Research Title: Comparison of Carbon Sequestration in Biomass of Teak (***Tectona grandis*** **L.f.**) and Neem (***Azadirachta indica*** **A.Juss**.) at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province

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Abstract

This comparative study of carbon sequestration in ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province, aimed to: 1) assess the total carbon sequestration in the biomass of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** in the area. It was found that ***Tectona grandis*** **L.f.** sequestered more carbon in their total biomass than ***Azadirachta indica*** **A.Juss.** ***Tectona grandis*** **L.f.** sequestered 2,796.28 kg of carbon, representing 54.80% of their total carbon, while ***Azadirachta indica*** **A.Juss.** sequestered 2,306.81 kg of carbon,representing 45.20% of their total carbon. 2) analyze and compare the carbon sequestration potential in the biomass of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** **.*Tectona grandis*** **L.f.** showed greater potential for carbon sequestration than ***Azadirachta indica*** **A.Juss.** . 3) study the economic return of carbon credits from ***Tectona grandis*** **L.f. and** ***Azadirachta indica*** **A.Juss. .** The results showed that the return on carbon credits from ***Tectona grandis*** **L.f. and** ***Azadirachta indica*** **A.Juss.** depends on the amount of carbon absorbed by the trees. ***Tectona grandis*** **L.f.** have a high potential for carbon sequestration when they are older and have a larger circumference, making them more valuable. ***Azadirachta indica*** **A.Juss.** are popular in climate change mitigation projects because of their rapid growth and carbon sequestration potential**.** ***Azadirachta indica*** **A.Juss.** are notable for their height, while ***Tectona grandis*** **L.f.** are notable for their girth, resulting in ***Tectona grandis*** **L.f.** having a higher biomass and greater long-term value. Both tree species generate income from selling carbon credits under the Thailand Voluntary Emission Reduction Program (T-VER) to polluters such as industrial plants and companies with high greenhouse gas emissions, according to research by CarbonWatch (Assessment of Carbon Sequestration in the Forestry Sector and Forest Management). Therefore, ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** offer significant economic returns in terms of carbon credits.

Keywords: *Tectona grandis* L.f. , *Azadirachta indica* A.Juss. , Carbon sequestration, Carbon credits

Introduction

Currently, people are experiencing global warming caused by human daily life. Trees have the ability to help reduce the amount of greenhouse gases in the atmosphere. Planting large numbers of trees helps offset greenhouse gas emissions from human activities such as burning fossil fuels and deforestation, which produce carbon dioxide (CO_2) that can negatively affect the environment and ecosystems. Therefore, the research team recognized the importance of reducing carbon dioxide emissions and conducted a study comparing the carbon sequestration of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.**

Tectona grandis **L.f.** are large, straight-trunked trees with smooth or shallowly furrowed gray bark. They are found in deciduous forests in South and Southeast Asia and are popularly used for furniture and construction. They grow well in loose, moist soil.

Azadirachta indica **A.Juss.** are medium to large trees with tall, straight trunks. Their bark is smooth when young and cracks and peels off in sheets when mature. They can also be used for furniture and decorative items. ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** are native Thai trees that thrive in hot and humid climates and can tolerate dry, infertile soil better than other plants**.**

Tectona grandis **L.f.** and ***Azadirachta indica*** **A.Juss.** are important economic trees playing a significant role in Thailand's agricultural sector. ***Tectona grandis*** **L.f.** is a high-value hardwood that grows slowly but is long-lived. It can efficiently accumulate biomass and store carbon in its trunk. Planting ***Tectona grandis*** **L.f.** provides not only economic benefits from its high-value timber but also plays a significant role in mitigating global warming. Because ***Tectona grandis*** **L.f.** has a tall, straight trunk with few branches, it has a large amount of wood, which is an important carbon sink. In addition, teak wood is strong and resistant to decay, allowing the stored carbon to remain for decades. The absorbed carbon is not released into the atmosphere when the teak trunk is used to make furniture. Therefore, ***Tectona grandis*** **L.f.** is a highly potential economic crop for long-term carbon sequestration coupled with income generation. In contrast, ***Azadirachta indica*** **A.Juss.** is a fast-growing tree that yields fruit in a short period. It can absorb carbon dioxide quickly, but its wood thickness and carbon storage are less than ***Tectona grandis*** **L.f. .** Therefore, it is suitable for farmers who want to generate income in a short period while still effectively reducing greenhouse gas emissions and mitigating global warming. Planting ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** provides not only economic benefits from their high-value timber, but also plays a significant role in mitigating global warming and reducing greenhouse gas emissions. Furthermore, the carbon sequestration capacity of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.can** be translated into economic value, generating income for farmers through the sale of carbon **credits.**

Besides ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** , other plants that can be used for carbon credit calculation include durian, bamboo, breadfruit, and avocado**.**

Objectives of the Research:

1. To assess the carbon sequestration capacity in the biomass of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** in the area of Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province.

2**.** To analyze and compare the carbon sequestration potential in the biomass of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss**. in the area of Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province. Scope of Study:

3. To study the economic return of carbon credits of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.**

Scope of Study

This study examines the carbon sequestration in the biomass of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province.

Research Question:

Do different tree species store different amounts of carbon in their biomass?

Research Hypothesis: ***Tectona grandis*** **L.f.** have a greater carbon sequestration capacity than ***Azadirachta indica*** **A.Juss. .**

Materials, Equipment, and Research Methodology

1. Measuring tape
2. Tape measure
3. Clinometer
4. Google Map
5. Website for assessing tree carbon sequestration
6. Camera

Main monitoring methods

- Biosphere measurement principle

Study Site Plan

This research studied the initial harvesting volume of ***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province, using the coordinates Latitude 7.5789416, Longitude 99.6648879 ***Tectona grandis* L.f.** were harvested in 10 sections, 3 sections apart, 1 week apart, within the study area. A total of 120 were harvested in this section**.** ***Azadirachta indica* A.Juss**. were harvested in 10 sections, 3 sections apart, 1 month apart, within the study area. A total of 58 ***Azadirachta indica* A.Juss.** were harvested in this section.

Image 1 shows the area around Baan Suan Prathanporn

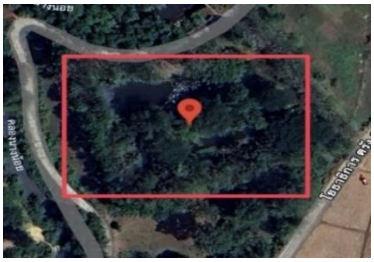


Image 2 also shows the area around Baan Suan Prathanporn.

Research Methodology

1. Research Preparation Phase

1) Identify the research question: Select the topic for study.

2) Research and gather knowledge and theories related to the research.

3) Define the research objectives.

4) Determine the area for random sampling of 10 ***Tectona grandis* L.f.** and 10 ***Azadirachta indica* A.Juss.** trees within the study area.

2. Research Implementation Phase

1) Define the study area for *Tectona grandis* L.f. and *Azadirachta indica* A.Juss. at the Baan Suan Prathanporn

2) Measure the height at a level of 1.30 meters from the ground and then measure the circumference of the trunk being studied.

3) Use a clinometer to measure the angle observed from the observer's eye level, and then measure the distance from the base of the tree to the point where the observer can see the tip of the tree.

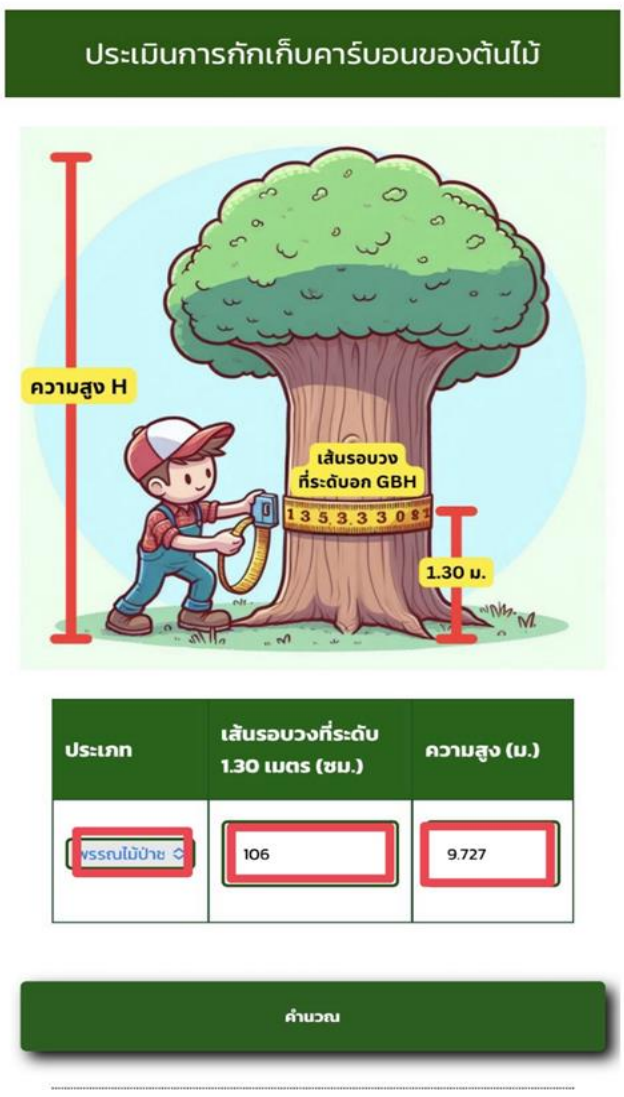
4) Calculate the total carbon in the biomass using a tree carbon sequestration assessment website. Use the values obtained from measuring the circumference at a height of 1.30 meters and the height of the studied trees to find the total carbon in the biomass.

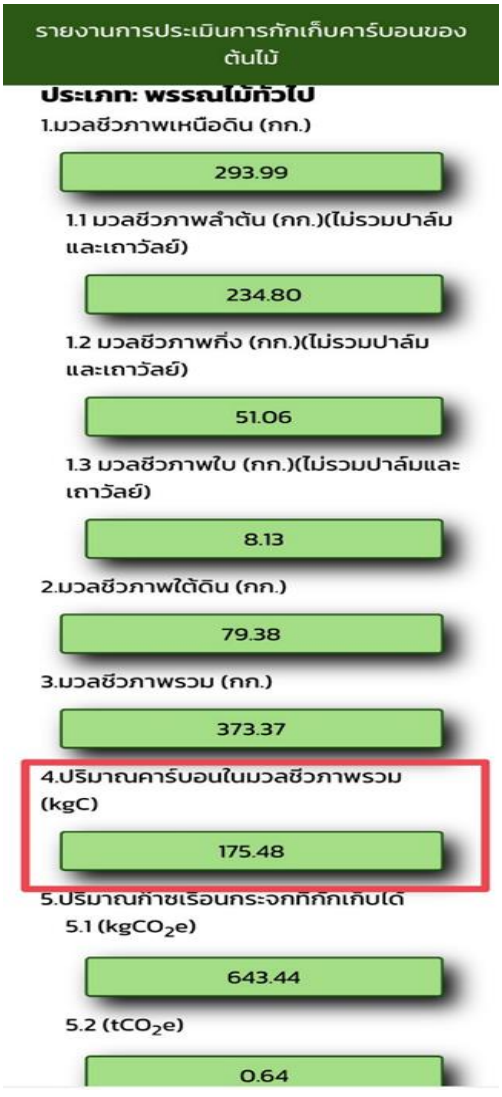
Calculating the height of the tree under study:

The observer stands at a distance of 12.49 meters. The angle measured at the top of the tree is 55 degrees. The tangent angle of 55 degrees is 0.42. Therefore, the height of the tree is 12.49 meters × 1.42 = 17.74 meters. By adding 1.6 meters to the observer's eye level, the total height of the tree is 19.34 meters.

Using a website to assess tree carbon sequestration, the total biomass carbon quantity was calculated.

The cumulative total biomass carbon data for teak and ***Azadirachta indica*** **A.Juss.** were analyzed using a website-based tree carbon sequestration assessment method**.**





Select the type of tree and use the measurements of the circumference at a height of 1.30 meters (in centimeters) and the height of the studied trees (in meters) from the table above to determine the total biomass carbon sequestration of ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** .

Research Results

Table 1 shows the analysis results of carbon sequestration in the total biomass of *Tectona grandis* L.f.

The tree being studied: *Tectona grandis* L.f.	**Distance (m.)**	**Tangent (°)**	**height (m.)**	**circumference (cm.)**	**Total carbon sequestration (kgc)**	**Percentage**
Example 1	15.93	0.51	9.72	106	175.36	6.27
Example 2	17.28	0.53	10.76	101	176.20	6.30
Example 3	18.57	0.75	15.53	95	221.97	7.94
Example 4	19.67	0.81	17.53	117	368.81	13.19
Example5	15.92	0.93	16.41	118	352.14	12.59
Example6	13.96	0.60	9.98	107	183.01	6.54
Example 7	11.69	0.70	9.78	102	164.02	5.87
Example 8	16.88	0.81	15.27	126	372.37	13.32
Example 9	15.70	0.90	15.73	160	601.15	21.50
Example 10	18.34	0.83	16.82	82	181.25	6.48
$\bar{X}$	16.39	0.74	13.75	111.4	279.63	54.80

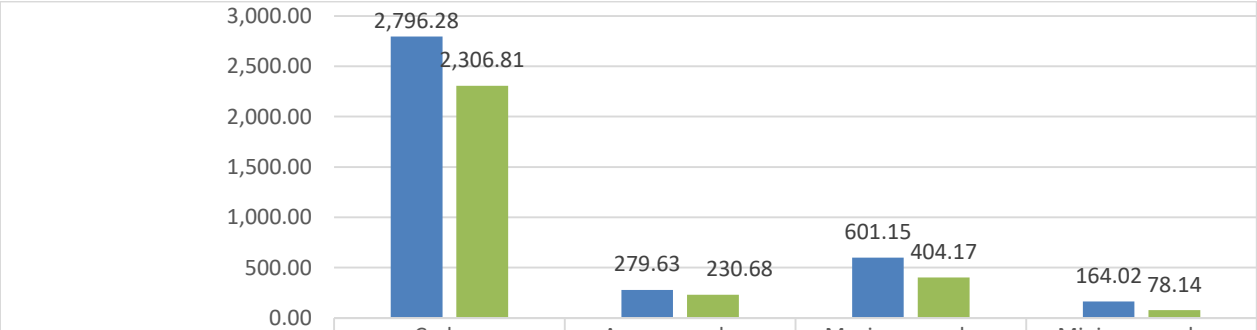
Table 1 shows that a study of 10 ***Tectona grandis*** **L.f.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, revealed an average distance from the base to the visible tip of the trunk of 16.39 m, an average height of 13.75 m, and an average circumference of 111.4 cm. The total biomass carbon sequestration was 2,796.28 kgc, representing 54.80% of all studied ***Tectona grandis*** **L.f.**

Table 2 shows the results of the analysis of carbon sequestration in the total biomass of *Azadirachta indica* A.Juss.

The tree being studied: *Azadirachta indica* A.Juss.	**Distance (m.)**	**Tangent (°)**	**height (m.)**	**circumference (cm.)**	**Total carbon sequestration (kgc)**	**Percentage**
Example 1	11.14	0.36	5.61	91	78.14	3.39
Example 2	11.70	1.11	14.59	78	144.16	6.25
Example 3	13.16	1.96	27.39	88	328.25	14.23
Example 4	12.49	1.42	19.34	70	153.35	6.65
Example5	16.42	0.53	10.30	159	398.37	17.27
Example6	15.39	0.67	11.91	149	404.17	17.52
Example 7	14.48	0.80	13.18	112	259.44	11.25
Example 8	12.70	0.84	12.27	89	157.06	6.80
Example 9	16.54	1.19	21.28	82	226.35	9.81
Example 10	15.16	1.11	18.43	72	154.52	6.70
$\bar{x}$	13.92	1.00	15.43	99	230.68	45.20

Table 2 shows that a study of 10 ***Azadirachta indica* A.Juss.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, revealed an average distance from the base to the visible tip of the trunk of 13.92 m, an average height of 15.43 m, and an average circumference of 99 cm. The total carbon sequestration in biomass was 2,306.81 kgc, representing 45.20% of all studied ***Azadirachta indica* A.Juss.** .

Chart 1 compares the carbon sequestration potential in the total biomass of *Tectona grandis* L.f. and *Azadirachta indica* A.Juss.



	Carbon sequestration in total biomass (kgc)	Average carbon sequestration (kgc/tree)	Maximum carbon sequestration capacity (kgc/tree)	Minimum carbon sequestration capacity (kgc/tree)
Tectona grandis L.f.	2,796.28	279.63	601.15	164.02
Azadirachta indica A.Juss.	2,306.81	230.68	404.17	78.14

Chart 1 compares the carbon sequestration potential in the total biomass of ***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** . It shows that ***Tectona grandis* L.f.** has a potential carbon sequestration capacity of 2,796.28 kgc in its total biomass, representing 54.80%, while ***Azadirachta indica* A.Juss.** has a capacity of 2,306.81 kgc, representing 45.20%. ***Tectona grandis* L.f.** can sequester a maximum of 601.15 kgc and a minimum of 164.02 kgc, while ***Azadirachta indica* A.Juss.** can sequester a maximum of 404.17 kgc and a minimum of 78.14 kgc. This reflects that ***Tectona grandis* L.f.** has a significantly higher carbon sequestration potential than ***Azadirachta indica* A.Juss.**

The Economic Returns of Carbon Credits from *Tectona grandis* L.f. and *Azadirachta indica* A.Juss. The carbon credit returns from ***Tectona grandis* L.f. and *Azadirachta indica* A.Juss.** depend on the amount of carbon sequestration each tree can make, which varies depending on age, species, environment, and the market price of carbon credits, which fluctuates but tends to be upward. ***Tectona grandis* L.f.** have a high potential for carbon sequestration when mature and have a large circumference, making them highly valuable**. *Azadirachta indica* A.Juss**. are popular in climate change mitigation projects because they grow quickly, have tall trunks, and similar carbon sequestration potential. Both species provide supplementary income from selling Thailand Voluntary Emission Reduction Program (T-VER) credits to polluters such as industrial factories, organizations seeking carbon offsetting for carbon neutrality, and companies wanting to reduce their carbon footprint. However, these companies must obtain certification from the Thailand Greenhouse Gas Management Organization (TGO). Research by CarbonWatch (Assessment of Carbon Sequestration in the Forestry Sector and Forest Management) shows that ***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** offer good economic returns in terms of carbon credits. ***Tectona grandis* L.f.** provides high value in the long term, while

***Azadirachta indica* A.Juss.** provides value faster and is easier to cultivate than ***Tectona grandis* L.f.** . Species selection should consider goals, timeframe, and land management to maximize carbon sequestration earnings**.**

Discussion of Results

From a random study of ***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** , Table 1 showed that *Tectona grandis* L.f. had an average trunk height of 16.39 m, an average height of 13.75 m, and an average circumference of 111.4 cm.They stored a total biomass of 2,796.28 kgc, representing 54.80% of all studied ***Tectona grandis* L.f. .** Table 2 showed that ***Azadirachta indica* A.Juss.** had an average trunk height of 13.92 m, an average height of 15.43 m, and an average circumference of 99 cm. They stored a total biomass of 2,306.81 kgc, representing 45.20% of all studied ***Azadirachta indica* A.Juss. .** Table 3 showed that ***Tectona grandis* L.f.** stored more carbon than ***Azadirachta indica* A.Juss.** , even though ***Azadirachta indica* A.Juss.** were taller. ***Tectona grandis* L.f.** had a larger circumference than ***Azadirachta indica* A.Juss. ,** resulting in higher biomass than ***Azadirachta indica* A.Juss. .** This allows it to store carbon in its biomass better than ***Azadirachta indica* A.Juss. .**

Conclusion

Comparison of carbon sequestration in the biomass of teak (***Tectona grandis* L.f**.) and neem (***Azadirachta indica* A.Juss.**) at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province, was conducted according to the research objective: to compare the carbon sequestration of ***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** at Baan Suan Prathanporn, Na Yong Tai Subdistrict, Mueang District, Trang Province. Data was collected from 10 trees of each species. ***Tectona grandis* L.f.** were able to sequester a total of 2,796.28 kg of carbon in their biomass, representing 54.80% of their total carbon, while ***Azadirachta indica* A.Juss.** were able to sequester a total of 2,306.81 kg of carbon in their biomass, representing 45.20% of their total carbon. This shows that ***Tectona grandis* L.f.** have a greater carbon sequestration potential than ***Azadirachta indica* A.Juss.** The carbon credit return from ***Tectona grandis* L.f.** and***Azadirachta indica* A.Juss.** depends on the amount of carbon absorbed by the trees. Although and ***Azadirachta indica A.Juss.*** are taller than ***Tectona grandis* L.f.**, ***Tectona grandis* L.f.** yielded significantly less carbon credits. However, ***Tectona grandis* L.f.** have a larger circumference than ***Azadirachta indica* A.Juss.** , resulting in a higher biomass. This makes ***Tectona grandis* L.f.** more valuable in the long term. Both species generate income from selling carbon credits under the Thailand Voluntary Emission Reduction Program (T-VER) to polluters such as industrial factories and companies with high greenhouse gas emissions, according to research by CarbonWatch (Assessment of Carbon Sequestration in the Forest Sector and Forest Management). Therefore,

***Tectona grandis* L.f.** and ***Azadirachta indica* A.Juss.** offer good economic returns in terms of carbon credits.

Bibliography

A study of the characteristics of teak and neem trees. Plant Genetic Conservation Project. Source: https://www.rspg.or.th/ Accessed on December 27, 2025.

Asst. Prof. Dr. Chakrit Na Takua Thung. Using total biomass carbon (kgC) to estimate tree carbon sequestration. Source: https://eng.forest.ku.ac.th/project/carbon/Accessed January 14, 2026.

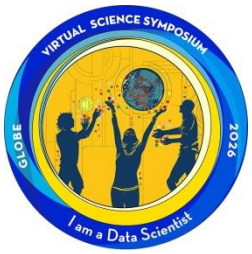
Document for calculating greenhouse gas emission reductions for forestry and agriculture projects. Source: https://ghgreduction.tgo.or.th/th/calculation/less-calculate-document/less-forest-agriculture.html
Accessed on January 14, 2026.

Thidarat Chiawchan, Calculating Tree Height, EP01 DIY: Creating a Simple Crinometer. Source: https://www.scribd.com/document/783842895/63-EP01-DIY
Accessed January 13, 2026.

Dr. Wijarn Simachaya, Director, Thailand Environment Institute. The meaning of Carbon Credit in the economic system. Source: https://www.tei.or.th/th/article_detail.php?bid=129
Accessed December 25, 2025.

Planting trees with the ability to store carbon: 10 fast-growing, high-carbon sequestration tree species commonly planted in Thailand. Source: https://carbonwatch.earthinsights.net/articles/blog-top-10-fast-growing-high-carbon-sequestration-trees-thailand
Accessed December 27, 2025.

Tree evaluation: Not just "wood," but "life value." Evaluating trees for carbon credits generates income. Source: https://m-property.co.th/2025/11/07/evalution_trees_carbon_credit/
Accessed December 28, 2025.



Badges

I am a Problem Solver

This research focuses on carbon sequestration in the biomass of trees. Currently, people are facing problems related to global warming and greenhouse gases. Trees have the ability to store carbon, reducing greenhouse gas emissions in the atmosphere. Therefore, the researchers selected trees with high carbon sequestration potential and compared their biomass carbon sequestration capacities to determine which trees are more efficient. This research can be applied to maximize benefits in the agricultural sector and the carbon credit economy in the future, as global warming is becoming increasingly severe. However, planting trees to replace existing ones can help mitigate this problem.

I am a Data Scientist

This research involved collecting data on carbon sequestration in biomass and calculating averages in a table. The results were then compared to the biomass carbon sequestration potential of ***Tectona grandis*** **L.f**. and ***Azadirachta indica*** **A.Juss.** trees to identify the tree with the best carbon sequestration potential in the studied area. The economic returns in terms of carbon credits from ***Tectona grandis*** **L.f.** and ***Azadirachta indica*** **A.Juss.** trees were then studied.

I am a Collaborator

This research was conducted using a scientific team-based process, encompassing planning, collaboration, fieldwork for data collection, and collaborative data analysis. It also promoted teamwork skills, resulting in a comprehensive and complete research project. It can be used to expand knowledge and can be disseminated or utilized further in the future.