

2026VSS

**Investigate the basic data and carbon
sequestration of trees on the campus of
Kaohsiung Girls' High School**

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I. Abstract

This study aims to utilize a campus tree information platform to investigate the relationship between tree species, trunk circumference, and height with their carbon sequestration capacity. Through field measurements and data analysis, a predictive model for tree carbon storage was developed. The findings were presented through posters and interpretive signs, and shared with students and faculty during on-campus events. Results indicate a positive correlation between tree volume, species, and carbon sequestration, with tree size being the most significant factor influencing carbon storage capacity.

II. Motivation and Objectives

1. Motivation

As global warming becomes increasingly severe, the role of carbon dioxide in climate change has gained widespread attention. Due to its ability to absorb infrared radiation, re-emit heat, and remain in the atmosphere for extended periods, CO₂ is a major contributor to the greenhouse effect. This study aims to explore the carbon sequestration capacity of campus trees and examine how it changes after typhoons.

2. Objectives

Our main goal is to install “Tree Carbon Sequestration Signs” around the Kaohsiung Girls’ Senior High School campus. Through this initiative, we aim to promote the concept of carbon sinks and help students and faculty gain a clear understanding of what carbon sequestration is, why it matters, and how campus trees contribute to carbon reduction.

III. Literature Review

Plants not only absorb carbon dioxide (CO₂) through photosynthesis but also release a portion of it back into the atmosphere via respiration. Therefore, one method for estimating carbon sequestration is to calculate the net carbon exchange, which involves subtracting the amount of CO₂ emitted from the amount absorbed—yielding the net carbon gain, or actual carbon sequestration.

In addition to the visible above-ground biomass—such as trunks, branches, bark, leaves, seeds, and stumps—plants also store carbon below ground. This includes living roots, fallen leaves and branches, and the soil itself, which are collectively referred to as below-ground biomass. These components form various types of carbon pools that work together to create and maintain a forest's carbon sink capacity.

IV. Research Methods and Overview of Research Questions

1. Introduction to the MOE Campus Tree Information Platform

This study utilizes the Ministry of Education's Campus Tree Information Platform for data collection and carbon sink estimation. The platform includes the following core functions:

(1) Campus Tree Mapping System:

A user-friendly map interface allows users to view the GPS locations, photos, and species names of trees on campus.

(2) Tree Species Identification Database:

A digital encyclopedia of common tree species provides descriptions, key features, and reference images to assist in accurate identification.

(3) Carbon Sink Calculator:

By entering tree species, height, and trunk circumference, the platform calculates the estimated amount of CO₂ absorbed by a specific tree.

(4) Tree Maintenance and Management Information:

Offers professional guidance on tree care, planting, and sustainable management practices.

2. Field Measurement Methods

(1) Measuring Trunk Circumference:

A measuring tape was used to record the tree's circumference at 1.3 meters above ground (breast height).

(2) Measuring Tree Height:

Tree height was calculated using trigonometric functions based on the horizontal distance from the tree and the angle of elevation to the treetop (see Figures 1 and 2).

(3) Calculating Carbon Sequestration:

The measured tree data were input into the platform's carbon sink calculator to estimate each tree's CO₂ absorption (see Figure 3).

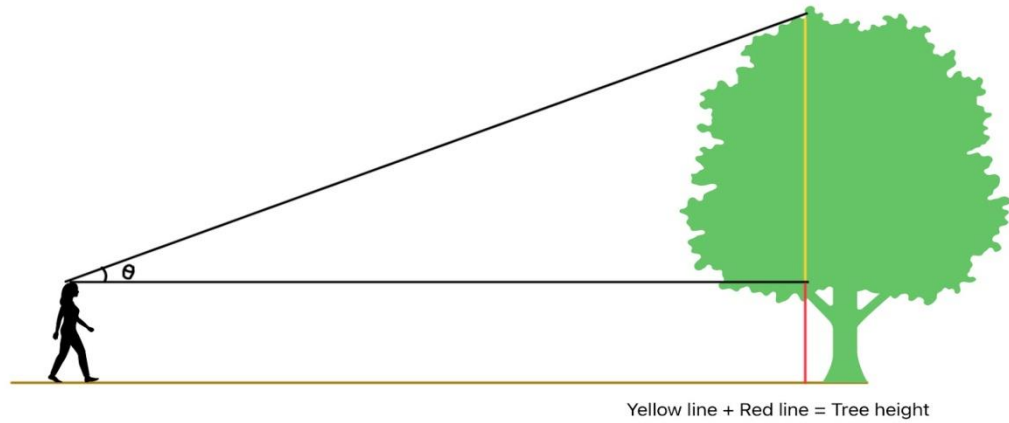


Figure 1



Figure 2

Figure 3 Enter the measured tree height and tree circumference into the carbon sink calculator on the website.

3. Carbon Sink

A carbon sink refers to natural or man-made systems that can store carbon dioxide and other greenhouse gases over the long term, such as forests, soil, and oceans. Carbon sinks can be seen as "warehouses" for carbon dioxide, helping to reduce the concentration of greenhouse gases in the atmosphere through absorption or storage, thereby mitigating the effects of global warming.

4. Promotion

a. Global Carbon Cycle Research

By measuring and calculating the carbon sink of trees, we can help predict climate change trends. This data also supports the development of regional carbon coefficient databases based on dominant tree species, climate zones, and forest types.

b. Community Carbon Sink Survey

In the future, we hope to encourage community organizations, other schools, and agricultural or forestry-related groups to participate in regular tree measurements. These efforts would support the creation of regional carbon sink maps. The collected tree carbon sink data from local areas could then be uploaded and integrated into a nationwide carbon sink monitoring system.

c. On-Campus Promotion

- (a) Incorporate carbon storage data into local “Green Space Carbon Inventory” or climate action plans, promoting the contribution of carbon sinks to the planet.
- (b) Through a series of on-campus carbon sink activities, teachers and students can participate firsthand and learn about the environmental benefits of carbon sinks in schools.
- (c) Create campus tree models and explain them with posters during Atmosphere Week to help teachers and students understand the distribution of trees. See Figures 4 to 9 for reference.
- (d) Create tree information signs that include tree height, tree circumference, and carbon sink amount. See Figures 10 and 11 for reference.



Figure 4



Figure 5



Figure 6



Figure 7

第八屆雄女大氣週

捕風的築夢人

雄女校園綠化樹木調查和碳中和初探

205黃海雁、207莊璨語、215陳臻、217余沛璇、101楊晴涵、104鄭詠潔

研究方法

- 一. 利用手機水平儀app軟體測量樹木仰角後計算樹高。
- 二. 以皮尺環繞離地面約1.3公尺高的樹幹位置，測量記錄樹幹圓周長度。
- 三. 教育部校園樹木資訊平台查詢雄女樹種。



Figure 8

碳匯計算

- 一. 測量雄女樹木基本資料後比對資訊平台資料。
- 二. 利用碳匯計算機計算樹木碳匯量, 建立檔案。
- 三. 共統計數量最多的前36種樹種的樹高和樹圍後, 計算雄女總碳匯量約=934,797kg (下表為計算範例)

項次	樹種	數量	樹圍(公分)	樹高(公尺)	單一樹木固碳量(公斤)	固碳總量(公斤)
1	大王椰子	76	139.5	22.70	436.6	33181.6
2	菲島福木	32	17.2	11.06	19.9	636.8
3	黑板樹	31	280.0	18.18	6175.3	191434.3

未來願景

製作斑城碳徑小卡, 未來希望建置校園每一棵樹的碳匯身分證。



Figure 9



斑城碳徑地圖 D01-1

第11屆大氣社

大王椰子 Kuban Royal Palm

學名：Roystonea regia

樹圍：157cm

樹高：17.78m

碳匯量：441.8kg



Figure 10



斑城碳徑地圖 F02-1

第11屆大氣社

菲島福木 Clusiaceae

學名：Garcinia subelliptica Merr.

樹圍：61.5cm

樹高：16.72m

碳匯量：381.4kg



Figure 11

V. Data Analysis

Refer to Table (1) and Figure (12)

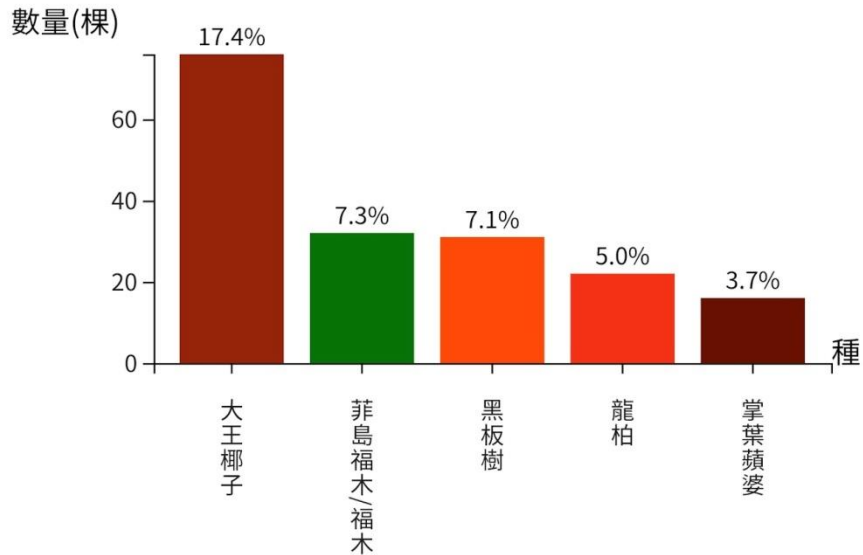


Figure 12 The top five most common tree species at Kaohsiung Girls' Senior High School (ranked by quantity)

Table 1 Tree Data for the Six Most Common Tree Species at Kaohsiung Girls' Senior High School

No.	Tree Species	Quantity	Avg. Circumference (cm)	Avg. Height (m)	Avg. Carbon Storage per Tree (kg)	Total Carbon Storage (kg)
1	Royal Palm	7	104.09	13.21	436.6	33,181.6
2	Philippine Ebony	32	61.83	9.47	19.9	636.8
3	Blackboard Tree	31	239.83	13.89	6,175.3	191,434.3
4	Chinese Juniper	22	40.0	2.50	22.7	499.4
5	Lanyu Podocarpus	15	28.0	1.88	7.8	117
6	Tropical Almond	14	223.0	11.86	5,750.3	80,504.2

Conclusion:

The total carbon sink capacity of all trees at Kaohsiung Girls' Senior High School is approximately **934,797 kg**.

VI. Research Results and Discussion

Survey Objective:

To assess the carbon sink capacity of various tree species on the Kaohsiung Girls' High School campus.

Survey Period:

February 8, 2025 – April 25, 2025

1. Purpose of the Study

This experiment aimed to understand the carbon sink capacity of different tree species on campus as a basis for future carbon sink assessments and promotion efforts.

2. Scientific Principle

Carbon sink capacity is closely related to tree volume. By measuring tree circumference and height, one can estimate the tree's carbon absorption capacity.

3. Materials Used

Measuring tape, and a mobile app capable of measuring angles (e.g., Bubble Level).

4. Discussion

The results show that different tree species and sizes significantly affect carbon sink capacity. Larger, taller trees store more carbon, while smaller trees contribute less. This finding aligns with the theory that carbon is stored in biomass and supports using tree volume as a key indicator for estimating carbon sink capacity.

5. Conclusion

The measurements indicate a positive correlation between tree volume/species and carbon sink capacity. Trees with greater circumference and height have higher carbon storage; conversely, smaller trees store less carbon. These results emphasize the importance of tree structure in contributing to carbon sequestration.

VIII. References

1. *How Can Forest Carbon Sinks Be Turned into Forest Carbon Credits? Understanding Carbon Sinks, Carbon Credits & Methods for Calculating Forest Carbon Credit Prices*
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