# The difference of economic's plant types on Carbon Sequestration Performance in Mueang Nakhon Si Thammarat, Thailand.

**Students:** Suphasan Kaeoaudom, Benyapa Tanlawan and Kamonwan Dechaporn

**School:** Princess Chulabhorn Science High School Nakhon Si Thammarat

**Teacher:** Mr.Thapanawat Chuklin, Kanokrat Singnui

**Email:** mix_mix2346@hotmail.com

## ABSTRACT

This study investigated the difference of economic's plant types on Carbon Sequestration Performance in Mueang Nakhon Si Thammarat, Thailand. We randomly selected 30 trees per plant types in the area of Bangjak sub-district, that is Palm Oil, Coconut and Tubtim Siam Grapefruit Garden. The resulted the plants that have the most circumference is palm oil, showed the most biomass, most ability to absorb carbon dioxide. Next is coconut and Siam Ruby Pomelo will have biomass circumference and the least ability to absorb carbon dioxide, respectively. In tha case of most ability to absorb carbon dioxide, palm oil, Carbon content (Ton), carbon dioxide absorption (Ton) and oxygen production capacity (Ton) were positively correlated with Palm oil's circumference in Muang Nakhon Si Thammarat.

**Keywords:** Carbon Sequestration Performance and Muang Nakorn Si Thammarat, Thailand

**Research Questions**

How do different types of trees affect the amount of carbon sequestration in Muang Nakhon Si Thammarat?

**Introduction and review of literature**

Global warming and climate change are growing environmental concerns that are resulting from the accumulation of greenhouse gases such as carbon dioxide (CO2) in our atmosphere. There is strong evidence that human activities have affected the world's climate (IPCC 2001a). Deforestation and burning of forests releases CO2 to the atmosphere. The CO2 concentration in atmosphere increased from 280 ppm at the beginning of the industrial revolution to 368 ppm by the year 2000 and is projected to increase to 540 ppm by 2100 (Houghton et al. 2001). Indeed, land-use change and forestry (LUCF) is responsible for about 25% of all greenhouse emissions So, reducing carbon dioxide in the air is very important, in part because of the plant respiration process. The respiration process of the plant must mainly use carbon dioxide. Plants are therefore part of helping to absorb the amount of carbon dioxide in the air because it can help reduce the amount of carbon dioxide in the air . So, forests are an important part of absorbing carbon dioxide. In Thailand, the trend of carbon dioxide emissions tends to increase every year. As shown in the graph. ( Ministry of energy , 2017 )

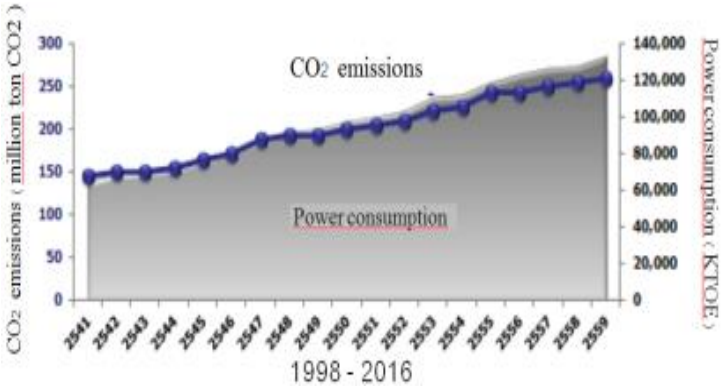


**Figure 1** The trend of carbon dioxide emissions tends to increase from 1998-2016.

Currently, there are 102,820,253.86 rai of forest in Thailand (Royal Forest Department,2019), divided into northern region with 64.17 percent forestry area, central region having 21.37 percent forestry area, northeastern region having 15.03 percent forestry area, eastern region 21.93 percent forestry area Western region has forest area 59.08 percent, southern region has forest area 24.28 percent. Forest area in Nakhon Si Thammarat province, which is the province that we use to study the data, has forest area accounting for 1.13 percent of the total forestry in Thailand. The occupation of the people of Nakhon Si Thammarat Province, most of them are agricultural professions. Agricultural areas in the province are therefore very abundant. Also,there are many economic crops. Therefore, the study area was chosen to grow economic crops such as coconut trees garden, palm trees

garden and Tubtim Siam grapefruit trees garden. The agriculturist's income from the sale of coconut at 8.41 baht per one coconut , palm sales at 3.45 baht per kilogram and from the sale of Tubtim Siam grapefruit 200 baht per kilogram. These plants have generated a lot of income for the farmers in Nakhon Si Thammarat province for a long time.

Therefore, the study team wants to study that, in addition to these crops, they are economic crops that generate a lot of income for farmers. Can also help absorb carbon dioxide and how much power to produce oxygen

## Materials and Methods

### Study site

The Study was carried out in south of Thailand in Nakhon Si Thammarat provice, Study area ( 8.3782 ºN and 100.0444 ºE ) (Figure 2). Study area were divided into 3 areas, Coconut Trees , Plam Oil , Grapefruit Ruby of Siam all of these are all economic crops . By studying 3 types of plot , each plot of 30*30 meters. In each plot of study , 30 trees each type. With an average temperature form 2009-2019 is 27.97 ºC , average of humidity from 2009-2019 is 82.20% , average of rainfall form 2009-2019 is 2835.76 millimeters per year. ( Meteorological station Nakhon Si Thammarat , 2018 )

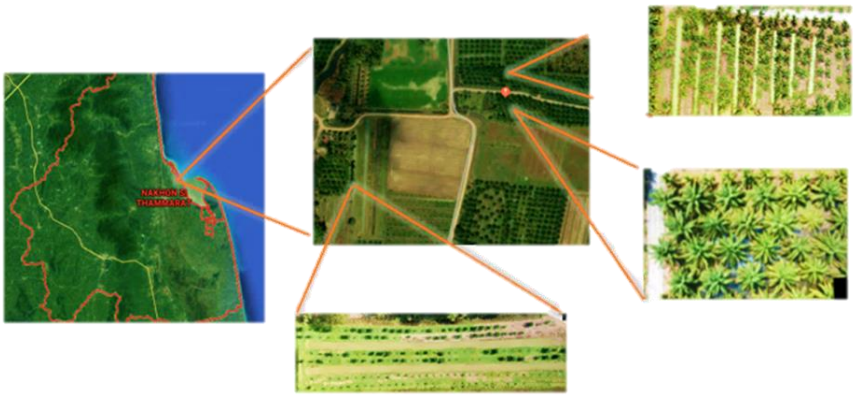

**Figure** 1 Map of Thailand and study site at Nakhon Si Thammarat province, Thailand ( 1 ; coconut plantation , 2 ; palm oil platations , 3 ; Grapefruit Ruby of Siam plantation )

### Data Collection

**Land Cover:** Bangjak subdistrict , Maueng district, Nakhon Sri Thamarat, Thailand.

Take a photo over study site by using Dron, Mavic Pro Platinum and camera with wide angle lens 3 -axis image stabilizer supports 4 K resolution. It is designed to fly at an altitude of 90 meters from the ground. ImageJ application is used to study land cover

**Data collection of perimeter of trees.**

Collect tree circumference information by using a tape around the tree at a height of 1.35 meters and recording the results.

Collect temperature and humidity data of the air by using digital thermometer and humidity Which will collect data every half an hour per garden by placing the meter in the middle of the garden.

Collect temperature and soil humidity data by using digital thermometer and soil moisture by dipping 5 centimeters deep in the soil, reading and recording the results.

Collect soil pH data by collecting soil samples at a depth of 10 centimeters and dissolving it in 200 milliliters of distilled water. Then dip the pH measuring pen in the mixed suspension.

**Data analysis**

Calculation of carbon content in the bark, carbon adsorption of trees And oxygen production of all 3 plants

Calculation of diameter ( D )

The calculation can take the circumference value from the measurement using a tape measure in centimeters. $\pi$ will use the approximation equal to 3.14 in the calculation. And use the following formula.

$$D = \text{circumference}/\pi \text{ (cm.)}$$

Calculation of dry weight ( Y )

The calculation uses the diameter of the tree in centimeters. And use the formula for calculating the amount of rainfall in areas with rainfall between 1,500 - 4,000 millimeters, in Nakhon Si Thammarat province with 2,778.30 millimeters of rainfall (Meteorological Department Nakhon Si Thammarat, 2019 ). And use the following formula. (Brown et al ,1989)

$$Y = 38.4908 - 11.7883D + 1.1926D^2 \text{ (kg.)}, Y = \text{Dry weight (kg.)}$$

Calculation of carbon content ( C )

The calculation uses dry weight values in kilograms and use the following formula. (Carswell et al. , 2009 )

$$C = 0.5Y \text{ (ton carbon)}$$

Calculation of carbon dioxide absorption Use the following formula. (Carswell et al., 2009 )

$$\text{Carbon dioxide absorption} = C(44) / 12 \text{ (ton carbondioxide)}$$

Calculation of oxygen production capacity. The calculation uses carbon values in ton carbon and use the following formula. . (Carswell et al., 2009 )

oxygen production capacity = C( 32 ) / 12 (ton oxygen )

Independent sampled t-test was used to test the mean differences of circumference and the global carbon cycle values using the carbon content (C), carbon dioxide absorption, and the oxygen production capacity. Pearson correlations were used. The significant tests were one-tailed with significant level at $P<0.05$.

## Results

### The relationship between the biomass circumference and the carbon dioxide absorption.

The plants that have the most circumference is palm oil, showed the most biomass, most ability to absorb carbon dioxide. Next is coconut and Siam Ruby Pomelo will have biomass circumference and the least ability to absorb carbon dioxide, respectively.

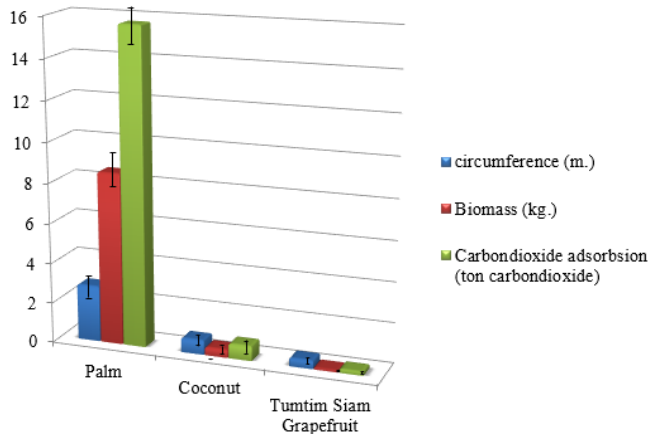


**Figure 3.** The relationship between the biomass circumference and the carbon dioxide absorption of each plant.

### Palm oil's circumference and Soil pH and carbon contents.

Pearson correlation coefficient of Palm oil's circumference and Soil pH and carbon contents in Muang Nakhon Si Thammarat, Thailand, N=30 (P<0.05) (Table 1).

Table 1 Pearson correlation coefficient of Palm oil's circumference and Soil pH and carbon contents in Muang Nakhon Si Thammarat, Thailand. N=30

| | Soil pH | Tree's high (m) | Carbon content (Ton) | carbon dioxide absorption (Ton) | oxygen production capacity (Ton) |
|---|---|---|---|---|---|
| Pearson Correlation | -0.008 | -0.020 | .997** | .997** | .997** |
| Sig (1-tailed) | 0.483 | 0.459 | .000 | .000 | .000 |

Carbon content (Ton), carbon dioxide absorption (Ton) and oxygen production capacity (Ton) were positively correlated with Palm oil's circumference in Muang Nakhon Si Thammarat.

**Discussion**

The results of this study present carbon stocks and tree's types in Muang Nakhon Si Thammarat, Thailand. Therefore, the results showed the plants that have the most circumference is palm oil, showed the most biomass, most ability to absorb carbon dioxide. Next is coconut and Siam Ruby Pomelo will have biomass circumference and the least ability to absorb carbon dioxide, respectively. The is larger the circumference will get the greater biomass, more absorb carbon dioxide. Which can reflect that the cycle of carbon cycle will increase.

**Acknowledgements**

We thank Assoc. Prof. Dr. Krisanadej Jaroensutasinee, Assoc. Prof. Dr. Mullica Jaroensutasinee and Teacher Kanokrat Singnui for helping with give an advice experimental design, data analysis and manuscript preparation. This work was supported in part by Princess Chulabhorn Science High School Nakhon Si Thammarat and The faculty and staff of the Walailak University.

**References**

Anna Dey, Mahmuda Islam* and Kaji Mohammed Masum. (2014). *Above Ground Carbon Stock Through Palm Tree in the Homegarden of Sylhet City in Bangladesh*. Journal of Forest and Environmental Science Vol. 30, No. 3, pp. 293-300, August, 2014.

Brown, S., AJ.R. Gillespie, and A.E. Lugo. *Biomass estimation methods for tropical forests with applications to forest inventory data*, Forest Science, 35, 881-902 (1989).

Clare Crosby and others. (2010). *Carbon Sequestration and its Relationship to Forest Management and Biomass Harvesting in Vermont*. Environmental Studies Senior Seminar (ES 401) Middlebury College.

Carswell, F.E. and others. (2003) *Exchanging emissions for biodiversity— in pursuit of an integrated solution in New Zealand*. Ecological Management and Restoration 4: 85–93.

Edward Amara, Janne Heiskanen, Ermias Betemariam. (2018). *Relationship between carbon stocks and tree species diversity in a humid Guinean savanna landscape in northern Sierra Leone.* Southern Forests: a Journal of Forest Science, April 2019.

Houghton RA, Lawrence KT, Hackler JL, Brown S. 2001. *The spatial distribution of forest biomass in the Brazilian Amazon: a comparison of estimate*. Global Change Biol 7:731-746

IPCC (International Panel on Climate Change). 2001a. Third Assessment Report. Justus J. and Fletcher S. 2001. IB 89005: *Global Climate Change* (Congressional Research Service, Library of Congress).

Keredin Temam Siraj and Beka Benti Teshome. (2017). *Potential Difference of Tree Species on Carbon Sequestration Performance and Role of Forest Based Industry to the Environment (Case of Arsi Forest Enterprise Gambo District).* Environ Pollut Climate Change 2017, 1:3 DOI: 10.4172/2573-458 X.1000132.

Kathryn R. Kirby, Catherine Potvin. (2007). *Variation in carbon storage among tree species: Implications for the management of a small-scale carbon sink project.* Forest Ecology and Management 246 (2007) 208-221.

Meteorological Department. (2019). *Rainfall of 2019*. Nakhon Sri Thammarat, Thailand.

Ministry of energy. [2017]. *Carbon dioxide emissions (CO2) and energy use in Thailand*. Thailand.

Royal Forest Department [ROD]. (2019). *Forest area of Thailand*. Thailand: ROD.