Research Report

Research Proposal: The Relationship Between Canopy Cover and Carbon Sequestration Potential in Phakmaiwittayanukul School

Teachers

Mrs.Darunee Samerphak , Mrs.Atchara Poung-ok , Mr.Suriya Yaowaman

Students

Mr.Krittanop Wongpakdee, Mr.Thanakrit Ngeksoongnern, Mr.Peeraphat Keskul, Mr.Watcharapong Thongmaen

Abstract

The study compared forest structure and carbon sequestration between Open and Dense Forest at Phakmaiwittayanukul School using GLOBE Protocols.

Results showed that the Dense Forest had higher canopy cover (51.56%), while the Open Forest had greater carbon sequestration (18,175.14 $kgCO_2eq$) than the Dense Forest (13,960.31 $kgCO_2eq$).

Carbon storage was more strongly influenced by individual tree biomass than canopy density, highlighting the importance of conserving mature trees for effective greenhouse gas reduction.

Research Question and Hypothesis

Research Questions

1. How do forest structures (Open vs. Dense Forest) influence canopy cover and ground cover percentages?
2. What is the relationship between canopy density and carbon sequestration in trees?

Research Hypotheses

1. Dense Forest has higher canopy cover and ground cover than Open Forest.
2. Higher canopy cover leads to greater carbon sequestration capacity.

Introduction

Phakmaiwittayanukul School has implemented continuous tree-planting activities to enhance green spaces and mitigate climate change through carbon sequestration. This study investigated how forest structure, particularly canopy cover, influences ground cover characteristics and carbon storage in Open Forest and Dense Forest areas within the school.

Badges

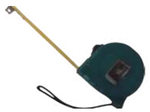
I AM A DATA SCIENTIST

I AM AN EARTH SYSTEM SCIENTIST

I MAKE AN IMPACT

Research Methods and Materials

1. Densiometer 2. Compass 3. Measuring Tape 5.GLOBE Observer app

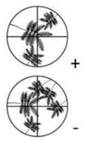


6. LESS-FOR-01 Calculation Tool 4.Diameter Tape

Scope of the Study

1. Canopy cover percentage of the study areas.
2. Ground cover percentage on the forest floor.
3. Tree biometrics: height and circumference at breast height.
4. Carbon sequestration potential ($kgCO_2eq$).
   - Open Forest: 14.943871° N, 104.027387° E
   - Dense Forest: 14.944081° N, 104.027504° E

Study Area Scope



1. Site Selection and Plot Establishment

1.1 Two 30 × 30 m plots were established in Open and Dense Forest sites, with plot centers recorded using Google Maps.

1.2 Pace length was calibrated over 50 m, and plot boundaries were marked along NE, SE, NW, and SW directions.

2.3 Ground cover was observed by identifying the surface type between the observer's feet.

2.4 Canopy and ground cover data were recorded at each sampling point within the plot.

2.5 Calculation: Calculate the Canopy Cover Percentage and ground cover based on the collected data.

$$\text{Canopy Cover \%} = \left(\frac{\text{Total (+)}}{\text{Total (+)} + \text{Total (-)}}\right) \times 100$$

$$\text{Green Ground Cover \%} = \left(\frac{\text{Total (G)}}{\text{Total (G)} + \text{Total (B)} + \text{Total (-)}}\right) \times 100$$

$$\text{Brown Ground Cover \%} = \left(\frac{\text{Total (B)}}{\text{Total (G)} + \text{Total (B)} + \text{Total (-)}}\right) \times 100$$

$$\text{Total Ground Cover \%} = \text{Green Ground Cover \%} + \text{Brown Ground Cover \%}$$

2. Measuring Canopy Cover Percentage and Ground Cover

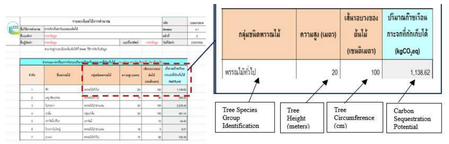
2.1 Starting from the plot center, researchers walked toward flags in the NE, SE, NW, and SW directions.

2.2 At each step, canopy cover was recorded using a densiometer by observing overhead foliage.

3. Measuring Tree Height and Circumference

3.1 Tree height was measured using the GLOBE Observer app by photographing the tree base and top and estimating distance through calibrated paces.

3.2 Tree circumference was measured at 1.35 m above ground, and verified data were submitted to the GLOBE system.



4. Carbon sequestration was calculated using the LESS-FOR-01 program by inputting tree species group, height, and circumference to estimate carbon storage ($kgCO_2eq$).

Results

Table 7: Summary of Research Results

Study Area	Canopy Cover (%)	Green Ground Cover (G) %	Brown Ground Cover (B) %	Total Ground Cover %	Carbon Sequestration Potential ($kgCO_2eq$)
Open Forest	45.31	31.25	17.19	48.44	18,175.14
Dense Forest	51.56	40.63	0	40.63	13,960.31

Table 8: Comparison of Dominant Species and Tree Biometrics

Study Area	Dominant Species	Max Height	Max Circumference	Carbon Sequestration Potential (Range per Tree)
Open Forest	*Sindora siamensis*	21 m.	190 cm	250.86 - 4,006.30 ($kgCO_2eq$)
Dense Forest	*Sindora siamensis* & Bamboo	22 m.	145 cm	23.11 - 2,512.29 ($kgCO_2eq$)

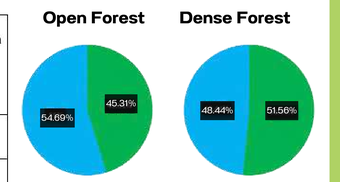


Figure 3.Comparison of Canopy Cover Percentage between Open Forest (45.31%) and Dense Forest(51.56%)

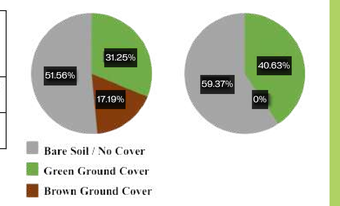


Figure 4. Comparison of Ground Cover Composition, highlighting the presence of brownlitter only in the Open Forest

Discussion

1. **Individual tree biomass**, determined by tree circumference and height, played a more important role in carbon sequestration than tree density or canopy cover.

2. The Open Forest contained large *Sindora siamensis* trees (143–190 cm. circumference), resulting in higher total carbon storage, while the Dense Forest was dominated by smaller trees and bamboo (13–60 cm), leading to lower carbon accumulation despite higher canopy cover.

3. Additionally, lower canopy cover in the Open Forest allowed greater light penetration, promoting higher ground cover diversity and nutrient cycling through leaf litter decomposition.

Bibliography

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Phakmaiwittayanukul School, Thailand