Title: A Comparison of Carbon Sequestration in Tree Species at Wichienmatu School, City District, Trang Province

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Abstract

This research, *A Comparison of Carbon Sequestration in Tree Species at Wichienmatu School, Mueang District, Trang Province*, aims to study the carbon sequestration capacity of trees within Wichienmatu School. The study involved measuring the height and circumference of nine tree species, with five trees sampled per species. The studied tree species were **Coconut Palm** (*Cocos nucifera*), **Rough-leaved Fig** (*Ficus hispida*), **Eucalyptus** (*Eucalyptus spp.*), **Cajeput** (*Melaleuca cajuputi*), **Jacaranda** (*Jacaranda obtusifolia*), **Dipterocarp** (*Dipterocarpus alatus*), **Teak** (*Tectona grandis*), **Betel Nut Palm** (*Areca catechu*), and **Perfume Flower Tree** (*Fagraea fragrans*).

The carbon sequestration of each species was estimated using biomass calculation methods. The results showed that **Dipterocarp** (*Dipterocarpus alatus*) had the highest carbon sequestration, exceeding **760.962 kgC**. **Cajeput** (*Melaleuca cajuputi*) and **Eucalyptus** (*Eucalyptus spp.*) followed, with average carbon storage values of approximately **574.446 kgC** and **444.788 kgC**, respectively. In contrast, Rough-leaved Fig (*Ficus hispida*) had the lowest carbon sequestration among the studied species.

Keywords: Carbon sequestration, Tree species, Wichienmatu School

Introduction

Global warming is one of the most critical environmental crises, impacting ecosystems and human societies worldwide. A major cause of global warming is the increasing concentration of greenhouse gases, particularly carbon dioxide (CO_2), which is released from fossil fuel combustion, industrial activities, and human-related processes. The accumulation of CO_2 in the atmosphere intensifies the greenhouse effect, leading to rising global temperatures, polar ice melting, sea level rise, and extreme weather changes.

One effective approach to reducing atmospheric CO_2 levels is increasing green spaces and enhancing carbon sequestration through trees. Trees absorb CO_2 during photosynthesis and store it in their biomass, making the study of carbon sequestration an essential tool for assessing the potential of different tree species in mitigating greenhouse gas emissions. Additionally, in the context of the carbon economy, tree carbon sequestration is linked to the concept of Carbon Credit, a mechanism that incentivizes CO_2 reduction. By quantifying the amount of carbon stored, this data can be used to support reforestation projects, forest conservation initiatives, and carbon credit trading in the carbon market.

This study aims to evaluate the carbon sequestration potential of nine tree species found at Wichienmatu School, Trang Province. The study involves measuring tree circumference at a height of 130 cm from the ground and calculating biomass using data from the Faculty of Forestry, Kasetsart University. The collected data will be analyzed to compare the carbon sequestration capacities of each tree species, providing insights into their role in CO_2 absorption. The findings can contribute to future environmental policies and conservation efforts.

Research Question:

-How does the carbon sequestration capacity differ among the nine tree species at Wichienmatu School?

Research Hypothesis:

-The nine tree species—**Coconut Palm** (*Cocos nucifera*), **Rough-leaved Fig** (*Ficus hispida*), **Eucalyptus** (*Eucalyptus spp.*), **Cajeput** (*Melaleuca cajuputi*), **Jacaranda** (*Jacaranda obtusifolia*), **Dipterocarp** (*Dipterocarpus alatus*), **Teak** (*Tectona grandis*), **Betel Nut Palm** (*Areca catechu*), and **Perfume Flower Tree** (*Fagraea fragrans*)—have varying carbon sequestration capacities.

Independent Variable:

The tree species studied, including **Coconut Palm** (*Cocos nucifera*), **Rough-leaved Fig** (*Ficus hispida*), **Eucalyptus** (*Eucalyptus spp.*), **Cajeput** (*Melaleuca cajuputi*), **Jacaranda** (*Jacaranda obtusifolia*), **Dipterocarp** (*Dipterocarpus alatus*), **Teak** (*Tectona grandis*), **Betel Nut Palm** (*Areca catechu*), and **Perfume Flower Tree** (*Fagraea fragrans*).

Dependent Variable:

The amount of carbon sequestration in trees.

Controlled Variables:

1. The same method is used to measure tree circumference, height, and biomass calculation.
2. The same measuring tools are used, including a measuring tape, clinometer, and the same website for biomass calculation.
3. The circumference is measured at a height of 130 cm above the ground for all trees.
4. Measurements are taken at similar times of the day to minimize the effects of temperature and humidity.
5. The measurers follow the same standardized method and receive training to ensure consistency.

Materials and Equipment:

1. **INVICTA MK1 Clinometer** – Used to measure the elevation angle for tree height calculation.
2. **Tangent (tan) table** – Used in conjunction with the clinometer to determine tree height.
3. **Fiberglass measuring tape** – Used to measure tree circumference at 130 cm above the ground and the distance between the measurer and the tree.
4. **Carbon sequestration assessment website** (https://eng.forest.ku.ac.th/project/carbon/) – Used to calculate the amount of carbon stored in trees.
5. **Google Sheets** – Used for data recording and calculations.

Research Methodology

Study Site Selection

The study focuses on trees within the area of Wichianmatu School, Trang Province (7.5553°N, 99.6146°E).

Part 1: Studying the Carbon Sequestration of Selected Trees

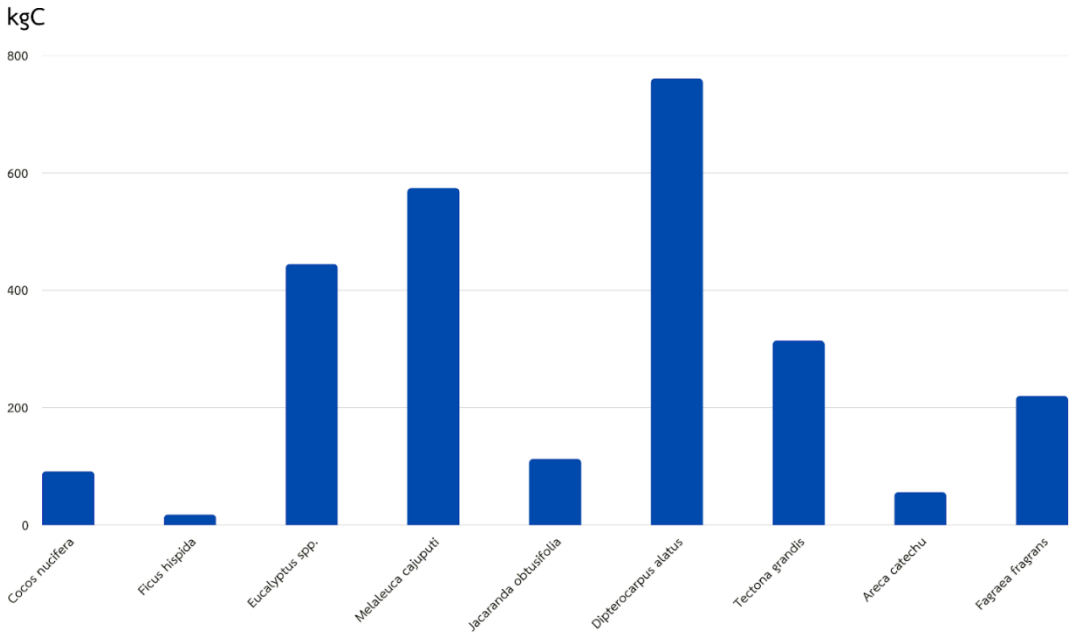
1. **Selection of Tree Species** – Nine tree species within the study area are selected: Coconut Palm (*Cocos nucifera*), Rough-leaved Fig (*Ficus hispida*), Eucalyptus (*Eucalyptus spp.*), Cajeput (*Melaleuca cajuputi*), Jacaranda (*Jacaranda obtusifolia*), Dipterocarp (*Dipterocarpus alatus*), Teak (*Tectona grandis*), Betel Nut Palm (*Areca catechu*), and Perfume Flower Tree (*Fagraea fragrans*).
2. **Measuring Tree Circumference** – Measure the tree circumference at a height of 130 cm from the ground using a fiberglass measuring tape (Diameter at Breast Height, DBH).
3. **Determining the Measurement Position for Tree Height** – Move to an appropriate distance from the tree to ensure a clear view of its highest point.
4. **Measuring Tree Height** – Use a clinometer in combination with a tangent table to determine tree height.
5. **Data Recording** – Record all measurements in Google Sheets for further analysis.
6. **Carbon Sequestration Calculation** – Input the tree height (in meters) and circumference (in centimeters) into the carbon sequestration assessment website (https://eng.forest.ku.ac.th/project/carbon/) to estimate carbon storage.
7. **Calculating the Average Carbon Sequestration** – Sum the carbon sequestration values of all trees and divide by the total number of trees studied to obtain the average sequestration per tree species.
8. **Data Analysis and Comparison** – Analyze and compare the carbon sequestration capacity of each tree species to identify differences in their carbon storage capabilities.

Results: Part 1

Table 1: Recorded Data of Tree Height, Circumference, and Carbon Sequestration of the Studied Tree Species

	Tree Specie	Tree Height (m)	Circumference (cm)	Carbon Content in Biomass (KgC)
1	Cocos nucifera 1	13.559	83.3	75.58
	Cocos nucifera 2	16.166	92	87.45
	Cocos nucifera 3	22.615	85	114.65
	Cocos nucifera 4	16.741	90.9	90
	Cocos nucifera 5	16.934	107.8	90.84
2	Ficus hispida 1	8.054	29.3	12.88
	Ficus hispida 2	7.606	30.7	13.33
	Ficus hispida 3	6.537	33.8	13.85
	Ficus hispida 4	8.251	29.4	13.26
	Ficus hispida 5	8.792	49	37.04
3	Eucalyptus spp. 1	20.345	128	502.92
	Eucalyptus spp. 2	19.87	99.4	305.14
	Eucalyptus spp. 3	38.181	83.6	407.68
	Eucalyptus spp. 4	39.622	122	861.82
	Eucalyptus spp. 5	17.306	72.2	146.38
4	Melaleuca cajuputi 1	21.242	113	414.01
	Melaleuca cajuputi 2	23.25	142	693.93
	Melaleuca cajuputi 3	18.285	190	958.64
	Melaleuca cajuputi 4	22.84	106	392.93
	Melaleuca cajuputi 5	15.056	134	412.72
5	Jacaranda obtusifolia 1	14.11	56	74.63
	Jacaranda obtusifolia 2	14.862	77.9	146.34
	Jacaranda obtusifolia 3	17.23	61.8	108.63
	Jacaranda obtusifolia 4	13.282	31	23.01
	Jacaranda obtusifolia 5	20.25	81	211.04
6	Dipterocarpus alatus 1	22.7035	86.7	267.34
	Dipterocarpus alatus 2	15.76	90.4	204.93
	Dipterocarpus alatus 3	36.933	137.9	1016.51
	Dipterocarpus alatus 4	35.598	167.9	1424.5
	Dipterocarpus alatus 5	26.25	152.6	891.53
7	Tectona grandis 1	14.974	161	580.63
	Tectona grandis 2	14.306	78.9	144.61
	Tectona grandis 3	23.73	77.1	223.32
	Tectona grandis 4	17.398	123.9	408.01
	Tectona grandis 5	16.586	90.4	215.06
8	Areca catechu 1	5.782	55	35.4
	Areca catechu 2	10.79	49.3	62.24
	Areca catechu 3	10.0076	49.4	58.31
	Areca catechu 4	9.082	52.3	53.54
	Areca catechu 5	12.5	102	70.58
9	Fagraea fragrans 1	17.779	86.6	211.75
	Fagraea fragrans 2	25.016	114.4	494.46
	Fagraea fragrans 3	17.44	59.5	102.27
	Fagraea fragrans 4	15.63	102.1	255.89
	Fagraea fragrans 5	7.878	50.6	35.48

A chart showing the average carbon sequestration capacity of the studied tree species.



Conclusion and Discussion

From the study of carbon sequestration in the nine tree species, it was found that *Dipterocarpus alatus* had the highest carbon content in its biomass, exceeding 760.962 kgC. *Melaleuca cajuputi* and *Eucalyptus spp.* followed, with average carbon storage of approximately 574.446 kgC and 444.788 kgC, respectively. Meanwhile, *Ficus hispida* had the lowest carbon sequestration capacity.

Discussion

Tree size and characteristics affect biomass carbon content. Large and tall trees, such as *Dipterocarpus alatus* and *Tectona grandis*, store more carbon than smaller trees like *Ficus hispida* and *Areca catechu*, which have lower overall biomass.

Tree species influence carbon sequestration. Fast-growing hardwood species, such as *Eucalyptus spp.* and *Dipterocarpus alatus*, tend to store higher amounts of carbon. In contrast, trees with lower biomass, such as *Areca catechu* and *Ficus hispida*, have lower carbon sequestration capacity compared to other species.

Acknowledgments

The completion of this project would not have been possible without the support of many individuals. The project team would like to express deep gratitude to the project approvers and extend special thanks to **Mrs. Khwanjai Karnchanasrimak** for her invaluable guidance and constructive feedback throughout the research process.

We also sincerely appreciate **Mr. Sakda Phrasombun**, the Director of Wichianmatut School, Trang Province, for his support, as well as **Mrs. Orapin Noonum** for providing information on the location and names of the studied trees. The project team is truly grateful for the kindness and assistance received from all contributors. Any errors or omissions in this work are solely our responsibility, and we apologize for any inaccuracies.

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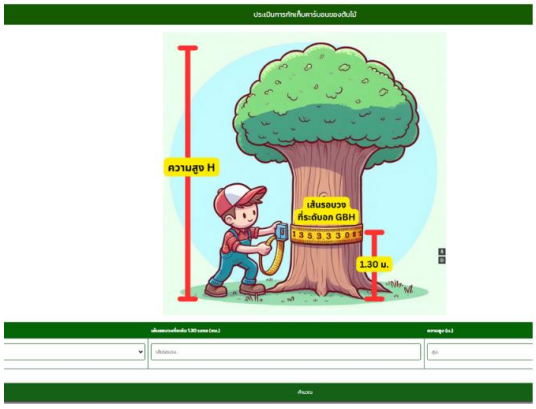
Appendix


ประเมินการศึกษาพื้นฐานร่วมของต้นไม้
ความสูง H
เส้นรอบวง
ที่ระดับอก GBH
1.30 ม.


ประเภท: พรรณไม้ทั่วไป
1.มวลชีวภาพเหนือดิน (กก.)
447.87
1.1 มวลชีวภาพต้นไม้ (กก.)(ไม่รวมปาล์มและเถาวัลย์)
355.85
1.2 มวลชีวภาพหญ้า (กก.)(ไม่รวมปาล์มและเถาวัลย์)
80.80
1.3 มวลชีวภาพไม้พุ่ม (กก.)(ไม่รวมปาล์มและเถาวัลย์)
11.22
2.มวลชีวภาพใต้ดิน (กก.)
120.93
3.มวลชีวภาพรวม (กก.)
568.80
4.ปริมาณสารอินทรีย์ในมวลชีวภาพรวม (kgC)
267.34
5.ปริมาณก๊าซเรือนกระจกที่กักเก็บได้
5.1 (kgCO2e)
980.23
5.2 (tCO2e)
0.98