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Research Article

Biodiversity and community structure of Ban Non- Hin Phueng community forest, Thailand

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Abstract: Community forests play a critical role in conserving biodiversity while supporting local livelihoods, particularly in tropical regions where forest-dependent communities remain prevalent. This study investigated the biodiversity of vascular plants, mammals, edible insects, and edible mushrooms in Ban Non-Hin Phueng Community Forest, Prachinburi Province, Thailand, to provide a scientific basis for sustainable conservation and resource-use planning. Biodiversity data were collected through systematic ecological surveys and participatory fieldwork with local community members. Resource utilization patterns were classified into four main categories: (1) food resources derived from plants, wildlife, edible insects, and wild mushrooms; (2) medicinal plant use; (3) plant materials for housing construction and maintenance; and (4) commercial utilization of biological resources. The results reveal that the Ban Non-Hin Phueng Community Forest constitutes a socio-ecological system characterized by mutual benefits between forest ecosystems and local communities. Forest resources contribute directly to household food security and income generation, while strong community participation enhances forest protection and regeneration. The forest exhibits clear signs of ecological recovery following historical logging, with high regeneration potential reflected by the abundance of saplings and seedlings relative to mature trees. These findings highlight the importance of integrating biodiversity conservation, traditional ecological knowledge, and community-based governance to achieve long-term sustainability in community forest management.

Keywords: Community forestry; Biodiversity conservation; Tropical dry evergreen forest

1. Introduction

Tropical forests are globally recognized for their high biodiversity and ecosystem services, yet they are increasingly threatened by land-use change, overexploitation, and weak governance [1, 2]. In response, community-based forest management has emerged as a key strategy for reconciling biodiversity conservation with local livelihood needs, particularly in Southeast Asia [3 ,4].

Despite these advances, shifts in forest resource use—from subsistence-based collection to market-oriented exploitation—have intensified harvesting pressure on economically valuable plants, edible mushrooms, insects, and small wildlife species. In addition, extraction by non-local collectors has further accelerated biodiversity loss and ecosystem degradation in many community forests [5, 6].

Systematic biodiversity inventories that integrate ecological data with traditional environmental knowledge remain limited, particularly for community forests located in buffer zones adjacent to protected areas. This study addresses this gap by documenting biodiversity patterns, forest structure, and resource-use practices in the Ban Non-Hin Phueng Community Forest, Prachinburi Province, Thailand, to inform sustainable management and policy-relevant conservation strategies [7].

2. Materials and Methods

2.1 Study area

The study was conducted in Ban Non-Hin Phueng Community Forest, Dong Bang Subdistrict, Prachantakham District, Prachinburi Province, eastern Thailand. The forest covers approximately 100 rai (≈16 ha) and is classified as a dry evergreen forest. Historically, the area experienced selective logging, followed by community-led protection and management (Figure 1).

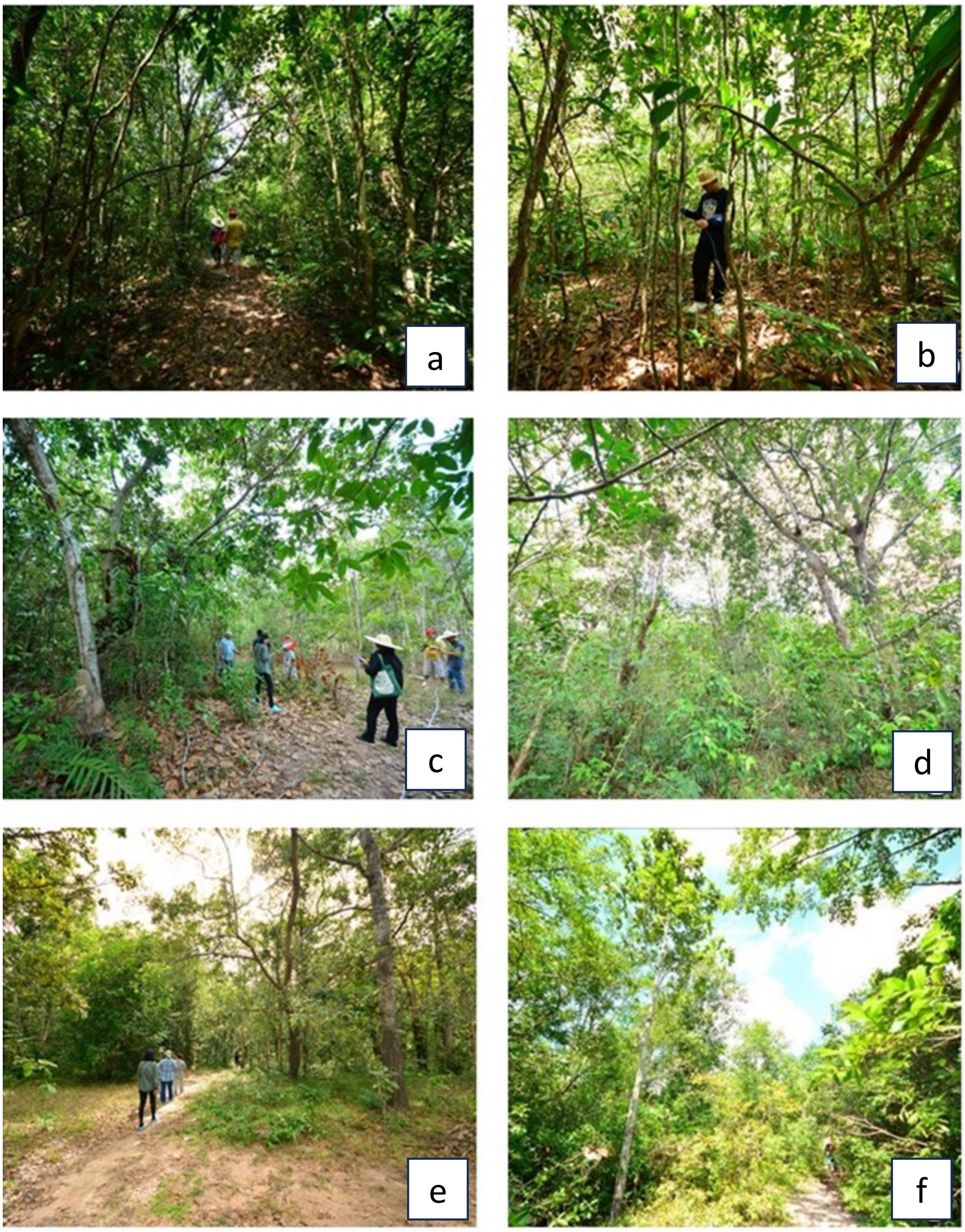

Figure 1. Locations and representative views of vegetation sampling plots in Ban Non-Hin Phueng Community Forest, showing (a–b) Plot 1, (c–d) Plot 2, and (e–f) Plot 3.

2.2 Vegetation sampling and forest structure analysis

Vegetation surveys employed a nested plot design across three representative locations within the forest. Main plots (20 × 50 m) were established to assess mature trees (DBH ≥ 4.5 cm). Subplots (4 × 4 m) were used for saplings (DBH < 4.5 cm; height ≥ 1.3 m), and microplots (1 × 1 m) for seedlings (height < 1.3 m).

Tree diameter at breast height (DBH, 1.3 m) and total height were measured using standard forestry instruments. Vertical forest structure and canopy stratification were analysed using profile diagrams constructed from selected 10 × 10 m subplots.

2.3 Data analysis

Plant community structure was analysed using classical phytosociological indices, including density, dominance (basal area), frequency, relative density (RD), relative dominance (RDo), and relative frequency (RF). Species importance was evaluated using the Importance Value Index (IVI), while community classification was based on relative importance values. Sapling and seedling importance values were calculated using relative density and frequency.

3. Results

3.1 Plant Community Structure of Ban Non-Hin Phueng Community Forest

3.1.1 Plant communities and species composition

Variation and similarity in plant community structure are strongly influenced by environmental factors such as topography, climate, rainfall, seasonality, temperature, geological conditions, and disturbance regimes, including fire. These factors shape vegetation composition by selecting for species with ecological traits adapted to local environmental conditions. Ban Non-Hin Phueng Community Forest is located in Dong Bang Subdistrict, Prachantakham District, Prachinburi Province, Thailand. Local communities traditionally utilise the forest for the collection of non-timber forest products, including tubers, wild mushrooms, *Melientha suavis* shoots, bamboo shoots, and red ant eggs. Historically, the forest was classified as a dry evergreen forest, but it was subjected to selective logging of large trees. As a result, the current vegetation is dominated by regenerating stands composed primarily of saplings and seedlings. Based on surveys conducted in three permanent plots (20 × 50 m each), a total of 46 tree species belonging to 26 families were recorded. Most species are characteristic of dry evergreen forests in eastern Thailand. A complete species list and associated structural attributes are presented in Table 1.

Table 1. List of vascular plant species recorded in Ban Non-Hin Phueng Community Forest.

No.	Scientific Name	Family
1	*Anacardium occidentale*	ANACARDIACEAE
2	*Artabotrys siamensis*	ANNONACEAE
3	*Desmos chinensis*	ANNONACEAE
4	*Melodorum fruticosum*	ANNONACEAE
5	*Polyalthia viridis*	ANNONACEAE
6	*Wrightia arborea*	APOCYNACEAE
7	*Peltophorum dasyrrhachis*	CAESALPINIACEAE
8	*Parinari anamensis*	CHRYSOBALANACEAE
9	*Anisoptera costata*	DIPTEROCARPACEAE
10	*Dipterocarpus alatus*	DIPTEROCARPACEAE
11	*Shorea roxburghii*	DIPTEROCARPACEAE

No.	Scientific Name	Family
12	*Vatica harmandiana*	DIPTEROCARPACEAE
13	*Croton oblongifolius*	EUPHORBIACEAE
14	*Phyllanthus emblica*	EUPHORBIACEAE
15	*Entada rheedii*	FABACEAE
16	*Pterocarpus macrocarpus*	FABACEAE
17	*Quercus kerrii*	FAGACEAE
18	*Hydnocarpus ilicifolia*	FLACOURTIACEAE
19	*Fagraea fragrans*	GENTIANACEAE
20	*Cratoxylum formosum*	HYPERICACEAE
21	*Gonocaryum lobbianum*	ICACINACEAE
22	*Cinnamomum verum*	LAURACEAE
23	*Litsea glutinosa*	LAURACEAE
24	*Adenanthera pavonina*	LEGUMIMOSAE-MIMOSOIDEAE
25	*Senna siamea*	LEGUMINOSAE
26	*Lagerstroemia floribunda*	LYTHRACEAE
27	*Memecylon caeruleum*	MELASTOMATACEAE
28	*Memecylon myrsinoides*	MELASTOMATACEAE
29	*Walsura trichostemon*	MELIACEAE
30	*Streblus asper*	MORACEAE
31	*Rhodamnia dumetorum*	MYRTACEAE
32	*Syzygium cumini)*	MYRTACEAE
33	*Syzygium gratum*	MYRTACEAE
34	*Melientha suavis Pierre*	OPILIACEAE
35	*Carallia brachiata*	RHIZOPHORACEAE
36	*Catunaregam spathulifolia*	RUBIACEAE
37	*Lxora cibdela*	RUBIACEAE
38	*Oxyceros horridus*	RUBIACEAE
39	*Tarenna* sp.	RUBIACEAE
40	*Acronychia pedunculata*	RUTACEAE
41	*Clausena harmandiana*	RUTACEAE
42	*Glycosmis pentaphylla*	RUTACEAE
43	*Allophylus cobbe*	SAPINDACEAE
44	*Lepisanthes rubiginosa*	SAPINDACEAE
45	*Aquilaria crassna*	THYMELAEACEAE
46	*Microcos tomentosa*	TILIACEAE

3.1.2 Plant community structure of Plot 1

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Plot 1 depicts a regenerating dry evergreen forest in which most of the original large trees had been removed. The plot currently supports secondary growth dominated by saplings and seedlings. A total of 10 tree species with a diameter at breast height (DBH) ≥ 4.5 cm (or circumference ≥ 14 cm) were recorded.

The vertical structure consists of two distinct canopy layers. The upper canopy reaches approximately 15 m in height, while the lower canopy averages around 5 m (Figure 2).

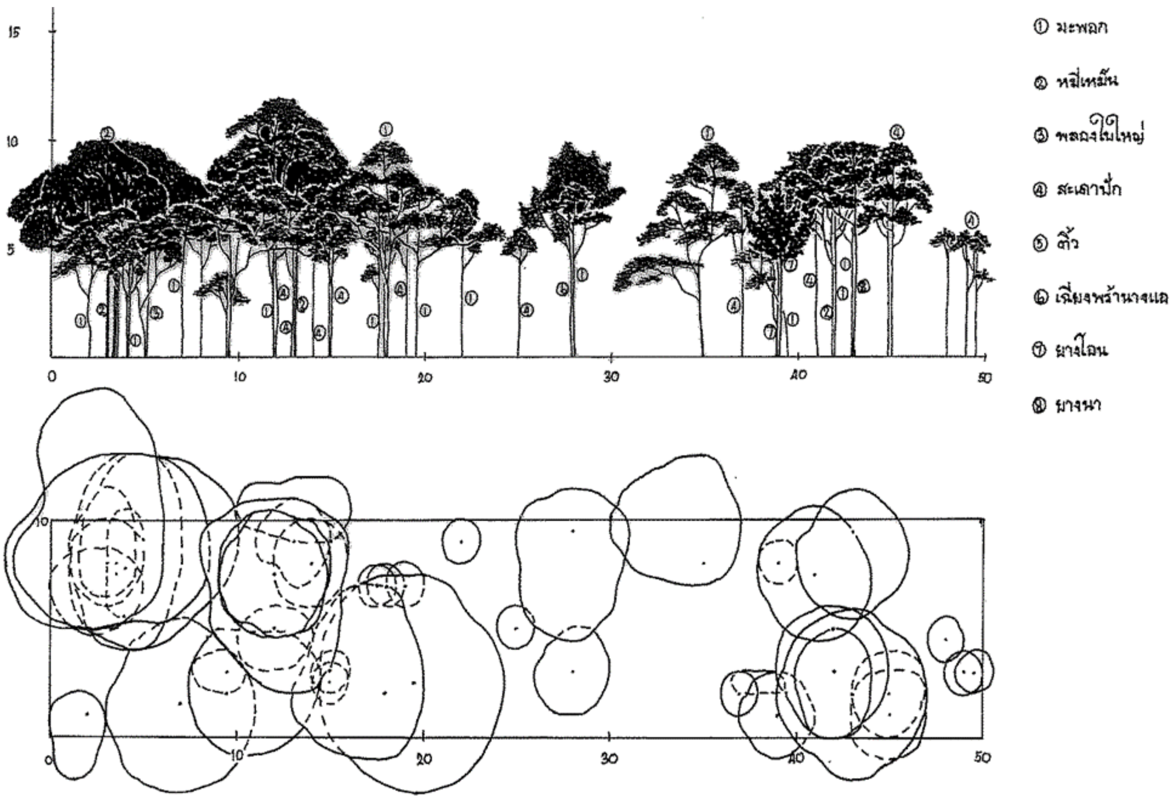

Figure 2. Vertical profile diagram illustrating the plant community structure and canopy stratification in Plot 1.

Overall canopy cover is approximately 70%. Importance Value Index (IVI) analysis identified *Parinari anamensis* as the most dominant species (IVI = 99.77), followed by *Vatica harmandiana* (84.04), *Litsea glutinosa* (52.12), *Shorea roxburghii* (21.51), *Carallia brachiata* (14.65), and *Dipterocarpus alatus* (7.73). Detailed IVI values are presented in Table 2.

Table 2. Importance Value Index (IVI) of tree species in the plant community of Plot 1.

No.	Scientific Name	D	F	Do	RD	RF	Rdo	IVI
1	*Parinari anamensis*	0.0430	0.8000	0.0005082	38.7387	25.8064	35.2257	99.7708
2	*Vatica harmandiana*	0.0440	0.9000	0.0002217	39.6396	29.0324	15.3691	84.0411
3	*Litsea glutinosa*	0.0100	0.6000	0.0003427	9.009	19.3548	23.7573	52.1211
4	*Shorea roxburghii*	0.0020	0.1000	0.0002378	1.8018	3.2258	16.4852	21.5128
5	*Carallia brachiata*	0.0040	0.2000	0.0000664	3.6036	6.4516	4.6031	14.6583

6	*Dipterocarpus alatus*	0.0020	0.1000	0.000039	1.8018	3.2258	2.7036	7.7312
7	*Polyalthia viridis*	0.0020	0.1000	0.0000104	1.8018	3.2258	0.7209	5.7485
8	*Memecylon myrsinoides*	0.0020	0.1000	0.0000081	1.8018	3.2258	0.5615	5.5891
9	*Pterocarpus macrocarpus*	0.0010	0.1000	0.0000062	0.9009	3.2258	0.4350	4.5617
10	*Cratoxylum formosum*	0.0010	0.1000	0.0000020	0.9009	3.2258	0.1386	4.2653
	Total	0.1110	3.1000	0.0014425	100.00	100.00	100.00	300.00

Sapling composition was assessed in ten 4 × 4 m subplots. A total of nine sapling species were recorded, with *Vatica harmandiana* being the most abundant (33 individuals), followed by *Memecylon caeruleum* (9 individuals). Other species occurred at lower densities.

Seedling surveys conducted in ten 1 × 1 m subplots recorded nine species. The most abundant seedlings were Memecylon caeruleum (10 individuals), *Vatica harmandiana* (6 individuals), and *Cinnamomum verum* (6 individuals), with additional species occurring at lower frequencies.

3.1.3 Plant community structure of Plot 2

Plot 2 represents a regenerating dry evergreen forest that has undergone historical removal of large trees, followed by natural regeneration dominated by saplings and seedlings. A total of 10 tree species with a diameter at breast height (DBH) ≥ 4.5 cm (or circumference ≥ 14 cm) were recorded.

The vertical structure consists of two canopy layers. The upper canopy reaches approximately 15 m in height, while the lower canopy averages around 5 m. Canopy cover is estimated at approximately 80%, indicating a more advanced regeneration stage than in Plot 1 (Figure 3).

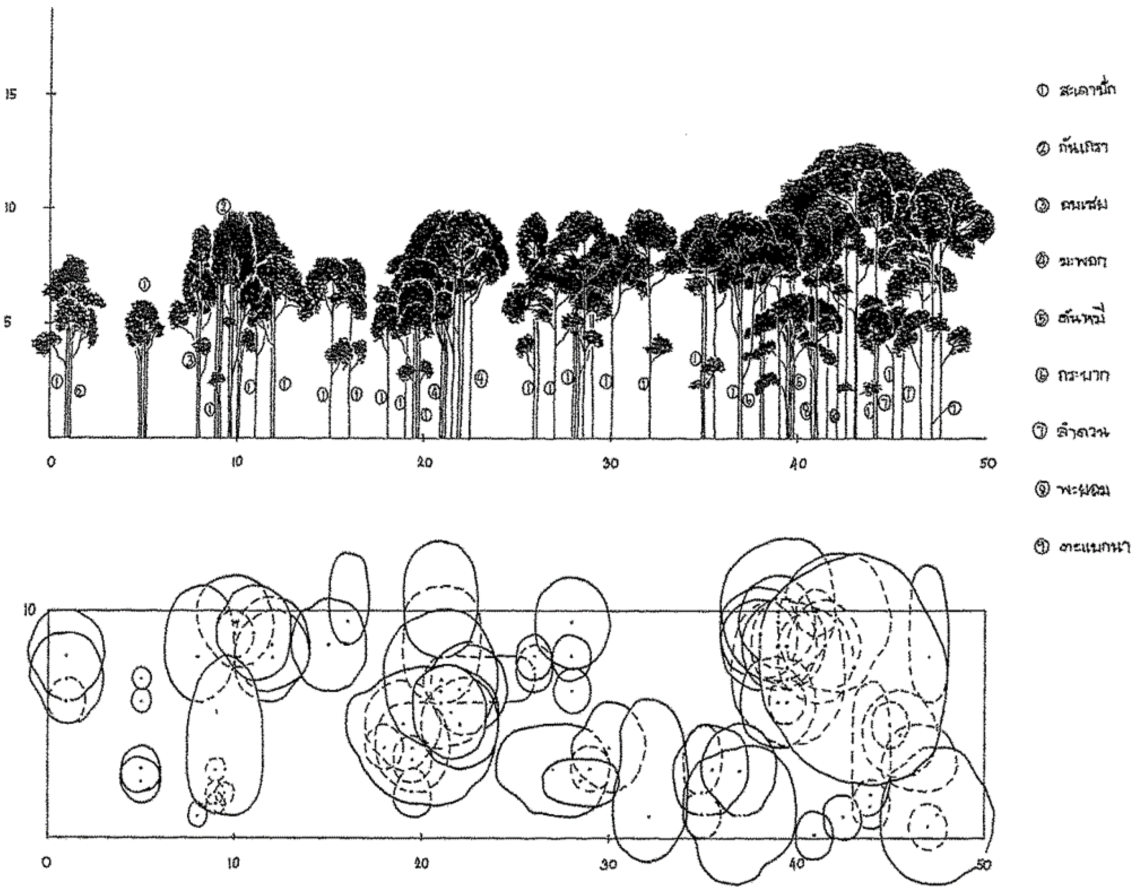

Figure 3. Vertical profile diagram illustrating the plant community structure and canopy stratification in Plot 2.

Importance Value Index (IVI) analysis identified *Vatica harmandiana* as the most dominant species (IVI = 146.29), followed by *Parinari anamensis* (79.72), *Cinnamomum verum* (20.30), *Shorea roxburghii* (12.30), and *Anisoptera costata* (12.17). Detailed IVI values are presented in Table 3.

Table 3. Importance Value Index (IVI) of tree species in the plant community of Plot 2.

No.	Scientific Name	D	F	Do	RD	RF	Rdo	IVI
1	*Vatica harmandiana*	0.1180	1.0	0.000433	68.6046	33.3	44.36	146.29
2	*Parinari anamensis*	0.0340	0.7	0.000358	19.7674	23.3	36.63	79.73
3	*Cinnamomum verum*	0.0050	0.4	3.97E-05	2.9069	13.3	4.06	20.31
4	*Shorea roxburghii*	0.0050	0.2	2.67E-05	2.9069	6.6	2.73	12.31
5	*Anisoptera costata*	0.0020	0.2	4.24E-05	1.1627	6.6	4.35	12.17
6	*Fagraea fragrans*	0.0020	0.1	3.58E-05	1.1627	3.3	3.67	8.16

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7	*Melodorum fruticosum*	0.0020	0.1	1.68E-05	1.1627	3.3	1.72	6.22
8	*Carallia brachiata*	0.0010	0.1	1.61E-05	0.5813	3.3	1.65	5.56
9	*Gonocaryum lobbianum*	0.0020	0.1	4.9E-06	1.1627	3.3	0.50	4.99
10	*Lagerstroemia floribunda*	0.0010	0.1	3.2E-06	0.5813	3.3	0.33	4.24

Sapling surveys conducted in ten 4 × 4 m subplots recorded a total of 11 species. *Vatica harmandiana* was strongly dominant at the sapling stage, with 140 individuals, while other species occurred at substantially lower abundances.

Seedling surveys conducted in ten 1 × 1 m subplots recorded 10 species. The most abundant seedlings were *Syzygium gratum* (36 individuals), followed by Ixora sp. (26 individuals), *Memecylon caeruleum* (11 individuals), *Carallia brachiata*, and other species occurring at lower frequencies.

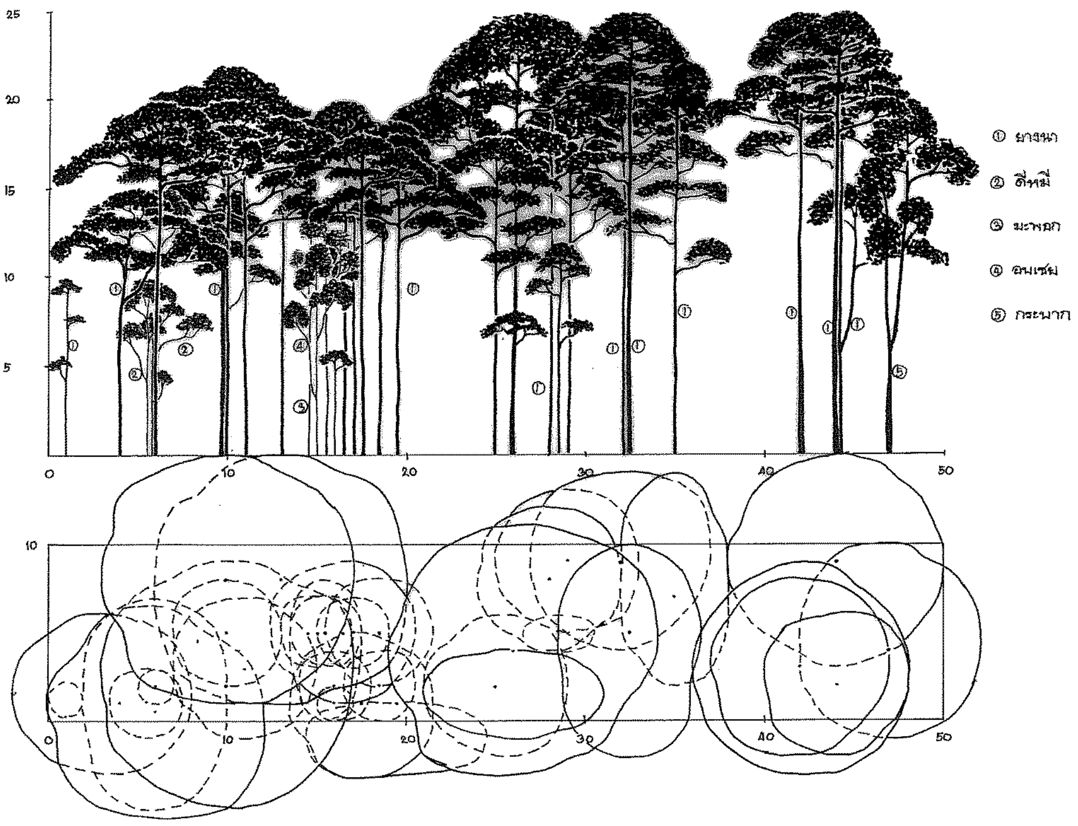

Figure 4. Vertical profile diagram illustrating the plant community structure and canopy stratification in Plot 3.

3.1.4 Plant community structure of Plot 3

Plot 3 represents a more structurally complex regenerating dry evergreen forest compared with Plots 1 and 2. A total of six tree species with DBH ≥ 4.5 cm were recorded, forming a distinct two-layered canopy structure.

The upper canopy reaches approximately 25 m in height, while the lower canopy averages around 15 m. Canopy cover is approximately 100%, indicating a closed-canopy forest structure (Figure 4). Importance Value Index (IVI) analysis identified Dipterocarpus alatus as the overwhelmingly dominant species (IVI = 215.22). Subdominant species included *Vatica harmandiana* (33.46), *Parinari anamensis* (24.56), *Anisoptera costata* (12.72), *Gonocaryum lobbianum* (7.73), and *Cinnamomum verum* (6.28). Detailed IVI values are shown in Table 4.

Table 4. Importance Value Index (IVI) of tree species in the plant community of Plot 3.

No.	Scientific Name	D	F	Do	RD	RF	Rdo	IVI
1	*Dipterocarpus alatus*	5.8	0.9	0.00267	78.3783	42.8571	93.9851	215.2205
2	*Vatica harmandiana*	0.6	0.5	0.00004	8.1080	23.8095	1.5484	33.4659
3	*Parinari anamensis*	0.5	0.3	0.00010	6.7567	14.2857	3.5251	24.5675
4	*Anisoptera costata*	0.2	0.2	0.00002	2.7030	9.5238	0.4950	12.7218
5	*Gonocaryum lobbianum*	0.2	0.1	0.00001	2.7030	4.7619	0.2709	7.7358
6	*Cinnamomum verum*	0.1	0.1	0.00001	1.3510	4.7619	0.1755	6.2884
	Total	7.4	2.1	0.00285	100	100	100	300

Sapling composition in Plot 3 was assessed in ten 4 × 4 m subplots, revealing a total of 19 species, indicating high regenerative diversity. Dominant sapling species included *Garcinia* sp., *Stereospermum* sp., *Gonocaryum lobbianum*, *Wendlandia tinctoria*, *Oroxylum indicum*, *Anisoptera costata*, and *Cratoxylum formosum*, among others. Seedling surveys conducted in ten 1 × 1 m subplots recorded 11 species.

The most abundant Seedlings were *Ixora* sp. (40 individuals), followed by *Stereospermum* sp. (6 individuals), *Gonocaryum lobbianum* (10 individuals), *Wendlandia tinctoria* (3 individuals), *Dipterocarpus alatus* (5 individuals), *Carallia brachiata* (3 individuals), *Memecylon caeruleum* (2 individuals), and several other species at lower densities.

4. Conclusions

Ban Non-Hin Phueng Community Forest is a relatively small forest area (approximately 100 rai, ~16 ha) characterized by three structurally similar sampling sites distributed across the forest. The area was historically classified as a dry evergreen forest and was subjected to selective logging. However, following community-based protection and controlled resource use, the forest has shown clear signs of ecological recovery.

A total of 41 tree species across 23 families were recorded in the study area, most typical of dry evergreen forests in eastern Thailand. Differences in forest structure among plots reflected varying stages of regeneration. Plot 1 supported 10 mature tree species with two canopy layers and approximately 70% canopy cover. Plot 2 also contained 10 mature tree species, with a similar two-layered canopy structure but higher canopy cover (approximately 80%). Plot 3 exhibited a more structurally developed forest condition, with six mature tree species, a two-layered canopy reaching up to 25 m in the upper layer, and complete canopy closure (approximately 100%).

Regeneration patterns across the community forest indicate favorable successional trends. Saplings and seedlings were abundant and diverse, representing characteristic dry evergreen forest species. In total, 19 sapling species and 11 seedling species were recorded, exceeding the number of mature tree species in some plots. This pattern suggests strong regenerative potential and increasing structural complexity under current community-based management practices.

This study demonstrates the practical relevance of community-based forest management by showing how it can simultaneously support biodiversity recovery and local livelihoods in a regenerating dry evergreen forest. By combining quantitative vegetation-structure analysis with evidence of natural-regeneration dynamics, the findings provide practical guidance for identifying recovery stages, prioritising species for protection, and designing site-specific management interventions. In particular, the documented dominance patterns, regeneration potential, and vulnerability of economically valuable medicinal plants directly inform harvest regulations, access controls, and seasonal forest-closure strategies. These results are readily transferable to community forests across Southeast Asia that face similar challenges of post-disturbance recovery, market-driven resource pressure, and governance by local institutions, thereby providing a concrete, evidence-based framework for sustainable forest management and policy implementation.

6. Patents

Author Contributions: For research articles, S.H. Conceptualized the study, data curation and formal analysis were carried out by S.H. The original draft with review and editing by S.H. The authors have read and agreed to the published version of the manuscript.

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