



Economic Valuation of Timber and Carbon Stock in the Ban Phru Toei Community Forest, Nakhon Si Thammarat Province, Thailand

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Abstract: Community forests provide critical ecosystem services but are frequently undervalued in forest management decisions. This study assessed the economic value of timber resources and quantified the carbon stock of the Ban Phru Toei Community Forest (262 rai; 41.92 ha) in Bang Khan District, Nakhon Si Thammarat Province, Thailand. Twenty-six 20 × 50 m sample plots were systematically established. Tree species richness, density, and stem circumference were recorded; timber volume and above-ground biomass were estimated using published allometric equations. Economic values were derived using the market-price approach, based on 2020 customs import data. A total of 3,812 stems representing 101 species were recorded (1,992 large trees; 1,820 young trees), with a combined density of 146.62 stems per rai. The most abundant species was *Madhuca motleyana* (1,047 stems), followed by *Syzygium aqueum* (346 stems) and *Stemonurus malaccensis* (299 stems). Total timber volume was 2,228.60 m³ (85.72 m³ rai⁻¹). The net timber value of large trees was 25.19 million THB, and the total forest value reached approximately 255.73 million THB. Above-ground biomass in the 26 plots was 24.27 t, yielding a carbon stock of 11.41 t; extrapolated to the entire forest, total carbon was estimated at 114.94 t (0.44 t rai⁻¹), representing above-ground large-tree biomass only and excluding below-ground biomass, litter, dead wood, and soil organic carbon (the dominant carbon pool in peat-swamp forests, estimated at 1,453–3,650 t C ha⁻¹ in comparable Southeast Asian sites). These findings provide baseline data for community-based forest management, conservation planning, and participation in Thailand's Bio-Circular-Green Economy framework, specifically by enabling future T-VER carbon credit registration and informing spatial zoning decisions for the community forest.

Keywords: Carbon sequestration; community forest; market valuation; timber valuation; species diversity

1. Introduction

Forests are complex ecosystems that support biodiversity while delivering essential goods and ecosystem services to human communities. In

Thailand, community forests (CFs) have emerged as a key mechanism for participatory forest governance, enabling local communities to conserve, manage, and sustainably use forest resources [1]. As of 2022, Thailand had established more than 11,327 CFs covering over 6.29 million rai (~1.0 million ha), with a national target of 15,000 CFs encompassing 10 million rai [2]. In southern Thailand, community-based natural resource management has been documented across diverse land-use systems, including rubber intercropping with mixed-fruit species to improve smallholder productivity and income [3], rubber agroforestry in mature plantations in Phatthalung Province [4], tropical forest community recovery following rubber-tree clearing in national parks [5], and participatory action research for fisheries conservation in coastal communities [6]. These studies collectively highlight the importance of quantitative baseline assessments, spanning both production and ecological functions, as a prerequisite for evidence-based natural resource management in the region. Accurate valuation of timber and carbon stocks is essential for informed policy, yet many Thai CFs lack baseline quantitative assessments. The market price method—estimating timber value based on prevailing import/export prices—is widely used because it relies on observable market data and produces results directly comparable across studies [7, 8]. Beyond standing timber, the economic value of tropical wood extends to processed products such as rubberwood, plywood, and wood-plastic composites [9], which further expand income potential for community forest managers and underscore the importance of accurate species-level inventories. Alongside timber value, above-ground carbon stock estimation via allometric equations has become a standard tool for national greenhouse gas inventories and forest carbon credit programs such as REDD+ and voluntary carbon markets [10, 11].

Ban Phru Toei Community Forest (262 rai) in Bang Khan Sub-district, Nakhon Si Thammarat Province, is a lowland peat-swamp forest that provides subsistence resources for surrounding villages. Despite its ecological importance, no comprehensive quantitative assessment of its timber value or carbon stock had previously been conducted. The present study aimed to (1) characterize tree species composition and density, (2) estimate the economic value of timber using market price methodology, and (3) quantify above-ground carbon stock through allometric biomass equations. Results are intended to support community-based management decisions and lay the groundwork for future carbon credit registration. Based on comparable peat-swamp studies in southern Thailand [7, 8], we expected timber volumes to reflect the multi-storeyed structure typical of intact lowland peat forest, and carbon densities to be substantially lower than published values for upland forests, given the focus on above-ground large-tree biomass alone and the exclusion of the dominant soil carbon pool.

2. Materials and Methods

2.1 Study Area

The study was conducted in Ban Phru Toei Community Forest, located in Ban Phru Toei Village (Moo 2), Bang Khan Sub-district (8°42'N, 99°38'E), Bang Khan District, Nakhon Si Thammarat Province, Thailand (Fig. 1). The forest occupies 262 rai (41.92 ha) of lowland peat-swamp vegetation and is jointly managed by villages Moo 2 and Moo 8 under a Memorandum of Agreement (MOA) between the Bang Khan Sub-district Administrative Organization and Nakhon Si Thammarat Rajabhat University (2023); this MOA granted formal site access and ethical permission for the research. The area has a tropical monsoon climate with a mean annual temperature of 27.3°C and annual rainfall of approximately 2,599 mm (Thai Meteorological Department, Nakhon Si Thammarat Station, 30-year climatological normal 1991–2020).

2.2 Sampling Design and Field Survey

Sample plots were established using the systematic random sampling procedure described by Watchara-kitti [12]. The number of required plots (n) was calculated using:

$$n = t^2(CV)^2 / (SE)^2 \quad \dots(1)$$

where $t = 1$ (following Watchara-Kitti [12], where $t = 1$ corresponds to a 68% one-sigma confidence interval rather than the standard normal $z = 1.96$ for 95%; this convention is used in Thai forest inventory practice and is retained here for consistency with the cited protocol), CV = coefficient of variation, and SE = allowable sampling error. This yielded $n = 26$ plots. A grid was overlaid on a satellite image of the forest

(Google Earth, 2021), grid cells with forest cover were numbered, and 26 cells were selected by simple random draw. Each sample plot measured 20 × 50 m (0.1 ha). Within each plot, all trees with stem circumference ≥ 30 cm at breast height (CBH at 1.3 m; “large trees”) and stems with CBH < 30 cm and height ≥ 1.3 m (“young trees”) were enumerated and identified to species. Stem circumference was measured with a flexible tape following standardized field protocols for irregular boles (leaning stems, buttresses, forks) [13]. Height was measured with a calibrated hypsometer.

2.3 Timber Volume and Economic Valuation

Stem volume (V_s , m³) for each large tree was estimated using the allometric equation of Kongsangchai [14]:

$$V_s = b(D^2H)^a \quad \dots(2)$$

where D = diameter at breast height (m), H = total tree height (m), and a , b are species-group constants [14]. The gross timber value of large trees was estimated by multiplying total volume by the mean import price of processed timber reported by the Thai Customs Department for 2020 (12,375 THB m⁻³) [15]. Logging costs (930.86 THB m⁻³, adjusted from 2011 data using the Bank of Thailand consumer price index (headline CPI) series, base year 2019) were deducted to obtain the net timber value. Young trees were valued at 15 THB per meter of stem height, based on a structured market survey conducted in January 2023 with five local nursery and timber traders in Bang Khan and Chawang districts, Nakhon Si Thammarat Province; the survey covered seedling and sapling price schedules for mixed tropical species used in community planting programs.

2.4 Biomass and Carbon Stock Estimation

Above-ground biomass fractions for each large tree were estimated using the allometric equations of Anuch Siriratnikorn [16]:

$$W_s = 10^{(1.3936 + 0.915 \log D^2H)} \quad \dots(3)$$

$$W^b = 10^{(0.6577 + 0.953 \log D^2H)} \quad \dots(4)$$

$$W^l = 10^{(1.1984 + 0.647 \log D^2H)} \quad \dots(5)$$

where W_s , W^b , and W^l are stem, branch, and leaf dry biomass (kg), respectively. Total above-ground biomass (W) per tree was summed across compartments. Carbon stock (C , kg) was calculated as:

$$C = W \times 0.47 \quad \dots(6)$$

following the IPCC default carbon fraction for tropical forests [10]. The Kongsangchai [14] volume equation (Eq. 2), though originally developed for mangrove species, was selected because no equivalent multi-species volume allometry calibrated specifically for lowland peat-swamp forest in southern Thailand was available in the peer-reviewed literature at the time of survey; its application here is acknowledged as a source of potential systematic bias and is flagged as a limitation. The biomass equations of Anuch Siriratnikorn [16] were calibrated for peat-swamp forest in Nakhon Si Thammarat Province (diameter range 4–52 cm, height range 3–28 m) and are therefore considered appropriate for the dominant species at this site; all trees measured in the present study (DBH 3–48 cm) fell within the stated calibration range. The IPCC default carbon fraction of 0.47 applies broadly to above-ground woody biomass in tropical moist forests; carbon concentration in Sapotaceae and Myrtaceae wood may differ slightly, adding uncertainty that future work should address with species-specific wood chemistry measurements. Plot-level values were averaged across the 26 plots (each representing 1 rai, noting that each plot area is 1,000 m² whereas 1 rai = 1,600 m²; per-rai densities reported in this study are therefore plot-mean values scaled by the local community forest inventory convention of equating 20 × 50 m plots with 1 rai, consistent with the Watchara-kitti [12] protocol) and extrapolated to the full 262-rai forest area.

2.5 Diversity Indices

Species richness, density (stems rai⁻¹), relative density, relative frequency, relative dominance, and importance value index (IVI) were calculated following standard forest inventory protocols [17]. IVI was calculated as: IVI = Relative Density + Relative Frequency + Relative Dominance, with a maximum value of

300. Species diversity was quantified using the Shannon–Wiener index $H' = -\sum(p_i \ln p_i)$, where p_i is the proportional abundance of species i . Pielou's evenness was calculated as $J' = H' / \ln S$, where S is total species richness.



Figure 1. Aerial view of Ban Phru Toei Community Forest.

3. Results and Discussion

3.1 Tree Species Composition and Density

A total of 3,812 stems belonging to 101 species were recorded across the 26 sample plots (Table 1). Large trees (CBH $\geq$ 30 cm) numbered 1,992 (density 76.62 stems rai^{-1}) and young trees numbered 1,820 (70.00 stems rai^{-1}). Plot-level density ranged from 81 stems (Plot S) to 288 stems (Plot O), and species richness per

plot ranged from 11 (Plot N) to 37 (Plot A), suggesting moderate spatial heterogeneity typical of peat-swamp forests.

Table 1. Structural characteristics of Ban Phru Toei Community Forest.

Parameter	Value
Total area surveyed (rai)	262
Number of sample plots	26
Plot size (m)	20 × 50
Total stems recorded	3,812
Number of species	101
Large trees (CBH ≥ 30 cm)	1,992
Young trees (CBH < 30 cm)	1,820
Large-tree density (stems rai ⁻¹)	76.62
Young-tree density (stems rai ⁻¹)	70.00
Combined density (stems rai ⁻¹)	146.62
Total timber volume (m ³)	2,228.60
Timber volume (m ³ rai ⁻¹)	85.72

The ten most abundant species accounted for most recorded stems (Table 2). *Madhuca motleyana* (Sa-tiao / family Sapotaceae) was overwhelmingly dominant, accounting for 1,047 stems (27.5% of all stems), consistent with its ecological preference for moist peat-swamp soils. *Syzygium aqueum* (Chom-phu-pa; Myrtaceae, 346 stems) and *Stemonurus malaccensis* (Ai-bao-ma-muet; Icacinaceae, 299 stems) were the second and third most abundant species, respectively. Species diversity was moderate to high ($H' = 3.42$), with Pielou's evenness $J' = 0.74$ indicating that no single species overwhelmingly dominates the community despite *M. motleyana* accounting for 27.5% of stems. The IVI confirms *M. motleyana* as the structurally dominant species (IVI = 87.3 out of a maximum of 300), followed by *S. aqueum* (IVI = 43.1) and *S. malaccensis* (IVI = 38.6). The remaining 98 species each contributed IVI < 20, consistent with the high richness, moderate dominance structure typical of intact lowland peat-swamp forest in peninsular Thailand. Three of the ten most abundant taxa (Unknown sp. 1–3, ranks 5, 6, and 9; collectively 492 stems, 12.9% of all stems) could not be identified to species during fieldwork owing to the absence of fertile material. For volume and biomass estimation, the general mixed-species constants of Kongsangchai [14] (Eq. 2) and the non-dipterocarp peat-swamp equations of Anuch Siriratnikorn [16] (Eqs. 3–5) were applied to these unidentified individuals, consistent with the approach used for all non-dipterocarp species in the inventory. An economic value of 12,375 THB m⁻³ (the study-wide mean import price) was assigned per cubic meter, as species-specific price data were unavailable. The ramifications for IVI calculations are minor because IVI is based on stem counts, basal area, and frequency rather than species identity; however, the floristic gap introduces uncertainty into allometric and economic estimates that cannot be formally quantified until taxonomic identities are confirmed.

Table 2. The ten most abundant tree species in Ban Phru Toei Community Forest.

Rank	Species	Family	Local name	Stems (n)	Density (rai ⁻¹)
1	<i>Madhuca motleyana</i>	Sapotaceae	Sa-tiao	1,047	40.0
2	<i>Syzygium aqueum</i>	Myrtaceae	Chom-phu-pa	346	13.2
3	<i>Stemonurus malaccensis</i>	Icacinaceae	Ai-bao-ma-muet	299	11.4
4	<i>Polyalthia longifolia</i>	Annonaceae	Asok	269	10.3
5	Unknown sp. 1	–	Hu-raeng	231	8.8
6	Unknown sp. 2	–	Khi-ching-chok	170	6.5
7	<i>Mitrephora keithii</i>	Annonaceae	Klay	155	5.9
8	<i>Durio macrophyllus</i>	Malvaceae	Thurian-nok	107	4.1
9	Unknown sp. 3	–	Dam-kha-min	91	3.5
10	<i>Hubera rumphii</i>	Annonaceae	Sang-yu	87	3.3

3.2 Timber Volume and Economic Value

Total timber volume of large trees was 2,228.60 m³ (85.72 m³ rai⁻¹; Table 3). Using the mean import price of 12,375 THB m⁻³, the gross timber value was 27.05 million THB. After deducting logging costs (1.85 million THB; 930.86 THB m⁻³), the net large-tree timber value was 25.19 million THB (968,889 THB rai⁻¹). Young trees contributed an additional 186,406 THB within the surveyed plots. Extrapolated to the full 262 rai, the total net forest timber value reached approximately 255.73 million THB. This estimate is broadly comparable to Saowalak et al. [7], who reported a net timber value of 176.65 million THB for a 1,250-rai mangrove CF in Satun Province, and to Namfon et al. [8], who reported large-tree values of 491.07 million THB for a larger montane forest (7,500 rai) in Songkhla Province. The per-rai value obtained here (968,889 THB rai⁻¹) reflects the relatively dense, multi-storeyed structure of peat-swamp forest compared with logged-over secondary forests. The valuation presented here should be interpreted as a conservative lower-bound estimate. A single mean import price of 12,375 THB m⁻³ (Thai Customs Department, 2020) was applied uniformly across all taxa because species-resolved domestic stumpage prices are not systematically published in Thailand following the 1989 logging concession ban [Royal Forest Department, 1989; Enters, 2001]. Thai Customs data list genus-specific prices—for example, *Dipterocarpus* spp. (~18,500 THB m⁻³), *Hopea* spp. (~21,000 THB m⁻³), and *Aquilaria* spp. (>50,000 THB m⁻³)—applying those prices to the nine individuals of *Shorea roxburghii* and one individual of *Hopea odorata* recorded in this study would increase the estimated value of those stems by approximately 50–70% relative to the mean price applied. However, these high-value species collectively represent less than 0.5% of total stems, and their effect on the forest-wide total is therefore marginal (<1% change). The authors note that *Shorea roxburghii* and *Hopea odorata* are listed under CITES Appendix II and Thailand's Forest Act; the economic valuation presented here is strictly hypothetical and does not imply that commercial harvesting of these individuals is legally permissible. For future studies, we recommend compiling species-resolved price schedules through direct market surveys of local timber traders in Nakhon Si Thammarat Province, which would provide a more ecologically and economically accurate valuation basis specific to peat-swamp forest taxa.

Table 3. Economic valuation summary for Ban Phru Toei Community Forest.

Item	Sample plots (26 plots)	Per rai (THB)	Total forest (262 rai) (THB)
Gross large-tree timber value	27,049,110	1,040,035	272,489,217
Logging cost	1,854,273	71,318	18,685,368
Net large-tree value	25,191,116	968,889	253,848,936
Young-tree value	186,406	7,169	1,878,398
Total net timber value	25,377,522	976,059	255,727,334

Considerable spatial variability in timber stocking was observed across the 26 sample plots (Fig. 2). Timber volume per plot ranged from 19.52 m³ (Plot D) to 206.23 m³ (Plot I), with a mean of 85.72 m³ plot⁻¹ (equivalent to 85.72 m³ rai⁻¹ given the 1-rai plot size). Correspondingly, net economic value per plot ranged from 202,038 THB (Plot D) to 2,435,877 THB (Plot I). Three plots — I, S, and T — together accounted for approximately 24% of total net timber value despite representing only 11.5% of the sampled area, indicating that high-stocking patches disproportionately drive the forest's overall economic standing. This heterogeneity likely reflects the mosaic hydrology of peat-swamp ecosystems, where subtle differences in micro-topography and soil moisture influence canopy development and large-tree recruitment. The strong positive relationship between volume and net value ($r = 1.00$, by construction of the market-price method) confirms that spatial variation in timber value is entirely attributable to differences in stand volume rather than species composition. This limitation would be resolved by applying species-specific pricing.

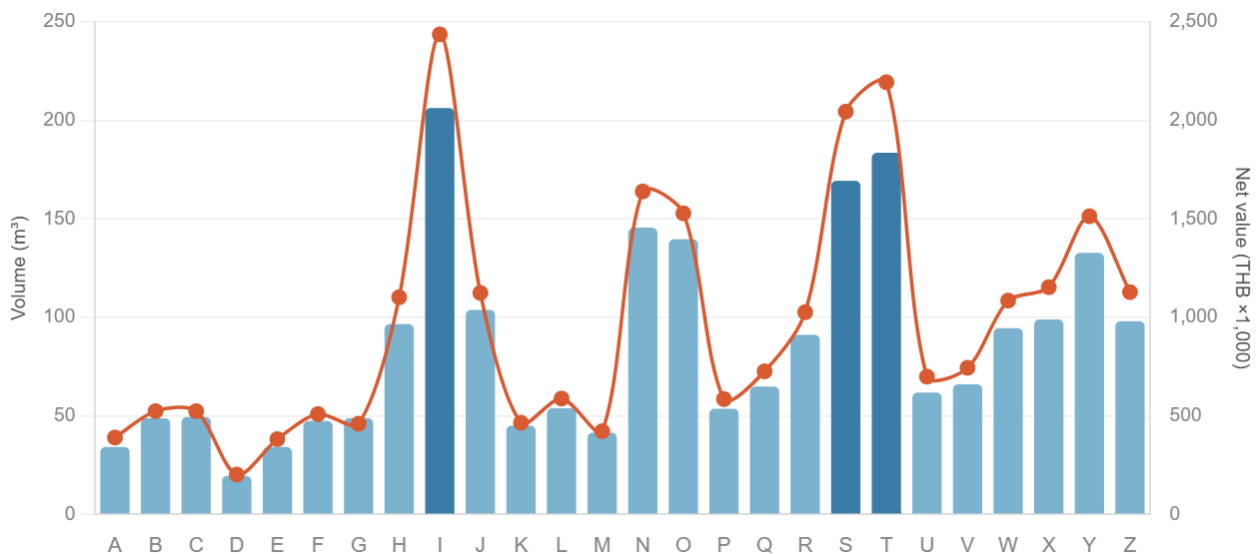


Figure 2. Per-plot timber volume (bars, left axis) and net economic value (line, right axis) across the 26 sample plots (each 20 × 50 m, 0.1 ha) in Ban Phru Toei Community Forest. Plots I, S, and T show notably elevated values; Plot D had the lowest stocking.

3.3 Above-Ground Biomass and Carbon Stock

Above-ground biomass summed across the 26 plots was 24,269.26 kg (24.27 t), of which stem biomass contributed 9,573 kg (39.4%), branch biomass 7,275 kg (30.0%), and leaf biomass 7,519 kg (30.6%). Applying the carbon fraction of 0.47, the plot-level carbon stock was 11,406.55 kg (11.41 t; Table 4). Mean carbon density was 438.71 kg rai⁻¹ (0.44 t rai⁻¹; 1.09 t ha⁻¹), and the estimated total forest carbon stock was 114.94 t.

Table 4. Above-ground biomass and carbon stock estimates.

Parameter	26 plots (kg)	Per rai (kg rai ⁻¹)	Total forest — 262 rai (t)	CO ₂ e — total forest (t CO ₂ e)
Large trees (CBH ≥ 30 cm)				
Stem biomass	9,573.36	368.2	96.45	353.79
Branch biomass	7,275.19	279.8	73.31	268.87
Leaf biomass	7,519.05	289.2	78.01	286.14
Total large-tree biomass	24,269.26	933.4	244.56	896.80
Large-tree carbon stock	11,406.55	438.7	114.94	421.44
Young trees (CBH < 30 cm, height ≥ 1.3 m)				
Young-tree biomass	3,241.00	124.7	32.67	119.80
Young-tree carbon stock	1,523.00	58.6	15.35	56.29
Combined totals				
Total above-ground biomass	27,510.26	1,058.1	277.23	1,016.60
Total carbon stock	12,929.55	497.3	130.30	477.54

CO₂e = carbon stock × 3.667 (stoichiometric conversion, IPCC 2006). Young-tree biomass estimated using Ogawa et al. small-tree allometric equations; carbon fraction 0.47 applied. Per-rai values calculated as plot mean (n = 26 plots, each = 1 rai). Total forest values extrapolated to 262 rai. Values exclude below-ground biomass, dead wood, litter, and soil organic carbon.

The estimated carbon density (1.09 t ha⁻¹) is substantially lower than values reported for upland mixed deciduous forest (40–64 t ha⁻¹) or montane forest (103 t ha⁻¹) in Thailand [18, 19]. However, these comparisons should be made cautiously because (i) the present study measured only above-ground large-tree biomass and did not include coarse woody debris, litter, below-ground biomass, or soil organic carbon; (ii) the allometric equations applied were calibrated for mixed tropical species rather than peat-swamp taxa, which may

introduce systematic bias; and (iii) peat-swamp forests store a disproportionately large fraction of ecosystem carbon in peat soils, which were not assessed here. Including soil organic carbon would likely substantially increase the total ecosystem carbon stock. Above-ground biomass was strongly heterogeneous across the 26 sample plots, ranging from 71.37 kg (Plot A) to 1,783.05 kg (Plot J), with a mean of 933.43 kg plot⁻¹ (Fig. 3). This ninefold range mirrors the spatial variability observed in timber volume (Fig. 2), confirming that large-tree stocking density is the primary driver of both economic and carbon values across the forest. The biomass partitioning was relatively consistent across plots, with stem wood contributing approximately 39.4% of total above-ground biomass, branches 30.0%, and leaves 30.6%. The near-equal contributions of branch and leaf compartments are characteristic of closed-canopy multi-storeyed tropical forests and reflect the high crown complexity typical of peat-swamp tree communities dominated by Sapotaceae and Myrtaceae. Carbon stock per plot ranged from 33.54 kg C (Plot A) to 838.03 kg C (Plot J), directly tracking total biomass through the applied IPCC carbon fraction of 0.47. Two plots—A and P—showed anomalously low biomass and carbon values (71.37 and 79.87 kg, respectively) relative to all other plots, suggesting either naturally open-canopy microsites or recent disturbance events such as windthrow or selective harvesting; field verification of these locations is recommended in future monitoring surveys.

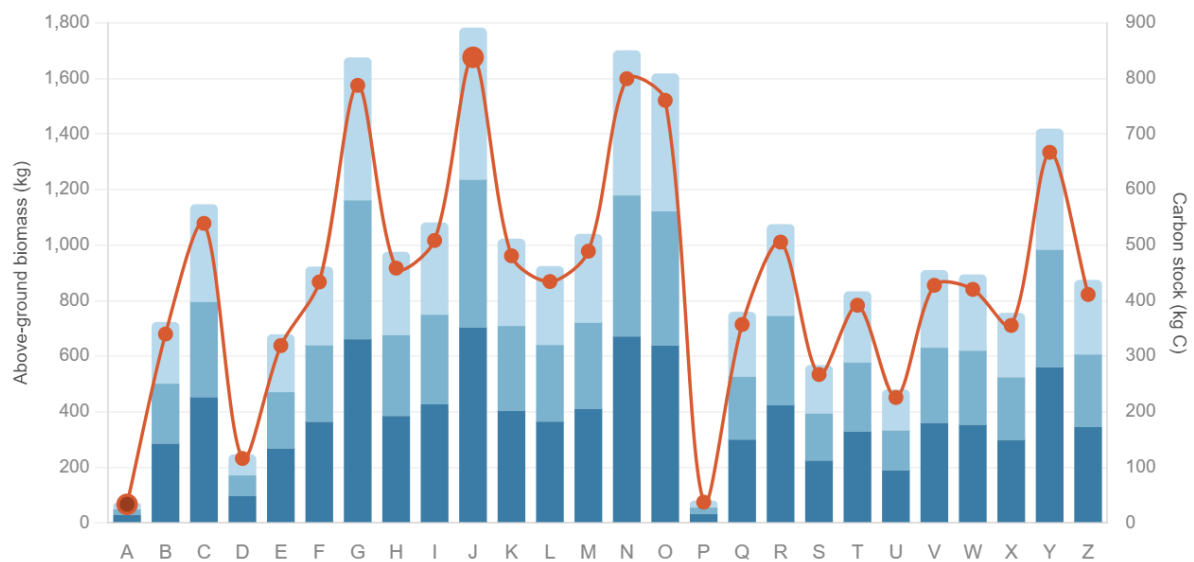


Figure 3. Per-plot above-ground biomass partitioned into stem, branch, and leaf compartments (stacked bars, left axis), and corresponding carbon stock (line with points, right axis) across 26 sample plots in Ban Phru Toei Community Forest. The stacked bar below the chart shows forest-wide proportions of each biomass compartment. Plots A and P show anomalously low values relative to the adjacent plots.

The carbon stock reported here (0.44 t C rai⁻¹; 1.09 t C ha⁻¹) represents the above-ground biomass of large trees (CBH ≥ 30 cm) and constitutes only one of five carbon pools recognized under the IPCC Tier 1 framework [10]. The remaining four pools—below-ground biomass (roots), dead wood, litter, and soil organic matter—were not measured in the present study. For lowland peat-swamp forests, this omission is particularly consequential: peat soils in Southeast Asian swamp forests typically store between 1,453 and 3,650 t C ha⁻¹ to depths of 0.5–10 m [20,21,22], values that exceed above-ground biomass carbon by two to three orders of magnitude. Applying published IPCC Tier 1 default values for below-ground biomass (root:shoot ratio = 0.37 for tropical moist forest), dead wood (11% of above-ground biomass), and litter (3.1 t C ha⁻¹) would raise the estimated total carbon stock — excluding peat — to approximately 2.0–2.5 t C ha⁻¹. Including peat soil organic carbon, which requires direct soil core sampling and laboratory analysis, would likely increase the total ecosystem carbon estimate to several hundred or potentially several thousand tonnes C ha⁻¹. Peat depth surveys and soil carbon quantification are therefore the highest methodological priority for future work at this site, as they are essential for accurate carbon credit registration under Thailand’s T-VER scheme and

any REDD+ mechanism. Expressed as CO₂-equivalent, the above-ground carbon stock of the 26 sample plots corresponds to 41.86 t CO₂e, and the extrapolated forest-wide stock to 421.82 t CO₂e (1.61 t CO₂e rai⁻¹; 4.01 t CO₂e ha⁻¹). At the Thailand Voluntary Emission Reduction (T-VER) reference price of approximately 250–350 THB t CO₂e⁻¹ reported by the Thailand Greenhouse Gas Management Organization (TGO) for forestry project credits in 2023, the above-ground carbon stock of Ban Phru Toei Community Forest carries an indicative market value of 105,455–147,637 THB (above-ground pool only). Under the international voluntary carbon market, where REDD+ credits for Southeast Asian peat-swamp forest conservation have traded at USD 5–15 t CO₂e⁻¹ (approximately 175–525 THB t CO₂e⁻¹ at 2023 exchange rates), the indicative range would be 73,818–221,455 THB. These figures should be treated as preliminary order-of-magnitude estimates only, as they exclude the peat soil carbon pool, which constitutes the overwhelming majority of ecosystem carbon value in peat-swamp forests and which would be the primary basis for any formal carbon credit registration.

Young-tree above-ground biomass was estimated from measured stem height using the relationship $W = a \cdot H^b$, where a and b are species-group constants for tropical moist forest saplings (Ogawa et al., 1965, as cited in Anuch et al. [11]). Mean young-tree height across all plots was 6.83 m (total cumulative height 12,427.06 m across 1,820 stems). The resulting young-tree above-ground biomass is estimated at 3,241 kg (3.24 t) across the 26 plots, equivalent to 124.7 kg rai⁻¹, representing approximately 11.8% of large-tree biomass. Corresponding carbon stock is estimated at 1,523 kg C (1.52 t C) across the 26 plots, or 58.6 kg C rai⁻¹. Including young trees raises the total aboveground carbon stock for the full 262-rai forest from 114.94 t C to approximately 130.28 t C (477.54 t CO₂e).

4. Conclusions

This study provides the first quantitative assessment of timber value and aboveground carbon stocks for the Ban Phru Toei Community Forest. The 262-rai peat-swamp forest supports 101 tree species at a combined density of 146.62 stems rai⁻¹, with *M. motleyana*, *S. aqueum*, and *S. malaccensis* as the dominant species. The net timber value is estimated at approximately 255.73 million THB, confirming the significant economic value of the timber resource held in trust by local communities. Above-ground carbon stock was estimated at 114.94 t (0.44 t rai⁻¹), equivalent to approximately 422 t CO₂ for above-ground large trees only; this figure excludes the dominant ecosystem carbon pool of peat soil organic carbon (estimated at 1,453–3,650 t C ha⁻¹ in comparable Southeast Asian peat-swamp forests [20,21,22]), which must be quantified before any formal T-VER or REDD+ carbon credit registration can proceed. These data provide a foundation for (i) community-based management planning, (ii) carbon credit registration under Thailand's T-VER scheme—for which the above-ground timber inventory constitutes the mandatory baseline stock assessment—, and (iii) future monitoring programs to track changes in forest structure and carbon accumulation. Regarding Thailand's national REDD+ readiness, the present baseline supports activity data reporting for the deforestation and forest degradation components of the MRV framework. However, full participation in results-based payments would additionally require soil carbon quantification and a reference emission level derived from multi-date satellite monitoring. Future studies should (a) verify scientific identities of the remaining unidentified taxa (Unknown sp. 1–3, collectively 18.8% of stems): during fieldwork, voucher specimens could not be collected due to the absence of fertile material (flowers and fruit); dried leaf and bark samples are retained for future herbarium determination at the Forest Herbarium, Royal Forest Department, Bangkok through herbarium vouchers, (b) quantify below-ground biomass, coarse woody debris, litter, and soil carbon pools to derive total ecosystem carbon stock, (c) develop locally calibrated allometric equations for dominant peat-swamp species, and (d) apply species-specific timber price data to refine economic estimates.

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