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DIVERSITY OF NON-TIMBER FOREST PRODUCT SPECIES IN PROTECTION AND PRODUCTION FOREST ECOSYSTEMS OF LAM DONG PROVINCE, VIETNAM

Abstract: This study evaluated the diversity of non-timber forest product (NTFP) species in protection and production forest ecosystems at Lam Ha PFMB and Di Linh Co., Lam Dong Province, Vietnam. Field surveys and plant identification methods recorded 70 species belonging to 36 families in Lam Ha PFMB and 78 species belonging to 43 families in Di Linh Co., with Magnoliophyta as the dominant plant division in both areas. The results provide scientific data for biodiversity conservation and sustainable forest resource management in Lam Dong Province.

Keywords: Non-timber forest products, plant diversity, forest ecosystems, protection forest, production forest, Lam Dong Province.

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РАЗНООБРАЗИЕ ВИДОВ НЕДРЕВЕСНЫХ ЛЕСНЫХ РЕСУРСОВ В ЭКОСИСТЕМАХ ЗАЩИТНЫХ И ЭКСПЛУАТАЦИОННЫХ ЛЕСОВ ПРОВИНЦИИ ЛАМДОНГ, ВЬЕТНАМ

Аннотация. В настоящем исследовании проведена оценка разнообразия видов недревесных лесных ресурсов (НДЛР) в экосистемах защитных и эксплуатационных лесов на территории Управления защитных лесов Ламха (Lam Ha PFMB) и Лесохозяйственной компании Di Linh Co. провинции Ламдонг, Вьетнам. В результате полевых обследований и ботанической идентификации растений зарегистрировано 70 видов, относящихся к 36 семействам, в Lam Ha PFMB и 78 видов, относящихся к 43 семействам, в Di Linh Co. Доминирующим отделом растений в обоих районах исследований являлся Magnoliophyta. Полученные результаты дополняют научные данные, необходимые для сохранения биоразнообразия и устойчивого управления лесными ресурсами в провинции Ламдонг.

Ключевые слова: недревесные лесные ресурсы, разнообразие растений, лесные экосистемы, защитные леса, эксплуатационные леса, провинция Ламдонг.

1. INTRODUCTION

Non-timber forest products (NTFPs) are important components of forest ecosystems and contribute significantly to biodiversity conservation and sustainable forest development. In tropical countries, NTFPs are widely utilized for food, medicinal uses, handicrafts, and other daily needs.

Vietnam possesses rich NTFP resources due to its high biodiversity and diverse forest ecosystems. In Lam Dong Province, local communities have traditionally utilized forest plant resources for food and medicinal purposes. However, comparative studies evaluating NTFP diversity between forest ecosystems under different management functions remain limited.

This study was conducted at Lam Ha Protection Forest Management Board (Lam Ha PFMB) and Di Linh Forestry One Member Limited Company (Di Linh Co.) to evaluate and compare the diversity of NTFP species in protection and production forest ecosystems of Lam Dong Province. The study focused on species composition, taxonomic diversity, life forms, and habitat distribution of NTFPs. The scientific novelty of the study lies in the comparative assessment of NTFP diversity between two representative forest management systems, providing baseline scientific data for biodiversity conservation and sustainable forest management in the Central Highlands of Vietnam.

2. RESEARCH OBJECTIVES

2.1. General Objective

To evaluate the diversity of non-timber forest product species in protection and production forest ecosystems in Lam Dong Province.

2.2. Specific Objectives

- To identify NTFP species composition in the study areas.

- To compare taxonomic diversity, life forms, and habitat distribution of NTFP species between the two forest ecosystems.

3. MATERIALS AND METHODS

3.1. Study Subjects

The study focused on non-timber forest product (NTFP) species distributed within protection forest and production forest ecosystems in Lam Dong Province.

3.2. Study Areas

The study was conducted in Lam Ha PFMB and Di Linh Co., Lam Dong Province, located in the Central Highlands of Vietnam. The study areas are characterized by tropical monsoon climate and diverse forest ecosystems, including evergreen broadleaf forests, pine forests, and mixed bamboo forests at elevations ranging from approximately 800–1,500 m above sea level.

3.3. Research Methods

3.3.1. Field Survey Method

Field surveys were conducted from March to May 2026 using the representative transect method. In each study area, four survey transects with an average length of 2–3 km were established across representative habitat types, including natural forests, pine forests, stream banks, and secondary vegetation areas, to record NTFP species composition and distribution. During the surveys, information on species occurrence, life forms, and habitats was collected through direct observation, photography, and specimen collection.

3.3.2. Species Identification

Plant species were identified using comparative morphological methods based on specialized references, *including An Illustrated Flora of Vietnam, Vietnam Forest Trees*, and online databases such as World Flora Online (WFO) and Kew Science.

3.3.3. Data Analysis

Collected data were compiled and analyzed using Microsoft Excel to evaluate NTFP diversity based on species composition, taxonomic diversity, life forms, and habitat distribution in the two study areas.

4. RESULTS AND DISCUSSION

4.1. Species Composition of NTFPs

The survey results showed that NTFP resources in both study areas were relatively diverse and widely utilized by local ethnic minority communities. A total of 70 species belonging to 36 families were recorded in Lam Ha PFMB, while 78 species belonging to 43 families were documented in Di Linh Co. Species comparison indicated that 26 NTFP species were shared between the two study areas. After excluding duplicated taxa, the combined checklist comprised 122 NTFP species.

Table 1. Shared NTFP species recorded in both Lam Ha PFMB and Di Linh Co.

No.	Scientific name	Life form	Use category
1	*Gnetum gnemon* L.	Shrub	Food

No.	Scientific name	Life form	Use category
2	*Amaranthus spinosus* L.	Herb	Food
3	*Mangifera minutifolia* Evrard	Medium tree	Food
4	*Centella asiatica* (L.) Urb.	Climber	Food–Medicinal
5	*Trevesia palmata* (Roxb. ex Lindl.) Vis.	Small tree	Food–Medicinal
6	*Polyscias fruticosa* (L.) Harms	Shrub	Medicinal
7	*Pluchea indica* (L.) Less.	Shrub	Food–Medicinal
8	*Momordica charantia* L.	Climber	Food–Medicinal
9	*Gymnopetalum cochinchinense* Kurz	Climber	Food–Medicinal
10	*Dillenia scabrella* (D.Don) Roxb. ex Wall.	Small tree	Food–Medicinal
11	*Manihot esculenta* Crantz	Shrub	Food
12	*Melastoma candidum* D.Don	Shrub	Food–Medicinal
13	*Mimosa pudica* L.	Herb	Medicinal
14	*Ficus hirta* Vahl	Shrub	Food
15	*Ficus racemosa* L.	Large tree	Food–Medicinal
16	*Plantago major* L.	Herb	Medicinal
17	*Rubus* spp.	Creeping shrub	Food–Medicinal
18	*Nephelium melliferum* Gagnep.	Medium tree	Food
19	*Eurycoma longifolia* Jack	Shrub	Medicinal
20	*Solanum torvum* Sw.	Shrub	Food–Medicinal
21	*Plectocomiopsis geminiflora* (Griff.) Becc.	Woody climber	Food
22	*Livistona cochinchinensis* (Blume) Mart.	Palm	Food–Handicraft
23	*Dioscorea persimilis* Prain & Burkill	Climber	Food
24	*Musa acuminata* Colla	Herb	Food–Medicinal
25	*Bambusa procera* A.Chev. & A.Camus	Bamboo	Food–Handicraft
26	*Neohouzeaua dulloa* A.Camus	Bamboo	Food–Handicraft

Most shared species were edible plants, medicinal plants, and bamboo–rattan species commonly distributed in the forest ecosystems of Lam Dong Province. The higher number of species recorded in Di Linh Co. may be associated with greater habitat heterogeneity in production forest landscapes, including pine forests, mixed forests, riparian zones, and secondary vegetation areas.

4.2. Taxonomic Diversity

The taxonomic composition of NTFP plant resources at the division level in the two study areas is presented in Table 2. The results indicate that the plant resources utilized by local communities were predominantly concentrated in Magnoliophyta (angiosperms), while only a small proportion belonged to Polypodiophyta and Gymnospermae/Gnetophyta.

Table 2. Taxonomic diversity of NTFP plant species at the division level in the two study areas

Plant division	**Lam Ha PFMB**		**Di Linh Co.**	
	Species	**Percentage (%)**	**Species**	**Percentage (%)**
Polypodiophyta	4	5.7	1	1.3
Gymnospermae/ Gnetophyta	2	2.9	1	1.3
Magnoliophyta	64	91.4	76	97.4
Total	70	100	78	100

Magnoliophyta was the dominant plant division in both study areas, accounting for 91.4% of recorded species in Lam Ha PFMB and 97.4% in Di Linh Co. Ferns and gymnosperm species were recorded at much lower proportions and were mainly associated with moist habitats and natural forest ecosystems.

The dominance of Magnoliophyta is consistent with the floristic characteristics of tropical humid forests in Vietnam, where flowering plants

generally constitute the major component of forest vegetation. The relatively higher proportion of fern and gymnosperm species in Lam Ha PFMB may reflect the humid ecological conditions and larger areas of natural forest in watershed protection ecosystems.

4.3. Life-form Spectrum of NTFP Species

The comparison of life-form spectra of NTFP species recorded in the two study areas is presented in Table 3.

Table 3. Comparison of life-form spectra of NTFP species recorded in the two study areas

Code	Life form	Lam Ha PFMB		Di Linh Co.	
		Species	(%)	Species	(%)
COD	Herbs	22	31.4	20	25.6
BUI	Shrubs	11	15.7	12	15.4
COL	Herbaceous climbers	11	15.7	13	16.7
GOT	Medium-sized trees	7	10.0	1	1.3
DLG	Woody climbers	4	5.7	3	3.8
GON	Small trees	4	5.7	14	17.9
GOL	Large trees	3	4.3	7	9.0
TRE	Bamboo species	3	4.3	3	3.8
BTR	Creeping shrubs	2	2.9	2	2.6
CPS/ CTS	Epiphytes / aquatic plants	2	2.9	1	1.3
CAU	Palm species	1	1.4	2	2.6
Total		70	100	78	100

The life-form composition of NTFP species in the two study areas is presented in Table 3. Herbs (COD) were the dominant life form in both Lam Ha PFMB and Di Linh Co., accounting for 31.4% and 25.6% of recorded species, respectively. Shrubs (BUI), herbaceous climbers (COL), and small trees (GON)

were also commonly recorded, indicating that most NTFP species were distributed within lower and intermediate vegetation layers.

Herbaceous and shrub life forms dominated in both study areas, reflecting the ecological characteristics of secondary and disturbed tropical forest habitats. The higher proportion of herbs, shrubs, and climbers in Lam Ha PFMB was associated with humid understory conditions and dense forest canopies in watershed protection forests, whereas the greater occurrence of small and large tree species in Di Linh Co. reflected the more heterogeneous habitats of production forests combined with natural forests. These findings highlight the ecological diversity and multifunctional utilization value of NTFP resources in Lam Dong Province.

4.4. Habitat Diversity of NTFP Species

The habitat diversity of NTFP species recorded in the two study areas is summarized in Table 4.

Table 4. Habitat diversity of NTFP species recorded in the two study areas

Habitat	**Code**	**Lam Ha PFMB**		**Di Linh Co.**	
		Species	**%**	**Species**	**%**
Streamside	BS	33	47.1	49	62.8
Forest / Evergreen forest	R/EF	30	42.9	10	12.8
Medium evergreen forest	MEF	–	–	39	50.0
Pine forest	PF	17	24.3	36	46.2
Forest edge	FE	19	27.1	–	–
Mountain hills	MH	11	15.7	–	–
Agricultural land	AL	–	–	27	34.6

Abandoned agricultural land	AAL	–	–	12	15.4
Streamside evergreen forest	SEF	–	–	1	1.3
Total occurrences		110	157.1	174	223.1

Note: A species may occur in more than one habitat type; therefore, total percentages exceed 100%.

The habitat distribution of NTFP species in the two study areas is presented in Table 4. Streamside habitats recorded the highest number of species occurrences in both Lam Ha PFMB and Di Linh Co., accounting for 47.1% and 62.8% of total records, respectively. Natural forests, pine forests, and forest-edge habitats also supported relatively high numbers of NTFP species, indicating the importance of humid and forested environments for the growth and distribution of forest plant resources.

The dominance of streamside and forest habitats reflects the ecological preference of many NTFP species for moist and semi-shaded tropical forest conditions. In Lam Ha PFMB, species were mainly concentrated in natural forests and riparian habitats, whereas Di Linh Co. exhibited broader habitat heterogeneity, including pine forests, evergreen forests, and secondary habitats. This habitat diversity may contribute to the relatively higher number of recorded NTFP species in Di Linh Co.

5. CONCLUSION

The study conducted at Lam Ha PFMB and Di Linh Co. recorded a relatively rich diversity of non-timber forest products (NTFPs), including 70 species belonging to 36 plant families in Lam Ha PFMB and 78 species belonging to 43 plant families in Di Linh Co. Most recorded NTFP species belonged to the Magnoliophyta division and were commonly used by local communities for food, medicinal purposes, and daily livelihood activities. The differences in species composition, life forms, and habitat distribution between

the two forest ecosystems reflected the ecological characteristics and forest management objectives of each study area. The findings contribute to the database of NTFP diversity in Lam Dong Province and provide useful scientific information for forest resource management, biodiversity conservation, and sustainable livelihood development for local communities.

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