

2024 IVSS

**Survey on the carbon
removal capacity of tree
species in schools**

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1. Abstract

In order to contribute to climate change, we selected eight tree species with a high proportion of the campus to investigate their carbon removal capacity, including **Autumn Maple Tree, Indian Almond, Palimara Alstonia, Small-leaved Mulberry, Bodhi Tree, Chinese Banyan, Burma Coast Padauk, Flame of the Forest**. It was found that plants had better carbon removal ability under high illumination, and the carbon removal ability of eggplant was the best, which could be widely planted.

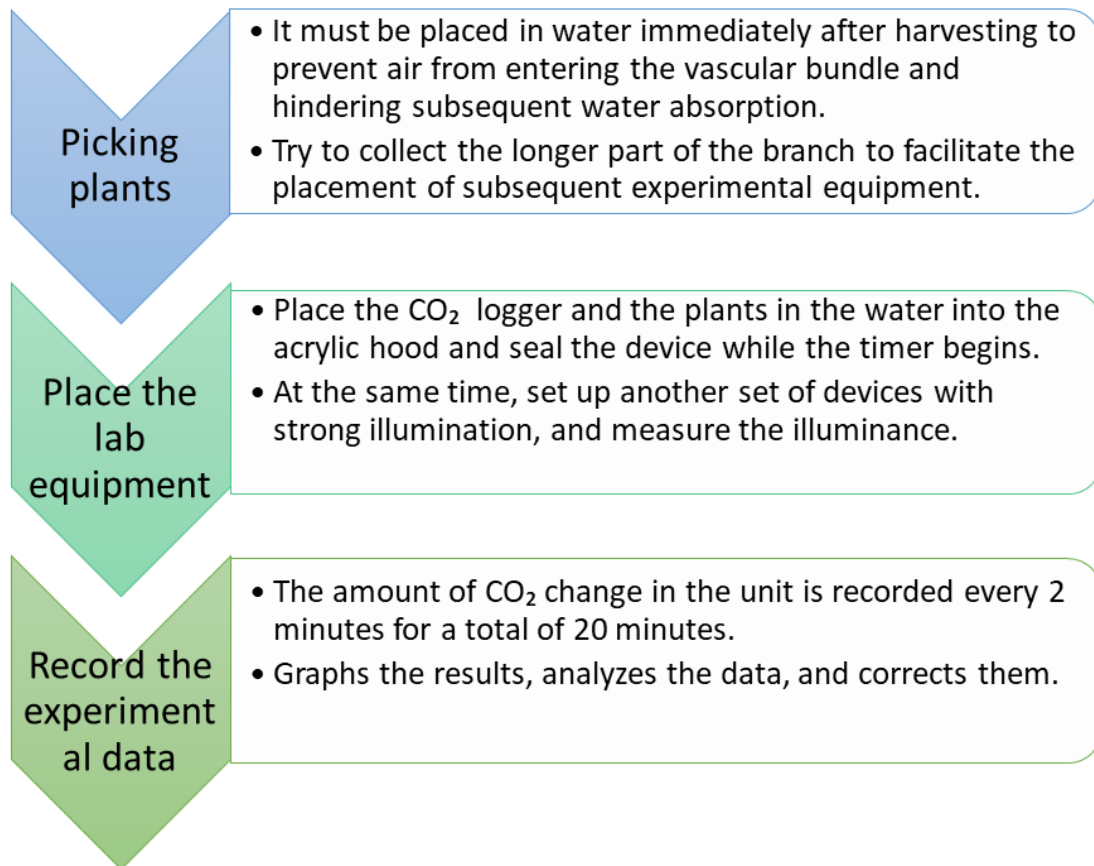
2. Motivation and purpose

Recently, climate change has seriously affected human life, and the main cause of this catastrophe is that a large amount of gas was emitted after the Industrial Revolution (CO₂). As students, we have good teachers and equipment for atmospheric observation at our disposal, although the strength is weak, it is still possible to investigate the carbon removal capacity of this tree species and contribute to saving climate change.

3. Assumptions and expectations

The concentration of CO₂ should be lowered after the species has undergone carbon removal, and it can be seen that different tree species have different carbon removal capabilities, and this tree species can be widely planted.

4. Experimental flow chart



5. Experiments and results

In order to keep the leaves fresh and ensure the same rate of photosynthesis, we soak the leaves in a basin of water and quickly bring them back to the laboratory for experiments. We put the branches and leaves into the acrylic box together with the carbon dioxide concentration observation instrument, and recorded the change in carbon dioxide concentration in units of two minutes at the beginning of the timer, for a total of 10 sets, i.e. 20 minutes.

Picture [1] We use tall shears to cut the leaves.



Picture [2] Laboratory site



Picture[3] Manuscript of Experiment Notes

儀器型號: _____
 日期: 11/3/13 植物: 菩提

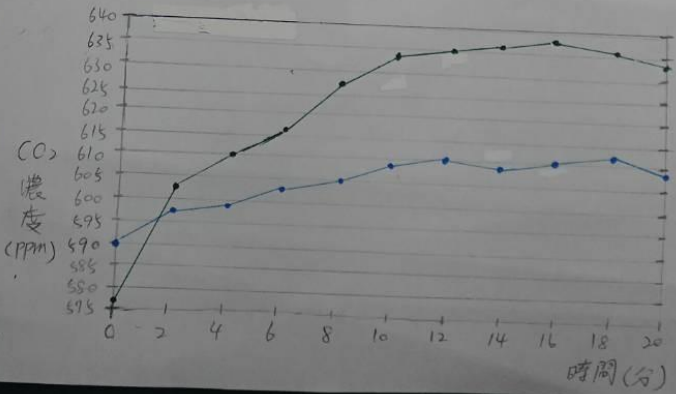
時間	氣溫 (°C)	CO2 濃度 (ppm)	備註
15:47	23.2	590	開始
2分	23.2	598	221 lux
4分	23.2	599	5片
6分	23.3	603	
8分	23.4	605	
10分	23.6	609	
12分	23.8	610	
14分	23.9	609	
16分	24.0	610	
18分	24.2	611	
20分	24.3	609	
共 上升		19 ppm	

儀器型號: _____
 日期: 11/3/13 植物: 榕樹

時間	氣溫 (°C)	CO2 濃度 (ppm)	備註
15:48	23.0	577	開始
2分	23.1	603	221 lux
4分	23.1	610	
6分	23.3	616	
8分	23.4	628	
10分	23.7	634	
12分	23.9	635	
14分	24.0	636	
16分	24.2	638	
18分	24.4	636	
20分	23.5	634	
共 上升		27 ppm	

數據初步分析:
 是否因為照度太弱,
 致光合作用不明顯。

光合作用測量曲線圖
 菩提
 榕樹



(1) Autumn Maple Tree




Autumn Maple Tree	Long distance photo	Close distance photo	Experiment photo
<p>Scientific name: <i>Bischofia javanica</i> Blume</p> <p>Family name: Phyllanthaceae</p> <p>Sexual condition: Evergreen</p> <p>Flower Color: Yellow</p> <p>Fruit: berry</p> <p>Tree shape: Circular expansion</p> <p>Leaf-shaped: ovate-shaped</p> <p>Percentage at Taiwan campus: 2.5%</p>			

Table [1]

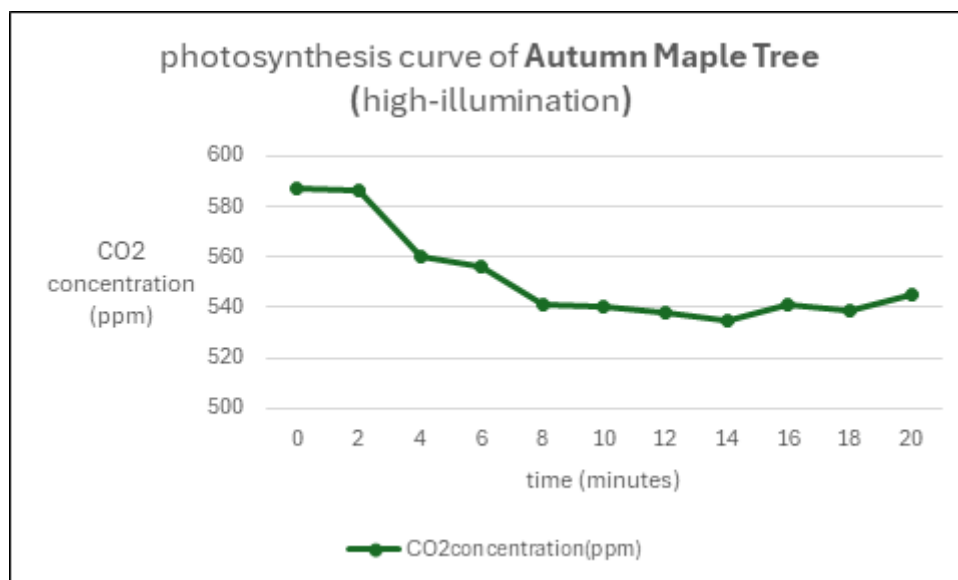


Chart [1]

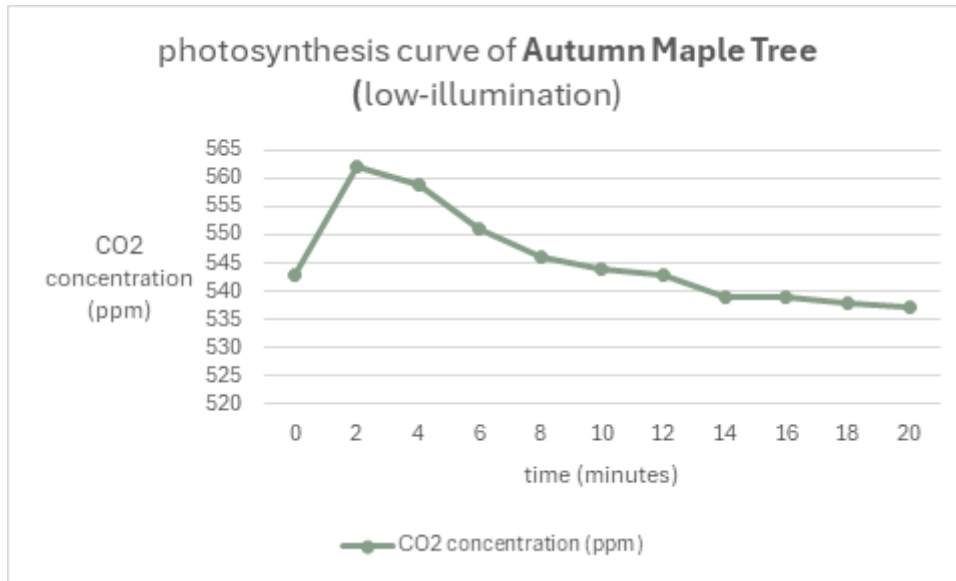


Chart [2]

Charts [1] and [2] show the photosynthesis curve of **Autumn Maple Tree**, and it can be seen that the carbon dioxide concentration of **Autumn Maple Tree** decreased by 42 ppm when exposed to high-illumination light, which was 36 ppm more than that of the low-illumination control group.

(2) Indian Almond



Indian Almond	long distance photo	close distance photo
<p>Scientific name: <i>Terminalia catappa</i> L.</p> <p>Family Name: Combretaceae</p> <p>Sexual condition: Lumpy wood</p> <p>Color: Green</p> <p>Fruit: Drupe</p> <p>Tree shape: Horizontal expansion (flat circle)</p> <p>Leaf-shaped: obovate</p> <p>Percentage at Taiwan campus: 2%</p>		

Table [2]

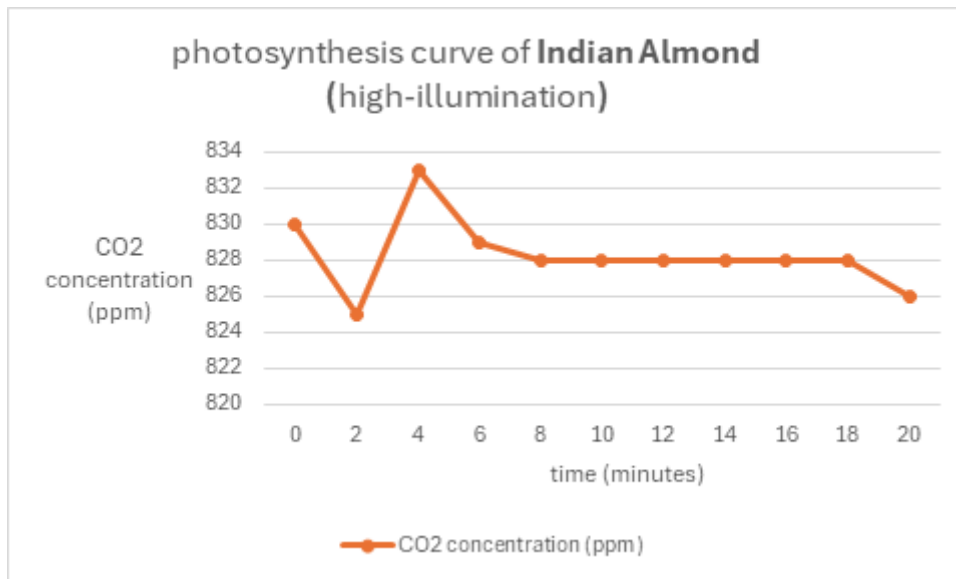


Chart [3]

Chart [3] shows the photosynthesis curve of **Indian Almond**, where we irradiated high-illumination light and finally decreased by a total of 4 ppm. In the first 4 minutes, the concentration decreased and then rose a little large, and then gradually slowed down or even flattened.

(3) Palimara Alstonia




Palimara Alstonia	long distance photo	close distance photo	Experiment photo
<p>Scientific name: <i>Alstonia scholaria</i>(L.)R.Br.</p> <p>Family name: Apocynaceae</p> <p>Sexual condition: Evergreen</p> <p>Flower color: yellow, green, white</p> <p>Fruit: Follicles</p> <p>Tree shape: Ellipse expansion(oval)</p> <p>Leaf shape: Shawl type, long oval shape</p> <p>Percentage at Taiwan campus: 4.6%</p>			

Table [3]

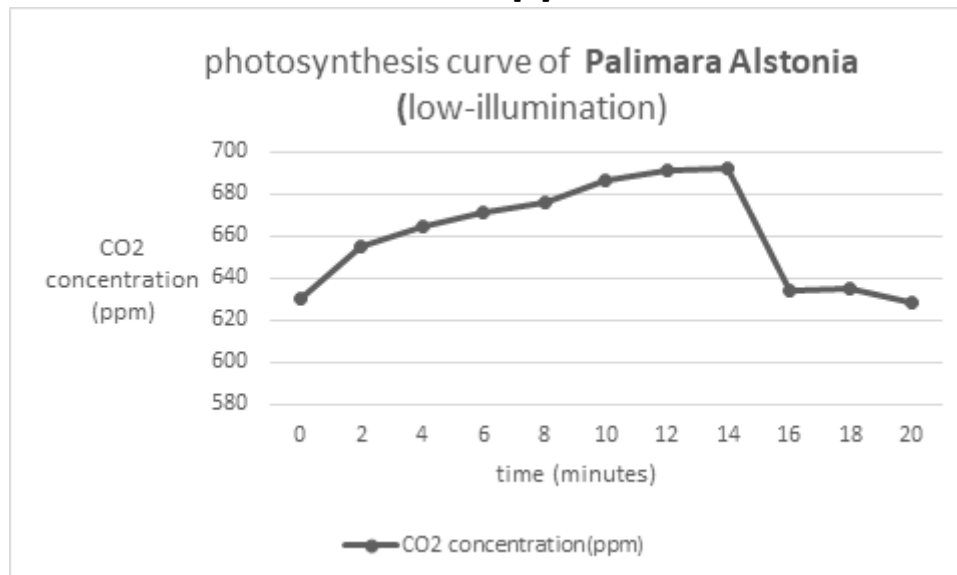


Chart [4]

Chart [4] shows the photosynthesis curve of the **Palimara Alstonia**, where we shine a low-illumination light and finally drop by a total of 2 ppm. The concentration was originally slowly rising for the first 14 minutes, then falling sharply and then returning to a plateau.

(4) Small-leaved Mulberry



<p>Small-leaved Mulberry</p>	<p>ing distance photo</p>	<p>lose distance photo</p>
<p>Scientific name: <i>Morus alba</i> L. Family name: Moraceae Sexual condition: Semi-deciduous tree or shrub Flower color: Yellow Fruit: Aggregate fruit Tree shape: Horizontal expansion (flat circle) Leaf shape: ovate, heart-shaped Percentage at Taiwan campus: 0.6%</p>		

Table [4]

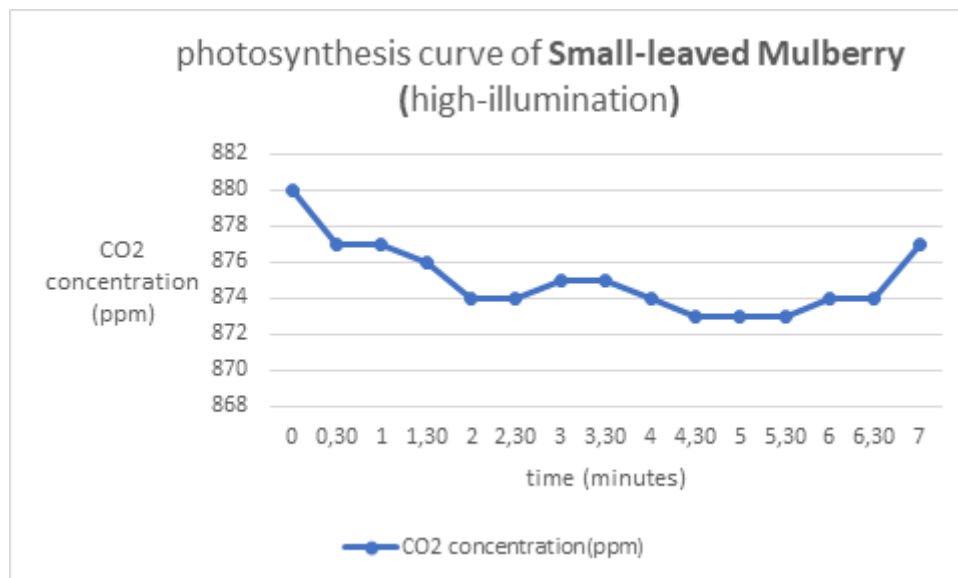


Chart [5]

Chart [5] shows the photosynthesis curve of **Small-leaved Mulberry**, where we irradiated high-illumination light and finally decreased by a total of 3 ppm. We only measured for 7 minutes this time, and the CO2 concentration seemed to be slowly decreasing, and by the 7th minute, the value had risen a bit.

(5) Bodhi Tree




Bodhi Tree	long distance photo	close distance photo	experiment photo
<p>Scientific name: <i>Ficus religiosa</i></p> <p>Family name: Moraceae</p> <p>Sexual condition: deciduous tree</p> <p>Flower color: The receptacle of Cryptocarpus changes from green to yellow</p> <p>Fruit: Aleus</p> <p>Tree shape: Ellipse expansion(oval)</p> <p>Leaf shape: Long leaf stalk heart-shaped</p> <p>Percentage at Taiwan campus: 0.7%</p>			

Table [5]

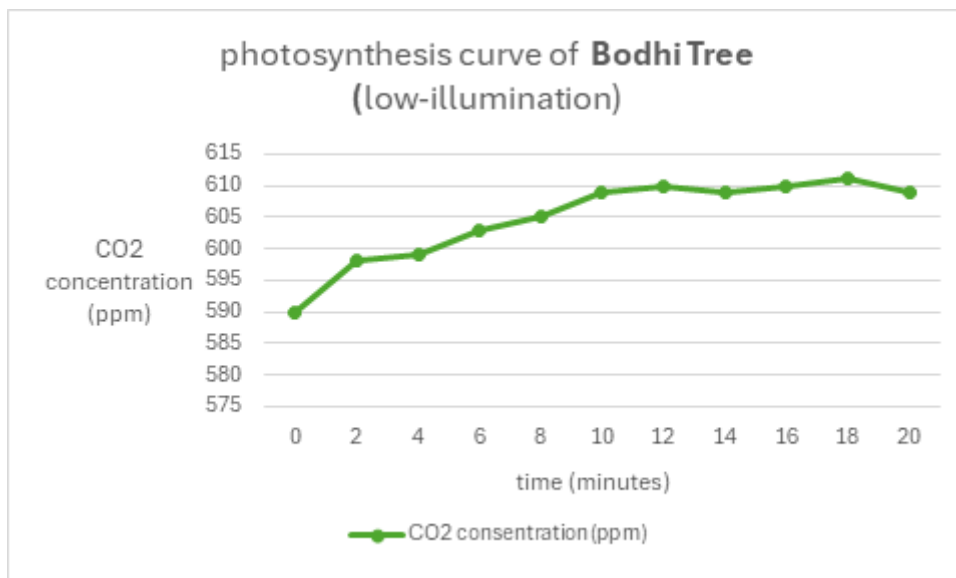


Chart [6]

Chart [6] shows the photosynthesis curve of **Bodhi Tree**, we irradiated low-illumination light, and found that the concentration of carbon dioxide did not decrease but increased, and it has been steadily increasing. In the end, it rose by a total of 19ppm.

(6) Chinese Banyan



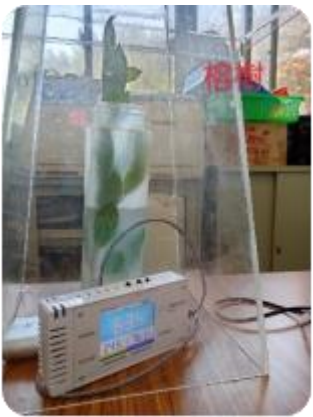
Chinese Banyan	long distance photo	close distance photo	Experiment photo
<p>Scientific name: <i>Ficus microcarpa</i> L. f.</p> <p>Family name: Moraceae</p> <p>Sexual condition: Evergreen large chaw</p> <p>Flower color: The receptacle of Cryptocarpus changes from green to red</p> <p>Fruit: Aleus</p> <p>Tree shape: Horizontal expansion (flat circle)</p> <p>Leaf shape: Ellipse</p> <p>Percentage at Taiwan campus: 7.9%</p>			

Table [6]

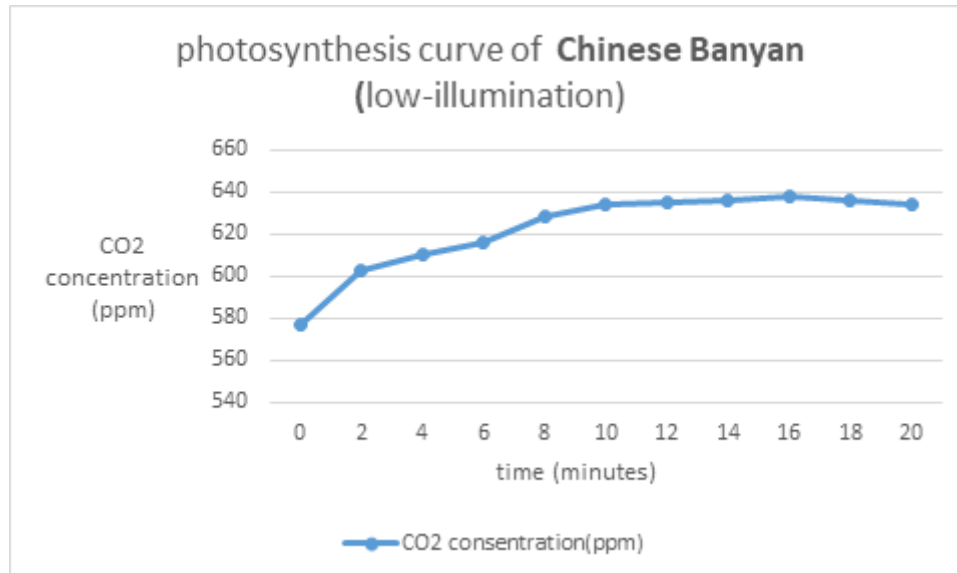


Chart [7]

Chart [7] shows the photosynthesis curve of **Chinese Banyan**, and we found that the concentration of carbon dioxide has increased steadily when we irradiated low-illumination light. In the end, it rose by a total of 27ppm.

(7) Burma Coast Padauk




Burma Coast Padauk	long distance photo	close distance photo	experiment photo
<p>Scientific name: <i>Pterocarpus indicus</i> Willd</p> <p>Family name: Fabaceae</p> <p>Sexual condition: deciduous tree</p> <p>Flower color: Yellow</p> <p>Fruit: Pod</p> <p>Tree shape: Circular expansion</p> <p>Leaf shape: ovate-shaped</p> <p>Percentage at Taiwan campus: 1.1%</p>			

Table [7]

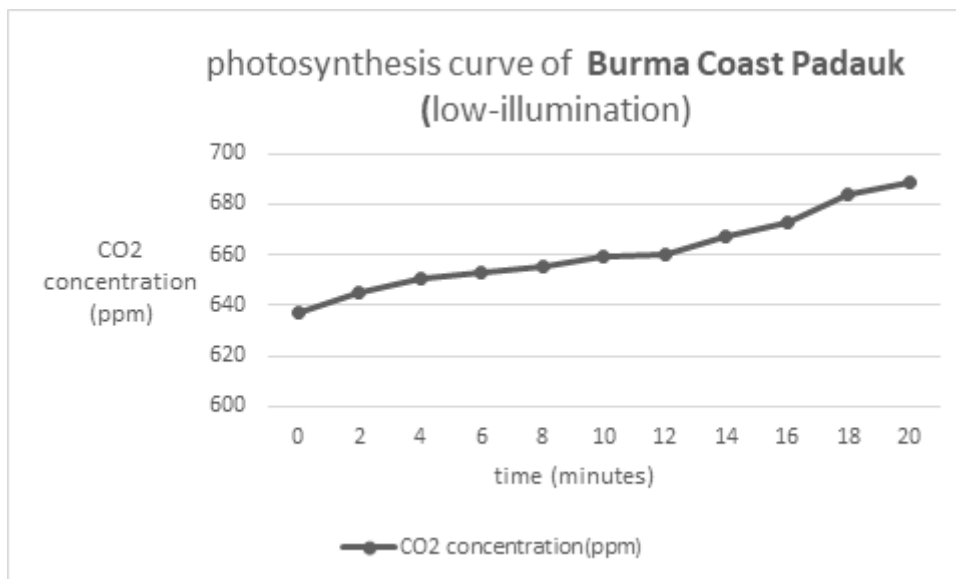


Chart [8]

Chart [8] shows the photosynthesis curve of **Burma Coast Padauk**, we irradiated low-illumination light, and found that the concentration of carbon dioxide did not decrease but increased, and has been steadily increasing. In the end, it rose by a total of 52ppm.

(8) Flame of the Forest





Flame of the Forest	long distance photo	close distance photo	Experiment photo
<p>Scientific name: <i>Delonix regia</i> (Bof. Ex Hook) Raf. Family name: Fabaceae Sexual condition: deciduous tree Color: orange, red Fruit: Pod Tree shape: Horizontal expansion (flat circle) Leaf shape: long oval shape Percentage at Taiwan campus: 1%</p>			 

Table [8]

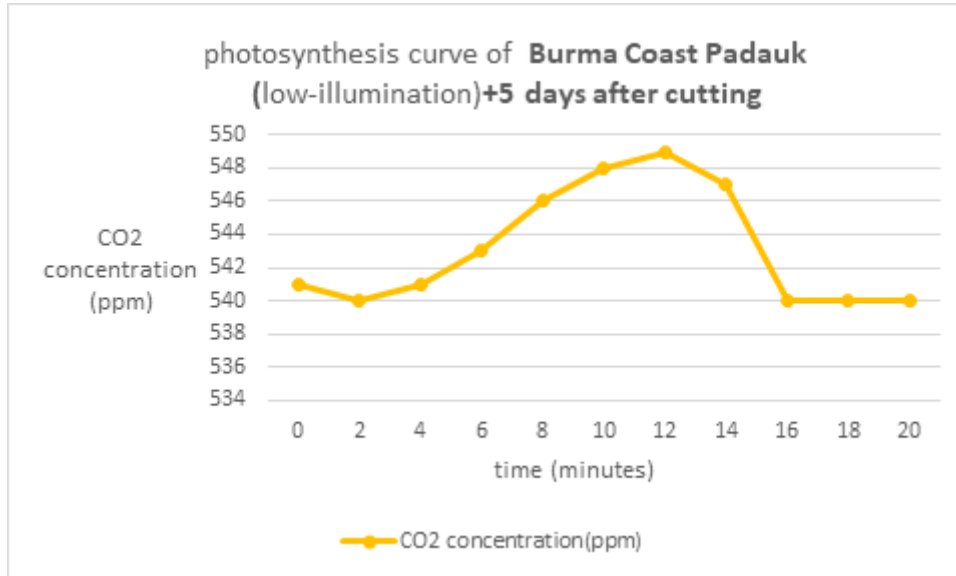


Chart [9]

Chart [9] shows the photosynthesis curve of **Flame of the Forest**, we cut the branches and leaves and soaked them in water for five days, as shown in Experiment photo, and then irradiated low-illumination light, and finally dropped by a total of 1 ppm. The concentration rose slowly for the first 12 minutes, then dropped sharply and then stabilized again.

6. Summary

tree species	illumination	CO2 concentration	
Autumn Maple Tree	High	Decline	42 ppm
	Low	Decline	8 ppm
Indian Almond	High	Decline	4 ppm
Palimara Alstonia	Low	Decline	2 ppm
Small-leaved Mulberry	High	Decline	3 ppm
Bodhi Tree	Low	Rise	19 ppm
Chinese Banyan	Low	Rise	27 ppm
Burma Coast Padauk	Low	Rise	52 ppm
Flame of the Forest	Low	Decline	1 ppm

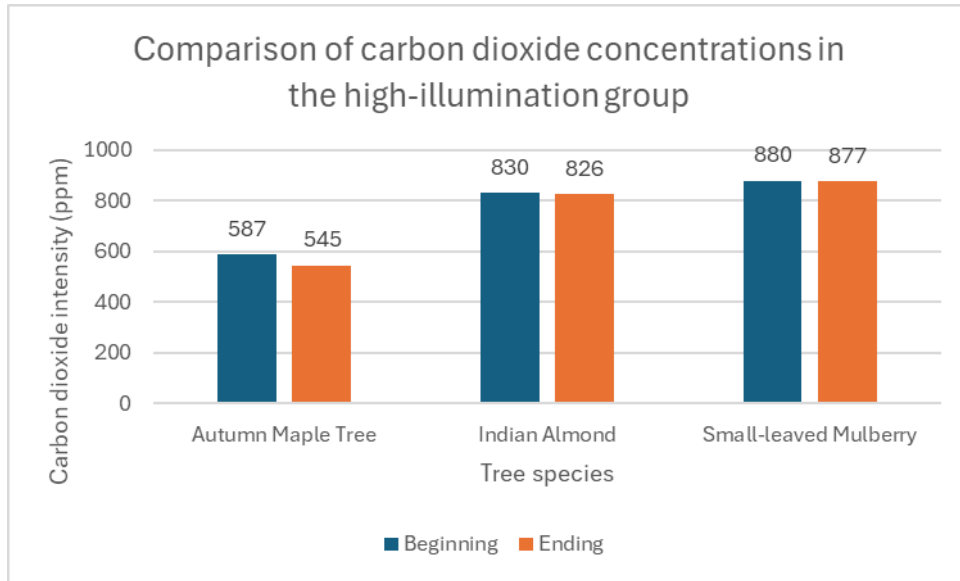


Chart [10]

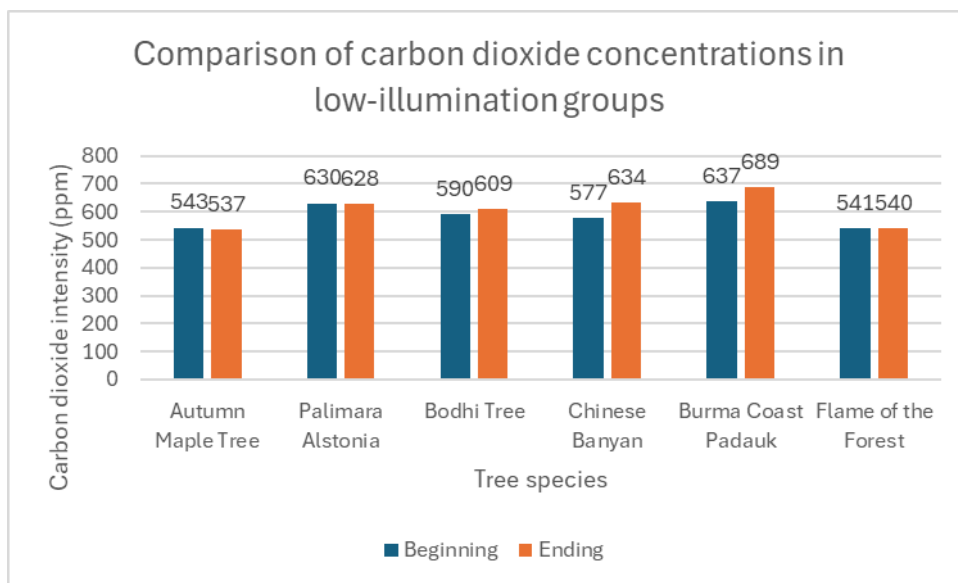


Chart [11]

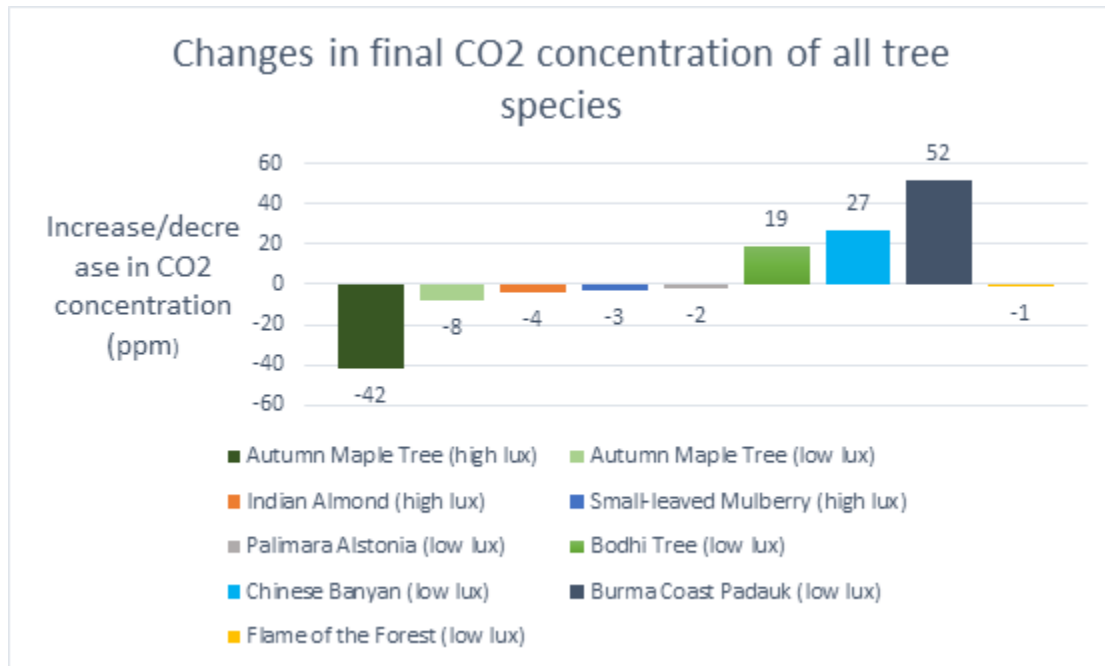


Chart [12]

From the data, it can be found that the carbon removal ability is affected by the light level:

The carbon dioxide concentration of the high-illumination light source decreased, but the decrease range was different according to the species, and it can be seen that the carbon removal ability of different tree species is different, and the carbon removal ability of **Autumn Maple Tree** is the best.

When exposed to low-light sources, the decrease in carbon dioxide concentration was small, or even increased, suggesting that the respiration of plants may be greater than that of photosynthesis.

7. Future outlook

- (1) Complete the comparison of the high and low illumination of the carbon removal capacity of the other seven tree species.
- (2) The effect of blade area on carbon removal capacity was counted.
- (3) Do more experiments with different light intensities.
- (4) Experiment with more tree species.

Acknowledgments: We would like to thank Nagoya Sangyo University in Japan for providing carbon dioxide detection equipment for related experiments.

8. References

- Campus tree information platform
<https://edutreemap.moe.edu.tw/trees/?fbclid=IwAR3ZDhuaQsrUgWvkhvZBg8lGv0CEP6P2CXmGkxxvYdQzFjKzGsCzWXXV07o#/Map>