

# Study of soil quality affecting carbon sequestration of mango trees In the area of Ban Phak Mai and Ban Krasang, Phak Mai Subdistrict, Huai Thap Than District, Si Sa Ket Province

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## Abstract

This research aimed to study soil quality and the carbon sequestration capacity of mango trees in Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province, with a focus on Phak Mai Yai Village and Krasang Village. The study compared soil quality factors—such as pH value, temperature, and major nutrients (nitrogen, phosphorus, and potassium)—with the amount of carbon sequestered by mango trees. The results showed that Phak Mai Yai Village had a soil pH of 5 and was able to sequester 61.61 kilograms of carbon dioxide, while Krasang Village had a soil pH of 8 and sequestered only 32.99 kilograms of carbon dioxide. Although both areas had low levels of major nutrients, the acidic soil conditions in Phak Mai Yai Village may have positively influenced the absorption of certain nutrients and supported better mango tree growth. The findings indicate a relationship between soil quality and carbon sequestration capacity, which can be applied to sustainable agricultural land management planning and to support the reduction of greenhouse gas emissions at the community level.

**Keywords:** Soil quality, carbon sequestration, and soil nutrients (e.g., N, P, K)

## Research Question and Hypothesis

1. Research Question: How does soil quality affect the carbon sequestration capacity of mango trees?
2. Research Hypothesis: Soil quality affects the carbon sequestration of mango trees; soils with better quality promote healthier mango tree growth and result in greater carbon sequestration.

## Introduction

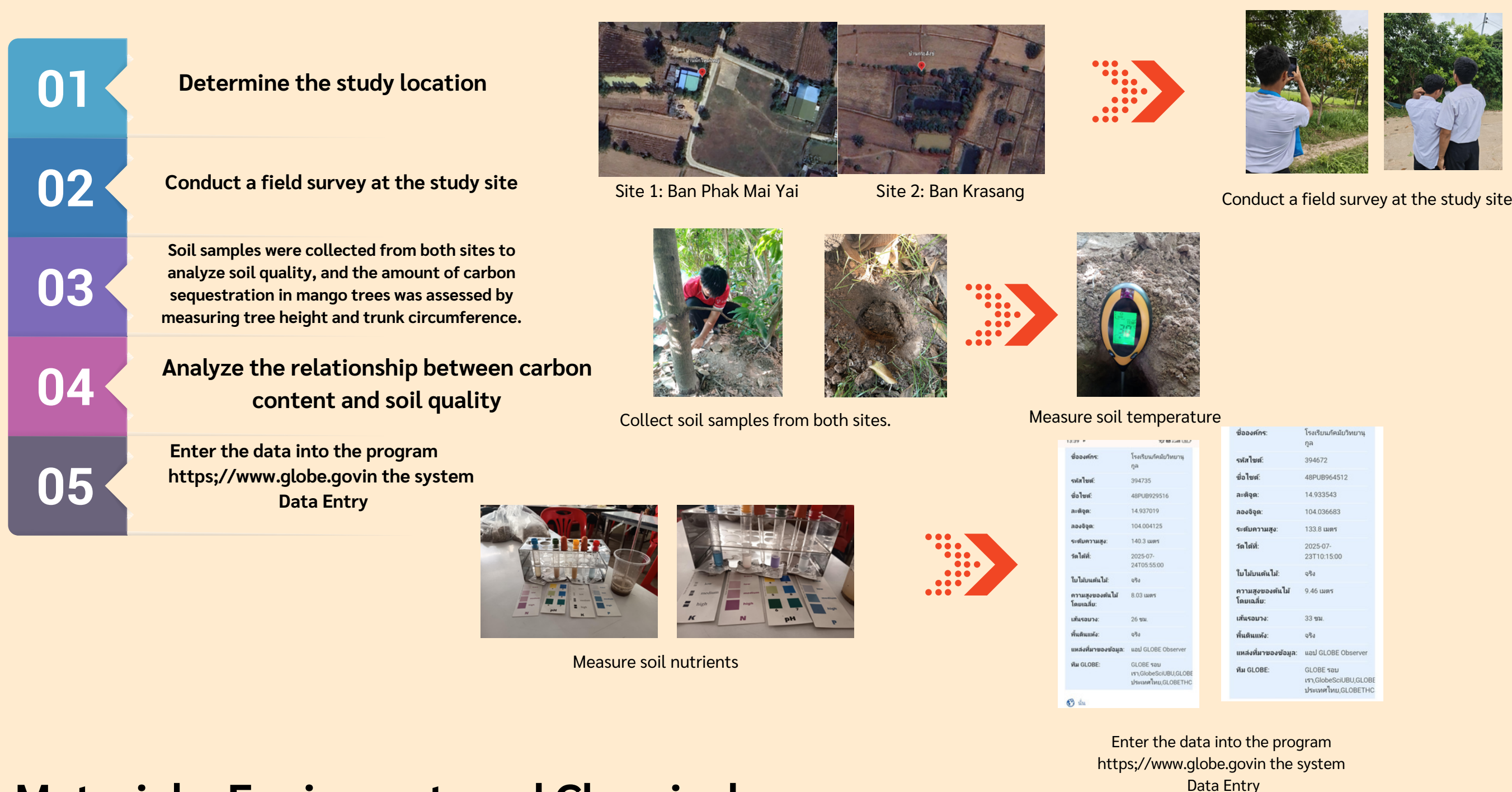
At present, climate change is a major issue affecting the agricultural sector in Thailand and around the world. Reducing greenhouse gas emissions and increasing carbon sequestration in agricultural ecosystems is one approach to addressing this problem. In particular, increasing soil organic carbon (SOC) is crucial for long-term soil fertility and ecosystem sustainability (Land Development Department, 2021).

In Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province, mango cultivation is widespread, especially in Phak Mai Village and Krasang Village. In addition to providing agricultural produce, mango trees can also contribute to carbon sequestration in ecosystems if appropriate soil and cultivation management practices are applied. However, there has been no systematic, in-depth research on soil quality and the carbon sequestration capacity of mango trees in this area.

Therefore, this study is important for evaluating soil quality—such as organic carbon content, soil bulk density, and other chemical properties—in order to examine the carbon sequestration capacity of mango trees in different areas, namely Phak Mai Village and Krasang Village. The findings can be applied to planning sustainable agricultural land management, enhancing carbon reduction potential, and developing planting models that promote both economic and environmental sustainability at the community level.

## Research Methods and Materials

### How to conduct research



### Materials, Equipment, and Chemicals

1. Soil thermometer	2. Soil nutrient test kit (N,P,K)	3. Measuring tape	4. Pencil and pen	5. Mobile phone
6. Record sheets / Data recording documents	7. Hoe	8. Measuring tape (or Measuring line)	9. Test tube rack	10. Soil sampling photographs
11. Distilled water	12. Stopwatch	13. Soil sample containers	14. Google	15. Google Maps

## Results

Table 1 shows the height, circumference, and carbon storage capacity of mango trees in the Ban Phak Mai Yai and Ban Krasang areas.

Study site	Plant Name	Plant Group	Height (m)	Circumference (Cm)	Carbon storage (KgCO <sub>2</sub> )
Ban Phak Mai Yai	Mango Tree	Common Plant Species	8	33	61.61
Ban Krasang	Mango Tree	Common Plant Species	7	26	32.99

Table 2 shows the temperature, pH, and major soil nutrients, including nitrogen, phosphorus, and potassium, in the Ban Phak Mai Yai and Ban Krasang areas.

Study site	Measured parameters				
	Temperature (°C)	pH	Nitrogen	Phosphorus	Potassium
Ban Phak mai yai	30	5	Low	Low	Medium
Ban krasang	29	8	Trace	Trace	Medium

## Discussion

Based on measurements of soil quality and the amount of carbon stored in the areas of Phak Mai Yai Village and Krasang Village, Phak Mai Subdistrict, Huai Thap Than District, Sisaket Province, this study aimed to identify suitable soil quality conditions and to compare soil quality with the amount of carbon that can be sequestered. The soil parameters measured included temperature, soil acidity–alkalinity (pH), and major soil nutrients: nitrogen (N), phosphorus (P), and potassium (K). In addition, the carbon sequestration of mango trees was also measured.

The research results showed that the study site in Phak Mai Yai Village had an average temperature of 30°C and a soil pH of 5. Nitrogen and phosphorus were at low levels, while potassium was at a moderate level. The total amount of carbon sequestered was 61.61 kilograms of carbon dioxide (kgCO<sub>2</sub>).

In contrast, the study site in Krasang Village had an average temperature of 29°C and a soil pH of 8. Nitrogen and phosphorus were at very low levels, and potassium was at a moderate level, with a total carbon sequestration of 32.99 kilograms of carbon dioxide (kgCO<sub>2</sub>).

When comparing the two sites, Phak Mai Yai Village showed nearly twice the carbon sequestration potential of Krasang Village. Although both areas had low nutrient levels, the acidic soil condition (pH 5) in Phak Mai Yai Village may be more suitable for the absorption of certain nutrients and may support mango tree growth better than the strongly alkaline soil (pH 8) found in Krasang Village.

Potassium levels in both areas were moderate, which may contribute to plant growth to some extent; however, this may not be sufficient without adequate nitrogen and phosphorus. Therefore, carbon sequestration in mango trees is related to soil quality, particularly soil pH and the availability of certain nutrients, which are key factors influencing tree structure development and biomass accumulation.

## Bibliography

- Phanomwantee, K., Chusomrong, S., Phamphasith, S., & Promprasit, R. (2025). Machine learning techniques for estimating carbon sequestration in mango orchard areas using data sources. *Environmental Monitoring and Assessment*, 197, Article 201. <https://doi.org/10.1007/s44246-025-00201-z>
- Arunrat, N., Serinnonthachai, S., Kongsurakhan, P., & Hatano, R. (2022). Soil organic carbon and soil erosion sensitivity in response to land use change in northern Thailand. *Journal of Environmental Management*, 305, 114381. <https://doi.org/10.1016/j.jenvman.2021.114381>

## Badges

