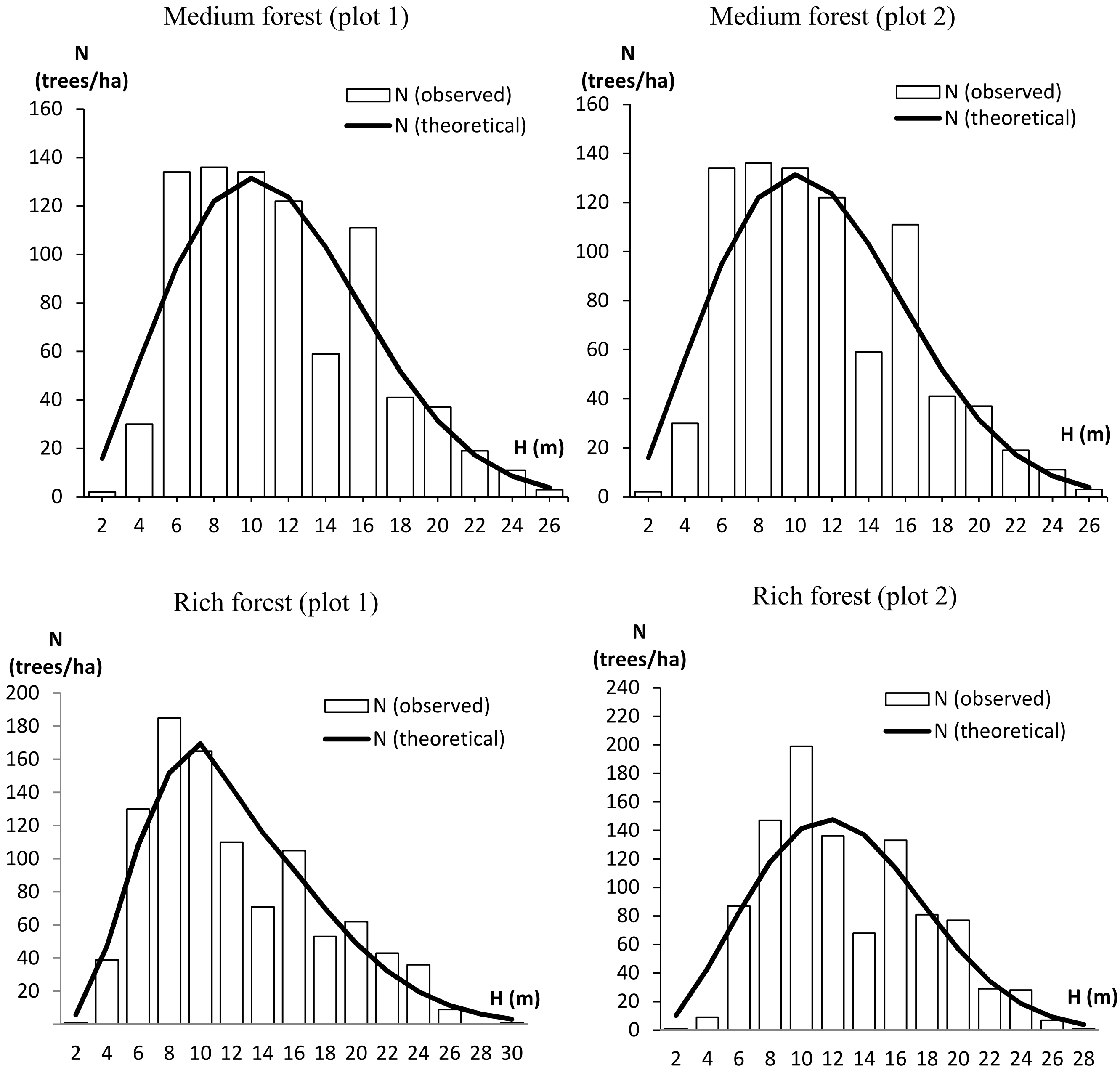

Figure 2. Frequency distributions of height for 4 plots in two forest states as fitted by Weibull distribution

A bimodality is clearly demonstrated in the height distributions in all 4 plots (Figure 2). In the medium and rich forests, the largest number of stems was found at a height of 6 m or 10 m which represented up to 130 - 200 stems in one hectare, respectively.

On the whole, the height frequency distributions were skewed to the left of graph, indicating that the plots had many young trees.

3.1.3. Comparison of key characteristics between medium forest and rich forest

Table 3. Differences in mean diameter, mean height, basal area, and density of trees between the medium forest and the rich forest

Forest states	Mean dbh (cm)		Mean height (m)		Basal area (m^2/ha)		Density (N/ha)	
	Z	p-value	Z	p-value	Z	p-value	Z	p-value
Medium forest - Rich forest	2.06	0.039	5.25	1.54E-07	5.23	1.66E-07	5.28	1.26E-07

Z test analysis at p-value < 0.05 showed significant difference in mean diameter, mean height, mean basal area, mean density between the medium forest and the rich forest (with p-values of 0.039; 1.54E-07; 1.66E-07; 1.26E-07, respectively) (Table 3). In the medium forest, the mean diameter, mean height, mean basal area, mean density were significantly lower than in the rich forest.

3.2. Tree species composition

To assess the species composition, the family importance values (FIV) and important value index (IVI) were used.

Table 4. Families with the highest importance value in two forest states

Forest states	Family	Sp.%	N%	G%	FIV
Medium forest	Fabaceae	4.9	8.1	15.2	9.4
	Burseraceae	3.3	11.0	13.7	9.3
	Lauraceae	4.9	12.1	8.2	8.4
	Meliaceae	6.6	8.3	7.6	7.5
	Sapindaceae	4.9	6.7	6.1	5.9
	Euphorbiaceae	9.8	2.0	3.6	5.1
Total	**35**	**34.4**	**48.2**	**54.4**	**45.6**
Rich forest	Burseraceae	5.6	17.5	14.3	12.5
	Lauraceae	5.6	17.0	14.7	12.4
	Fabaceae	3.7	8.3	10.4	7.5
	Ulmaceae	5.6	6.4	5.3	5.8
	Meliaceae	7.4	4.7	3.1	5.1
Total	**32**	**27.9**	**53.9**	**47.8**	**43.3**

Table 5. The most important tree species in two forest states

Forest state	Vietnamese name	Scientific name	G%	N%	F%	IVI
Medium forest	Chủa	*Garuga pierrei*	11.13	8.80	8.8	9.6
	Ràng ràng mít	*Ormosia balansae*	11.79	6.19	6.2	8.1
	Chua luỹ	*Bursera tonkinensis*	3.06	7.58	7.6	6.1
	Bời lời nhớt	*Litsea glutinosa*	4.10	6.80	6.8	5.9
	Trường mật	*Paviesia annamensis*	5.28	5.76	5.8	5.6
	Trâm trắng	*Syzygium wightianum*	4.28	5.76	5.8	5.3
	Dẻ gai Bắc Bộ	*Castanopsis tonkinensiss*	5.14	4.92	4.9	5.0
Rich forest	Re gừng (bầu)	*Cinnamomun bejolghota*	10.06	8.69	8.7	9.1
	Ràng ràng mít	*Ormosia balansae*	8.44	7.20	7.2	7.6
	Chủa	*Garuga pierrei*	9.33	6.61	6.6	7.5
	Bời lời nhớt	*Litsea glutinosa*	3.69	5.81	5.8	5.1
	Trám trắng	*Canarium album*	3.25	6.01	6.0	5.1
	Dung giấy	*Symplocos laurina*	3.61	5.71	5.7	5.0

The most dominant families in both two forest states were Fabaceae, Burseraceae, Lauraceae and Meliaceae (Table 4) and the most important species registered for both two forest states were *G. pierrei*, *O. balansae* and *L. glutinosa*.

No family in the medium forest made up more than 10% of the FIV (Table 4). Fabaceae and Burseraceae were the two most important family with FIV of 9.4% and 9.3%, respectively (Table 4). This elevated value resulted from the fact that many Fabaceae and Burseraceae individuals were of large diameter. The total basal area of Fabaceae and Burseraceae were 6.36 m^2/ha and 5.72 m^2/ha, representing 15.23% and 13.70% of the entire basal area of this forest state, respectively. These two most diverse families were represented by three and two tree species, respectively. Lauraceae was most abundant (200 individuals) and was the third most important family. The six most important families constituted 45.7% of the total FIV. 14.3% of all families were represented by a single individual. The seven most important species was *G. pierrei*, *O. balansae*, *B. tonkinensis*, *L. glutinosa*, *P. annamensis*, *S. wightianum*, *C. tonkinensis* (Table 5). Their importance value accounted for 45.5% of the total IVI and most of this value was mainly contributed by its relative dominance.

In the rich forest, Burseraceae and Lauraceae, with the highest relative density, had the highest FVI, 12.5% and 12.4%, respectively (Table 4). The 5 most diverse families accounted for 43.2% of the total FIV. 3 families were each represented by a single individual. At the species level, *C. bejolghota* was most abundant species, with 175 individuals (relative density of 8.69%), a relative dominance of 10.06% and a relative frequency of 8.7% (Table 5). The 6 important species comprised 39.5% of the total IVI.

3.3. Measuring biodiversity

3.3.1. Diversity indices

Tree species diversity as indicated by species richness, Shannon-Wiener, Pielou's and Simpson indices (Table 6).

Table 6. Tree species diversity indices of two forest states

Forest states	Species richness	H'	J'	D
Medium forest	57	3.36	0.83	0.96
Rich forest	45	3.34	0.88	0.96

The medium forest had 57 tree species. The numbers of the tree-standing woody species in 10 m × 10 m subplots ranged from 5 to 18, with an average of 15 species (results not shown). In the rich forest, 45 species were found and species numbers in all 10 m × 10 m subplots were between 1 and 21 with an average of 12 species (results not shown). The and the Shannon-Wiener index, Pielou's evenness index and Simpson index of the medium forest were 3.36; 0.83; 0.96, respectively, whereas these numbers of the rich forest were 3.34; 0.88 and 0.96, respectively.

3.3.2. Diversity profile

a) Dichotomous type

The medium forest's Δ_β diversity profile crossed the rich forest's profile at β = - 0.1 (Figure 3), explaining why the ranking of both the species richness and Shannon-Wiener of the two forest states differ from that of the Simpson index.

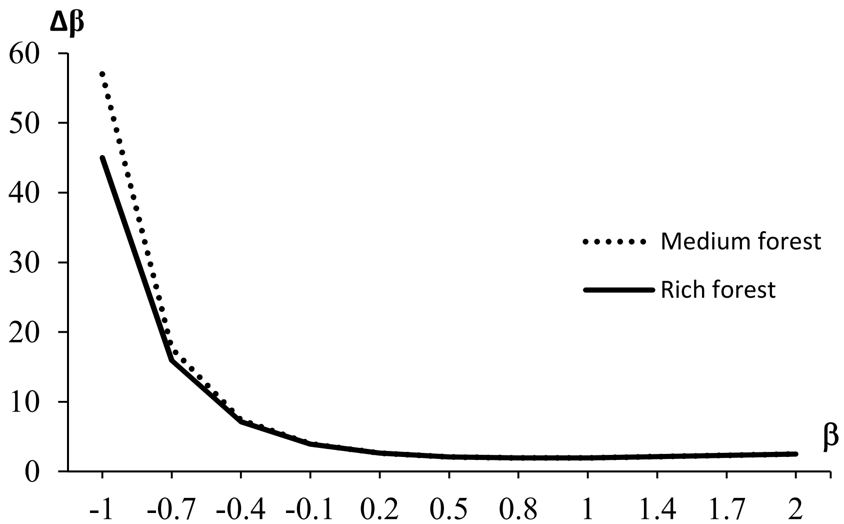

Figure 3. The Δ_β - profiles for two forest states

b) Rank type

The profile of the medium forest intersected that of the rich forest at j = 2 (Figure 4). Consequently, there is no intrinsic diversity ordering between these two forest states.

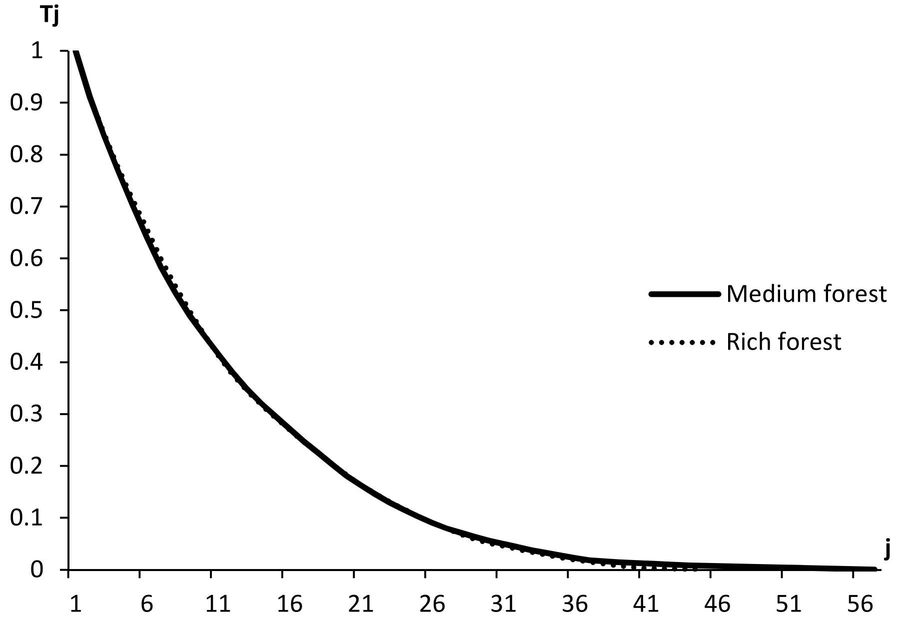

Figure 4. Right tail-sum T_j - profiles for the two forest states

4. DISCUSSION

Results from this study showed several characteristics of structure, composition and tree species diversity of the medium and rich forest in the tropical moist evergreen forests of the Truong Son Forestry Company, Quang Binh Province.

A total of 4 plots in two forest states were surveyed and all stems ≥ 6 cm DBH were measured. 3661 live stems ≥ 6 cm DBH were encountered, representing 40 families and 70 tree species. The stand density in this study ranged from 809 to 1010 stems/ha, was higher compared with other tropical forests reported from the Eastern Ghats of Andhra Pradesh, India (639 - 836 trees/ha, Reddy et al., 2011), Brazil (420 - 777 trees/ha, Campbell et al., 1992), Sulawesi (408 trees/ha, Whitmore and Sidiyasa, 1986). Tree density can be affected by natural calamities, anthropogenic activities, and soil properties (Richard 1952). The basal area of trees in this study varied from 19.35 m^2/ha – 29.00 m^2/ha mean 24.75 m^2/ha, is lower than 32.30 m^2/ha (Small et al., 2004) reported for the forests of Borneo and much lower than that of a primary forest in Indonesia (139.7 m^2/ha, Kessler et al. 2005), which is among the highest values ever recorded in tropical forests.

We examined the horizontal and vertical stand structural characteristics of the tropical moist evergreen forests in Truong Son Forestry Company based on the frequency distributions of the DBH and the total tree height. The distributions denote that the regeneration in the forest is present. Large trees (DBH ≥70 cm) play an important role in carbon storage and disturbance regimes in the tropical forests and are more tightly coupled to weather and climate conditions (Clark & Clark, 1996). However, we know little about the large trees in tropical forests of South-East Asia. Our study showed that the density of large trees in the medium forest was only 3 stems/ha, accounting for 0.36% of the total stems, this number in the rich forest ranged from 3 to 6 stems/ha, accounting for 0.3% - 0.6% of the total stems. In a Neotropical lowland rainforest, large trees accounted for 2% of stems (Clark & Clark, 1996), whereas they accounted for 4.5% of total stems in Tanzanian tropical forests (Huang et al., 2003).

The differences in the mean dbh, mean height, basal area and the density of trees between the study forest states may be due to differences in species composition and extent of disturbances and successional strategies of the stands.

The analysis of the tree flora of the study area showed that the families of Fabaceae, Burseraceae, Lauraceae and Meliaceae are the most dominant families in both two forest states. These four families except Fabaceae and Burseraceae appeared among the top 10 abundant families in the tropical forest of Doi Inthanon, Thailand (Kanzaki et al. 2004). Similarly to tropical rainforests in some sites of South-East Asia (Proctor et al., 1983; Hamann et al., 1999; Small et al., 2004; Kessler et al., 2005), the most dominant families observed in our four plots were Meliaceae and Lauraceae. Similar to forests in Cat Tien National Park, Vietnam (Blanc et al., 2000), Lauraceae and Meliaceae were the most diverse families in our four plots. All these results suggest that floristic composition of the tropical moist evergreen forests of the Truong Son Forestry Company, Quang Binh Province is similar to other tropical forests in Vietnam, Thailand and Indonesia.

A few species were important in the tropical moist evergreen forests in Truong Son Forestry Company. For example, with an IVI value 9.6%, *Garuga pierrei* ranked first in the medium forest, while *Cinnamomun bejolghota* was most important in the rich forest (9.1%). Tropical forests are usually characterised by an abundance of species with a low frequency of occurrence (Pitman et al. 1999, Small et al., 2004). In this study, 22/57 species in the medium forest and 10/45 species in the rich forest were represented by only one or two individuals.

The number of tree species of 45 - 57 species/ha in this study is much lower than the range of mature tropical forest from South-East Asia (62–247 species/ha, Losos & Leigh, 2004), the mature lowland dense forest in Vietnam (81 species, Blanc et al., 2000) and the tropical montane forest in Doi Inthanon of Thailand (67 species, Kanzaki et al., 2004). The differences of tree species richness among these forest types may be accounted for by the different length of time they were subjected to catastrophic. Although the lowland dense forest in Vietnam can be considered as mature forest, it is in the process of community succession (Blanc et al., 2000).

Based on the diversity profile, there is no intrinsic diversity ordering between the medium and the rich forests.

5. CONCLUSION

A total of 3661 live stems ≥ 6 cm DBH were encountered, representing 40 families and 70 tree species. The density, mean dbh, mean height and total basal area of the medium forest ranged 809 trees/ha - 839 trees/ha, 14.55 cm – 15.05 cm, 10.80 m – 11.06 m and 19.35 m^2/ha – 22.42 m^2/ha, and these numbers in the rich forest were 1003 trees/ha - 1010 trees/ha, 15.55 cm – 15.64 cm, 11.79 m – 12.60 m and 28.22 m^2/ha – 29.00 m^2/ha, respectively. The Exponential and Weibull distributions could provide good fit for the tree diameter and height data. Based on the diversity profile, there is no intrinsic diversity ordering between the medium and the rich forests.

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SO SÁNH CẤU TRÚC VÀ ĐA DẠNG LOÀI CỦA LÂM PHẦN RỪNG CÓ TRỮ LƯỢNG TRUNG BÌNH VÀ GIÀU Ở LÂM TRƯỜNG TRƯỜNG SƠN, TỈNH QUẢNG BÌNH

Cao Thị Thu Hiền, Nguyễn Hồng Hải

Trường Đại học Lâm nghiệp

TÓM TẮT

Nghiên cứu này giới thiệu một số đặc điểm về cấu trúc, thành phần và đa dạng loài cây của rừng trung bình và rừng giàu ở Công ty Lâm nghiệp Trường Sơn, tỉnh Quảng Bình. Số liệu được thu thập từ 4 ô đo đếm (ODD) 1 ha. Trong mỗi ODD, tất cả các cây có DBH ≥ 6 cm được xác định tên loài, đo đường kính và chiều cao. Kết quả cho thấy, tổng có 3661 cây thuộc 40 họ và 70 loài cây. Mật độ, đường kính trung bình, chiều cao trung bình và tổng tiết diện ngang của rừng trung bình nằm lần lượt là 809 cây/ha - 839 cây/ha; 14,55 cm – 15,05 cm; 10,80 m – 11,06 m và 19,35 m^2/ha – 22,42 m^2/ha, những giá trị này ở rừng giàu là 1003 cây/ha - 1010 cây/ha; 15,55 cm – 15,64 cm; 11,79 m – 12,60 m và 28,22 m^2/ha – 29,00 m^2/ha. Những chỉ tiêu này có sự khác nhau giữa hai trạng thái rừng. Phân bố khoảng cách và phân bố Weibull mô phỏng tốt cho phân bố số cây theo cỡ đường kính và chiều cao. Các họ ưu thế nhất ở cả hai trạng thái rừng là họ Đậu, họ Trám, họ Re và họ Xoan, và các loài cây quan trọng nhất đều có ở hai trạng thái rừng là Chủa, Ràng ràng mít và Bời lời nhớt. Theo kết quả của hồ sơ đa dạng thì không trạng thái rừng nào đa dạng hơn.

Từ khóa: Cấu trúc rừng, chỉ số đa dạng, đa dạng loài cây, hồ sơ đa dạng, tổ thành loài cây.

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