THE ASSESSMENT OF ABOVEGROUND CARBON USING UNMANNED AERIAL VEHICLE IN BANLAEM MANGROVE, NAKHON SI THAMMARAT, THAILAND

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การประเมินการกักเก็บคาร์บอนเหนือพื้นดินโดยประยุกต์ใช้อากาศยานไร้คนขับในป่าชายเลนบ้านแหลม จังหวัดนครศรีธรรมราช ประเทศไทย

นายศิลปชาติ พึ่งป่า

มหาวิทยาลัยเทคโนโลยีสุรนารี

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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ศิลปชาติ พึ่งป่า : การประเมินการกักเก็บคาร์บอนเหนือพื้นดินโดยประยุกต์ใช้อากาศยานไร้คนขับในป่าชายเลนบ้านแหลม จังหวัดนครศรีธรรมราช ประเทศไทย (THE ASSESSMENT OF ABOVEGROUND CARBON USING UNMANNED AERIAL VEHICLE IN BANLAEM MANGROVE, NAKHON SI THAMMARAT, THAILAND)
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คำสำคัญ: มวลชีวภาพเหนือพื้นดิน, ปริมาณกักเก็บคาร์บอน, ป่าชายเลน, การสำรวจระยะไกล, ดัชนีชีวภาพ

การตรวจวัดและติดตามป่าโกงกางให้แม่นยำนั้นจำเป็นสำหรับการจัดการบลูคาร์บอน (blue carbon) จากป่าโกงกางอย่างยั่งยืน แบบวิธีการดั้งเดิมมีข้อจำกัดหลายประการ เช่น ต้นทุนที่สูง ความต้องการแรงงาน และข้อจำกัดในการเข้าถึงพื้นที่ ซึ่งทำให้การศึกษาในหลายๆ กรณีถูกจำกัดเพียงในพื้นที่ขนาดเล็ก วิธีการสำรวจระยะไกล (remote sensing) ที่ทันสมัยมีศักยภาพที่จะนำมาประยุกต์ในการพัฒนาการประมาณการคาร์บอนในป่าโกงกาง ทั้งนี้ป่าโกงกางบ้านแหลมเป็นพื้นที่ป่าชายเลนที่ถูกคาดว่ามีศักยภาพที่สูงในการเป็นแหล่งกักเก็บคาร์บอน (carbon sink) แต่อย่างไรก็ตามป่าชายเลนแห่งนี้ยังขาดการประเมินและติดตามการกักเก็บคาร์บอน การศึกษานี้มุ่งที่สร้างองค์ความรู้ที่ยังมีข้อจำกัด เหล่านี้โดย 1) ประเมินมวลชีวภาพเหนือพื้นดิน (AGB) และปริมาณการกักเก็บคาร์บอนเหนือพื้นดิน (AGC stock) ในป่าโกงกางบ้านแหลม จังหวัดนครศรีธรรมราช ประเทศไทย และ 2) พัฒนาโมเดลการประเมิน AGB โดยใช้เทคโนโลยีอากาศยานไร้คนขับ (UAV) ในป่าโกงกางแห่งนี้ การตรวจวัดภาคพื้นดินได้ดำเนินการเพื่อวิเคราะห์ข้อมูลมวลชีวภาพเหนือพื้นดินและการกักเก็บคาร์บอนเหนือพื้นดินของป่าโกงกาง ภาพจาก อากาศยานไร้คนขับซึ่งเป็นการรับรู้ระยะไกลระบบพาสซีฟ (passive remote sensing) ถูกใช้เพื่อวิเคราะห์ดัชนีชีวภาพ (VIs) และแบบจำลองความสูงของป่า (CHM) ดัชนีเหล่านี้ถูกประเมินโดยการเปรียบเทียบกับมวลชีวภาพเหนือพื้นดิน ซึ่งการตรวจสอบเทียบข้อมูลจากภาคพื้นดินจะใช้การวิเคราะห์การถดถอยหลายตัวแปร (multiple regression) ชนิดพันธุ์โกงกางที่พบในป่าโกงกางบ้านแหลม ได้แก่ *Rhizophora mucronata*, *R. apiculata* และ *Avicennia marina* มวลชีวภาพเหนือพื้นดินและการกักเก็บคาร์บอนเหนือพื้นดินมีค่าตั้งแต่ 0 ถึง 179.78 ตัน/เฮกตาร์ (โดยมีค่าเฉลี่ย 56.30 ± 51.81 ตัน/เฮกตาร์) และ 0 ถึง 89.89 ตัน/เฮกตาร์ (โดยมีค่าเฉลี่ย 28.15 ± 25.90 ตัน/เฮกตาร์) ตามลำดับ โมเดลการประเมินประเมินมวลชีวภาพเหนือพื้นดินที่แม่นยำที่สุดมีค่า R^2 เท่ากับ 0.577 ค่า *Root Mean Square Error* (*RMSE*) เท่ากับ 27.5 ตัน/เฮกตาร์ และค่า *p-value* < 0.001 การศึกษานี้นำเสนอกรอบแนวคิดการประเมินที่สามารถตรวจซ้ำได้สำหรับการประเมินการกักเก็บคาร์บอนในชุมชนบ้านแหลม โดยเน้นถึงความสำคัญ

ของข้อมูลแบบหลายสเปกตรัม การให้ข้อมูลการกักเก็บคาร์บอนรวมถึงชนิดพันธุ์ป่าชายเลนที่พบในการศึกษานี้เป็นข้อมูลพื้นฐานสำคัญที่เอื้ออำนวยต่อการมีส่วนร่วมของชุมชนให้มีการเก็บข้อมูลทางสถิติต่อไปในการประเมินผลกระทบการปลูกป่าชายเลนต่อการลดก๊าซเรือนกระจก รวมไปถึง การจัดการป่าโกงกางอย่างยั่งยืนเพื่อสนับสนุนเป้าหมายความเป็นกลางทางคาร์บอนของประเทศไทย

มหาวิทยาลัยเทคโนโลยีสุรนารี

สาขาวิชาชีววิทยา
ปีการศึกษา 2567

ลายมือชื่อนักศึกษา ศิลปชาติ พึ่งป่า
ลายมือชื่ออาจารย์ที่ปรึกษา
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม

SINLAPACHAT PUNGPA : THE ASSESSMENT OF ABOVEGROUND CARBON USING UNMANNED AERIAL VEHICLE IN BANLAEM MANGROVE, NAKHON SI THAMMARAT, THAILAND. THESIS ADVISOR : SIRILAK CHUMKIEW, Ph.D. 162 PP.

Keyword: ABOVEGROUND BIOMASS/ CARBON STOCK/ MANGROVE/ REMOTE SENSING/VEGETATION INDEX

Accurately measuring and monitoring of mangrove forests are crucial for sustainable management of blue carbon in mangroves. Traditional methods face limitations such as high costs, workforce demands, and limited accessibility, restricting most studies to small areas. Advanced remote sensing (RS) methods offer a potential solution to improve carbon estimation in mangroves, addressing these challenges. The Banlaem mangrove forest, the study area, is expected to hold significant potential as a high-capacity carbon sink. However, there is a lack of carbon assessment and monitoring in this mangrove forest. This study aims to generate knowledge in an area that remains limited by 1) assessing the aboveground biomass (AGB) and aboveground carbon (AGC) stocks in the Banlaem mangrove forest in Nakhon Si Thammarat, Thailand, and 2) developing AGB models using unmanned aerial vehicle (UAV) technology within the mangrove forest. On-ground measurements were conducted to assess the AGB and AGC stocks of the mangrove forest. Following this, UAV imagery as a passive remote sensing method was used to derive vegetation indices (VIs) and a canopy height model (CHM). These indices were then evaluated by comparing them to the ground-truth AGB using multiple regression analysis. Mangrove species, including *Rhizophora mucronata*, *R. apiculata*, and *Avicennia marina*, are present in the Banlaem mangrove forest. The AGB and AGC stocks ranged from 0 to 179.78 tons/ha (with a mean of 56.30 ± 51.81 tons/ha) and 0 to 89.89 tons/ha (with a mean of 28.15 ± 25.90 tons/ha), respectively. The most accurate AGB model achieved an R^2 of 0.577, a root mean square error (*RMSE*) of 27.5 tons/ha, and a *p-value* of < 0.001. This study provides a replicable framework for assessing carbon stocks in the Banlaem community, highlighting the importance of multispectral data. The information on carbon storage, as well as the mangrove species identified in this study, facilitates

community participation in the continuous recording of statistical data and the assessment of impacts on greenhouse gas reduction, contributing to sustainable mangrove management in support of Thailand's carbon neutrality goals.

มหาวิทยาลัยเทคโนโลยีสุรนารี

School of Biology
Academic Year 2024

Student's Signature ศิลปชาติ พึ่งป่า
Advisor's Signature
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LIST OF ABBREVIATIONS

AGB	Aboveground biomass
AGC	Aboveground carbon
BA	Basal area
BEF	Biomass expansion factor
CHM	Canopy height model
DBH	Diameter at breast height
DSM	Digital surface model
DTM	Digital terrain model
GHG	Greenhouse gas
GNDVI	Green Normalized Difference Vegetation Index
H	Tree height
ha	Hectare
LiDAR	Light Detection and Ranging
LMR	Lower Mekong Region
NDC	Nationally Determined Contributions
NDVI	Normalized Difference Vegetation Index
RADAR	Radio Detection and Ranging
RS	Remote sensing
SAVI	Soil-Adjusted Vegetation Index
SEA	Southeast Asia
UAV	Unmanned aerial vehicle
VI	Vegetation index

มหาวิทยาลัยเทคโนโลยีสุรนารี

CHAPTER I

INTRODUCTION

1.1 Background

Blue carbon ecosystems are critical natural systems that sequester carbon, enhance coastal and marine biodiversity, and provide protection against shoreline erosion, extreme weather events, pollution, and sea level rise (Choudhary, Dhar, and Pawase, 2024) . Mangroves are one of the blue carbon coastal ecosystems known for their significant long-term carbon storage capacity and strong potential to reduce greenhouse gas emissions and atmospheric carbon dioxide levels (Choudhary et al., 2024). Among coastal ecosystems, mangroves have the most well-defined carbon budget, globally absorbing approximately 700 million tons of carbon per year through gross primary production, while releasing about 525 million tons (75%) back into the atmosphere as carbon dioxide through respiration (Alongi, 2014). Mangroves absorb large amounts of carbon dioxide through photosynthesis, making them vital for climate change mitigation and requiring regular monitoring (Paramanik, Varghese, Behera, Barnwal, Behera, and Bhattyacharya, 2022).

Accurately measuring, mapping, and monitoring of mangrove forests are essential for the sustainable management of blue carbon in mangrove forests (Dutta, Pitumpe, Watt, Kale, Davies, Heng et al., 2024). Only a limited number of studies have focused on estimating their carbon stocks, mainly because of the technical challenges and the limitations of traditional methods. These challenges encompass financial limitations, workforce availability, time requirements, and the processing of data inventories (Mariano, Da, and De, 2024). Moreover, the difficult accessibility of mangrove habitats has led most studies to be restricted to small areas and reliant on a limited number of field samples (Wang, Wan, Liu, Su, Guo, Qiu, and Wu, 2020). These constraints emphasize the need to develop more advanced methods to improve mangrove carbon stock assessment.

Remote sensing (RS) provides effective methods for accurately estimating carbon stocks in mangrove forests, addressing the difficulties posed by conventional methods. Conventional methods rely exclusively on field surveys for estimation, limiting their effectiveness to small-scale areas (Nguyen and Nguyen, 2021). In contrast, RS provides a solution to the challenges of fieldwork, especially through passive RS, which is both cost-effective and easy to interpret, while providing comprehensive information (Shangari, Shams, Azari, Shamshirdar, Baltes, and Sadeghnejad, 2017). Satellite-based research is becoming more prevalent due to the increasing availability of satellite data, enhanced image resolution, time-series datasets, and reduced time and computational costs (Tassi and Vizzari, 2020). Vegetation indices (VIs) can demonstrate a strong correlation with mangrove aboveground biomass (AGB), as demonstrated by models achieving R^2 values of 0.81 using Sentinel-2 (Farzanmanesh, Khoshelham, Volkova, Thomas, Ravelonjatovo, and Weston, 2024), and 0.90 using Lansat-8 (Mariano et al., 2024). However, Unmanned Aerial Vehicles (UAVs) can carry multiple sensors, allowing for the collection of various data types at different resolutions (Rina, Ying, Shan, Du, Liu, Li, Deng, 2023). The advancement of RS methods is essential for estimating mangrove biomass, especially in large-scale areas that are difficult to access. UAVs should be employed to estimate the biomass and carbon stocks of mangroves using VIs due to their exceptionally high spatial resolution and the ability to take off at any time, on the other hand, satellites have limitations such as revisit time, lower resolution, and atmospheric distortion.

Thailand, located in Southeast Asia (SEA), has a substantial wealth of mangrove forests. Between 1989 and 2020, the mangrove area in the Lower Mekong Region (LMR), encompassing Myanmar, Thailand, Cambodia, and Vietnam, there was a dramatic increase (Bajaj, Sasaki, Tsusaka, Venkatappa, Abe, and Shrestha, 2024). In Thailand, the mangrove area nearly doubled, rising from 339,613 hectares to 601,642 hectares during that period (Bajaj et al., 2024). This emphasizes the need to explore carbon storage in the expanding mangrove areas, particularly in regions where carbon levels have not been examined.

The Banlaem mangrove forest is a promising area that should deserve consideration for its role as a carbon sink. It is located within the Banlaem community of Tha Sala, Nakhon Si Thammarat, in Southern Thailand. Based on a personal interview with the community tourism coordinator (Minmun, personal communication, June 23, 2024), the area underwent an ecological transition from a sandy beach to a muddy-soil wetland approximately 30 to 40 years ago (1984–1994). Following this transformation, various mangrove planting initiatives were implemented, particularly the introduction of loop-root mangroves (*R. mucronata*), which facilitated the rapid expansion of the mangrove ecosystem. However, regarding carbon assessment efforts, this community lacks statistical data on carbon storage, which would facilitate impact assessments and monitoring efforts in this mangrove area.

To address these gaps, this study aimed to 1) evaluate AGB and AGC stocks in the Banlaem mangrove forest located in Nakhon Si Thammarat, Thailand, and 2) generate AGB models from an UAV in the mangrove forest. Furthermore, this study represents the first effort to identify the biodiversity of mangrove trees within the Banlaem mangrove forest. A ground truth assessment was conducted to establish baseline measurements AGB and AGC stocks for validation against RS data. Regression analysis was employed to develop models for estimating AGB in relation to VIs and the canopy height model (CHM). The results of this research will provide a valuable tool for estimating carbon storage in the Banlaem mangrove forest, assisting land managers in making informed decisions regarding harvesting, tree planting, and habitat conservation in this promising area, thereby fostering community engagement in sustainable management and carbon offset initiatives

1.2 Research Objectives

1.2.1 To evaluate AGB and AGC stocks in the Banlaem mangrove forest located in Nakhon Si Thammarat, Thailand

1.2.2 To generate AGB models from an UAV in the mangrove forest

1.3 Scope of the Study

The scope of this study is to assess the AGB and AGC stock of the mangrove forest, followed by the development of an AGB model utilizing RS and regression techniques. The research was carried out in the mangrove forest (ecotourism zone) of the Banlaem community, Moo 7, Tha Sala Subdistrict, Tha Sala District, Nakhon Si Thammarat Province, Southern Thailand (**Figure 1.1**). The study was conducted from April 2023 to July 2024.

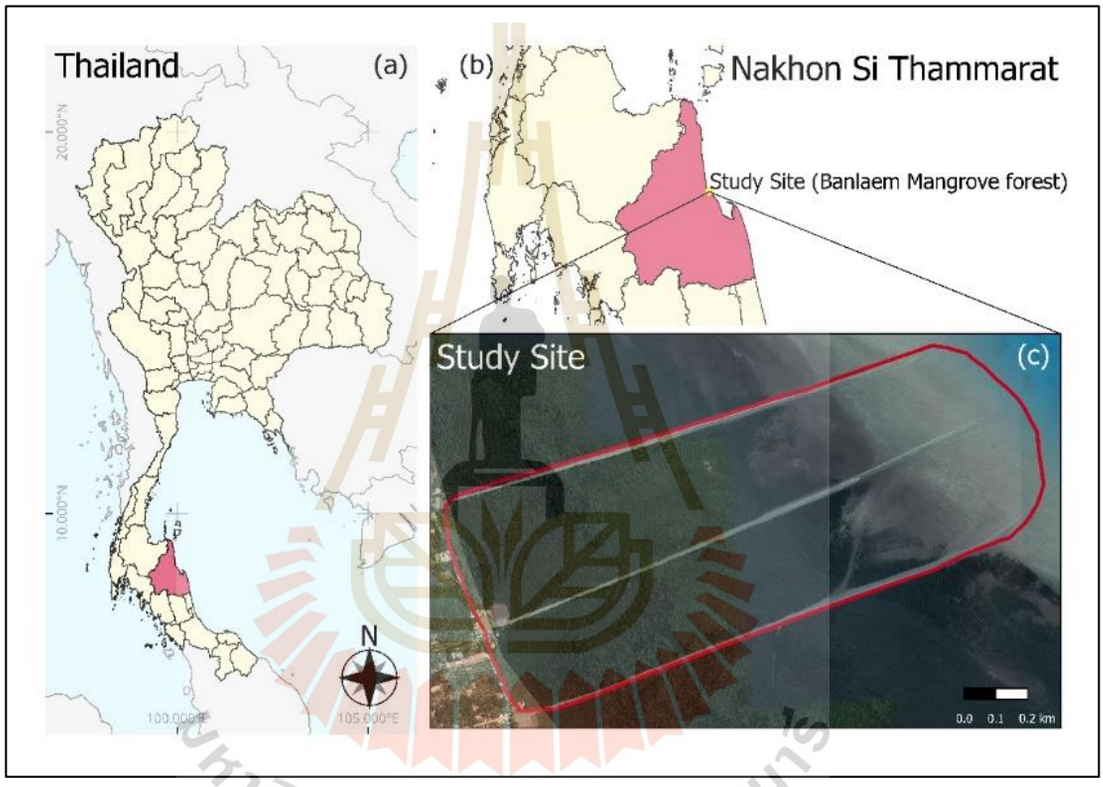

Figure 1.1 The study area: a) Thailand map; b) Nakhon Si Thammarat province; and c) the study site in Banlaem mangrove forest.

CHAPTER II
LITERATURE REVIEWS

2.1 Forest Carbon Pools

A forest ecosystem is one of the big carbon pools in the globe because of the capability to store carbon in various pools. There are seven standard carbon pools in a forest (**Table 2.1**) including: 1) aboveground biomass (AGB), all living biomass above the soil (e.g., stem, branches, seeds, foliage, and living understory plants); 2) belowground biomass, all living root biomass of plants; 3) deadwood, all dead woody biomass (either standing, down, or in the soil); 4) floor litter biomass, the dead biomass of leaves, twigs, needles, and others that lying on the ground and not yet become part of the soil by decomposition (with the diameter less than 7.5 centimeters); 5) soil carbon, all carbon-based material in soil including small-sized roots; 6) harvested wood products in use, which are currently being used (e.g., paper, boards, poles, and wood chips); and 7) harvested wood products in solid waste disposal sites, where they may eventually degrade and release their stored carbon, or remain intact for extended periods (Environmental Protection Agency (EPA), 2020; Hoover and Riddle, 2020). In tropical forests, AGB is a parameter for characterizing forest ecosystems and investigating production potential (Behera, Sahu, Mishra, Bargali, Behera, and Tuli, 2017).

Table 2.1 The types of carbon pools from forest ecosystem.

Type of the forest biomass	Standard forest pools
1 In part of the forest ecosystem	Aboveground biomass
	Belowground biomass
	Deadwood
	Floor litter biomass
	Soil carbon
2 Transported out of the forest ecosystem	Harvested wood products in use
	Harvested wood products in solid waste disposal sites

2.2 Basic Knowledge on Mangrove Forest

2.2.1 The Definition

Mangrove forests (also called mangrove swamps or mangals) are forests that are distributed in tropical and subtropical tidal areas, along estuaries and marine shorelines (Mathias, 2012). Mangrove forests are ecologically defined as the assemblages of trees and shrubs growing in the intertidal zone (foreshore). They include two components: 1) mangrove vegetation (mangrove forest) and 2) associated water bodies. The mangrove forest and associated water bodies are together called "mangrove wetland" (**Figure 2.1**). During the monsoon season, most of the mangrove wetlands are inundated by low saline water, and sometimes freshwater, brackish water, or sea water during other periods (Selvam and Karunagaran, 2019).

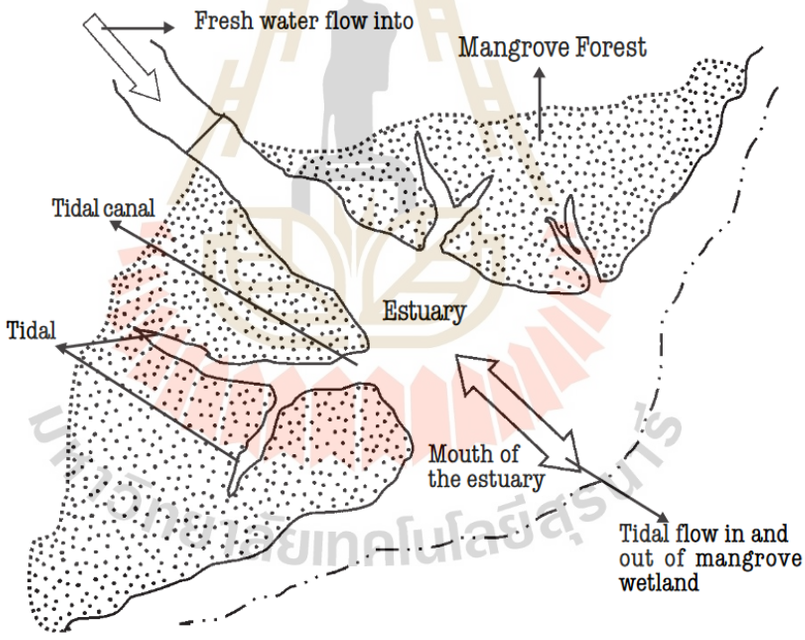

Figure 2.1 Mangrove wetland diagram (Selvam and Karunagaran, 2019).

2.2.2 Mangrove Plant Adaptation

The conditions of mangrove ecosystems are characterized by regular tidal inundation, elevated salinity levels, and reduced oxygen. The soil can be different in each place (firm, muddy, or slushy), besides, muddy and slushy can produce hydrogen sulfide (a gas with a rotten egg smell) showing that waterlogged soils are entirely

anaerobic. On some shorelines, the mangrove forests show distinct zonation because each mangrove species has a different adaptation. Small environmental variations may lead each species to have different strategies to overcome the environment. The mix of mangrove species can be influenced by the tolerances of each species to physical conditions (such as salinity and tidal flooding) and biological conditions (such as crabs feeding on seedlings) (Cannicci, Fusi, Cimó, Dahdouh-Guebas and Fratini, 2018; Selvam and Karunagaran, 2019). The convergent evolution, which happens in several plant families, causes mangroves to be taxonomically diverse. Mangroves grow worldwide mainly between latitudes 30°N and 30°S (cover tropical, subtropical, and some temperate coastal areas), however, the greatest mangrove areas are within 5° of the (Friess and Webb, 2014; Giri, Ochieng, Tieszen, Zhu, Singh, Loveland, Masek, and Duke, 2011).

Mangrove plants' adaptation to their environments contributes to the distinctive appearance of the vegetation. Each mangrove species can grow in different zones. Theoretically, five salinity zones can be accounted for horizontally in mangrove wetlands based on salinity distribution including: euhaline, polyhaline, mesohaline, oligohaline, and limnetic zone (**Table 2.2**). For example, in the Australian mangrove, it was found that *Avicennia marina* can grow in a broad range of salinity; *Sonneratia alba* grow in only euhaline zones; *A. integra* grow in polyhaline and mesohaline zones, while *S. lanceolata* grow in mesohaline and oligohaline zones (**Figure 2.2**). In addition, physical adaptation can be noticed in mangroves, such as looping stilt roots, needle-like aerial roots, and evergreen with shiny leaves. Moreover, mangrove canopy height is affected by climate, topography, and human disturbance. The mature undisturbed mangrove forest grows a high, dense canopy with tall trunks. The canopy is monotonous due to the relatively similar size, shape, and texture of the mangrove leaves. Besides, mangrove plants can become stunted and scrubby in a disturbed environment (Selvam and Karunagaran, 2019).

Table 2.2 The salinity range in different estuarine zones.

Zone	Range of salinity
Euhaline	> 30%
Polyhaline	18 - 30%
Mesohaline	5 - 18%
Oligohaline	0.5 - 5%
Limnetic	< 0.5% (fresh water)

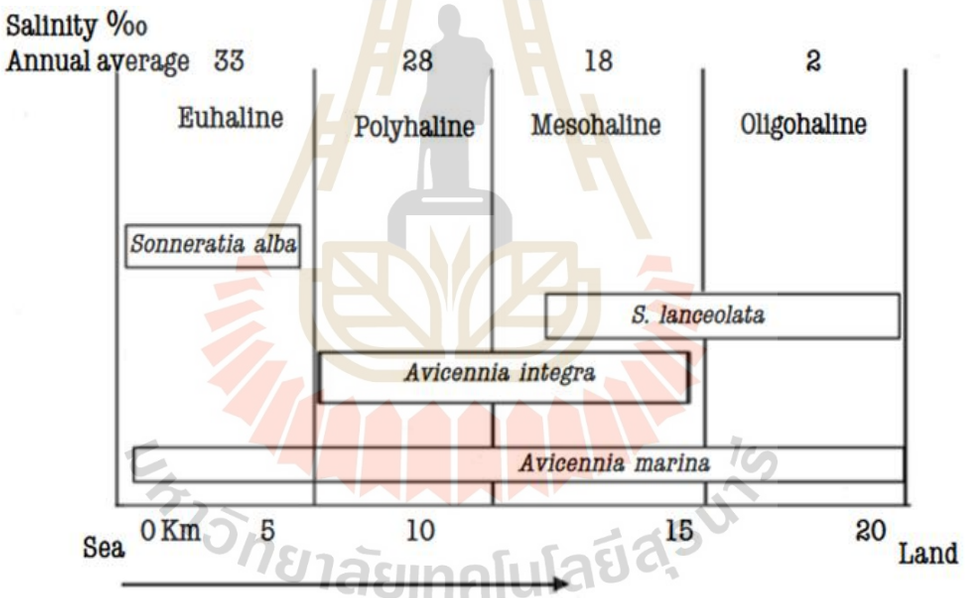

Figure 2.2 Distribution of mangrove species in an Australian mangrove in different salinity zones (Selvam and Karunagaran, 2019).

2.2.3 Mangrove Forest in the Sundaic Region

The three distinct biogeographic regions are located in Southeast Asia, which are Indochina, the Sundaic region (Sundaland), and the Philippines (Woodruff, 2010). The Sundaic region has seen rapid and severe mangrove degradation (Friess, Rogers, Lovelock, Krauss, Hamilton and Lee et al., 2019; Thomas, Lucas, Bunting, Hardy, Rosenqvist, and Simard, 2017). The region covers a part of southern Thailand,

Malaysia, Indonesia, Sumatra Island, Borneo Island, Java Island, and Bali Island. **Figure 2.3** illustrates the mangrove area in the Sundaic region, Southeast Asia. The mangroves, which are in the Sundaic region, consist of 58 genera and 69 species that are three times more diverse than mangroves in the Atlantic East Pacific zone (Saenger, Ragavan, Sheue, López-Portillo, Yong, and Mageswaran, 2019). This region is the center of key mangrove genera, including *Avicennia*, *Bruguiera*, *Ceriops*, *Lumnitzera*, *Rhizophora*, and *Sonneratia* (Chapman, 1977).

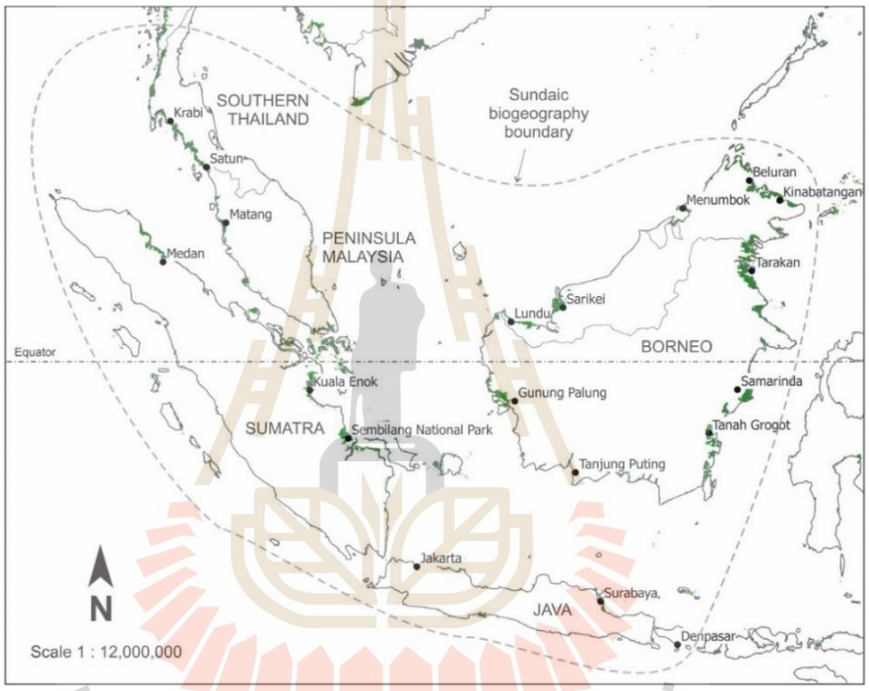

Figure 2.3 The Sundaic biogeographical region (dashed line) and its mangrove area (Bunting et al., 2018; Ng and Ong, 2022; Woodruff, 2010).

2.2.4 Mangrove Carbon Storage in the Sundaic Region

In the Sudanic region, the carbon storage in the mangrove ecosystem is exceptionally high compared to other world's major forests (**Figure 2.4**). Donato, Kauffman, Murdiyarso, Kurnianto, Stidham, and Kanninen (2011) found that the mangrove ecosystem contains an average carbon stock of 1,023 ± 88 Mg C ha^{-1}, which is three to five times more carbon (C) per unit area compared with boreal, temperate, and tropical upland forests, with rich organic sediment accounting for 49 to 98% of the carbon storage.

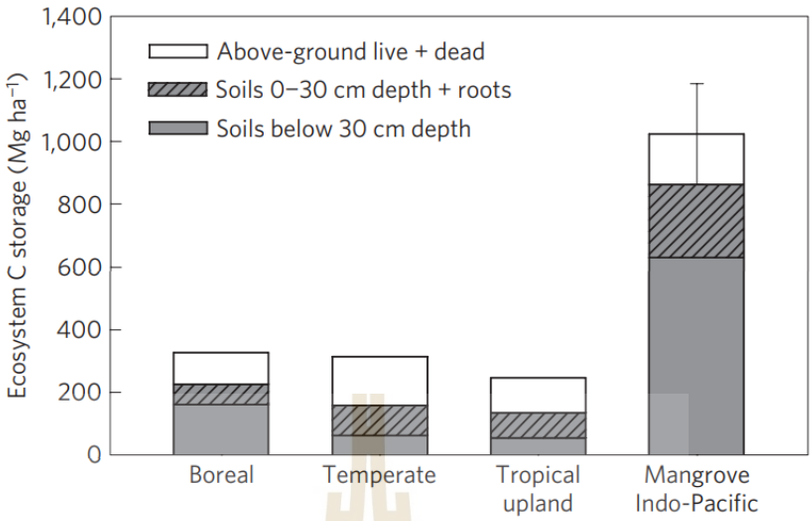

Figure 2.4 Comparison of mangrove carbon storage with different global forest domains (Donato et al., 2011).

2.2.5 Mangroves in Thailand

Mangroves in Thailand are found on mudflats at river mouths and along the country's eastern and southern coastlines, particularly along the Andaman Sea and the Gulf of Thailand. (**Figure 2.5**). In addition, the mangrove families are distributed in the Chao Phraya Delta. Typically, the mangroves form two stories: 1) the upper layer (grows to 20 m in height) that is dominated by *R. apiculata, R. mucronata, Heritiera littoralis, and Xylocarpus mekongensis*; whereas the lower layer is commonly dominated by *Bruguiera cylindrica*, *B. parviflora, B. sexangula*, *Ceriops decandra*, and *C. tagal*). However, *B. gymnorrhiza* can grow 40 m in height (above the forest) with 2 m in girth. Near the land where mud accumulates, drier soil supports the growth of ferns and herbs, forming evergreen forests. The chak palm, *Nypa fruticans*, is commonly found along creek edges (FAO, 2005). Mangrove species are influenced by their location, which is affected by the chemical and physical properties of the sediment, salinity levels, water drainage and current, sediment moisture, and the frequency of flooding (Aksornkoae, 1999). In 1975, mangroves in Thailand covered about 320,000 hectares. However, by 1996, this area had decreased to around 160,000 hectares. Due to the conservation and rehabilitation efforts in Thailand, the mangrove area increased to

240,000 hectares by 2004 (Pumijumnong, 2014). By the year 2020, the mangrove area had expanded to over 601,642 hectares. (Bajaj et al., 2024).

Mangroves in Thailand have faced a variety of challenges. These challenges include: 1) the remaining mangrove areas, which are continuously utilized by local inhabitants, particularly evident along the Andaman coastline in Ranong, Krabi, Trang, Satun, and Phuket; 2) the encroachment of mangrove areas by shrimp farmers in the eastern Thai Gulf and in the provinces of Chantaburi, Surat Thani, and Nakhon Si Thammarat; 3) the sale of mangrove land titles prompted by losses from prior utilization. Additionally, improper land use continues to contribute to coastal erosion, particularly in the provinces of Samut Prakarn, Samut Sakhon, Samut Songkhram, Phetchaburi, and Chacheongsao. In 2007, using remote sensing technology and interpreting LANDSAT 5 satellite images, the mangrove area in Thailand was estimated to cover 1,435,116 Rai, with the largest portion in Phang Nga province, accounting for 18.55% of the total mangrove area in the country (Pumijumnong, 2014).

Figure 2.5 The distribution of mangrove along coastline of Thailand (Elwin, 2020).

2.2.6 Mangrove Forest in Nakhon Si Thammarat

The official website of the Department of Marine and Coastal Resources (Department of Marine and Coastal Resources, 2018), indicated that the mangrove area, in Nakhon Si Thammarat province, Southern Thailand, is approximately 80,922.14 rai (12,947.54 ha). The mangroves are distributed in four different districts: 1) Mueang Nakhon Si Thammarat district, 2) Khanom district, 3) Tha Sala district, and Pak Phanang district. The mangrove species with the highest density were tall-stilt mangrove (*Rhizophora apiculata*), cannonball mangrove (*Xylocarpus granatum*), and loop-root mangrove (*Rhizophora mucronata*) with respective weights of 47, 36, and 30 tons/rai. The highest average mangrove tree heights were recorded for the mangrove apple (*Sonneratia alba*) at 12.5 meters, followed by the sunder (*Heritiera fomes*) at 12.5 meters, the crabapple mangrove (*Sonneratia caseolaris*) at 12.03 meters, and the Indian mangrove (*Avicennia officinalis*) at 10.93 meters.

2.3 Estimation of Forest Biomass

Various methods have been developed to estimate forest biomass. Shi and Liu (2017) showed the comparison of different measurement methods including allometric equation, mean biomass density, biomass expansion factor, forest identify, remote sensing, and geostatistics (**Table 2.3**). Each method is appropriate to different forest scales including: 1) individual or stand (allometric equation), 2) stand (biomass expansion factor), 3) stand or region (mean biomass density and remote sensing), and 4) region (forest identity and geostatistics). Each technique has its limitations and improvement practices, for example, the allometric-equation method has limitations in terms of less sampling trees, and improvement practices in terms of incorporating other factors into allometric coefficients.

Table 2.3 Comparison of the estimation methods of forest biomass (Shi and Liu, 2017).

Scale	Method	Limitation	Improvement practices
Individual or stand	Allometric equation	Varying with many factors (species, terrain, temperature, and rainfall); less sampling of trees	Incorporating other factors into the allometric coefficient, such as combining with LIDAR
Stand	Biomass expansion factor	Varying with many factors (species, terrain, temperature, and rainfall)	Incorporating other factors into the conversion factor
Stand or region	Mean biomass density	Leading to an overestimation	More random plots
	Remote sensing	Saturation and bidirectional reflectance from surface features	Finer spatiotemporal resolution, advanced technology, and algorithm
Region	Forest identity	The requirement for comprehensive analysis	-
	Geostatistics	The requirement for more field data	Creating of biomass database

Note:

Allometric equation: the equation that is used to estimate the ecological factors (such as biomass) by measuring the diameter at breast height (DBH) and/or height of trees.

Biomass expansion factor (BEF): the estimation of forest biomass based on the assumption that there is a certain relationship between the growing stock and biomass;

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thus, the forest biomass can be estimated based on BEF conversion factor multiplied by the growing stock (derived from national forest inventory (NFI), for example).

Mean biomass density: the estimation of stand or forest biomass by the area multiplied by the mean biomass density.

Remote sensing (RS): the applying of RS in biomass estimation, such as the use of normalized difference vegetation index (NDVI)

Forest identity: the use of measurable variables and integrating their changes quantitatively and logically into a relationship.

Geostatistics: the applying of various types of spatial phenomena, such as climate, physicalness, and other natural disturbances, to study nature (including forest biomass).

2.4 Remote Sensing (RS)

2.4.1 Basic Knowledge of Remote Sensing

Remotely sensed data provide an effective solution to the challenges of traditional field-based methods. Their key benefits—such as frequent data acquisition, a broad perspective, digital format allowing for quick processing of large datasets, and strong correlations between spectral bands and vegetation variables—make them a primary tool for AGB across vast regions. (Lu, 2006). Advances in space-borne and air-borne RS technologies are increasingly being used to obtain fast, reliable, and consistent data over extensive areas (Saukkola, Melkas, Riekki, Sirparanta, Peuhkurinen, and Holopainen et al., 2019).

RS can generally be divided into two categories (Campbell and Wynne, 2011; Lillesand, Kiefer and Chipman, 2015), according to **Figure 2.6**: 1) passive remote sensing, this method detects natural radiation emitted or reflected by an object or its surroundings, with sunlight being the most common source, optical sensors are frequently employed in passive remote sensing; 2) active remote sensing: this approach involves sending energy towards a target and analyzing the energy that is reflected to the sensor. Examples of active remote sensing technologies include Radio Detection and Ranging (RADAR) and Light Detection and Ranging (LiDAR).

Both passive and active remote sensing possess distinct advantages and disadvantages. Passive remote sensing provides numerous benefits, such as abundant data acquisition, ease of interpretation, cost-efficiency, minimal environmental interference, and the ability to measure temperature. However, it also has notable limitations, including high sensitivity to weather conditions and reduced effectiveness in low-light or nighttime environments (Shangari, Shams, Azari, Shamshirdar, Baltes, and Sadeghnejad, 2017). Active remote sensing is known for its high accuracy in both lateral and longitudinal measurements, its capability to determine target distances, and its independence from sunlight. However, it also has some limitations, including high costs, complex interpretation, and sensitivity to weather conditions (Shangari et al., 2017).

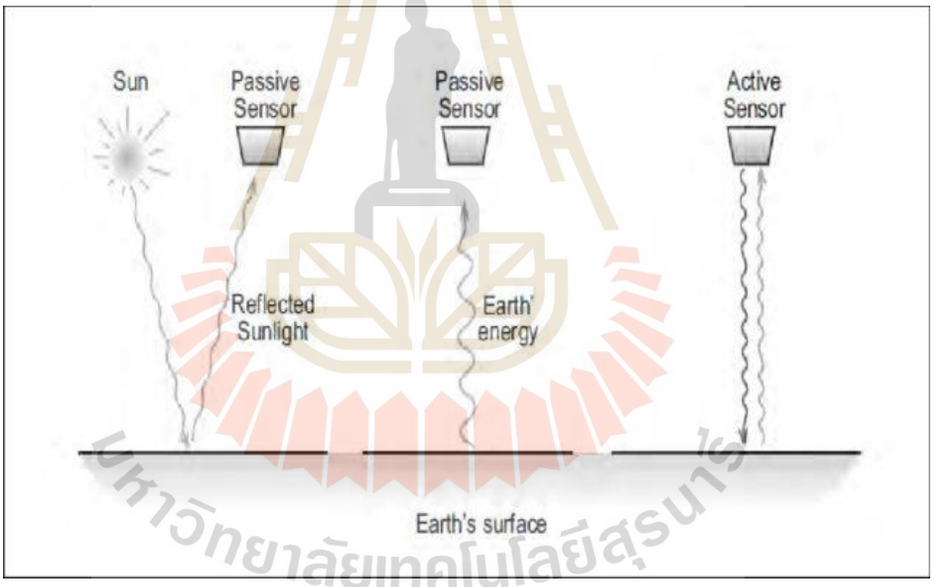

Figure 2.6 Passive and active remote sensing (Sourav, 2017).

2.4.2 Unmanned Aerial Vehicles (UAVs)

The UAVs or drones have attracted considerable interest in recent years because of their diverse applications in areas such as agriculture, surveillance, environmental monitoring, and disaster management. This increasing focus on UAVs is largely due to technological advancements that have enhanced their functionalities, including improved sensors, greater autonomy, and more efficient communication systems (Colomina and Molina, 2014). UAVs can be utilized in smart agriculture to

gather specific data via ground sensors (such as water quality, soil composition, humidity, and more), apply pesticides, diagnose diseases, schedule irrigation, identify weeds, and oversee crop management. The use of drones in precision agriculture is a cost-effective and time-efficient approach that can enhance the revenue, performance, and overall productivity of agricultural systems (Mohsan, Othman, Li, Alsharif, and Khan, 2023). Moreover, UAVs fitted with multispectral sensors offer the ability to monitor vegetation with high spatial and temporal resolution as needed (Easterday, Kislik, Dawson, Hogan, and Kelly, 2019).

2.5 Vegetation Indices (VIs)

Vegetation indices are numerical measures derived from reflective data captured by satellite or airborne sensors to assess the condition and quality of vegetation in a given region. These indices are crucial in agriculture, forestry, environmental monitoring, and land-use planning. Among the numerous vegetation indices, the Normalized Difference Vegetation Index (NDVI), Soil-Adjusted Vegetation Index (SAVI), and Green Normalized Difference Vegetation Index (GNDVI) are commonly applied in environmental and agricultural monitoring. Each of these indices tackles challenges in vegetation analysis, including issues related to soil brightness and the structure of the plant canopy. Some study utilized these indices to evaluate their effectiveness in developing models for mangrove AGB (Nguyen et al., 2019).

2.5.1 Normalized Difference Vegetation Index (NDVI)

The NDVI is the most frequently utilized vegetation index due to its ease of use and adaptability. Healthy vegetation reflects a significant amount of NIR light while absorbing red light, leading to higher NDVI values (usually between 0.2 and 0.8 for areas with vegetation). NDVI is widely used in land cover classification, monitoring vegetation health, and evaluating agricultural productivity. It serves as a vital tool for observing changes in vegetation, such as deforestation, desertification, and seasonal growth trends (Tucker, 1979). A significant limitation of the NDVI is its sensitivity to soil background and atmospheric conditions, which can distort results in regions with sparse vegetation or inconsistent soil reflectance (Huete, 1988).

It is calculated using the following formula:

$$\mathrm{NDVI} = \left(\frac{\mathrm{NIR}-\mathrm{RED}}{\mathrm{NIR}+\mathrm{RED}}\right)$$ Zaitunah, Samsuri, Ahmad, and Safitri (2018)

Where: NIR is the reflectance in the near-infrared region, and RED is the reflectance in the red portion.

2.5.2 Soil-Adjusted Vegetation Index (SAVI)

The SAVI is developed to overcome the limitations of NDVI in regions with sparse vegetation, where soil reflectance can significantly affect the NDVI accuracy. This index was introduced to reduce the impact of soil brightness on spectral vegetation indices that involve red and near-infrared (NIR) wavelengths (Huete, 1988).

It is calculated using the following formula:

$$\mathrm{SAVI} = \left(\frac{\mathrm{NIR}-\mathrm{RED}}{\mathrm{NIR}+\mathrm{RED}+\mathrm{L}}\right) \times (\mathrm{L}+1)$$ Huete (1988)

Where: L is a constant that ranges from 0 to 1, with lower values assigned to denser vegetation and higher values for sparser vegetation. A common value for L is 0.5, which has proven effective in balancing soil influence and the vegetation signal (Huete, 1988).

2.5.3 Green Normalized Difference Vegetation Index (GNDVI)

The GNDVI is a modified version of NDVI that utilizes green light reflectance instead of red light, providing improved sensitivity to chlorophyll levels in plants. In comparison to NDVI, GNDVI is more responsive to changes in plant health related to chlorophyll content, particularly in crops and grasses (Gitelson Kaufman and Merzlyak, 1996).

It is calculated using the following formula:

$$\mathrm{GNDVI} = \left(\frac{\mathrm{NIR}-\mathrm{GREEN}}{\mathrm{NIR}+\mathrm{GREEN}}\right)$$ Gitelson et al. (1996)

Where: GREEN is the reflectance in the green portion.

2.6 Related Studies in Mangrove Biomass and Carbon Stock

Estimations of mangrove biomass and carbon stock have been performed using various techniques. Over the past five years (2019-2023), both conventional methods (destructive and allometric) and remote sensing techniques have continued to be utilized. Southeast Asia (SEA) is one of the regions that has been the focus of studies on mangrove biomass and carbon stock. **Table 2.4** presents a summary of some literature reviews related to the assessment of mangrove biomass and carbon stock.

2.6.1 The Related Studies of RS to Mangrove AGB Model in Thailand

In Thailand, a study was identified that developed mathematical models to estimate the AGB and AGC stock in mangrove forest. The study evaluated mangrove biomass along Thailand's Andaman Coast by integrating high-resolution GeoEye-1 satellite imagery, medium-resolution ASTER satellite elevation data, field-based tree measurements, existing allometric biomass equations, vegetation indices, and advanced machine learning techniques (Jachowski, Quak, Friess, Duangnamon, Webb, and Ziegler, 2013). The research successfully developed spatial models to estimate mangrove biomass with an R^2 of 0.66 to estimate the mangrove AGB (Jachowski et al., 2013).

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Table 2.4 Related studies in the estimation of mangrove carbon stocks.

No	Technique	Methodology	Finding	Location	References
1	Allometric equation and destructive samplings	The sample trees (different age classes and diameter sizes) were cut down and then measured the fresh biomass. The dry biomass and carbon content were analyzed in the laboratory. The linear functions were applied to generate models (allometric equations) for the mangrove AGB estimation.	The generated models formed a high R^2 (0.85 – 0.99) with the mangrove biomass. The carbon stock in forest biomass ranged from 23.8 to 188.7 tons C/ha (117.4 tons C/ha in average).	Ca Mau Province, Vietnam	Quang, Thi, Nguyet, Hoan, Viet, and Hung (2022)
2	Allometric equation and sample collection	Sampling the mangrove ecosystem components (root, litter, downed wood, and soil) to analysis in the laboratory, whereases the mangrove tree biomass was measured with allometry.	The total ecosystem carbon stock ranged from 168.27 to 296.45 tons/ha. The most carbon fraction is in sediment (168.27 – 243.87 tons/ha), followed by tree (0 – 66.20 tons/ha), respectively.	Along the Straits of Malacca between Merlimau and Kuala Sebatu in Jasin, Malacca, Malaysia	Safwan, Mohd, Sharma, Liyana, Mohamad, Palaniveloo, and MacKenzie (2023)

Table 2.4 (Continued).

No	Technique	Methodology	Finding	Location	References
3	Remote Sensing (Satellite imagery)	The AGB was estimated by using linear regression between vegetation indices (NDVI, SAVI, and GNDVI) and AGB from ground truth data. The vegetation indices were calculated from satellite imageries (Landsat and Sentinel-2).	All the tested vegetation indices (NDVI, SAVI, and GNDVI) had a high coefficient of determination (R^2 = 0.68). The mangrove AGB was 22.57 tons/ha (1998) and 37.74 (2018) ton/ha with the total change of 15.17 ton/ha.	Thai Binh Province coastal area and Xuan Thuy national park (Giao Thuy district - Nam Dinh province), that is part of the Red River Delta of Vietnam	Nguyen et al. (2019)
4	Remote Sensing (Satellite imagery)	The AGB was estimated by AGB estimation model through stepwise linear regression approaches between spectral bands/vegetation indices and AGB from ground truth data. The spectral bands and vegetation indices were calculated from satellite imageries (Landsat-8 and Sentinel-2).	The models based on Sentinel-2 spectral bands and vegetation indices (R^2 > 0.855) were more accurate in estimating the overall AGB of mangrove forests than those based on Landsat-8 data.	Mong Cai, a coastal city of Quang Ninh Province in the Red River Delta region of Vietnam	Nguyen and Nguyen (2021)

Table 2.4 (Continued).

No	Technique	Methodology	Finding	Location	References
5	Remote Sensing (UAV imagery)	For the aerial imagery, the tree height and number of branches were calculated using a Digital Surface Model (DSM) corrected by a digital elevation model (DEM). Then, the mangrove biomass was estimated with an allometric equation that only uses height as the parameter.	The tree's height ranges from 1 to 15.5 meters, with an average height of 4.4 meters. The estimated mangrove biomass was 82,154 tons/ha.	Karimunjawa National Park, Jepara Regency, Central Java Province, Indonesia	Salim, Adi, Kepal, and Ati (2020)
6	Remote Sensing (UAV imagery)	Tree detection and canopy segmentation algorithms were applied to Structure from Motion and Multi-View Stereo reconstructions from Unmanned Aerial Vehicles imagery (UAV-SfM) data to estimate AGB.	The comparison of ground AGB estimates to UAV-SfM derived estimates using all data and only top canopy provided a strong correlation (*adjusted* R^2 of 0.932 and 0.91, respectively).	the southeastern coast of Australia including: 1) Western Port, Victoria and 2) Richmond River Estuary, New South Wales	Navarro, Young, Allan, Carnell, Macreadie, and Ierodiaconou (2020)

Table 2.4 (Continued).

No	Technique	Methodology	Finding	Location	References
7	Remote Sensing (UAV imagery)	The mangrove canopy height was calculated by subtracting Digital Surface Model (DSM) from Digital Terrain Model (DTM), then converting the canopy height to Lorey's height using exponential regression with the mangrove survey data. The AGBs were calculated using an allometric equation, then converted to above-ground carbon by multiplying with 0.5	The regression model to estimate mangrove Lorey's height shows a good accuracy (bias and RSME of 0.04 m and 1.28 m, respectively).The mangrove AGB and carbon stock range from 8 tons/ha to 328 tons/ha, and from 4 tons/ha to 164 tons/ha, respectively.	Karimunjawa Islands, Indonesia	Wirasatriya, Pribadi, Iryanthony, Maslukah, Sugianto, Helmi et al. (2022)

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CHAPTER III
MATERIALS AND METHODS

3.1 Workflow

The workflow diagram of this study is shown in **Figure 3.1.** Data were collected from both ground truth measurements and RS (UAV imagery) sources. Information concerning mangrove trees and their associated biodiversity indices was documented. AGB was estimated using species-specific allometric equations and then converted to AGC stock using a conversion factor. UAV imagery was utilized to calculate VIs and the canopy height model (CHM) for the development of mangrove AGB models via linear regression analysis. Finally, statistical methods were applied to assess the performance of the models.

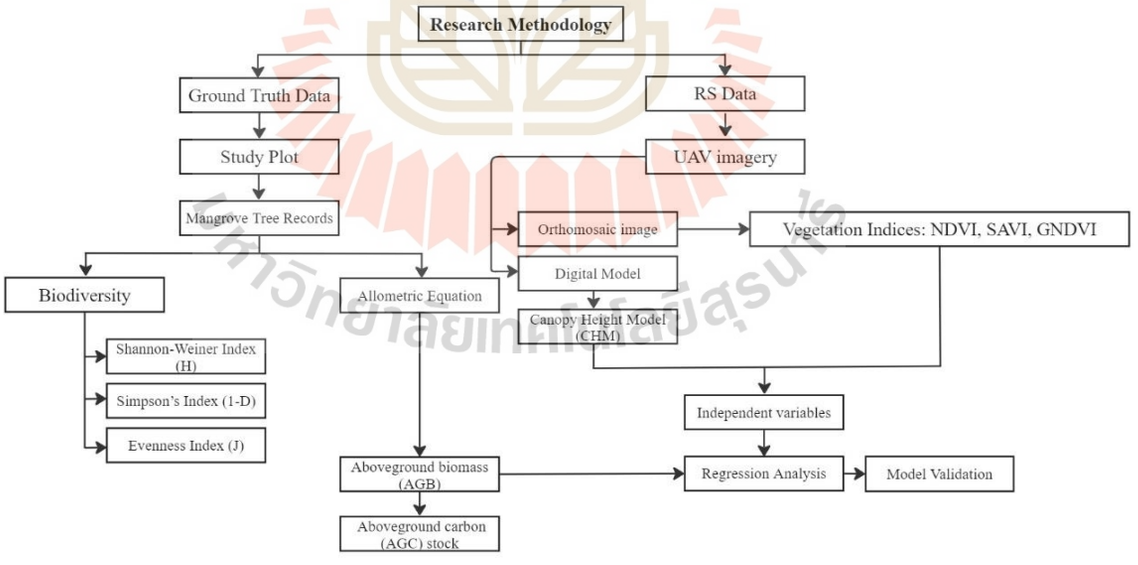

Figure 3.1 Workflow diagram of this study.

3.2 Study Site

The Banlaem mangrove forest, located at coordinates 8°36'32.7" N, 99°57'59.0" E, is situated within the Banlaem community in Moo 7, Tha Sala Subdistrict, Tha Sala District, Nakhon Si Thammarat Province, Southern Thailand, in a tropical region (**Figure 3.2**). The total area of the study site spans 123.5 ha, which is an ecotourism zone. The only species intentionally planted within the Banlaem mangrove forest is *Rhizophora mucronata*. For planting, propagules of *R. mucronata* are placed into the muddy soil, with each propagule spaced 1 to 1.5 meters apart and inserted to a depth of 15 to 20 cm (Minmun, personal communication, June 23, 2024) . However, observations from this study indicated that another species, *Avicennia marina*, dominates the upland areas as an interior species, while *R. mucronata* primarily occupies the peripheral zones as an edge species. In southern Thailand, the average annual rainfall ranges from 1,200 to 4,500 mm, with higher amounts observed on the windward side compared to the leeward side. The mean temperature in this region is 27.5°C (The World Bank Group, 2023)

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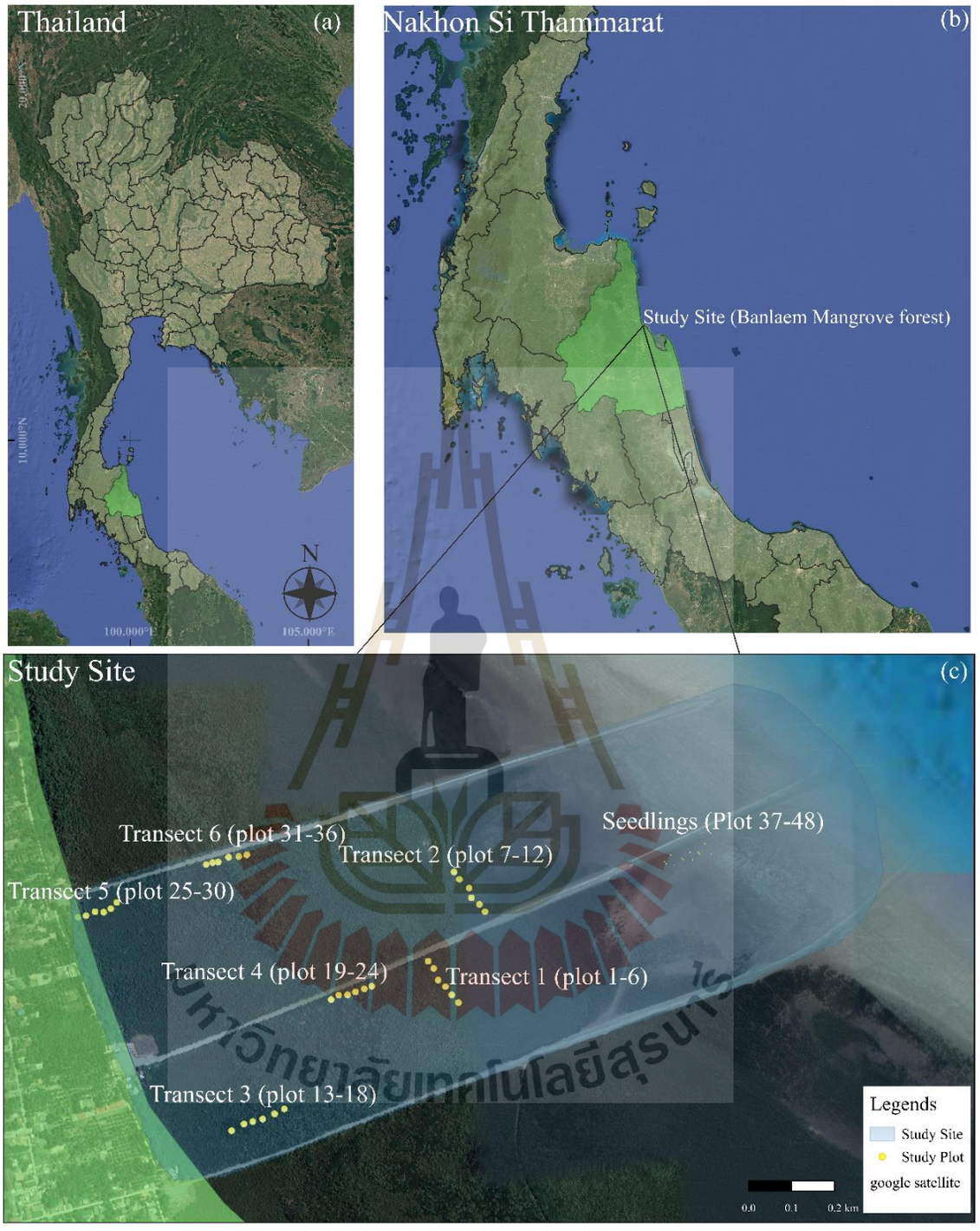

Figure 3.2 Study area in this study: a) Thailand map; b) Nakhon Si Thammarat province, southern Thailand; c) study plot arrangements in the study site (Banlaem mangrove forest).

3.3 Ground Truth Measurements

3.3.1 Data Collection

To assess AGB and AGC stocks within the Banlaem mangrove forest, six-line-transect plot configurations were established. The study was conducted from April 2023 to July 2024, following the plot design protocol outlined by Kauffman and Donato (2012). Each transect consisted of 6 circular plots with a radius of 7 meters (**Figure 3.3**), amounting to 36 plots in total (plots 1–36). Additionally, square plots (1×1 m^2) were established to assess mangrove seedlings, identified as plots 37–48. This resulted in a total of 48 sampling plots (**Figure 3.2**). Plot locations and dimensions were constrained due to difficulties accessing the mangrove areas, therefore they were based on collecting in easily accessible areas (Nguyen et al., 2019). In each plot, data were collected on mangrove trees (**Figure 3.5**), including their species, diameter at breast height (DBH), tree height (H), tree density, and basal area (BA). Tree H will be collected with the laser distance meter and the Trees application (Forest Monitoring Tools), and DBH will be measured with the tape measure. The data collection form was designed and applied to record data in the study plots (**Figure 3.4**). Only mangrove individuals with a DBH greater than 5 cm were recorded (Zarawie et al., 2015). Species identification followed the handbook by Trakulsiriphanit (2009) and expert consultation. Data were systematically documented on collection forms, with unique codes assigned to each tree. Stratified random sampling was applied in the Banlaem mangrove forest due to its distinct mangrove tree composition. Stratified random sampling was employed in the Banlaem mangrove forest to account for its heterogeneous composition of mangrove tree species. The strata consisted of three groups: 1) a mixture of grey mangrove (*Avicennia mari*na) and loop-root mangroves (*Rhizophora* spp.), observed in plots 1, 2, 7, 13–22, and 31–36 (a total of 19 plots); 2) homogenous *A. marina*, in plots 3–6, 8–12, and 23–30 (17 plots in total); and 3) predominantly seedlings (with *Rhizophora mucronata* being dominant) in plots 37–48 (12 plots in total). The position of the study plots was recorded using the Geo Tracker application (version 5.3.4.3912).

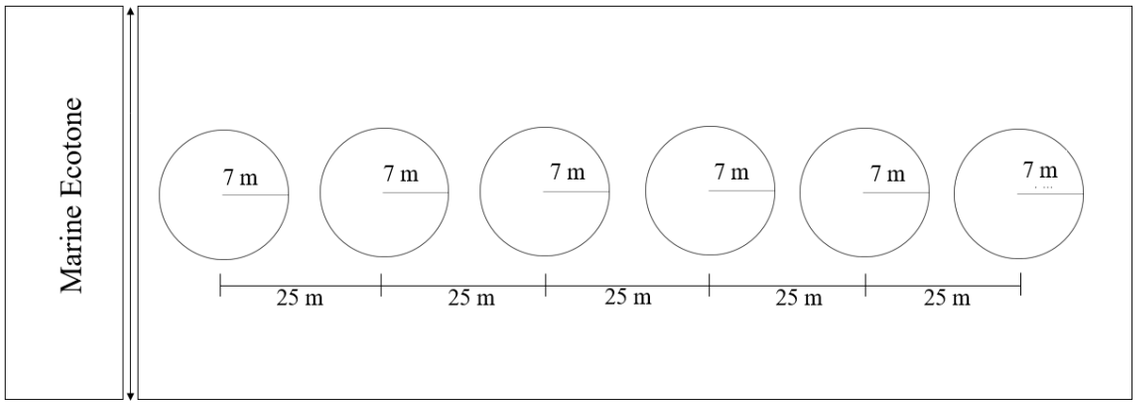

Figure 3.3 The study plot design implemented in the mangrove area (1 line transect).

Data Collection Sheet
Plot Identifier:
Location:
Date:
GPS coordinates and precision (± X m)
Crew Member Present:
Directions to the plot location:
Site Categories: forest, dwarf, scrub, others
Ecological Condition and land use: intact, degraded, deforested
Others:

No	Code	H (m)	Circumference (cm)	DBH (cm)	Latitude	Longitude	Note	Species	X_mamual_m	Y_mamual_m	Direction_manual

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Figure 3.4 The ground truth collection form used in this study.

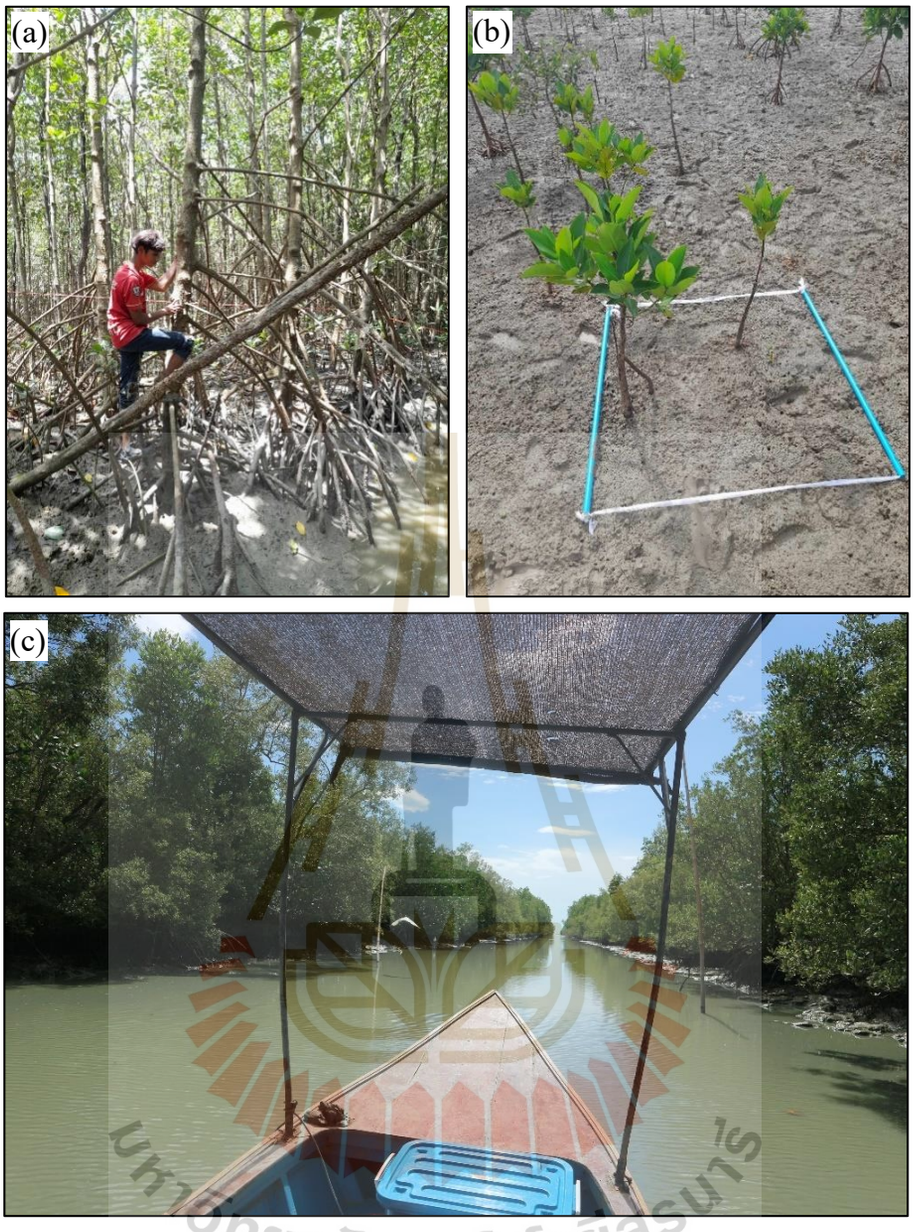

Figure 3.5 Ground truth records in this study: a) Data collection records for mangrove trees; b) Data collection records for mangrove seedlings; c) Transportation to the study plots by boat (used in this study).

Although plot locations and dimensions were constrained due to difficulties accessing the mangrove areas, the transect plot arrangement can capture the variation according to the mangrove ages. Mangrove ages were determined based on thematic classification maps derived from a previous study (Pungpa and Chumkiew, 2025).

The 30 to 28-year-old mangroves were represented by Transect 5 (Plots 25–30), while the 28 to 20-year-old mangroves were captured by Transect 3 (Plots 13–18). The 20 to 14-year-old mangroves were represented by Transect 4 (Plots 19–24) and Transect 6 (Plots 31–36). Transect 1 (Plots 1–6) and Transect 2 (Plots 7–12) captured the 14 to 10-year-old mangroves. Seedlings were represented by Plots 37–48. Overall, the transect plot arrangement in this study effectively captured the variation across mangrove age classes, thereby reducing potential bias in the estimation of the AGB and AGC stocks in the Banlaem mangrove forest.

3.3.2 Aboveground Biomass

The ground truth AGB of the mangroves was estimated using species-specific allometric equations, outlined by Komiyama, Poungparn and Kato (2005). The wood density values (ρ) used in these equations were sourced from the Global Wood Density Database (Zanne, Lopez-Gonzalez, Coomes, Ilic, Jansen, Lewis et al., 2009). The ρ values utilized in this study are presented in **Table 3.1**. Biomass measurements were taken for all individual trees with a DBH greater than 5 cm, as recommended by Zarawie, Suratman, Jaafar, Hasmadi and Abu (2015).

It is calculated using the following formula:

$$\mathrm{AGB}\ (\mathrm{kg}) = 0.25 \times \rho\ (\mathrm{g/cm^3}) \times \mathrm{DBH}^{2.46}$$ Komiyama et al. (2005)

Where: AGB = aboveground biomass (kg)

ρ = wood density (g/cm^3)

DBH = diameter at breath height (at 0.3 m above prop root for Rhizophoraceae species)

Table 3.1 The wood density values (ρ) utilized in this study.

Scientific name	ρ (g/cm^3)
A. marina	0.65
R. mucronata	0.82
R. apiculata	0.85

3.3.3 Aboveground Carbon Stock

The AGC stock is estimated to be 50% of the biomass, as indicated by the Intergovernmental Panel on Climate Change (IPCC, 2006). Carbon contributions from understory vegetation, seedlings, and herbs were not included in the assessment due to their negligible impact within a mangrove ecosystem (Kauffman and Donato, 2012; Vinod, Anusu, Kunhikoya, Shilpa, Akosan, Zacharia, and Joski 2018).

3.3.4 Biodiversity

Additionally, this study calculated the diversity indices for mangrove tree species in the Banlaem mangrove forest. Biodiversity was assessed using the Shannon-Wiener Index (*H*) and Simpson's Index (*1-D*). The value of *H* varied among the sampling plots and was influenced by species richness (*S*). The Evenness Index (*J*) was employed to measure species dominance within the community.

The indices were calculated using the following formulas (Shannon, 1948; Simpson, 1949):

$$H = -\sum_{i=1}^{S} p_i \times \ln p_i$$

Where: p_i refers to the proportion of individuals belonging to species i, and $\ln$ represents the natural logarithm. The value of H ranges from 0 to H_{max}, with a higher H indicating increased diversity.

$$D = \sum_{i=1}^{s} (\frac{n_i}{N})^2$$

Where: n_i represents the number of individuals of species i, and N is the total number of individuals across all species. The value of $1 - D$ ranges from 0 to 1, where 1 represents infinite diversity, and 0 indicates no diversity.

$$J = \frac{H}{H_{max}}$$

Where: the value of J ranges from 0 to 1, with a lower J value suggesting that one or a few species dominate the study areas.

3.4 Remote Sensing Measurements

3.4.1 UAV Photogrammetry

The study utilized UAV imagery obtained with a DJI Mavic 2 Enterprise Advanced, equipped with both visible and near-infrared (Vis/NIR) cameras. Data collection was carried out during ground truth surveys on April 28, 2023, and July 15, 2024. The UAV flight settings included a frontal overlap of 80%, a side overlap of 70%, and a flight altitude of 90 meters. Pix4Dmapper (version 4.8.4) was used to process the imagery, generating an ortho mosaic, a digital terrain model (DTM), and a digital surface model (DSM). The difference between the DSM and DTM, known as the canopy height model (CHM), was calculated by subtracting the DTM from the DSM. This calculation, which indicates vegetation height above ground level (Nasiri, Darvishsefat, Arefi, Pierrot-Deseilligny, Namiranian, and Le 2021), was performed using Quantum GIS (version 3.34.1-Prizren) via the raster calculator tool. Along with vegetation indices (VIs), the CHM derived from UAV data was included as a variable to develop the AGB model for the Banlaem mangrove forest. The maximum CHM value for each plot was used as an independent variable in the AGB model using the Zonal Statistics Plugin (Quantum GIS). This plugin enables the calculation of various pixel values from a raster layer using a polygonal vector layer as a reference. Thus, the polygons representing the study plots were used as reference areas for the calculations. The workflow is illustrated in **Figure 3.6**.

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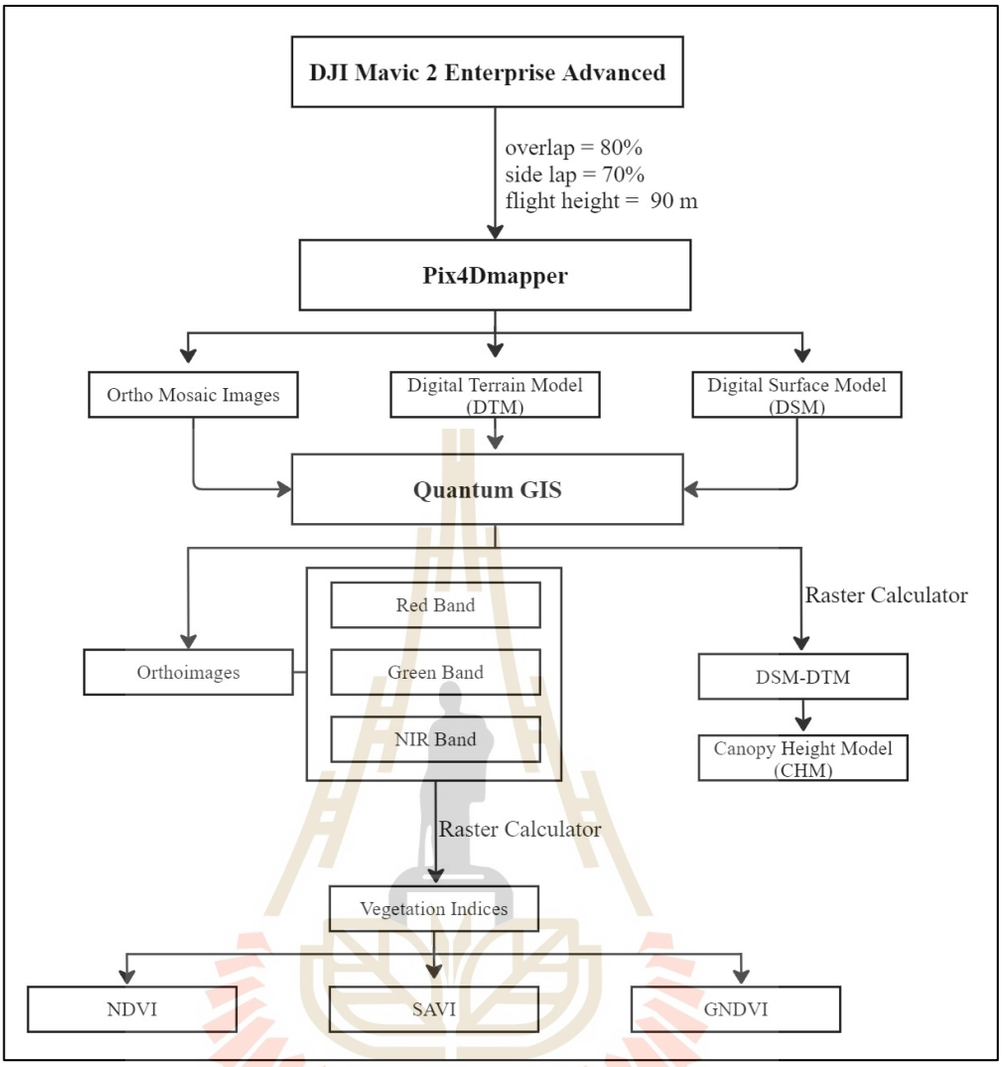

Figure 3.6 Workflow diagram for the remote sensing analysis.

3.4.2 Vegetation Indices

In this study, three different vegetation indices (VIs) were employed to develop AGB models for the Banlaem mangrove forest (**Table 3.2**). The specific VIs examined included NDVI (normalized difference vegetation index), SAVI (soil-adjusted vegetation index), and GNDVI (green normalized difference vegetation index), as referenced by Nguyen et al (2019). The red, green, and near-infrared (NIR) bands from UAV-derived orthoimages were used to compute the VIs. These calculations were carried out using Quantum GIS's raster calculator tool. The average VI values for each plot served as

independent variables in the AGB models, with the Zonal Statistics Plugin (Quantum GIS) being used for the final calculations.

This study selected VIs based on their common use. NDVI is a widely used metric in plant studies; however, SAVI and GNDVI were also included to address some of the limitations associated with NDVI. SAVI is used to correct the NDVI for the influence of soil brightness, particularly in areas with low vegetative cover. GNDVI is also used to correct NDVI because it is more sensitive to chlorophyll and better at detecting plant stress and monitoring dense vegetation. NDVI can saturate in high biomass areas, while GNDVI performs better under those conditions. These three VIs, taken collectively, provide a comprehensive representation of mangrove canopy conditions, encompassing dense, typical, and sparse cover types.

Table 3.2 The vegetation indices used in this study.

No.	Vegetation Indices	Equations	References
1	NDVI	$\mathrm{NDVI} = \left(\frac{\mathrm{NIR} - \mathrm{RED}}{\mathrm{NIR} + \mathrm{RED}}\right)$	Zaitunah et al. (2018)
2	SAVI	$\mathrm{SAVI} = \left(\frac{\mathrm{NIR} - \mathrm{RED}}{\mathrm{NIR} + \mathrm{RED} + \mathrm{L}}\right) \times (\mathrm{L} + 1)$	Huete (1988)
3	GNDVI	$\mathrm{GNDVI} = \left(\frac{\mathrm{NIR} - \mathrm{GREEN}}{\mathrm{NIR} + \mathrm{GREEN}}\right)$	Gitelson et al. (1996)

Where: L represents soil brightness correction factor (0.5), GREEN represents green wavelength, RED represents red wavelength, and NIR represents near-infrared wavelength

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3.5 AGB Model Development and Validation

Linear and multiple linear regression models were developed and validated to estimate mangrove AGB using Jamovi (version 2.6.2). A linear regression model was applied when there was a single independent variable, whereas a multiple regression model was used when there were multiple independent variables. Ground truth AGB served as the dependent variable, with the predetermined VIs (NDVI, SAVI, GNDVI) and

CHM used as independent variables for estimating AGB in the Banlaem mangrove forest. Subsequently, the models for ground truth AGB and predicted AGB were developed, validated, and presented in this study. The best model was selected based on the combination of the correlation coefficient (*r*), coefficient of determination (r^2), root mean square error (*RMSE*), probability value (p-value), and its residual plot. In a residual plot, if the residuals are randomly dispersed around zero without any noticeable pattern, it suggests that the model fits well, indicating that the linearity assumption holds true and the errors are both random and normally distributed. However, this study excluded certain plots (plots 13-18) from the AGB model development because the UAV could not access those areas. Additionally, the mangrove seedling plots (plots 37-48) that displayed a pattern in the residual plots were also excluded because their AGBs were considered to be 0 ton/ha, as their DBH was less than 5 cm.

The statistics were calculated using the following formulas:

Correlation coefficient (*r*):

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where r ranges from -1 to 1, r = 1 is a perfect positive correlation, r =−1 is a perfect negative correlation, r = 0 indicates no linear relationship (Field, 2018).

Coefficient of determination (r^2):

$$r^2 = \frac{SS_{regression}}{SS_{total}} = 1 - \frac{SS_{residual}}{SS_{total}}$$

Where r^2 ranges from 0 to 1, the higher value, the better fit of model (Upton and Cook, 1996).

p-value: a p-value below the significance level of 0.05 suggests that the results are statistically significant (Wackerly et al., 2008).

Residuals:

$$\text{residual} = y_i - \hat{y}_i$$

Residual analysis aids in evaluating model fit; when residuals are random, it indicates that the model is performing well (Kutner, 2005).

CHAPTER IV
RESULTS AND DISCUSSION

4.1 Ground Truth Data

4.1.1 Ground Truth Records

The field data were collected between April 2023 and July 2024 in the Banlaem planted mangrove forest, located in Nakhon Si Thammarat, Thailand (**Table 4.1**). The forest was found to contain relatively few species (**Figure 4.1**). *Rhizophora* species generally functioned as edge species, primarily distributed along upland boundaries, while grey mangrove (*A. marina*) was more commonly found in interior areas. However, within the study plots, the *Rhizophora* species often coexisted with *A. marina*. No study plots contained single species, *Rhizophora* species, except for those dominated by seedlings. The mangrove trees appeared to form three distinct composition types: 1) a mixture of *A. marina* and *Rhizophora* spp. in plots 1, 2, 7, 13–22, and 31–36; 2) *A. marina* in plots 3–6, 8–12, and 23–30; and 3) predominantly seedlings, with *R. mucronata* dominant in plots 37–48. The overall tree density was 4,386±4,732 mangrove trees/ha, with an average DBH of 6.32±3.84 cm, H of 6.15±3.78 m and a basal area of 8.76±7.40 m²/ha, respectively.

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Table 4.1 The ground truth records in the Banlaem mangrove forest.

Plot	Species Occurrence			Tree Density (No/ ha)	Mean H (m)	Mean DBH (cm)	BA (m^2/ ha)
	R. mucronata	*R. apiculata*	*A. marina*				
1	✓	×	✓	4,355	8.29	7.61	21.42
2	✓	×	✓	2,535	6.95	8.64	16.16
3	×	×	✓	1,690	11.71	7.61	8.02
4	×	×	✓	2,015	7.33	7.83	10.28
5	×	×	✓	3,250	7.08	7.28	14.34
6	×	×	✓	3,770	5.65	8.07	12.08
7	✓	×	✓	2,340	6.88	7.17	13.72
8	×	×	✓	2,340	6.40	7.17	10.81
9	×	×	✓	1,300	5.41	6.27	6.01
10	×	×	✓	845	5.49	6.55	3.65
11	×	×	✓	780	5.09	6.79	3.27
12	×	×	✓	1,365	5.40	6.85	5.51
13	✓	×	✓	2,665	8.06	7.89	13.34
14	✓	×	✓	3,055	10.38	8.58	19.01
15	✓	×	✓	2,340	8.14	9.44	17.85
16	✓	×	✓	2,015	9.12	11.62	22.33
17	✓	×	✓	1,430	9.34	10.41	13.17
18	✓	×	✓	1,950	8.64	9.26	14.43
19	✓	×	✓	3,965	7.97	8.57	23.64
20	✓	×	✓	2,795	8.86	8.53	16.68
21	✓	×	✓	2,210	9.52	8.35	13.34
22	✓	×	✓	1,690	8.74	9.13	11.48
23	×	×	✓	2,080	6.46	8.26	11.69
24	×	×	✓	2,145	6.18	7.15	8.67
25	×	×	✓	1,690	9.40	10.50	15.72
26	×	×	✓	455	4.50	9.71	3.48
27	×	×	✓	260	3.53	9.12	1.37
28	×	×	✓	455	4.70	7.98	2.37
29	×	×	✓	390	4.40	8.70	2.58
30	×	×	✓	130	4.25	7.64	0.60
31	✓	×	✓	3,315	12.38	8.52	19.31
32	✓	×	✓	1,755	11.87	8.83	11.74
33	✓	×	✓	2,210	10.73	9.02	15.15
34	✓	✓	✓	1,820	9.77	10.53	17.06
35	✓	✓	✓	1,430	9.17	8.08	7.60
36	✓	×	✓	1,690	15.50	9.89	12.64
37	✓	×	×	10,000	1.00	0.00	0.00
38	✓	×	×	10,000	0.66	0.00	0.00
39	✓	×	×	20,000	0.71	0.00	0.00
40	×	×	✓	10,000	1.10	0.00	0.00
41	✓	×	×	10,000	1.20	0.00	0.00
42	✓	×	×	10,000	0.71	0.00	0.00
43	✓	×	×	10,000	0.35	0.00	0.00
44	✓	×	×	10,000	0.95	0.00	0.00
45	×	×	✓	10,000	0.96	0.00	0.00
46	✓	×	×	20,000	1.05	0.00	0.00
47	✓	×	×	10,000	1.30	0.00	0.00
48	✓	×	×	10,000	1.91	0.00	0.00
		Mean		**4,386**	**6.15**	**6.32**	**8.76**
		SD		**4,732**	**3.18**	**3.84**	**7.40**

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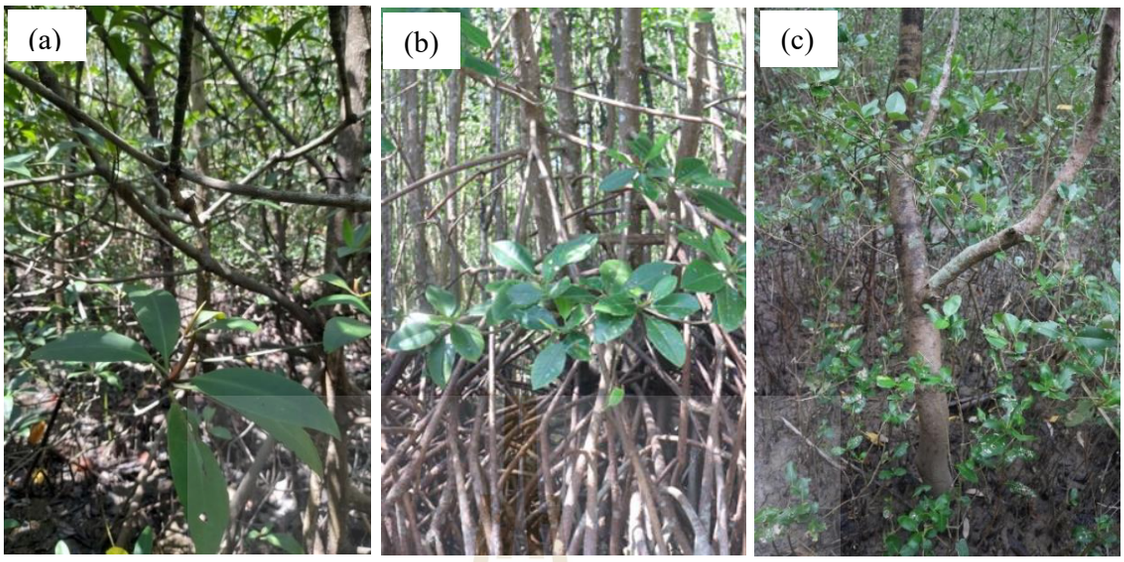

Figure 4.1 The mangrove tree species found in the study area: a) *R. apiculata*; b) *R. mucronata*; and c) *A. marina.*

4.1.2 Biodiversity

The mangrove biodiversity in the Banlaem community was limited due to its low species richness (*S*), with only three species from two genera being recorded in this study (**Table 4.3**). Two species (loop-root mangroves), *R. mucronata* and *R. apiculata*, belong to the family Rhizophoraceae, while the third species, *A. marina* (grey mangrove), is part of the family Acanthaceae. The biodiversity indices further reflect the limited diversity of the mangroves in Banlaem. Simpson's index (*1-D*), Shannon-Wiener index (*H*), and evenness index (*J*) showed values ranging from 0.00 to 0.50 (0.11±0.17), 0.00 to 0.69 (0.17±0.25), and 0.00 to 1.00 (0.25±0.36), respectively (**Table 4.2**). Plot 17 demonstrated the highest diversity with the *1-D*, H, and *J* of 0.50, 0.69, and 1.00, respectively. In contrast, the plots that were dominated by a single species exhibited the lowest levels of diversity.

Table 4.2 Diversity indices recorded in the Banlaem mangrove forest.

Plot	Diversity Indices		
	1-D	*H*	*J*
1	0.49	0.69	0.99
2	0.14	0.27	0.39
3	0.00	0.00	0.00
4	0.00	0.00	0.00
5	0.00	0.00	0.00
6	0.00	0.00	0.00
7	0.24	0.34	0.49
8	0.00	0.00	0.00
9	0.00	0.00	0.00
10	0.00	0.00	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00
13	0.05	0.11	0.17
14	0.12	0.24	0.34
15	0.15	0.29	0.41
16	0.27	0.44	0.64
17	0.50	0.69	1.00
18	0.44	0.64	0.92
19	0.06	0.14	0.21
20	0.30	0.48	0.69
21	0.46	0.65	0.94
22	0.20	0.36	0.52
23	0.00	0.00	0.00
24	0.00	0.00	0.00
25	0.00	0.00	0.00
26	0.00	0.00	0.00
27	0.00	0.00	0.00
28	0.00	0.00	0.00
29	0.00	0.00	0.00
30	0.00	0.00	0.00
31	0.04	0.10	0.14
32	0.35	0.53	0.76
33	0.42	0.61	0.87
34	0.30	0.56	0.81
35	0.24	0.49	0.70
36	0.50	0.69	1.00
37	0.00	0.00	0.00
38	0.00	0.00	0.00
39	0.00	0.00	0.00
40	0.00	0.00	0.00
41	0.00	0.00	0.00
42	0.00	0.00	0.00
43	0.00	0.00	0.00
44	0.00	0.00	0.00
45	0.00	0.00	0.00
46	0.00	0.00	0.00
47	0.00	0.00	0.00
48	0.00	0.00	0.00
Mean	**0.11**	**0.17**	**0.25**
SD	**0.17**	**0.25**	**0.36**

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Table 4.3 List of mangrove tree species found in the Banlaem mangrove forest.

Order	Family	Genus	Scientific name
Malpighiales	Rhizophoraceae	*Rhizophora*	*R. mucronata*
Malpighiales	Rhizophoraceae	*Rhizophora*	*R. apiculata*
Lamiales	Acanthaceae	*Avicennia*	*A. marina*

4.1.3 Aboveground Biomass and Carbon Stock

The AGB and AGC stocks in the Banlaem mangrove ecosystem varied across different study plots (**Figure 4.2**). Overall, AGB ranged from 0 to 179.78 (with an average of 56.30±51.81) tons/ha, while AGC ranged from 0 to 89.89 (with an average of 28.15±25.90) tons/ha. The highest AGC stock was observed in the plot with the largest average DBH, specifically plot 16 (DBH = 11.62±2.52 cm), dominated by *A. marina* and *R. mucronata*. In contrast, the lowest AGC stock was recorded in plots with very small DBH values (plots 37–48, DBH ≤ 5 cm), located along the seafront (small-mangrove group). When comparing study plots with DBH ≥ 5 cm based on species composition (**Figure 4.3**), it was found that plots containing a mix of *A. marina* and *Rhizophora* species had significantly higher AGB (43.4–180, averaging 108±33 tons/ha) and AGC (21.7–89.9, averaging 53.8±16.7 tons/ha). These values were higher than those in *A. marina*-only plots, which had an AGB of 3.2–102 (38.6±27.9) tons/ha and an AGC of 1.6–51.0 (19.3±14.0) tons/ha ($t_{34} = -6.68$, $p < 0.001$).

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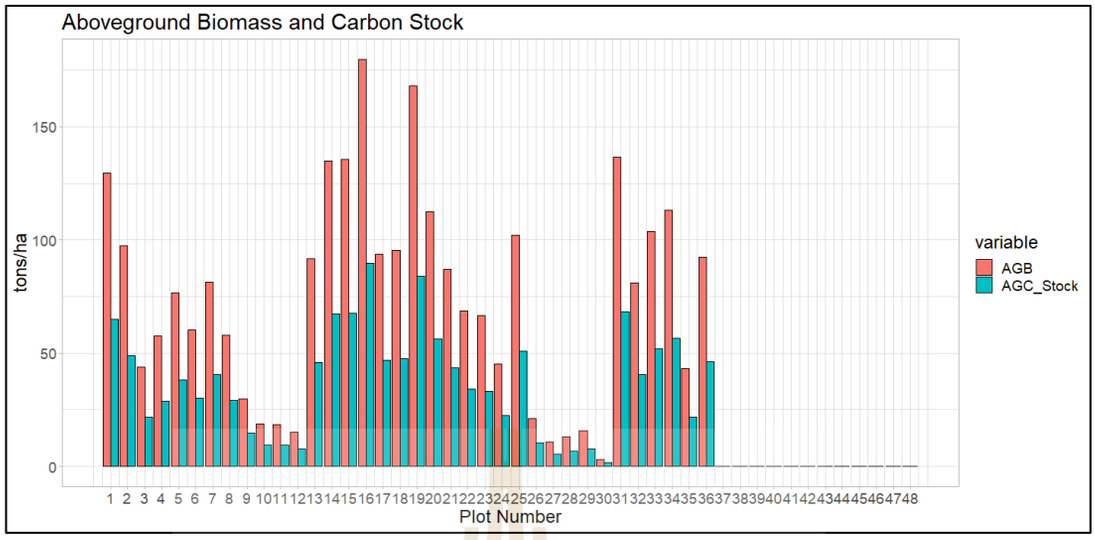

Figure 4.2 The AGB and AGC stock in each study plot of the Banlaem mangrove forest.

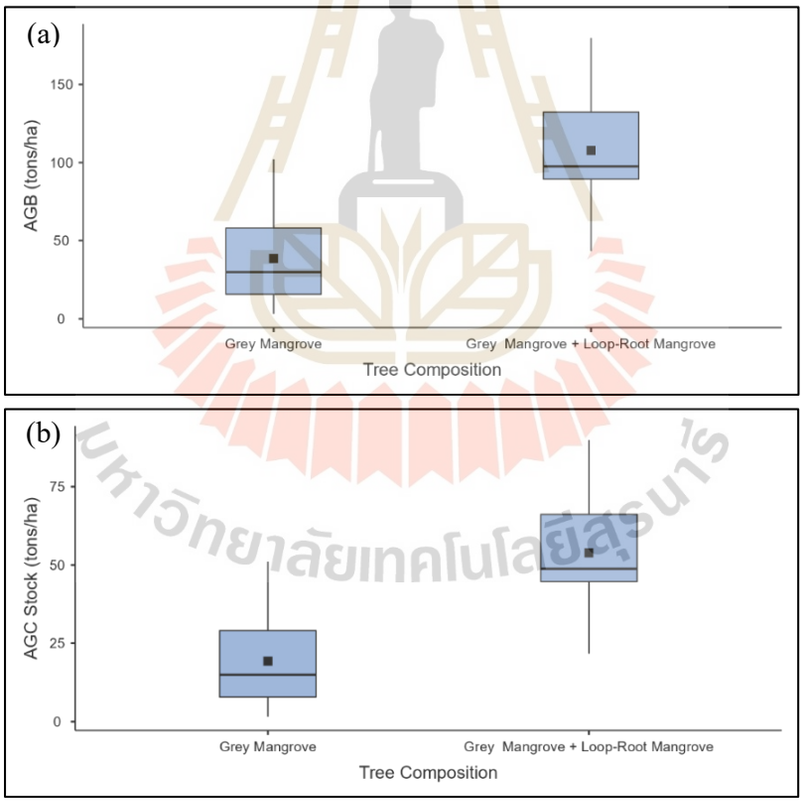

Figure 4.3 The boxplots of the AGB and ABC stocks: a) represents AGB; and b) represents AGC stock in the Banlaem mangrove based on tree composition.

4.1.4 Discussion on The Ground Truth Data

This study offers the first evaluation of AGB and AGC stock along with its biodiversity in the Banlaem mangrove forest, located in Nakhon Si Thammarat, southern Thailand. The results indicate a relatively low species diversity (*S* = 3) compared to other studies on planted mangrove ecosystems in Thailand. Only *R. mucronata* was actively planted in Banlaem, but tidal currents have naturally dispersed propagules of other species (Minmun, personal communication, June 23, 2024). In contrast, the Ranong Biosphere Reserve (RBR) in southern Thailand's Ranong province recorded four mangrove species across three genera (*Rhizophora*, *Bruguiera*, and *Ceriops*) (Macintosh and Ashton, 2023). Additionally, the DBH of mangroves in the RBR (15.12 ± 7.34 cm) is significantly larger than the DBH of those in Banlaem (6.32 ± 3.84 cm). This contributes to the lower AGB in Banlaem (ranging from 0 to 179.78 ton/ha) compared to the RBR, where AGB ranged from 117.78 to 336.41 tons/ha. Notably, the lowest AGB (0 ton/ha) in Banlaem was found in mangrove seedlings, while the highest AGB in the RBR (336.41 ton/ha) was recorded in mixed-species conservation areas (Macintosh and Ashton, 2023). Mangrove biodiversity is positively correlated with both biomass and carbon storage, and carbon stock evaluations typically use allometric equations based on DBH (Bai, Meng, Gou, Lyu, Dai, and Diao et al., 2021). Therefore, the smaller DBH and low species diversity (*1-D* = 0.11 ± 0.17, *H* = 0.17 ± 0.25, *J* = 0.25 ± 0.36) in Banlaem contributes to reduced carbon storage. A study conducted by the Sirinart Rajini Ecosystem Learning Center in Prachuap Khiri Khan Province indicated that a mangrove species richness (*S* = 6) was higher than in Banlaem mangrove forest, although the AGB was somewhat lower (ranging from 0 to 159.63 tons per hectare) (Sribut, Sunthornhao, and Diloksumpun, 2020). This suggests that species richness alone is not a definitive predictor of AGB or AGC stock. Other factors, such as latitude, tidal range, and heavy metal pollution, also influence mangrove biomass (Wang, Singh, Wang, Xiao, and Guan, 2021). Future research could explore how these and other factors affect biomass and carbon stocks in the Banlaem mangroves.

This study found that the composition of mangrove species affects the AGB and AGC stocks in the Banlaem mangrove forest (**Figure 4.3**). Specifically, the presence

of *A. marina* and *Rhizophora* species results in higher AGB compared to areas dominated solely by *A. marina*. This observation supports previous research indicating that *Rhizophora* species generally exhibit greater biomass than *Avicennia* species (Sribut et al., 2020), and that mixed-species plots have higher biomass than those dominated by a single species (Macintosh and Ashton, 2023). This difference may be attributed to the higher wood density of *R. mucronata* and *R. apiculata*, which contributes to greater biomass compared to *A. marina* in this study (Zanne et al., 2009).

In the Banlaem mangrove forest, an evaluation of mangrove AGB by age revealed no apparent correlation between stand age and AGB or AGC stocks. Notably, the presence of *Rhizophora* species appears to contribute to higher AGB levels, even in younger mangrove plots. Age of the mangrove tree is a factor that contributes to AGB and AGC stock in a mangrove forest. However, stand age showed no clear influence on AGB or AGC stocks in the Banlaem mangrove forest. A study conducted in Lamongan, Indonesia, showed a positive correlation between mangrove age and AGB (Asadi, Rr, Adam, Novianti, and Isdianto 2017). The highest AGB was recorded at the site with 100-year-old mangroves (302.24 tons/ha), followed by 70-year-old (288.12 tons/ha), 20-year-old (98.62 tons/ha), and 15-year-old (60.01 tons/ha) sites. Notably, *Rhizophora* sp. was present at all study sites (Asadi et al., 2017). The Banlaem mangrove forest is around 30 to 40 years old and may continue to accumulate AGB and AGC stock. *Rhizophora* sp. could play a crucial role in carbon sequestration in this forest, as observed in the Lamongan study. Moreover, the Banlaem mangrove area has expanded significantly from 56.16 ha in 1995 to 527.55 ha in 2023 (Pungpa and Chumkiew, 2025). Ongoing monitoring of carbon stocks in the Banlaem mangrove forest is essential for the sustainable management of this blue carbon ecosystem due to its rapid spatial expansion.

4.2 AGB Model Development and Validation

4.2.1 Model Development and Validation

Various vegetation indices (NDVI, SAVI, GNDVI) and CHM, derived from remote sensing (UAV), were used to generate regression models to estimate mangrove AGB. Overall, the results showed that combining different vegetation indices (including CHM) improved the accuracy of the prediction models, with R^2 values ranging from 0.124 to 0.577 and *RMSE* values between 27.5 and 39.5 tons/ha. Using a single index resulted in lower accuracy, with R^2 values ranging from 0.070 to 0.108 and *RMSE* values between 39.2 and 40.7 tons/ha. The optimum single index for generating mangrove AGB was NDVI, which had an R^2 = 0.108 and an *RMSE* of 39.2 tons/ha, with a p = 0.08. The most accurate AGB model (model 11) in this study was derived from combining multiple indices (NDVI, SAVI, GNDVI, CHM), yielding an R^2 of 0.577, an *RMSE* = 27.5 tons/ha, and a $p < 0.001$ (**Table 4.4; Figure 4.4**).

Model 11, which exhibited the highest predictive accuracy, was selected for comparison between its estimated AGB and the observed AGB values. The Omnibus ANOVA test in Jamovi revealed a significant statistical relationship between the UAV-predicted and observed AGB values ($F_{(1, 28)} = 38.1$, $p < .001$), suggesting that the association is not likely due to random chance. The predicted AGB from this model was 65.71 ± 32.63 tons/ha, which overestimated the ground truth value (56.30 ± 51.81 tons/ha); however, there was no significant difference between the two measurements ($t_{76} = 0.89$, $p = 0.19$). It can be concluded that the model 11 (UAV-based measurement) is highly effective in estimating AGB in the Banlaem mangrove forest. This model is suitable for application in monitoring mangrove AGB and AGC stocks in this area.

Moreover, this study demonstrates the influence of different plant compositions, including (1) monogenous *A. marina* and (2) a mixture of *A. marina* and *Rhizophora* spp., on mangrove AGB model development (**Table 4.5; Table 4.6**). Overall, the results showed that combining different vegetation indices (including CHM) improved the accuracy of the prediction models. For the homogenous *A. marina* plots, the optimum model was Model No. 22, with an R^2 = 0.579, an *RMSE* = 17.6 tons/ha, and a $p < 0.025$ (**Figure 4.5**). For the mixture of *A. marina* and *Rhizophora* spp. plots,

the optimum model was Model No. 33, with an R^2 = 0.223, an *RMSE* = 27.1 tons/ha, and a p = 0.69 (**Figure 4.6**). Additionally, using a single index resulted in lower accuracy.

Finally, residual plots were generated to evaluate the fit of these models. The analysis revealed that the residuals were randomly distributed around the horizontal axis without any discernible pattern, suggesting that the models successfully captured the relationship between the independent and dependent variables (**Figure 4.4; Figure 4.5; Figure 4.6**).

Table 4.4 The AGB model development in this study using all plots.

Variable	Model No.	Equation	*R*	R^2	*p*-value	*RMSE* (tons/ha)
NDVI	1	AGB = 58.5+51.7(NDVI)	0.329	0.108	0.08	39.2
SAVI	2	AGB = 58.5+34.5(SAVI)	0.329	0.108	0.08	39.9
GNDVI	3	AGB = 60.8+46.4(GNDVI)	0.301	0.091	0.11	40.3
CHM	4	AGB = 35.05+5.68(CHM)	0.265	0.070	0.16	40.7
NDVI, SAVI	5	AGB = 55.9-25,212.4(NDVI)+16,877(SAVI)	0.352	0.124	0.17	39.5
NDVI, GNDVI	6	AGB = -14.5+2,152.1(NDVI)-2,063.8(GNDVI)	0.695	0.483	<0.001	30.4
NDVI, CHM	7	AGB = 37.62+43.68(NDVI)+4.08(CHM)	0.377	0.142	0.13	39.1
SAVI, GNDVI	8	AGB = -15.2+1,446.6(SAVI)-2,076.9(GNDVI)	0.697	0.486	<0.001	30.3
SAVI, CHM	9	AGB = 37.61+29.19(SAVI)+4.08(CHM)	0.377	0.142	0.17	39.1
GNDVI, CHM	10	38.77+38.12(GNDVI)+4.24(CHM)	0.356	0.127	0.16	39.5
NDVI, SAVI, GNDVI, CHM	11	AGB = -51.68+5.53 (CHM)-40,122.32 (NDVI)+28,315.69 (SAVI) -2185.20(GNDVI)	0.759	0.577	<0.001	27.5

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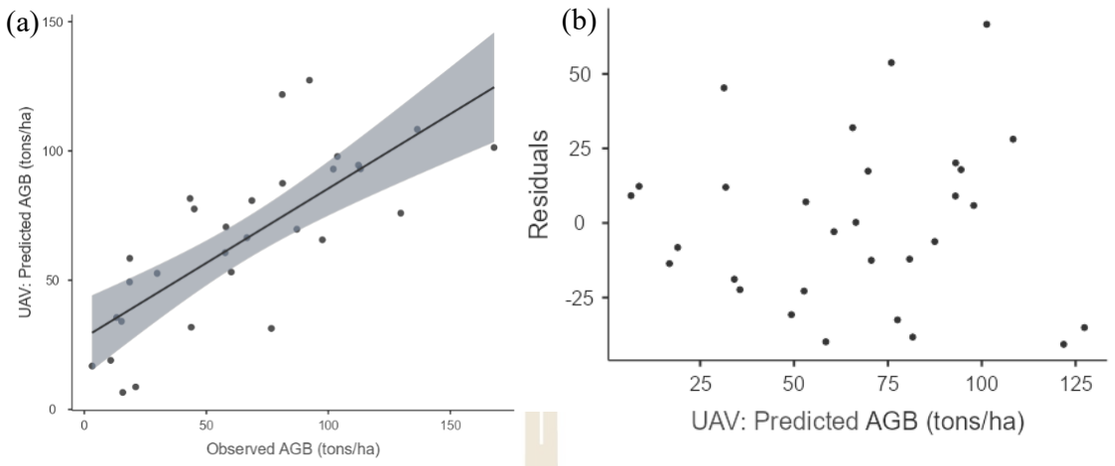

Figure 4.4 The most accurate AGB model (Model 11), generated from all plots: a) represents the regression model; and b) its residual plot.

Table 4.5 The AGB model development in using single species plots (*A. marina*).

Variable	Model No.	Equation	*R*	R^2	*p*-value	*RMSE* (tons/ha)
NDVI	12	AGB = 38.9-13.6(NDVI)	0.123	0.015	0.64	26.9
SAVI	13	AGB = 38.95-9.1(SAVI)	0.122	0.015	0.64	26.9
GNDVI	14	AGB = 38.6-14.3(GNDVI)	0.134	0.018	0.61	26.8
CHM	15	AGB = 8.44+5.78(CHM)	0.517	0.267	0.03	23.2
NDVI, SAVI	16	AGB = 37.0-20,783.9(NDVI)+13,876.1(SAVI)	0.237	0.056	0.67	26.3
NDVI, GNDVI	17	AGB = 14.8+841.8(NDVI)-818.8(GNDVI)	0.326	0.106	0.46	25.6
NDVI, CHM	18	AGB = 5.72-28.29(NDVI)+6.43(CHM)	0.573	0.329	0.06	22.2
SAVI, GNDVI	19	AGB = 14+580.9(SAVI)-845.4(GNDVI)	0.333	0.111	0.44	25.5
SAVI, CHM	20	AGB = 5.73-18.88(SAVI)+6.42(CHM)	0.573	0.329	0.06	22.2
GNDVI, CHM	21	4.7-28.54(GNDVI)+6.47(CHM)	0.579	0.335	0.06	22.1
NDVI, SAVI, GNDVI, CHM	22	AGB = -37.39+7.24(CHM) -38,161.85 (NDVI)+ 26,310.11(SAVI) -1,196.66(GNDVI)	0.761	0.579	0.025	17.6

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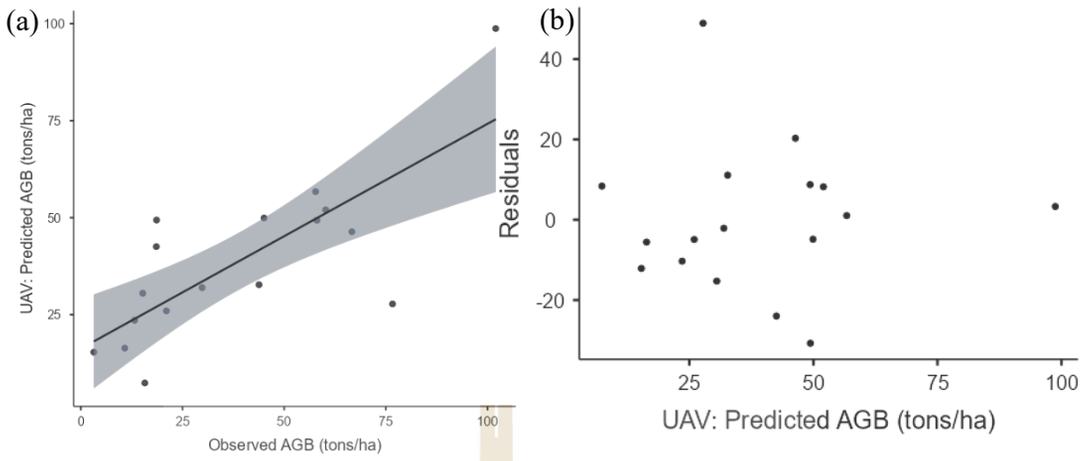

Figure 4.5 The most accurate AGB model (Model 22), generated from *A. marina* plots; a) represents the regression model; and b) its residual plot.

Table 4.6 The AGB model development in this study using coexisting plots (*A. marina* and *Rhizophora* spp).

Variable	Model No.	Equation	*R*	R^2	*p*-value	*RMSE* (tons/ha)
NDVI	23	AGB = 99.27-6.46(NDVI)	0.047	0.002	0.88	30.7
SAVI	24	AGB = 99.27-4.31(SAVI)	0.047	0.002	0.88	30.7
GNDVI	25	AGB = 99.91-4.9(GNDVI)	0.036	0.001	0.91	30.7
CHM	26	AGB = 198.02-6.55(CHM)	0.233	0.054	0.44	29.9
NDVI, SAVI	27	AGB = 108+77,459(NDVI)-51,739(SAVI)	0.230	0.053	0.76	29.9
NDVI, GNDVI	28	AGB = 22.7+1,738.2(NDVI)-1,695.1(GNDVI)	0.368	0.135	0.48	28.6
NDVI, CHM	29	AGB = 140.99+21.26(NDVI)-8.17 (CHM)	0.273	0.075	0.68	29.6
SAVI, GNDVI	30	AGB = 22.8+1,157.3(SAVI)-1,689.5(GNDVI)	0.366	0.134	0.49	28.6
SAVI, CHM	31	AGB = 140.98+14.19(SAVI)-8.17(CHM)	0.273	0.075	0.67	29.6
GNDVI, CHM	32	141.64+19.18(GNDVI)-8.04(CHM)	0.268	0.072	0.69	29.6
NDVI, SAVI, GNDVI, CHM	33	AGB = 74.99-7.65(CHM)+51,586.19(NDVI)-33,400.63(SAVI) -1,532.38(GNDVI)	0.472	0.223	0.689	27.1

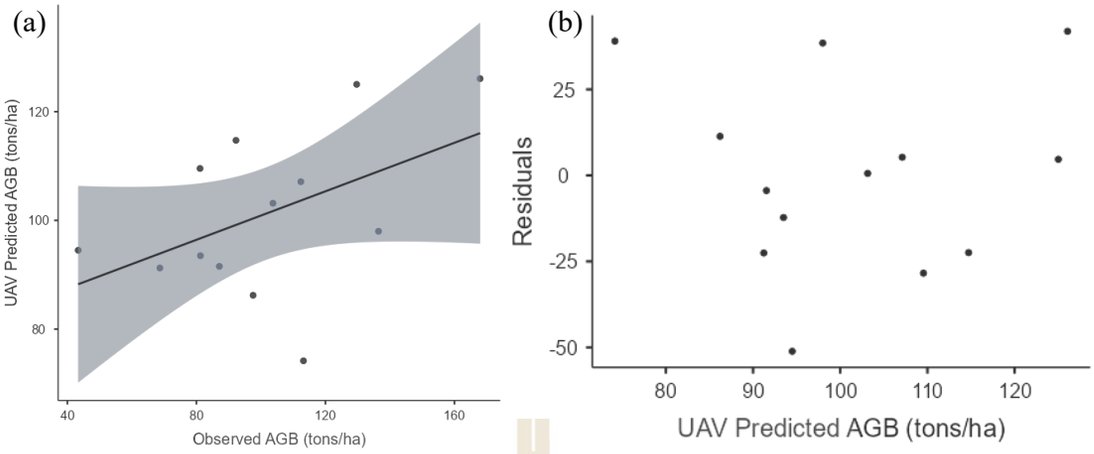

Figure 4.6 The most accurate AGB model (Model 33), from coexisting of *A. marina and Rhizophora spp.* plots: a) represents the regression model; and b) its residual plot.

4.2.2 Discussion on AGB Model

In examining AGB models for the Bamlaem mangrove forest, the integration of evaluated variables, including VIs and CHM, was found to significantly enhance prediction accuracy. The most effective models, Model 11 and Model 22, combined NDVI, SAVI, GNDVI, and CHM to estimate mangrove AGB, achieving an R^2 of approximately 0.58. Unlike prior research in Thailand, this study represents the first application of UAV imagery combined with VIs and CHM for estimating mangrove biomass and carbon storage. A study conducted in Ranong province, southern Thailand, employed medium-resolution (ASTER) and high-resolution (GeoEye-1) satellite data alongside machine learning techniques to model mangrove biomass, as reported by (Jachowski et al., 2013). The optimal AGB model from this research reached an R^2 value of 0.66 (Jachowski et al., 2013). In comparison, the combined model (Model 11) developed for the Banlaem mangrove exhibited slightly lower performance, with an R^2 value of 0.58. Moreover, the use of UAVs equipped with VIs and the height model, has been reported in other Southeast Asian countries. In Quang Ninh Province, Vietnam, a model utilizing NDVI and UAV-derived tree height data achieved high accuracy in estimating mangrove AGB, with an R^2 = 0.83 and an *RMSE* = 0.04 tons/ha (Ngo et al., 2023). Additionally, in Komodo National Park, Indonesia, multi-

source remote sensing data combined with machine learning techniques yielded an optimal model for mangrove AGB estimation, achieving an R^2 = 0.76 (Rijal et al., 2023). These findings are consistent with prior research (Nguyen et al., 2021), which indicated that integrating various VIs enhances model performance. The diverse age structures or mixed species compositions may reduce approach accuracy (Nguyen et al., 2019). Thus, in this study, models developed within homogeneous *A. marina* plots exhibited higher accuracy compared to those applied to mixed species plots containing both *A. marina* and *Rhizophora* species.

Despite its contributions, this study faced certain limitations. Specifically, some plots (plots 13-18) were excluded from the analysis of VIs derived from UAV data due to their location within a no-fly zone near an airport. Additionally, the UAV-derived height model demonstrated a low correlation with AGB. The dense canopy of the mangroves may have contributed to signal interference from the UAV. To enhance model accuracy in future research, incorporating LiDAR data, which provides distinct advantages for examining the vertical structure of mangroves (Tian, Zhang, Huang, Huang, Tao, and Zhou et al., 2022), could be beneficial.

4.3 Impacts on the Banlaem Community

To findings in this study reveal the ability of the Banlaem mangrove forest as the carbon sink and underscore the potential of UAV data in estimating mangrove biomass and carbon stocks. The proposed methodological framework and mathematical models, particularly Models 11 and 22 (**Table 4.4; Table 4.5**), offer a reproducible approach for evaluating carbon stocks not only in the Banlaem mangrove forest but also in other regions of Thailand and tropical mangrove ecosystems with similar species compositions. This study aligns with the Thai government's emission reduction targets, which include goals for carbon neutrality by 2050 and achieving net-zero greenhouse gas (GHG) emissions by 2065; to support these targets, Thailand has revised its Nationally Determined Contributions (NDC) strategy to increase the GHG emissions reduction goal from 25% to 40% by 2030 (ONEP, 2022).

Ultimately, with the presence of a voluntary market mechanism in Thailand, this study offers valuable insights for land managers in making informed decisions regarding harvesting, tree planting, and habitat conservation in this promising area. This approach fosters community engagement in sustainable management and carbon offset initiatives.

Notably, the Banlaem community hosts approximately 300-400 tourists and students each month who visit the mangrove forest to participate in tree planting activities (Minmun, personal communication, June 23, 2024). This study could enhance the community's understanding of the growing importance of carbon storage in mangroves and facilitate the collection of statistical data to assess the impact of mangrove planting on greenhouse gas reduction.

Additionally, the study found that the combination of grey and loop-root mangroves in this area leads to higher carbon stocks compared to stands of only grey mangroves (**Figure 4.3**). This finding may inform authorities as they develop mangrove plantation plans and management strategies to support blue carbon management in the region.

4.4 Limitations and Possible Applications of the AGB Model

The AGB model in this study was developed based on the specific characteristics of the Banlaem mangrove forest, which may limit its effectiveness when applied to mangroves with different characteristics. Mangrove forests with higher species diversity and more complex structures may require advanced modeling approaches instead of relying solely on linear relationships. It is recommended to apply the modeling approach used in this study to mangrove areas that share similar characteristics. Nevertheless, the modeling approach proposed in this study may apply to adjacent mangrove ecosystems that exhibit comparable features. For instance, a study conducted at the Mangrove Forest Resource Development and Learning Center 2 (Srimoh and Markphan, 2024), in Nakhon Si Thammarat, identified higher species diversity, with six mangrove species recorded. Despite this diversity, the *Avicennia* marina and *Rhizophora* species remained dominant. The study, which relied on field-

based methods, reported a carbon stock of 29.69 tons/ha, comparable to the 28.15 ± 25.90 tons/ha recorded in Banlaem. The similarity in dominant species and carbon storage capacity between the two sites suggests that the modeling approach developed in this study could be effectively applied to the Mangrove Forest Resource Development and Learning Center 2 for monitoring purposes. This application would help overcome challenges related to difficulties in field data collection

CHAPTER V
CONCLUSION

5.1 Conclusion of This Study

This study provides the first assessment of AGB and AGC stocks, alongside biodiversity, in the Banlaem mangrove forest in Nakhon Si Thammarat, southern Thailand. Findings reveal low species diversity, with only three mangrove species. This study highlights that mixed-species plots, particularly those including *Rhizophora* species, generally yield higher biomass than single-species plots. Further research could help determine how additional ecological factors influence biomass and carbon stocks in the Banlaem mangrove forest.

This study also evaluated AGB models for the Banlaem mangrove forest, finding that models incorporating VIs and the CHM significantly improved prediction accuracy. The top-performing models (Model 11 and Model 22) combined NDVI, SAVI, GNDVI, and CHM, yielding an R^2 = 0.58. This represents a novel application of UAV imagery with VIs and CHM for mangrove biomass estimation in Thailand. Although these models showed slightly lower accuracy compared to studies using satellite imagery, they align with findings from other Southeast Asian studies, demonstrating that multi-variable integration enhances model precision. Limitations included restricted UAV data collection in certain areas and low AGB correlation with the UAV-derived height model, potentially due to signal interference from dense canopy cover. Future research could improve accuracy by using LiDAR, which captures vertical structure more effectively.

This study highlights the effectiveness of UAV data and specific models (Models 11 and 22) in estimating biomass and carbon stocks in the Banlaem mangrove forest, supporting Thailand's carbon neutrality goals. The reproducible framework aids carbon assessment efforts and can inform conservation strategies in similar mangrove ecosystems. With strong community engagement through eco-tourism and tree

planting, the Banlaem community can play a vital role in carbon offset initiatives. Findings on species combinations for optimal carbon storage offer insights for authorities to enhance blue carbon management and contribute to Thailand's emission reduction targets.

5.2 Future Works

The development of the AGB model is essential for the accurate measurement of mangrove carbon stocks. In this study, the CHM showed a low correlation with AGB. Improving the CHM would enhance the accuracy of AGB estimation. The CHM was calculated by subtracting the DTM from the DSM. However, with the dense canopy of the Banlaem mangrove forest, radiation penetration between the UAV and the ground may be obstructed, negatively affecting the accuracy of both the DTM and the CHM. Incorporating the relative proportions of the tree trunk, canopy, and DSM may enhance the effectiveness of vertical structural variables used in the model, offering a cost-effective alternative to using active remote sensing data (such as LiDAR). Moreover, previous research has shown that Lorey's height, defined as the average tree height weighted by basal area, is an effective predictor of mangrove AGB (Wirasatriya et al., 2022). This approach should also be evaluated in the Banlaem mangrove forest. Therefore, developing vertical variables based on mangrove tree characteristics and integrating them with horizontal variables is essential for improving the AGB model in future studies.

Machine learning is also an alternative to use in the AGB model development. With the complex structures of the mangroves, non-linear models may effectively capture the relationship between the UAV variables and ground truth AGB. Previous studies in SEA have demonstrated the high effectiveness of algorithms such as XGBoost and SVR in estimating mangrove AGB (Jachowski et al., 2013; Rijal et al., 2023). However, using machine learning can be challenging, as it often requires knowledge of programming and data analysis.

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APPENDIX

มหาวิทยาลัยเทคโนโลยีสุรนารี

APPENDIX A

GROUND TRUTH DATA (SUMMARY):

Table A The summary of ground truth data in this study.

Transect	Plot	AGB (tons/ha)	AGC stock (tons/ha)	Mean H (m)	Mean DBH (cm)	BA (m^2/ha)	Note
1	1	129.69	64.84	8.29	7.61	21.42	Grey and Roop-root mangroves
1	2	97.57	48.79	6.95	8.64	16.16	Grey and Roop-root mangroves
1	3	43.81	21.91	11.71	7.61	8.02	Grey mangrove
1	4	57.73	28.87	7.33	7.83	10.28	Grey mangrove
1	5	76.66	38.33	7.08	7.28	14.34	Grey mangrove
1	6	60.22	30.11	5.65	8.07	12.08	Grey mangrove
2	7	81.25	40.62	6.88	7.17	13.72	Grey and Roop-root mangroves
2	8	58.07	29.04	6.40	7.17	10.81	Grey mangrove
2	9	29.83	14.92	5.41	6.27	6.01	Grey mangrove
2	10	18.63	9.31	5.49	6.55	3.65	Grey mangrove

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Table A (Continued).

Transect	Plot	AGB (tons/ha)	AGC stock (tons/ha)	Mean H (m)	Mean DBH (cm)	BA (m^2/ha)	Note
2	11	18.56	9.28	5.09	6.79	3.27	Grey mangrove
2	12	15.24	7.62	5.40	6.85	5.51	Grey mangrove
3	13	91.82	45.91	8.06	7.89	13.34	Grey and Roop-root mangroves
3	14	134.82	67.41	10.38	8.58	19.01	Grey and Loop-root mangroves
3	15	135.61	67.81	8.14	9.44	17.85	Grey and Loop-root mangroves
3	16	179.78	89.89	9.12	11.62	22.33	Grey and Loop-root mangroves
3	17	93.87	46.94	9.34	10.41	13.17	Grey and Loop-root mangroves
3	18	95.46	47.73	8.64	9.26	14.43	Grey and Loop-root mangroves
4	19	167.95	83.98	7.97	8.57	23.64	Grey and Loop-root mangroves
4	20	112.37	56.19	8.86	8.53	16.68	Grey and Loop-root mangroves
4	21	87.11	43.55	9.52	8.35	13.34	Grey and Loop-root mangroves
4	22	68.67	34.34	8.74	9.13	11.48	Grey and Loop-root mangroves
4	23	66.66	33.33	6.46	8.26	11.69	Grey mangrove
4	24	45.06	22.53	6.18	7.15	8.67	Grey mangrove
5	25	102.04	51.02	9.40	10.50	15.72	Grey mangrove

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Table A (Continued).

Transect	Plot	AGB (tons/ha)	AGC stock (tons/ha)	Mean H (m)	Mean DBH (cm)	BA (m^2/ha)	Note
5	26	21.05	10.53	4.50	9.71	3.48	Grey mangrove
5	27	10.80	5.40	3.53	9.12	1.37	Grey mangrove
5	28	13.23	6.62	4.70	7.98	2.37	Grey mangrove
5	29	15.75	7.88	4.40	8.70	2.58	Grey mangrove
5	30	3.20	1.60	4.25	7.64	0.60	Grey mangrove
6	31	136.46	68.23	12.38	8.52	19.31	Grey and Loop-root mangroves
6	32	81.12	40.56	11.87	8.83	11.74	Grey and Loop-root mangroves
6	33	103.72	51.86	10.73	9.02	15.15	Grey and Loop-root mangroves
6	34	113.19	56.60	9.77	10.53	17.06	Grey and 2 Loop-root mangroves
6	35	43.35	21.68	9.17	8.08	7.60	Grey and 2 Loop-root mangroves
6	36	92.27	46.13	15.50	9.89	12.64	Grey and Loop-root mangroves
7	37	0.00	0.00	1.00	0.00	0.00	Small Loop-root mangrove
7	38	0.00	0.00	0.66	0.00	0.00	Small Loop-root mangrove
7	39	0.00	0.00	0.71	0.00	0.00	Small Loop-root mangrove
7	40	0.00	0.00	1.10	0.00	0.00	Small Grey mangrove

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Table A (Continued).

Transect	Plot	AGB (tons/ha)	AGC stock (tons/ha)	Mean H (m)	Mean DBH (cm)	BA (m^2/ha)	Note
7	41	0.00	0.00	1.20	0.00	0.00	Small Loop-root mangrove
7	42	0.00	0.00	0.71	0.00	0.00	Small Loop-root mangrove
8	43	0.00	0.00	0.35	0.00	0.00	Small Loop-root mangrove
8	44	0.00	0.00	0.95	0.00	0.00	Small Loop-root mangrove
8	45	0.00	0.00	0.96	0.00	0.00	Small Grey mangrove
8	46	0.00	0.00	1.05	0.00	0.00	Small Loop-root mangrove
8	47	0.00	0.00	1.30	0.00	0.00	Small Loop-root mangrove
8	48	0.00	0.00	1.91	0.00	0.00	Small Loop-root mangrove

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APPENDIX B

GROUND TRUTH DATA (INDIVIDUAL-TREE RECORDS):

Table B The ground truth data (each individual tree).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1	P1T001	9.7	24.5	7.80	แสมทะเล	*Avicennia marina*	0.65	25.56	0.03	0.01
2	P1T002	10.2	31	9.87	แสมทะเล	*Avicennia marina*	0.65	45.59	0.05	0.02
3	P1T004	10.9	38	12.10	แสมทะเล	*Avicennia marina*	0.65	75.23	0.08	0.04
4	P1T005	10.4	20	6.37	โกงกาง	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
5	P1T006	11.2	28.5	9.08	โกงกาง	*Rhizophora mucronata*	0.82	46.77	0.05	0.02
6	P1T007	6.1	16.5	5.25	โกงกาง	*Rhizophora mucronata*	0.82	12.19	0.01	0.01
7	P1T009	7.2	23	7.32	โกงกาง ,marker	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
8	P1T010	10.8	26.5	8.44	โกงกาง	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
9	P1T011	6	18.5	5.89	โกงกาง	*Rhizophora mucronata*	0.82	16.15	0.02	0.01
10	P1T012	7	25.5	8.12	แสมทะเล	*Avicennia marina*	0.65	28.20	0.03	0.01
11	P1T013	10.5	34	10.83	แสมทะเล	*Avicennia marina*	0.65	57.22	0.06	0.03
12	P1T014	14.1	33	10.51	แสมทะเล	*Avicennia marina*	0.65	53.17	0.05	0.03

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
13	P1T015	7.6	16	5.10	โกงกาง	*Rhizophora mucronata*	0.82	11.30	0.01	0.01
14	P1T016	7	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
15	P1T017	5.1	16	5.10	โกงกาง	*Rhizophora mucronata*	0.82	11.30	0.01	0.01
16	P1T018	5	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
17	P1T019	6.2	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
18	P1T020	6.8	24.5	7.80	แสมทะเล	*Avicennia marina*	0.65	25.56	0.03	0.01
19	P1T021	10.8	38.5	12.26	แสมทะเล	*Avicennia marina*	0.65	77.69	0.08	0.04
20	P1T022	7.3	34.5	10.99	แสมทะเล	*Avicennia marina*	0.65	59.32	0.06	0.03
21	P1T023	5.7	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
22	P1T024	9.5	25	7.96	โกงกาง	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
23	P1T025	7	32	10.19	แสมทะเล	*Avicennia marina*	0.65	49.30	0.05	0.02
24	P1T026	5.2	17.5	5.57	โกงกาง	*Rhizophora mucronata*	0.82	14.09	0.01	0.01
25	P1T027	10.9	37	11.78	แสมทะเล	*Avicennia marina*	0.65	70.46	0.07	0.04
26	P1T028	5.4	20	6.37	โกงกาง	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
27	P1T029	5.9	17.5	5.57	โกงกาง	*Rhizophora mucronata*	0.82	14.09	0.01	0.01
28	P1T030	8.4	24.5	7.80	แสมทะเล	*Avicennia marina*	0.65	25.56	0.03	0.01
29	P1T032	12.9	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
30	P1T033	8.7	18	5.73	โกงกาง	*Rhizophora mucronata*	0.82	15.10	0.02	0.01
31	P1T034	7.9	23	7.32	โกงกาง	*Rhizophora mucronata*	0.82	27.60	0.03	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
32	P1T035	10.9	41	13.06	แสมทะเล ,marker	*Avicennia marina*	0.65	90.70	0.09	0.05
33	P1T036	7.1	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
34	P1T037	6	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
35	P1T038	5.7	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
36	P1T039	6.1	16	5.10	โกงกาง	*Rhizophora mucronata*	0.82	11.30	0.01	0.01
37	P1T040	6.4	16	5.10	โกงกาง	*Rhizophora mucronata*	0.82	11.30	0.01	0.01
38	P1T041	7.4	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
39	P1T042	7.6	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
40	P1T043	9.3	26	8.28	โกงกาง	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
41	P1T044	9.1	18	5.73	โกงกาง	*Rhizophora mucronata*	0.82	15.10	0.02	0.01
42	P1T045	9.2	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
43	P1T048	6.2	23.5	7.48	โกงกาง ,marker	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
44	P1T049	6.2	17.5	5.57	โกงกาง	*Rhizophora mucronata*	0.82	14.09	0.01	0.01
45	P1T050	10.5	31.5	10.03	แสมทะเล ,marker	*Avicennia marina*	0.65	47.42	0.05	0.02
46	P1T051	5.4	16.5	5.25	โกงกาง	*Rhizophora mucronata*	0.82	12.19	0.01	0.01
47	P1T052	10.4	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
48	P1T053	9.7	37	11.78	แสมทะเล	*Avicennia marina*	0.65	70.46	0.07	0.04
49	P1T054	5.1	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
50	P1T056	5.3	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01
51	P1T057	5.5	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
52	P1T058	4.7	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
53	P1T059	6.1	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
54	P1T061	7.3	26.5	8.44	แสมทะเล	*Avicennia marina*	0.65	31.00	0.03	0.02
55	P1T062	11.5	22	7.01	โกงกาง	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
56	P1T063	10.8	19	6.05	โกงกาง	*Rhizophora mucronata*	0.82	17.25	0.02	0.01
57	P1T064	6.4	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
58	P1T065	7.7	17	5.41	โกงกาง	*Rhizophora mucronata*	0.82	13.12	0.01	0.01
59	P1T066	9.2	20.5	6.53	โกงกาง	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
60	P1T068	8.4	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
61	P1T070	9.2	26	8.28	โกงกาง	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
62	P1T071	13.1	29	9.24	โกงกาง	*Rhizophora mucronata*	0.82	48.81	0.05	0.02
63	P1T072	12	24	7.64	โกงกาง	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
64	P1T073	13	28	8.92	โกงกาง	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
65	P1T074	8.9	20	6.37	โกงกาง	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
66	P1T076	7.8	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
67	P1T078	12.8	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
68	P2T001	7.7	38.1	12.13	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	75.72	0.08	0.04
69	P2T002	7	37.4	11.91	แสมทะเล	*Avicennia marina*	0.65	72.34	0.07	0.04
70	P2T003	5.8	20.3	6.46	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.30	0.02	0.01
71	P2T004	4.9	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
72	P2T005	6.5	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
73	P2T007	5.5	18.5	5.89	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	16.15	0.02	0.01
74	P2T008	7.3	30.5	9.71	แสมทะเล	*Avicennia marina*	0.65	43.80	0.04	0.02
75	P2T009	6.4	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
76	P2T010	8	24.6	7.83	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	25.81	0.03	0.01
77	P2T011	8.4	29.6	9.43	แสมทะเล	*Avicennia marina*	0.65	40.69	0.04	0.02
78	P2T012	7.2	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
79	P2T013	7.5	23.6	7.52	แสมทะเล	*Avicennia marina*	0.65	23.31	0.02	0.01
80	P2T014	4.8	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
81	P2T015	5	18.5	5.89	แสมทะเล	*Avicennia marina*	0.65	12.81	0.01	0.01
82	P2T016	10	51	16.24	แสมทะเล	*Avicennia marina*	0.65	155.15	0.16	0.08

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
83	P2T017	5.5	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01
84	P2T018	8.6	31.5	10.03	แสมทะเล	*Avicennia marina*	0.65	47.42	0.05	0.02
85	P2T019	6	27.6	8.79	แสมทะเล	*Avicennia marina*	0.65	34.26	0.03	0.02
86	P2T020	8	31.4	10.00	แสมทะเล	*Avicennia marina*	0.65	47.05	0.05	0.02
87	P2T022	8.8	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
88	P2T023	5.2	16.1	5.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	11.48	0.01	0.01
89	P2T024	4.6	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
90	P2T025	4.6	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
91	P2T027	6.5	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
92	P2T028	8.5	33.5	10.67	แสมทะเล	*Avicennia marina*	0.65	55.18	0.06	0.03
93	P2T029	7.8	37.9	12.07	แสมทะเล	*Avicennia marina*	0.65	74.75	0.07	0.04
94	P2T030	7.5	23.7	7.55	แสมทะเล	*Avicennia marina*	0.65	23.55	0.02	0.01
95	P2T031	7.4	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
96	P2T032	8	37.4	11.91	แสมทะเล	*Avicennia marina*	0.65	72.34	0.07	0.04
97	P2T033	6	21.2	6.75	แสมทะเล	*Avicennia marina*	0.65	17.90	0.02	0.01
98	P2T034	9.2	46.2	14.71	แสมทะเล	*Avicennia marina*	0.65	121.66	0.12	0.06
99	P2T035	7.3	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
100	P2T036	4.5	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
101	P2T037	8.6	28.5	9.08	แสมทะเล	*Avicennia marina*	0.65	37.07	0.04	0.02
102	P2T038	7	20.5	6.53	แสมทะเล	*Avicennia marina*	0.65	16.48	0.02	0.01
103	P2T039	7.3	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
104	P2T040	8.3	40.7	12.96	แสมทะเล	*Avicennia marina*	0.65	89.07	0.09	0.04
105	P2T041	6.2	19.4	6.18	แสมทะเล	*Avicennia marina*	0.65	14.39	0.01	0.01
106	P2T042	7.6	29	9.24	แสมทะเล	*Avicennia marina*	0.65	38.69	0.04	0.02
107	P3T002	6.4	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
108	P3T003	6.2	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
109	P3T004	7.3	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
110	P3T006	8.7	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
111	P3T007	12.1	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
112	P3T008	7.8	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
113	P3T009	13.5	31	9.87	แสมทะเล	*Avicennia marina*	0.65	45.59	0.05	0.02
114	P3T010	8.9	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
115	P3T011	13.5	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
116	P3T012	8.9	23	7.32	แสมทะเล	*Avicennia marina*	0.65	21.88	0.02	0.01
117	P3T013	11.5	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
118	P3T015	13.7	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
119	P3T016	11.2	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
120	P3T017	13.7	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
121	P3T018	18.2	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
122	P3T020	12.5	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
123	P3T021	11.2	18	5.73	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	11.97	0.01	0.01
124	P3T022	12.5	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
125	P3T023	15.6	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
126	P3T025	15.4	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
127	P3T026	15.3	34	10.83	แสมทะเล	*Avicennia marina*	0.65	57.22	0.06	0.03
128	P3T027	7.2	14	4.46	แสมทะเล	*Avicennia marina*	0.65	6.45	0.01	0.00
129	P3T028	12.5	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
130	P3T029	15.2	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
131	P3T031	15.6	32	10.19	แสมทะเล	*Avicennia marina*	0.65	49.30	0.05	0.02
132	P3T032	9.8	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
133	P4T001	6	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01
134	P4T002	6.9	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
135	P4T003	6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
136	P4T004	5.7	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
137	P4T005	8.1	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
138	P4T006	5.2	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
139	P4T007	6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
140	P4T008	6.2	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
141	P4T009	5.7	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
142	P4T010	7	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
143	P4T011	6	23	7.32	แสมทะเล	*Avicennia marina*	0.65	21.88	0.02	0.01
144	P4T012	7.2	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
145	P4T013	7.7	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
146	P4T015	11.7	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
147	P4T016	5.2	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
148	P4T017	10.2	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
149	P4T018	8.9	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
150	P4T019	8.6	25	7.96	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	26.86	0.03	0.01
151	P4T020	13.7	45	14.33	แสมทะเล	*Avicennia marina*	0.65	114.04	0.11	0.06
152	P4T021	5.7	25	7.96	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	26.86	0.03	0.01
153	P4T022	6.8	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
154	P4T023	8	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
155	P4T024	8	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
156	P4T025	6.3	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
157	P4T026	7.6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
158	P4T027	8.4	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
159	P4T028	8.6	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
160	P4T029	6.6	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
161	P4T030	9.4	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
162	P4T031	5.4	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
163	P4T032	4.3	18.5	5.89	แสมทะเล	*Avicennia marina*	0.65	12.81	0.01	0.01
164	P5T001	7.9	23.5	7.48	แสมทะเล, marker	*Avicennia marina*	0.65	23.07	0.02	0.01
165	P5T001	7.9	30.5	9.71	แสมทะเล, marker	*Avicennia marina*	0.65	43.80	0.04	0.02
166	P5T002	7.3	27.8	8.85	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	34.87	0.03	0.02
167	P5T003	6.1	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
168	P5T004	7.7	26.5	8.44	แสมทะเล	*Avicennia marina*	0.65	31.00	0.03	0.02
169	P5T005	6.8	18.7	5.96	แสมทะเล	*Avicennia marina*	0.65	13.15	0.01	0.01
170	P5T006	7.1	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
171	P5T007	10.5	29	9.24	แสมทะเล	*Avicennia marina*	0.65	38.69	0.04	0.02
172	P5T008	10.2	20.5	6.53	แสมทะเล	*Avicennia marina*	0.65	16.48	0.02	0.01
173	P5T009	8.1	23.4	7.45	แสมทะเล	*Avicennia marina*	0.65	22.83	0.02	0.01
174	P5T010	7.4	21.4	6.82	แสมทะเล	*Avicennia marina*	0.65	18.32	0.02	0.01
175	P5T011	4.3	15.5	4.94	แสมทะเล	*Avicennia marina*	0.65	8.29	0.01	0.00
176	P5T012	8.4	24.2	7.71	แสมทะเล	*Avicennia marina*	0.65	24.79	0.02	0.01
177	P5T013	7.2	21.6	6.88	แสมทะเล	*Avicennia marina*	0.65	18.75	0.02	0.01
178	P5T014	6.2	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
179	P5T015	8.1	21.1	6.72	แสมทะเล	*Avicennia marina*	0.65	17.70	0.02	0.01
180	P5T016	9.6	25.5	8.12	แสมทะเล	*Avicennia marina*	0.65	28.20	0.03	0.01
181	P5T017	5.9	18.8	5.99	แสมทะเล	*Avicennia marina*	0.65	13.32	0.01	0.01
182	P5T018	5.6	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
183	P5T019	6.2	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
184	P5T020	7	21.2	6.75	แสมทะเล	*Avicennia marina*	0.65	17.90	0.02	0.01
185	P5T021	7.9	23.3	7.42	แสมทะเล	*Avicennia marina*	0.65	22.59	0.02	0.01
186	P5T022	9.7	40.3	12.83	แสมทะเล	*Avicennia marina*	0.65	86.93	0.09	0.04
187	P5T023	7.2	27.6	8.79	แสมทะเล	*Avicennia marina*	0.65	34.26	0.03	0.02
188	P5T024	7.1	29.4	9.36	แสมทะเล	*Avicennia marina*	0.65	40.02	0.04	0.02
189	P5T025	4.1	16.2	5.16	แสมทะเล	*Avicennia marina*	0.65	9.24	0.01	0.00

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
190	P5T026	5.3	21.7	6.91	แสมทะเล	*Avicennia marina*	0.65	18.96	0.02	0.01
191	P5T027	7.3	26.3	8.38	แสมทะเล	*Avicennia marina*	0.65	30.43	0.03	0.02
192	P5T028	5.6	16.6	5.29	แสมทะเล	*Avicennia marina*	0.65	9.81	0.01	0.00
193	P5T029	6.6	21.2	6.75	marker อยู่ใกล้	*Avicennia marina*	0.65	17.90	0.02	0.01
194	P5T030	5.7	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
195	P5T031	7.6	25.5	8.12	แสมทะเล	*Avicennia marina*	0.65	28.20	0.03	0.01
196	P5T032	7.9	27.5	8.76	แสมทะเล	*Avicennia marina*	0.65	33.95	0.03	0.02
197	P5T033	7.2	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
198	P5T034	6.9	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
199	P5T035	7.2	21	6.69	แสมทะเล ,กลาง	*Avicennia marina*	0.65	17.49	0.02	0.01
200	P5T036	6.4	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
201	P5T037	6.5	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
202	P5T038	8.7	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
203	P5T039	8.4	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
204	P5T040	6.9	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
205	P5T041	6.2	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
206	P5T042	5.1	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
207	P5T043	6.2	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
208	P5T044	5.4	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01
209	P5T045	8	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
210	P5T046	7.1	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
211	P5T047	5.2	29	9.24	แสมทะเล	*Avicennia marina*	0.65	38.69	0.04	0.02
212	P5T048	8.6	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
213	P5T049	8.4	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
214	P5T050	5.2	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
215	P6T001	4.9	13	4.14	แสมทะเล	*Avicennia marina*	0.65	5.38	0.01	0.00
216	P6T002	5.9	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
217	P6T003	6	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
218	P6T004	6.3	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
219	P6T005	5.9	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
220	P6T006	5.4	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
221	P6T007	7	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
222	P6T008	6.6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
223	P6T009	4.6	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
224	P6T010	4.8	15	4.78	แสมทะเล	*Avicennia marina*	0.65	7.64	0.01	0.00
225	P6T011	5.3	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
226	P6T012	4.7	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
227	P6T013	5.4	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
228	P6T014	7.6	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
229	P6T015	5.9	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
230	P6T016	5	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
231	P6T017	5.1	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
232	P6T018	4.9	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
233	P6T019	5.7	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
234	P6T020	4.8	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
235	P6T021	7.6	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
236	P6T022	5.5	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
237	P6T023	5	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
238	P6T024	7.8	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
239	P6T025	5.3	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
240	P6T026	5.1	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
241	P6T027	5.7	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
242	P6T028	6	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
243	P6T029	5.2	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
244	P6T030	8.3	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
245	P6T031	5.5	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
246	P6T032	7	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
247	P6T033	5.4	19	6.05	ใกล้ต้น marker, แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
248	P6T034	5.9	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
249	P6T035	7.8	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
250	P6T036	5.3	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
251	P6T037	6.3	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
252	P6T038	4.8	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
253	P6T039	5.1	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
254	P6T040	4.3	23	7.32	แสมทะเล	*Avicennia marina*	0.65	21.88	0.02	0.01
255	P6T041	5.4	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
256	P6T042	5.2	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
257	P6T043	6.6	20.5	6.53	แสมทะเล	*Avicennia marina*	0.65	16.48	0.02	0.01
258	P6T044	6	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
259	P6T045	5.8	15	4.78	แสมทะเล	*Avicennia marina*	0.65	7.64	0.01	0.00
260	P6T046	4.9	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
261	P6T047	4.9	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
262	P6T048	5	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
263	P6T049	6.8	26	8.28	แสมทะเล	*Avicennia marina*	0.65	29.58	0.03	0.01
264	P6T050	4.3	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
265	P6T051	4.9	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
266	P6T052	6.6	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
267	P6T053	5.5	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
268	P6T054	4.7	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
269	P6T055	6.3	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
270	P6T056	4.9	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
271	P6T057	4.5	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
272	P6T058	4.9	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
273	P7T001	8.6	36.5	11.62	แสมทะเล	*Avicennia marina*	0.65	68.14	0.07	0.03
274	P7T002	7.4	41.5	13.22	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	93.44	0.09	0.05
275	P7T003	5.2	15.7	5.00	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	10.79	0.01	0.01
276	P7T004	5.5	16.4	5.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	12.01	0.01	0.01
277	P7T005	8	37.5	11.94	แสมทะเล	*Avicennia marina*	0.65	72.82	0.07	0.04

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
278	P7T006	6.3	27.4	8.73	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	33.65	0.03	0.02
279	P7T007	6	25.5	8.12	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	28.20	0.03	0.01
280	P7T008	11.1	39.8	12.68	แยก 2 กิ่ง ,แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	84.30	0.08	0.04
281	P7T008	11.1	37	11.78	แยก 2 กิ่ง, แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	70.46	0.07	0.04
282	P7T009	6.6	30.2	9.62	แสมทะเล	*Avicennia marina*	0.65	42.75	0.04	0.02
283	P7T010	7.9	20.3	6.46	แสมทะเล	*Avicennia marina*	0.65	16.09	0.02	0.01
284	P7T011	5.9	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
285	P7T012	5.6	18.5	5.89	แสมทะเล	*Avicennia marina*	0.65	12.81	0.01	0.01
286	P7T013	7.1	19.7	6.27	แสมทะเล	*Avicennia marina*	0.65	14.95	0.01	0.01
287	P7T014	5.2	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01
288	P7T015	5.9	29.9	9.52	แสมทะเล	*Avicennia marina*	0.65	41.71	0.04	0.02
289	P7T016	5.2	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
290	P7T017	6.6	29.2	9.30	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	39.35	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
291	P7T018	8.6	29.5	9.39	แยก 2 กิ่ง, แสมทะเล	*Avicennia marina*	0.65	40.36	0.04	0.02
292	P7T018	8.6	27	8.60	แยก 2 กิ่ง, แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
293	P7T019	4.4	16.4	5.22	แสมทะเล	*Avicennia marina*	0.65	9.52	0.01	0.00
294	P7T020	5.2	18.2	5.80	แสมทะเล	*Avicennia marina*	0.65	12.30	0.01	0.01
295	P7T021	4.9	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01
296	P7T022	6.6	23	7.32	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	21.88	0.02	0.01
297	P7T023	6.2	23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
298	P7T024	9.7	29.8	9.49	แสมทะเล	*Avicennia marina*	0.65	41.37	0.04	0.02
299	P7T025	7.3	31	9.87	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	45.59	0.05	0.02
300	P7T026	4.9	20.1	6.40	แสมทะเล	*Avicennia marina*	0.65	15.70	0.02	0.01
301	P7T027	6.9	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
302	P7T028	5.6	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
303	P7T029	5.5	17	5.41	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	13.12	0.01	0.01
304	P7T030	9.3	27.7	8.82	แสมทะเล	*Avicennia marina*	0.65	34.57	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
305	P7T031	9.2	33.5	10.67	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	69.61	0.07	0.03
306	P7T032	5.1	18.5	5.89	แสมทะเล	*Avicennia marina*	0.65	12.81	0.01	0.01
307	P7T033	4.4	19.8	6.31	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	15.13	0.02	0.01
308	P7T034	8.7	37	11.78	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	70.46	0.07	0.04
309	P7T035	8.5	29.19	9.30	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	39.32	0.04	0.02
310	P7T036	6.8	23	7.32	แสมทะเล	*Avicennia marina*	0.65	21.88	0.02	0.01
311	P8T001	5.9	20.2	6.43	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	15.90	0.02	0.01
312	P8T002	6.3	22.6	7.20	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	20.95	0.02	0.01
313	P8T003	6.6	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
314	P8T004	6.3	19.8	6.31	แสมทะเล	*Avicennia marina*	0.65	15.13	0.02	0.01
315	P8T005	7.5	18	5.73	แสมทะเล	*Avicennia marina*	0.65	11.97	0.01	0.01
316	P8T006	5.6	18.5	5.89	แสมทะเล	*Avicennia marina*	0.65	12.81	0.01	0.01
317	P8T007	5.1	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
318	P8T008	5.7	26.1	8.31	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	29.86	0.03	0.01
319	P8T009	7.3	31.2	9.94	แสมทะเล	*Avicennia marina*	0.65	46.32	0.05	0.02
320	P8T010	6.6	24.2	7.71	แสมทะเล	*Avicennia marina*	0.65	24.79	0.02	0.01
321	P8T011	5.1	17.4	5.54	แสมทะเล	*Avicennia marina*	0.65	11.01	0.01	0.01
322	P8T012	5.4	18.4	5.86	แสมทะเล, center	*Avicennia marina*	0.65	12.64	0.01	0.01
323	P8T013	6.5	23.7	7.55	แสมทะเล	*Avicennia marina*	0.65	23.55	0.02	0.01
324	P8T014	7	19	6.05	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	13.67	0.01	0.01
325	P8T015	5	17	5.41	แสมทะเล	*Avicennia marina*	0.65	10.40	0.01	0.01
326	P8T016	6.6	25.5	8.12	แสมทะเล	*Avicennia marina*	0.65	28.20	0.03	0.01
327	P8T017	7.9	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
328	P8T018	7.9	38	12.10	แสมทะเล	*Avicennia marina*	0.65	75.23	0.08	0.04
329	P8T019	6.9	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
330	P8T020	6.6	31.5	10.03	แสมทะเล	*Avicennia marina*	0.65	47.42	0.05	0.02
331	P8T021	5.6	23.7	7.55	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	23.55	0.02	0.01
332	P8T022	5.1	15.8	5.03	แสมทะเล	*Avicennia marina*	0.65	8.69	0.01	0.00
333	P8T023	6.4	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
334	P8T023	6.4	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
335	P8T024	6.6	26.9	8.57	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	32.16	0.03	0.02
336	P8T025	9.9	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
337	P8T026	6	21.8	6.94	แสมทะเล	*Avicennia marina*	0.65	19.18	0.02	0.01
338	P8T026	6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
339	P8T026	6	17.2	5.48	แสมทะเล	*Avicennia marina*	0.65	10.70	0.01	0.01
340	P8T027	7.2	18.4	5.86	แสมทะเล	*Avicennia marina*	0.65	12.64	0.01	0.01
341	P8T028	6.7	15.7	5.00	แสมทะเล	*Avicennia marina*	0.65	8.55	0.01	0.00
342	P8T029	5.2	18.3	5.83	แสมทะเล	*Avicennia marina*	0.65	12.47	0.01	0.01
343	P8T030	6.6	18.6	5.92	แสมทะเล	*Avicennia marina*	0.65	12.98	0.01	0.01
344	P8T031	6.6	17.1	5.45	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	10.55	0.01	0.01
345	P8T032	6.9	23.8	7.58	แสมทะเล	*Avicennia marina*	0.65	23.80	0.02	0.01
346	P8T033	5.7	23.4	7.45	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	22.83	0.02	0.01
347	P8T034	5.5	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
348	P8T035	4.2	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01
349	P8T036	9.2	28.3	9.01	แสมทะเล	*Avicennia marina*	0.65	36.44	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
350	P9T001	4.6	17.4	5.54	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	11.01	0.01	0.01
351	P9T002	6.2	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
352	P9T003	6.2	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
353	P9T004	6.3	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
354	P9T005	4.5	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
355	P9T006	6.1	28	8.92	แสมทะเล	*Avicennia marina*	0.65	35.49	0.04	0.02
356	P9T006	5.5	25	7.96	แสมทะเล	*Avicennia marina*	0.65	26.86	0.03	0.01
357	P9T006	5	24.8	7.90	แสมทะเล	*Avicennia marina*	0.65	26.33	0.03	0.01
358	P9T006	4	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
359	P9T007	6.8	16.5	5.25	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	9.66	0.01	0.00
360	P9T008	4.3	20	6.37	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	15.51	0.02	0.01
361	P9T009	4.8	20	6.37	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	15.51	0.02	0.01
362	P9T010	5.4	22.2	7.07	แสมทะเล, marker	*Avicennia marina*	0.65	20.05	0.02	0.01
363	P9T011	4.7	19.2	6.11	แสมทะเล	*Avicennia marina*	0.65	14.03	0.01	0.01
364	P9T011	4.7	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
365	P9T012	4.6	16.2	5.16	แสมทะเล	*Avicennia marina*	0.65	9.24	0.01	0.00
366	P9T012	4.6	15	4.78	แสมทะเล	*Avicennia marina*	0.65	7.64	0.01	0.00
367	P9T013	4.6	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
368	P9T013	4.6	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
369	P9T014	4.7	17.5	5.57	แสม (ลำต้นดำ)*, center	*Avicennia marina*	0.65	11.17	0.01	0.01
370	P9T015	4.6	16.5	5.25	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	9.66	0.01	0.00
371	P9T016	4.9	18.2	5.80	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	12.30	0.01	0.01
372	P9T016	4.9	17.5	5.57	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	11.17	0.01	0.01
373	P9T017	6.6	26.4	8.41	แสมทะเล	*Avicennia marina*	0.65	30.71	0.03	0.02
374	P9T018	6.6	25.4	8.09	แสมทะเล	*Avicennia marina*	0.65	27.93	0.03	0.01
375	P9T018	6.6	21	6.69	แสมทะเล	*Avicennia marina*	0.65	17.49	0.02	0.01
376	P9T019	6.7	22.5	7.17	แสมทะเล	*Avicennia marina*	0.65	20.73	0.02	0.01
377	P9T019	6.7	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
378	P9T020	7.2	16.4	5.22	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	9.52	0.01	0.00
379	P10T001	5	18.7	5.96	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	13.15	0.01	0.01
380	P10T002	5.7	16	5.10	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	8.96	0.01	0.00
381	P10T003	6.6	24	7.64	แสมทะเล	*Avicennia marina*	0.65	24.29	0.02	0.01
382	P10T003	4	27	8.60	แสมทะเล	*Avicennia marina*	0.65	32.46	0.03	0.02
383	P10T004	6.1	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
384	P10T005	4.4	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
385	P10T006	5.9	17.9	5.70	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	11.81	0.01	0.01
386	P10T006	5.8	15.7	5.00	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	8.55	0.01	0.00
387	P10T007	6	30	9.55	แสมทะเล	*Avicennia marina*	0.65	42.06	0.04	0.02
388	P10T007	5.9	20.5	6.53	แสมทะเล	*Avicennia marina*	0.65	16.48	0.02	0.01
389	P10T008	5.2	19.4	6.18	แสมทะเล	*Avicennia marina*	0.65	14.39	0.01	0.01
390	P10T009	5	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
391	P10T010	5	17	5.41	แสมทะเล, center	*Avicennia marina*	0.65	10.40	0.01	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
392	P10T011	5.2	25.5	8.12	แสมทะเล	*Avicennia marina*	0.65	28.20	0.03	0.01
393	P10T012	5.7	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01
394	P10T013	6.4	20.5	6.53	แสมทะเล	*Avicennia marina*	0.65	16.48	0.02	0.01
395	P11T001	6	19	6.05	แสมทะเล	*Avicennia marina*	0.65	13.67	0.01	0.01
396	P11T002	3.8	23.5	7.48	แสมทะเล	*Avicennia marina*	0.65	23.07	0.02	0.01
397	P11T003	5.4	19.5	6.21	แสมทะเล	*Avicennia marina*	0.65	14.58	0.01	0.01
398	P11T004	5.4	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
399	P11T005	4.4	16	5.10	แสมทะเล	*Avicennia marina*	0.65	8.96	0.01	0.00
400	P11T006	4.6	15.7	5.00	แสมทะเล	*Avicennia marina*	0.65	8.55	0.01	0.00
401	P11T007	5.7	16.2	5.16	แสมทะเล	*Avicennia marina*	0.65	9.24	0.01	0.00
402	P11T008	5.3	17.5	5.57	แสมทะเล	*Avicennia marina*	0.65	11.17	0.01	0.01
403	P11T009	5.3	16.2	5.16	แสมทะเล	*Avicennia marina*	0.65	9.24	0.01	0.00
404	P11T010	4.9	17.6	5.61	แสมทะเล	*Avicennia marina*	0.65	11.33	0.01	0.01
405	P11T011	5.4	43.6	13.89	แสมทะเล	*Avicennia marina*	0.65	105.51	0.11	0.05
406	P11T012	4.9	35	11.15	แสมทะเล	*Avicennia marina*	0.65	61.45	0.06	0.03
407	P12T001	5.7	17.1	5.45	แสมทะเล	*Avicennia marina*	0.65	10.55	0.01	0.01
408	P12T002	4.4	21.5	6.85	แสมทะเล	*Avicennia marina*	0.65	18.53	0.02	0.01
409	P12T003	5.4	22	7.01	แสมทะเล	*Avicennia marina*	0.65	19.61	0.02	0.01
410	P12T003	5.4	22.6	7.20	แสมทะเล	*Avicennia marina*	0.65	20.95	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
411	P12T004	4.9	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
412	P12T005	4.8	19.1	6.08	แสมทะเล	*Avicennia marina*	0.65	13.85	0.01	0.01
413	P12T006	4.5	18.2	5.80	แสมทะเล	*Avicennia marina*	0.65	12.30	0.01	0.01
414	P12T007	5.2	24.8	7.90	แสมทะเล	*Avicennia marina*	0.65	26.33	0.03	0.01
415	P12T008	5.5	27.7	8.82	แสมทะเล	*Avicennia marina*	0.65	34.57	0.03	0.02
416	P12T009	5.2	28.1	8.95	แสมทะเล	*Avicennia marina*	0.65	35.81	0.04	0.02
417	P12T010	5.5	22.1	7.04	แสมทะเล	*Avicennia marina*	0.65	19.83	0.02	0.01
418	P12T011	5.2	16.3	5.19	แสมทะเล, center	*Avicennia marina*	0.65	9.38	0.01	0.00
419	P12T012	4.8	16	5.10	แสมทะเล, marker	*Avicennia marina*	0.65	8.96	0.01	0.00
420	P12T013	6.8	19.2	6.11	แสมทะเล	*Avicennia marina*	0.65	14.03	0.01	0.01
421	P12T014	5.4	32	10.19	แสมทะเล	*Avicennia marina*	0.65	49.30	0.05	0.02
422	P12T015	6	21.4	6.82	แสมทะเล	*Avicennia marina*	0.65	18.32	0.02	0.01
423	P12T016	6.1	31.2	9.94	แสมทะเล	*Avicennia marina*	0.65	46.32	0.05	0.02
424	P12T017	5.2	16.5	5.25	แสมทะเล	*Avicennia marina*	0.65	9.66	0.01	0.00
425	P12T018	5	16.3	5.19	แสมทะเล	*Avicennia marina*	0.65	9.38	0.01	0.00
426	P12T019	5.6	23	7.32	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	21.88	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
427	P12T020	5.4	20	6.37	แสมทะเล	*Avicennia marina*	0.65	15.51	0.02	0.01
428	P12T021	6.9	18	5.73	แสม (ลำต้นดำ)*	*Avicennia marina*	0.65	11.97	0.01	0.01
429	P13T001		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
430	P13T002		24.5	7.80	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	32.24	0.03	0.02
431	P13T003		21.3	6.78	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.85	0.02	0.01
432	P13T004		23.6	7.52	แสม	*Avicennia marina*	0.65	23.31	0.02	0.01
433	P13T005		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
434	P13T006		29.6	9.43	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	51.34	0.05	0.03
435	P13T007		22.5	7.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.15	0.03	0.01
436	P13T008		22.4	7.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.86	0.03	0.01
437	P13T009		22.2	7.07	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.30	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
438	P13T010		28.6	9.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	47.17	0.05	0.02
439	P13T011		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
440	P13T012	7.3	30.1	9.59	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.50	0.05	0.03
441	P13T013	9.8	24.9	7.93	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.55	0.03	0.02
442	P13T014		25.5	8.12	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.57	0.04	0.02
443	P13T015		32.1	10.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.67	0.06	0.03
444	P13T016		22.5	7.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.15	0.03	0.01
445	P13T017		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
446	P13T018		29.2	9.30	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.65	0.05	0.02
447	P13T019	6.8	27.6	8.79	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.22	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
448	P13T020		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
449	P13T021		21.1	6.72	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.32	0.02	0.01
450	P13T022		18.9	6.02	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.03	0.02	0.01
451	P13T023		19.5	6.21	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	18.39	0.02	0.01
452	P13T024		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01
453	P13T025		18	5.73	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	15.10	0.02	0.01
454	P13T026		29.5	9.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.91	0.05	0.03
455	P13T027		18.5	5.89	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	16.15	0.02	0.01
456	P13T028		32.1	10.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.67	0.06	0.03
457	P13T029	9	21.6	6.88	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.65	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
458	P13T030		31.1	9.90	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.97	0.06	0.03
459	P13T031		20.7	6.59	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	21.30	0.02	0.01
460	P13T032		24.5	7.80	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	32.24	0.03	0.02
461	P13T033		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
462	P13T034		24.9	7.93	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.55	0.03	0.02
463	P13T035		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
464	P13T036		31.2	9.94	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	58.43	0.06	0.03
465	P13T037		25.8	8.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	36.61	0.04	0.02
466	P13T038		22.9	7.29	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.30	0.03	0.01
467	P13T039	7.4	23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
468	P13T040		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02
469	P13T041		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01
470	P14T001		27.3	8.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.07	0.04	0.02
471	P14T002		20.8	6.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	21.55	0.02	0.01
472	P14T003		28.8	9.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	47.99	0.05	0.02
473	P14T004		25.8	8.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	36.61	0.04	0.02
474	P14T005		24.8	7.90	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.22	0.03	0.02
475	P14T006		20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
476	P14T007		28	8.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
477	P14T008		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
478	P14T009		28.6	9.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	47.17	0.05	0.02
479	P14T010		33	10.51	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	67.08	0.07	0.03
480	P14T011		23.6	7.52	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.40	0.03	0.01
481	P14T012	10.6	22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
482	P14T013		55.8	17.77	แสม	*Avicennia marina*	0.65	193.58	0.19	0.10
483	P14T014		24.1	7.68	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.96	0.03	0.02
484	P14T015		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
485	P14T016		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
486	P14T017		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
487	P14T018		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
488	P14T019		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
489	P14T020		28.2	8.98	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.57	0.05	0.02
490	P14T021	9.1	27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
491	P14T022		44.3	14.11	แสม	*Avicennia marina*	0.65	109.72	0.11	0.05
492	P14T023		26.1	8.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.67	0.04	0.02
493	P14T024		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02
494	P14T025		21.3	6.78	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.85	0.02	0.01
495	P14T026		27.5	8.76	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.84	0.04	0.02
496	P14T027		25.4	8.09	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.23	0.04	0.02
497	P14T028		25.3	8.06	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.89	0.03	0.02
498	P14T029		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
499	P14T030		33.2	10.57	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	68.08	0.07	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
500	P14T031		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
501	P14T032		19.5	6.21	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	18.39	0.02	0.01
502	P14T033	10.1	34	10.83	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	72.19	0.07	0.04
503	P14T034		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
504	P14T035		27.7	8.82	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.61	0.04	0.02
505	P14T036	10.1	23.6	7.52	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.40	0.03	0.01
506	P14T037	12	30.9	9.84	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.06	0.06	0.03
507	P14T038		25.5	8.12	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.57	0.04	0.02
508	P14T039		20.4	6.50	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.55	0.02	0.01
509	P14T040		53.5	17.04	แสม	*Avicennia marina*	0.65	174.54	0.17	0.09
510	P14T041		25.2	8.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.55	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
511	P14T042		22.4	7.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.86	0.03	0.01
512	P14T043		32.3	10.29	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	63.63	0.06	0.03
513	P14T044		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
514	P14T045		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
515	P14T046		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
516	P14T047		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
517	P15T001	6.4	27.6	8.79	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.22	0.04	0.02
518	P15T002		24.4	7.77	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.92	0.03	0.02
519	P15T003		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
520	P15T004		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
521	P15T005		34.3	10.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	73.77	0.07	0.04
522	P15T006		22.4	7.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.86	0.03	0.01
523	P15T007		26.1	8.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.67	0.04	0.02
524	P15T008		21.4	6.82	แสม	*Avicennia marina*	0.65	18.32	0.02	0.01
525	P15T009		42.2	13.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	122.83	0.12	0.06
526	P15T010	10	52	16.56	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	205.31	0.21	0.10
527	P15T011		21.3	6.78	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.85	0.02	0.01
528	P15T012		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
529	P15T013		34.3	10.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	73.77	0.07	0.04
530	P15T014		22.7	7.23	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.72	0.03	0.01
531	P15T015		44.3	14.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	138.42	0.14	0.07

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
532	P15T016		25.8	8.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	36.61	0.04	0.02
533	P15T017		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
534	P15T018		31.8	10.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	61.24	0.06	0.03
535	P15T019		22.2	7.07	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.30	0.03	0.01
536	P15T020		35.5	11.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	80.28	0.08	0.04
537	P15T021		23.4	7.45	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.79	0.03	0.01
538	P15T022	7.1	23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
539	P15T023		19.2	6.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.70	0.02	0.01
540	P15T024		21.9	6.97	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.46	0.02	0.01
541	P15T025		47.7	15.19	แสม	*Avicennia marina*	0.65	131.61	0.13	0.07
542	P15T026		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
543	P15T027		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
544	P15T028		40.2	12.80	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	109.00	0.11	0.05
545	P15T029		23.4	7.45	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.79	0.03	0.01
546	P15T030		23.2	7.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.19	0.03	0.01
547	P15T031	9	38	12.10	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	94.91	0.09	0.05
548	P15T032		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02
549	P15T033		52.5	16.72	แสม	*Avicennia marina*	0.65	166.62	0.17	0.08
550	P15T034		31.2	9.94	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	58.43	0.06	0.03
551	P15T035		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
552	P15T036	8.2	28.8	9.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	47.99	0.05	0.02
553	P16T001		48.5	15.45	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	172.97	0.17	0.09

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
554	P16T002		42.5	13.54	แสม	*Avicennia marina*	0.65	99.08	0.10	0.05
555	P16T003	8.1	31.5	10.03	แสม	*Avicennia marina*	0.65	47.42	0.05	0.02
556	P16T004		32.3	10.29	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	63.63	0.06	0.03
557	P16T005		46	14.65	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	120.37	0.12	0.06
558	P16T006		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.65	32.46	0.03	0.02
559	P16T007		42.1	13.41	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	122.12	0.12	0.06
560	P16T008		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
561	P16T009		44.8	14.27	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	112.79	0.11	0.06
562	P16T010		29.5	9.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.91	0.05	0.03
563	P16T011	8.8	41.5	13.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	117.88	0.12	0.06
564	P16T012	9.4	32	10.19	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.19	0.06	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
565	P16T013		56.5	17.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	251.81	0.25	0.13
566	P16T014		45	14.33	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	143.86	0.14	0.07
567	P16T015		28.5	9.08	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	46.77	0.05	0.02
568	P16T016	8.7	39	12.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	101.17	0.10	0.05
569	P16T017		35.3	11.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	79.17	0.08	0.04
570	P16T018		36.2	11.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	84.23	0.08	0.04
571	P16T019		32.8	10.45	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	66.08	0.07	0.03
572	P16T020		27.5	8.76	แสม	*Avicennia marina*	0.65	33.95	0.03	0.02
573	P16T021		24.9	7.93	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.55	0.03	0.02
574	P16T022		37	11.78	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	88.88	0.09	0.04
575	P16T023	10.6	50	15.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	186.43	0.19	0.09

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
576	P16T024		28.4	9.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	46.37	0.05	0.02
577	P16T025		28.4	9.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	46.37	0.05	0.02
578	P16T026		35.9	11.43	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	82.52	0.08	0.04
579	P16T027		32.3	10.29	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	63.63	0.06	0.03
580	P16T028		34.8	11.08	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	76.44	0.08	0.04
581	P16T029		44	14.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	136.12	0.14	0.07
582	P16T030		38.9	12.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	100.53	0.10	0.05
583	P16T031		28	8.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
584	P17T001		33.6	10.70	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	70.12	0.07	0.04
585	P17T002		36	11.46	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	83.09	0.08	0.04

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
586	P17T003		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
587	P17T004		29.2	9.30	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.65	0.05	0.02
588	P17T005	12.3	45.7	14.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	149.43	0.15	0.07
589	P17T006		35.3	11.24	แสม	*Avicennia marina*	0.65	62.76	0.06	0.03
590	P17T007		34.8	11.08	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	60.59	0.06	0.03
591	P17T008		21.7	6.91	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.92	0.02	0.01
592	P17T009		20.3	6.46	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.30	0.02	0.01
593	P17T010	8.2	25.8	8.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	36.61	0.04	0.02
594	P17T011	10.7	42.4	13.50	แสม	*Avicennia marina*	0.65	98.51	0.10	0.05
595	P17T012	7.7	25.5	8.12	แสม	*Avicennia marina*	0.65	28.20	0.03	0.01
596	P17T013		35.6	11.34	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	80.84	0.08	0.04
597	P17T014	7.8	30.6	9.75	แสม	*Avicennia marina*	0.65	44.16	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
598	P17T015		28.8	9.17	แสม	*Avicennia marina*	0.65	38.04	0.04	0.02
599	P17T016		26.2	8.34	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	38.02	0.04	0.02
600	P17T017		53.3	16.97	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	172.94	0.17	0.09
601	P17T018		21.2	6.75	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.59	0.02	0.01
602	P17T019		53.6	17.07	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	175.34	0.18	0.09
603	P17T020		41.2	13.12	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	91.79	0.09	0.05
604	P17T021		28.8	9.17	แสม	*Avicennia marina*	0.65	38.04	0.04	0.02
605	P17T022		23.4	7.45	แสม	*Avicennia marina*	0.65	22.83	0.02	0.01
606	P18T001		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
607	P18T002		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
608	P18T003	9.2	46.5	14.81	แสม	*Avicennia marina*	0.65	123.62	0.12	0.06
609	P18T004	7.2	34.5	10.99	แสม	*Avicennia marina*	0.65	59.32	0.06	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
610	P18T005		23.6	7.52	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.40	0.03	0.01
611	P18T006		19.2	6.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.70	0.02	0.01
612	P18T007	9.3	19.3	6.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.93	0.02	0.01
613	P18T008	9.5	56.8	18.09	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	202.23	0.20	0.10
614	P18T009		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01
615	P18T010		42.3	13.47	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	123.55	0.12	0.06
616	P18T011		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
617	P18T012		29.1	9.27	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.23	0.05	0.02
618	P18T013		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
619	P18T014		30.2	9.62	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	42.75	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
620	P18T015		42.2	13.44	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	97.37	0.10	0.05
621	P18T016		26.1	8.31	แสม	*Avicennia marina*	0.65	29.86	0.03	0.01
622	P18T017		49	15.61	แสม	*Avicennia marina*	0.65	140.61	0.14	0.07
623	P18T018		31.1	9.90	แสม	*Avicennia marina*	0.65	45.95	0.05	0.02
624	P18T019		26.2	8.34	แสม	*Avicennia marina*	0.65	30.14	0.03	0.02
625	P18T020		21.3	6.78	แสม	*Avicennia marina*	0.65	18.11	0.02	0.01
626	P18T021		27.2	8.66	แสม	*Avicennia marina*	0.65	33.05	0.03	0.02
627	P18T022		26.3	8.38	แสม	*Avicennia marina*	0.65	30.43	0.03	0.02
628	P18T023		31.2	9.94	แสม	*Avicennia marina*	0.65	46.32	0.05	0.02
629	P18T024		27.1	8.63	แสม	*Avicennia marina*	0.65	32.75	0.03	0.02
630	P18T025		22.1	7.04	แสม	*Avicennia marina*	0.65	19.83	0.02	0.01
631	P18T026		27.1	8.63	แสม	*Avicennia marina*	0.65	32.75	0.03	0.02
632	P18T027		25.1	7.99	แสม	*Avicennia marina*	0.65	27.12	0.03	0.01
633	P18T028		27.4	8.73	แสม	*Avicennia marina*	0.65	33.65	0.03	0.02
634	P18T029		25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
635	P18T030	8	20.2	6.43	แสม	*Avicennia marina*	0.65	15.90	0.02	0.01
636	P19T001		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
637	P19T002		31.1	9.90	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.97	0.06	0.03
638	P19T003		24.2	7.71	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.28	0.03	0.02
639	P19T005		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
640	P19T006		26.1	8.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.67	0.04	0.02
641	P19T007		23.2	7.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.19	0.03	0.01
642	P19T008		34	10.83	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	72.19	0.07	0.04
643	P19T009		27.2	8.66	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	41.69	0.04	0.02
644	P19T010		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
645	P19T011		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02
646	P19T012	8.3	23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
647	P19T013	8.3	28	8.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
648	P19T014		30.3	9.65	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	54.37	0.05	0.03
649	P19T015	8.4	29	9.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	48.81	0.05	0.02
650	P19T016		27.1	8.63	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	41.32	0.04	0.02
651	P19T017		28.2	8.98	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.57	0.05	0.02
652	P19T018		19	6.05	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.25	0.02	0.01
653	P19T019	7.4	24.1	7.68	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.96	0.03	0.02
654	P19T020		32	10.19	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.19	0.06	0.03
655	P19T021		19.2	6.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.70	0.02	0.01
656	P19T022		19.1	6.08	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.47	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
657	P19T023		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01
658	P19T024		23.1	7.36	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.89	0.03	0.01
659	P19T025		27.4	8.73	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.45	0.04	0.02
660	P19T026		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02
661	P19T027		30.2	9.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.93	0.05	0.03
662	P19T028		31	9.87	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.52	0.06	0.03
663	P19T029		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
664	P19T030		28	8.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
665	P19T031		31.2	9.94	แสม	*Avicennia marina*	0.65	46.32	0.05	0.02
666	P19T032		18.1	5.76	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	15.31	0.02	0.01
667	P19T033		29.1	9.27	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.23	0.05	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
668	P19T034		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
669	P19T035		30.4	9.68	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	54.82	0.05	0.03
670	P19T036		27.3	8.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.07	0.04	0.02
671	P19T037		26.1	8.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.67	0.04	0.02
672	P19T038		30.1	9.59	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.50	0.05	0.03
673	P19T039		21.1	6.72	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.32	0.02	0.01
674	P19T040		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02
675	P19T041		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
676	P19T042		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
677	P19T043		23.1	7.36	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.89	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
678	P19T044		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02
679	P19T045		32.1	10.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.67	0.06	0.03
680	P19T046		22.2	7.07	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.30	0.03	0.01
681	P19T047		24.1	7.68	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.96	0.03	0.02
682	P19T048		29.4	9.36	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.49	0.05	0.03
683	P19T049		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
684	P19T050		29.2	9.30	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.65	0.05	0.02
685	P19T051		25.2	8.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.55	0.03	0.02
686	P19T052		33.1	10.54	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	67.58	0.07	0.03
687	P19T053		29	9.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	48.81	0.05	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
688	P19T054	7.5	33.6	10.70	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	70.12	0.07	0.04
689	P19T055		34.4	10.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	74.30	0.07	0.04
690	P19T056		23.6	7.52	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.40	0.03	0.01
691	P19T057	7.5	25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
692	P19T058		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
693	P19T059		29.3	9.33	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.07	0.05	0.03
694	P19T060		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
695	P19T061	8.4	33.3	10.61	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	68.59	0.07	0.03
696	P19T062		49.3	15.70	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	142.74	0.14	0.07
697	P20T001		22.5	7.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.15	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
698	P20T002		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01
699	P20T003		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01
700	P20T004		27.8	8.85	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.99	0.04	0.02
701	P20T005		26.2	8.34	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	38.02	0.04	0.02
702	P20T006		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
703	P20T007		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
704	P20T008		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
705	P20T009		27.6	8.79	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.22	0.04	0.02
706	P20T010		21.1	6.72	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.32	0.02	0.01
707	P20T011		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
708	P20T012		30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
709	P20T013		25.2	8.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.55	0.03	0.02
710	P20T014		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
711	P20T015		24.7	7.87	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	32.89	0.03	0.02
712	P20T016		24.5	7.80	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	32.24	0.03	0.02
713	P20T017		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01
714	P20T018		29	9.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	48.81	0.05	0.02
715	P20T019		35.6	11.34	แสม	*Avicennia marina*	0.65	64.08	0.06	0.03
716	P20T020		35.3	11.24	แสม	*Avicennia marina*	0.65	62.76	0.06	0.03
717	P20T021		20.2	6.43	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.05	0.02	0.01
718	P20T022		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
719	P20T023		26.6	8.47	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.47	0.04	0.02
720	P20T024		22.7	7.23	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.72	0.03	0.01
721	P20T025		25.3	8.06	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.89	0.03	0.02
722	P20T026		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
723	P20T027		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
724	P20T028		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
725	P20T029		20.1	6.40	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.81	0.02	0.01
726	P20T030	10.3	29.2	9.30	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.65	0.05	0.02
727	P20T031	8.8	29.5	9.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.91	0.05	0.03
728	P20T032		36.6	11.66	แสม	*Avicennia marina*	0.65	68.60	0.07	0.03
729	P20T033	9.5	40.1	12.77	แสม	*Avicennia marina*	0.65	85.88	0.09	0.04

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
730	P20T034	6	27.3	8.69	แสม	*Avicennia marina*	0.65	33.35	0.03	0.02
731	P20T035		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02
732	P20T036	9.7	25.4	8.09	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.23	0.04	0.02
733	P20T037		35	11.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	77.53	0.08	0.04
734	P20T038		26.3	8.38	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	30.43	0.03	0.02
735	P20T039		27.5	8.76	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.84	0.04	0.02
736	P20T040		25.6	8.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.92	0.04	0.02
737	P20T041		41.8	13.31	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	95.11	0.10	0.05
738	P20T042		41.7	13.28	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	94.55	0.09	0.05
739	P20T043		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
740	P21T001		25.3	8.06	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.89	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
741	P21T002		18.3	5.83	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	15.73	0.02	0.01
742	P21T003		18.7	5.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	16.59	0.02	0.01
743	P21T004		37.8	12.04	แสม	*Avicennia marina*	0.65	74.26	0.07	0.04
744	P21T005		50	15.92	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	147.78	0.15	0.07
745	P21T006		30.1	9.59	แสม	*Avicennia marina*	0.65	42.40	0.04	0.02
746	P21T007		51.8	16.50	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	161.21	0.16	0.08
747	P21T008		19.8	6.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.09	0.02	0.01
748	P21T009		19.2	6.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.70	0.02	0.01
749	P21T010		19.2	6.11	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.70	0.02	0.01
750	P21T011		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
751	P21T012		35.1	11.18	แสม	*Avicennia marina*	0.65	61.89	0.06	0.03
752	P21T013		20	6.37	แสม	*Avicennia marina*	0.65	15.51	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
753	P21T014		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
754	P21T015		30.2	9.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.93	0.05	0.03
755	P21T016		26.8	8.54	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.20	0.04	0.02
756	P21T017		31.3	9.97	แสม	*Avicennia marina*	0.65	46.69	0.05	0.02
757	P21T018		34.4	10.96	แสม	*Avicennia marina*	0.65	58.89	0.06	0.03
758	P21T019		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
759	P21T020		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
760	P21T021		19.5	6.21	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	18.39	0.02	0.01
761	P21T022		28.7	9.14	แสม	*Avicennia marina*	0.65	37.72	0.04	0.02
762	P21T023		31.3	9.97	แสม	*Avicennia marina*	0.65	46.69	0.05	0.02
763	P21T024		28.6	9.11	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	37.39	0.04	0.02
764	P21T025		18.3	5.83	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	15.73	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
765	P21T026		20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
766	P21T027		18.7	5.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	16.59	0.02	0.01
767	P21T028	9.7	23.4	7.45	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.79	0.03	0.01
768	P21T029	10	37.2	11.85	แสม	*Avicennia marina*	0.65	71.40	0.07	0.04
769	P21T030	10.3	20.7	6.59	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	21.30	0.02	0.01
770	P21T031	7.9	22.3	7.10	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.58	0.03	0.01
771	P21T032	9.7	24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
772	P21T033		20.1	6.40	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.81	0.02	0.01
773	P21T034		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
774	P22T001	7.5	33	10.51	แสม	*Avicennia marina*	0.65	53.17	0.05	0.03
775	P22T002	8.3	24.3	7.74	แสม	*Avicennia marina*	0.65	25.05	0.03	0.01
776	P22T003		28.3	9.01	แสม	*Avicennia marina*	0.65	36.44	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
777	P22T004	7	22.3	7.10	แสม	*Avicennia marina*	0.65	20.28	0.02	0.01
778	P22T005		33.5	10.67	แสม	*Avicennia marina*	0.65	55.18	0.06	0.03
779	P22T006		39.8	12.68	แสม	*Avicennia marina*	0.65	84.30	0.08	0.04
780	P22T007	10.9	22.5	7.17	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	26.15	0.03	0.01
781	P22T008		19.3	6.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	17.93	0.02	0.01
782	P22T009		18.4	5.86	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	15.94	0.02	0.01
783	P22T010		27.5	8.76	แสม	*Avicennia marina*	0.65	33.95	0.03	0.02
784	P22T011	10	33	10.51	แสม	*Avicennia marina*	0.65	53.17	0.05	0.03
785	P22T012		31.7	10.10	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	48.17	0.05	0.02
786	P22T013		39.5	12.58	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	82.75	0.08	0.04
787	P22T014		21	6.69	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	17.49	0.02	0.01
788	P22T015		25.8	8.22	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	29.02	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
789	P22T016		29.2	9.30	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	39.35	0.04	0.02
790	P22T017		33	10.51	แสม	*Avicennia marina*	0.65	53.17	0.05	0.03
791	P22T018		29.7	9.46	แสม	*Avicennia marina*	0.65	41.03	0.04	0.02
792	P22T019		27	8.60	แสม	*Avicennia marina*	0.65	32.46	0.03	0.02
793	P22T020		35.1	11.18	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	61.89	0.06	0.03
794	P22T021		30.5	9.71	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	43.80	0.04	0.02
795	P22T022		25.9	8.25	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	29.30	0.03	0.01
796	P22T023		29	9.24	แสม	*Avicennia marina*	0.65	38.69	0.04	0.02
797	P22T024		31.6	10.06	แสม	*Avicennia marina*	0.65	47.79	0.05	0.02
798	P22T025		22.1	7.04	แสม	*Avicennia marina*	0.65	19.83	0.02	0.01
799	P22T026		32.4	10.32	แสม	*Avicennia marina*	0.65	50.83	0.05	0.03
800	P23T001		26	8.28	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	29.58	0.03	0.01
801	P23T002	4	18	5.73	แสม	*Avicennia marina*	0.65	11.97	0.01	0.01
802	P23T003	6.9	29	9.24	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	38.69	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
803	P23T004		36	11.46	แสม	*Avicennia marina*	0.65	65.86	0.07	0.03
804	P23T005		30.7	9.78	แสม	*Avicennia marina*	0.65	44.51	0.04	0.02
805	P23T006		22.5	7.17	แสม	*Avicennia marina*	0.65	20.73	0.02	0.01
806	P23T007		28.4	9.04	แสม	*Avicennia marina*	0.65	36.75	0.04	0.02
807	P23T008		42.8	13.63	แสม	*Avicennia marina*	0.65	100.81	0.10	0.05
808	P23T009		19	6.05	แสม	*Avicennia marina*	0.65	13.67	0.01	0.01
809	P23T010		18.7	5.96	แสม	*Avicennia marina*	0.65	13.15	0.01	0.01
810	P23T011		27.3	8.69	แสม	*Avicennia marina*	0.65	33.35	0.03	0.02
811	P23T012		22.5	7.17	แสม	*Avicennia marina*	0.65	20.73	0.02	0.01
812	P23T013		21.3	6.78	แสม	*Avicennia marina*	0.65	18.11	0.02	0.01
813	P23T014		20.5	6.53	แสม	*Avicennia marina*	0.65	16.48	0.02	0.01
814	P23T015	6.9	29.6	9.43	แสม	*Avicennia marina*	0.65	40.69	0.04	0.02
815	P23T016	7	29.5	9.39	แสม	*Avicennia marina*	0.65	40.36	0.04	0.02
816	P23T017	7.5	31	9.87	แสม	*Avicennia marina*	0.65	45.59	0.05	0.02
817	P23T018		35.6	11.34	แสม	*Avicennia marina*	0.65	64.08	0.06	0.03
818	P23T019		33.2	10.57	แสม	*Avicennia marina*	0.65	53.97	0.05	0.03
819	P23T020		20.3	6.46	แสม	*Avicennia marina*	0.65	16.09	0.02	0.01
820	P23T021		21.3	6.78	แสม	*Avicennia marina*	0.65	18.11	0.02	0.01
821	P23T022		25.4	8.09	แสม	*Avicennia marina*	0.65	27.93	0.03	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
822	P23T023		21.9	6.97	แสม	*Avicennia marina*	0.65	19.39	0.02	0.01
823	P23T024		30.5	9.71	แสม	*Avicennia marina*	0.65	43.80	0.04	0.02
824	P23T025		23.9	7.61	แสม	*Avicennia marina*	0.65	24.04	0.02	0.01
825	P23T026		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
826	P23T027		21.8	6.94	แสม	*Avicennia marina*	0.65	19.18	0.02	0.01
827	P23T028		28.8	9.17	แสม	*Avicennia marina*	0.65	38.04	0.04	0.02
828	P23T029		24.9	7.93	แสม	*Avicennia marina*	0.65	26.59	0.03	0.01
829	P23T030		19	6.05	แสม	*Avicennia marina*	0.65	13.67	0.01	0.01
830	P23T031		21.5	6.85	แสม	*Avicennia marina*	0.65	18.53	0.02	0.01
831	P23T032		25.2	8.03	แสม	*Avicennia marina*	0.65	27.39	0.03	0.01
832	P24T001		18.7	5.96	แสม	*Avicennia marina*	0.65	13.15	0.01	0.01
833	P24T002		19.6	6.24	แสม	*Avicennia marina*	0.65	14.76	0.01	0.01
834	P24T003		27.8	8.85	แสม	*Avicennia marina*	0.65	34.87	0.03	0.02
835	P24T004		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
836	P24T005		21	6.69	แสม	*Avicennia marina*	0.65	17.49	0.02	0.01
837	P24T006		19.8	6.31	แสม	*Avicennia marina*	0.65	15.13	0.02	0.01
838	P24T007		19	6.05	แสม	*Avicennia marina*	0.65	13.67	0.01	0.01
839	P24T008		23	7.32	แสม	*Avicennia marina*	0.65	21.88	0.02	0.01
840	P24T009		20	6.37	แสม	*Avicennia marina*	0.65	15.51	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
841	P24T010		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
842	P24T011		19.9	6.34	แสม	*Avicennia marina*	0.65	15.32	0.02	0.01
843	P24T012	6.5	20	6.37	แสม	*Avicennia marina*	0.65	15.51	0.02	0.01
844	P24T013		18.3	5.83	แสม	*Avicennia marina*	0.65	12.47	0.01	0.01
845	P24T014		19.2	6.11	แสม	*Avicennia marina*	0.65	14.03	0.01	0.01
846	P24T015		19.6	6.24	แสม	*Avicennia marina*	0.65	14.76	0.01	0.01
847	P24T016		20.7	6.59	แสม	*Avicennia marina*	0.65	16.88	0.02	0.01
848	P24T017		27	8.60	แสม	*Avicennia marina*	0.65	32.46	0.03	0.02
849	P24T018	6	29	9.24	แสม	*Avicennia marina*	0.65	38.69	0.04	0.02
850	P24T019		27.9	8.89	แสม	*Avicennia marina*	0.65	35.18	0.04	0.02
851	P24T020		20.5	6.53	แสม	*Avicennia marina*	0.65	16.48	0.02	0.01
852	P24T021		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
853	P24T022		21.7	6.91	แสม	*Avicennia marina*	0.65	18.96	0.02	0.01
854	P24T023		22.6	7.20	แสม	*Avicennia marina*	0.65	20.95	0.02	0.01
855	P24T024		19.8	6.31	แสม	*Avicennia marina*	0.65	15.13	0.02	0.01
856	P24T025		23	7.32	แสม	*Avicennia marina*	0.65	21.88	0.02	0.01
857	P24T026	6.2	26	8.28	แสม	*Avicennia marina*	0.65	29.58	0.03	0.01
858	P24T027	6	23.5	7.48	แสม	*Avicennia marina*	0.65	23.07	0.02	0.01
859	P24T028		21.7	6.91	แสม	*Avicennia marina*	0.65	18.96	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
860	P24T029		28.1	8.95	แสม	*Avicennia marina*	0.65	35.81	0.04	0.02
861	P24T030		24.2	7.71	แสม	*Avicennia marina*	0.65	24.79	0.02	0.01
862	P24T031		22.2	7.07	แสม	*Avicennia marina*	0.65	20.05	0.02	0.01
863	P24T033		22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
864	P24T034		19	6.05	แสม	*Avicennia marina*	0.65	13.67	0.01	0.01
865	P25T001	8.1	41	13.06	แสม	*Avicennia marina*	0.65	90.70	0.09	0.05
866	P25T002	10.8	42.5	13.54	แสม	*Avicennia marina*	0.65	99.08	0.10	0.05
867	P25T003		34	10.83	แสม	*Avicennia marina*	0.65	57.22	0.06	0.03
868	P25T004		42.5	13.54	แสม	*Avicennia marina*	0.65	99.08	0.10	0.05
869	P25T005		34	10.83	แสม	*Avicennia marina*	0.65	57.22	0.06	0.03
870	P25T006		35	11.15	แสม	*Avicennia marina*	0.65	61.45	0.06	0.03
871	P25T007	9.3	31	9.87	แสม	*Avicennia marina*	0.65	45.59	0.05	0.02
872	P25T008		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
873	P25T009		28.5	9.08	แสม	*Avicennia marina*	0.65	37.07	0.04	0.02
874	P25T010		45	14.33	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	114.04	0.11	0.06
875	P25T011		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
876	P25T012		40	12.74	แสม	*Avicennia marina*	0.65	85.35	0.09	0.04
877	P25T013		22.5	7.17	แสม	*Avicennia marina*	0.65	20.73	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
878	P25T014		20.5	6.53	แสม	*Avicennia marina*	0.65	16.48	0.02	0.01
879	P25T015		29.5	9.39	แสม	*Avicennia marina*	0.65	40.36	0.04	0.02
880	P25T016		52	16.56	แสม	*Avicennia marina*	0.65	162.75	0.16	0.08
881	P25T017		56	17.83	แสม	*Avicennia marina*	0.65	195.29	0.20	0.10
882	P25T018		36	11.46	แสม	*Avicennia marina*	0.65	65.86	0.07	0.03
883	P25T019		21	6.69	แสม	*Avicennia marina*	0.65	17.49	0.02	0.01
884	P25T020		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
885	P25T021		24.5	7.80	แสม	*Avicennia marina*	0.65	25.56	0.03	0.01
886	P25T022		28.5	9.08	แสม	*Avicennia marina*	0.65	37.07	0.04	0.02
887	P25T023		32	10.19	แสม	*Avicennia marina*	0.65	49.30	0.05	0.02
888	P25T024		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
889	P25T025		25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
890	P25T026		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
891	P26T001		30.5	9.71	แสม	*Avicennia marina*	0.65	43.80	0.04	0.02
892	P26T002	5.4	21	6.69	แสม	*Avicennia marina*	0.65	17.49	0.02	0.01
893	P26T003		34.5	10.99	แสม	*Avicennia marina*	0.65	59.32	0.06	0.03
894	P26T004		30	9.55	แสม	*Avicennia marina*	0.65	42.06	0.04	0.02
895	P26T005		38	12.10	แสม	*Avicennia marina*	0.65	75.23	0.08	0.04
896	P26T006	4	34.5	10.99	แสม	*Avicennia marina*	0.65	59.32	0.06	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
897	P26T007	4.1	25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
898	P27T001	3.6	40.5	12.90	แสม	*Avicennia marina*	0.65	88.00	0.09	0.04
899	P27T002	3.5	26	8.28	แสม	*Avicennia marina*	0.65	29.58	0.03	0.01
900	P27T003	3.5	23	7.32	แสม	*Avicennia marina*	0.65	21.88	0.02	0.01
901	P27T004		25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
902	P28T001	5.3	23	7.32	แสม	*Avicennia marina*	0.65	21.88	0.02	0.01
903	P28T002	4.6	36	11.46	แสม	*Avicennia marina*	0.65	65.86	0.07	0.03
904	P28T003		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
905	P28T004		20.5	6.53	แสม	*Avicennia marina*	0.65	16.48	0.02	0.01
906	P28T005		22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
907	P28T006		21	6.69	แสม	*Avicennia marina*	0.65	17.49	0.02	0.01
908	P28T007	4.2	25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
909	P29T001	4.8	27	8.60	แสม	*Avicennia marina*	0.65	32.46	0.03	0.02
910	P29T002	4.4	32	10.19	แสม	*Avicennia marina*	0.65	49.30	0.05	0.02
911	P29T003		20	6.37	แสม	*Avicennia marina*	0.65	15.51	0.02	0.01
912	P29T004	4	19	6.05	แสม	*Avicennia marina*	0.65	13.67	0.01	0.01
913	P29T005		45	14.33	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	114.04	0.11	0.06
914	P29T006		21	6.69	แสม	*Avicennia marina*	0.65	17.49	0.02	0.01

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
915	P30T001	4.4	26	8.28	แสม	*Avicennia marina*	0.65	29.58	0.03	0.01
916	P30T002	4.1	22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
917	P31T001	12	25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
918	P31T002		31	9.87	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.52	0.06	0.03
919	P31T003		20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
920	P31T004		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
921	P31T005	11.8	29	9.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	48.81	0.05	0.02
922	P31T006		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
923	P31T007	11.4	41.2	13.12	แสม	*Avicennia marina*	0.65	91.79	0.09	0.05
924	P31T008		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
925	P31T009		30.3	9.65	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	54.37	0.05	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
926	P31T010		26.5	8.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
927	P31T011		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
928	P31T012		23.3	7.42	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.49	0.03	0.01
929	P31T013		32.1	10.22	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.67	0.06	0.03
930	P31T014		28	8.92	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	44.78	0.04	0.02
931	P31T015		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
932	P31T016		22.1	7.04	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.02	0.03	0.01
933	P31T017		21.4	6.82	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.11	0.02	0.01
934	P31T018		24.3	7.74	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.60	0.03	0.02
935	P31T019		30.2	9.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.93	0.05	0.03

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
936	P31T020		26.2	8.34	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	38.02	0.04	0.02
937	P31T021		25.4	8.09	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.23	0.04	0.02
938	P31T022		28.3	9.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.97	0.05	0.02
939	P31T023		22.4	7.13	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.86	0.03	0.01
940	P31T024		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
941	P31T025		29	9.24	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	48.81	0.05	0.02
942	P31T026		29.2	9.30	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	49.65	0.05	0.02
943	P31T027		23.2	7.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.19	0.03	0.01
944	P31T028		28.3	9.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.97	0.05	0.02
945	P31T029		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
946	P31T030		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
947	P31T031		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
948	P31T032		22.3	7.10	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.58	0.03	0.01
949	P31T033		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
950	P31T034		25.2	8.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.55	0.03	0.02
951	P31T035		24.3	7.74	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.60	0.03	0.02
952	P31T036		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
953	P31T037		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02
954	P31T038		27.3	8.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.07	0.04	0.02
955	P31T039		27.6	8.79	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	43.22	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
956	P31T040	13	35	11.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	77.53	0.08	0.04
957	P31T041		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
958	P31T042	12	27.1	8.63	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	41.32	0.04	0.02
959	P31T043		33.1	10.54	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	67.58	0.07	0.03
960	P31T044		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
961	P31T045		27.4	8.73	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.45	0.04	0.02
962	P31T046	14.1	31.5	10.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	59.83	0.06	0.03
963	P31T047		30.2	9.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.93	0.05	0.03
964	P31T048		32.2	10.25	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	63.15	0.06	0.03
965	P31T049		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
966	P31T050		30.6	9.75	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	55.71	0.06	0.03
967	P31T051		26.5	8.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
968	P32T001		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
969	P32T002		23.5	7.48	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	29.10	0.03	0.01
970	P32T003		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
971	P32T004	11.1	30.2	9.62	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.93	0.05	0.03
972	P32T005		20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
973	P32T006		26.5	8.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
974	P32T007		26.4	8.41	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	38.74	0.04	0.02
975	P32T008		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02
976	P32T009		47	14.97	แสม	*Avicennia marina*	0.65	126.91	0.13	0.06

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
977	P32T010		26	8.28	แสม	*Avicennia marina*	0.65	29.58	0.03	0.01
978	P32T011		25.1	7.99	แสม	*Avicennia marina*	0.65	27.12	0.03	0.01
979	P32T013	13.4	55.1	17.55	แสม	*Avicennia marina*	0.65	187.66	0.19	0.09
980	P32T014		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
981	P32T015	11.1	23.2	7.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.19	0.03	0.01
982	P32T016		34	10.83	แสม	*Avicennia marina*	0.65	57.22	0.06	0.03
983	P32T017		47.3	15.06	แสม	*Avicennia marina*	0.65	128.91	0.13	0.06
984	P32T018		26.5	8.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
985	P32T019		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
986	P32T020		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
987	P32T021		25.1	7.99	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.22	0.03	0.02
988	P32T022		28.1	8.95	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.17	0.05	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
989	P32T023		23	7.32	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	27.60	0.03	0.01
990	P32T024		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
991	P32T025		21.2	6.75	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.59	0.02	0.01
992	P32T026		24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02
993	P32T027		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
994	P32T028		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
995	P33T001	10.7	29.4	9.36	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	50.49	0.05	0.03
996	P33T002		33.2	10.57	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	68.08	0.07	0.03
997	P33T003		26	8.28	แสม	*Avicennia marina*	0.65	29.58	0.03	0.01
998	P33T004		28.1	8.95	แสม	*Avicennia marina*	0.65	35.81	0.04	0.02
999	P33T005		35	11.15	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	77.53	0.08	0.04

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1000	P33T006		22.3	7.10	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.58	0.03	0.01
1001	P33T007		26.5	8.44	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	39.10	0.04	0.02
1002	P33T008		23.2	7.39	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	28.19	0.03	0.01
1003	P33T009		21.5	6.85	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.38	0.02	0.01
1004	P33T010		20.2	6.43	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.05	0.02	0.01
1005	P33T011		33.1	10.54	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	53.57	0.05	0.03
1006	P33T012		29.3	9.33	แสม	*Avicennia marina*	0.65	39.69	0.04	0.02
1007	P33T013		56.6	18.03	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	200.48	0.20	0.10
1008	P33T014		20	6.37	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	19.57	0.02	0.01
1009	P33T015		27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
1010	P33T016		26	8.28	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.31	0.04	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1011	P33T017		21.2	6.75	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.59	0.02	0.01
1012	P33T018		25.2	8.03	แสม	*Avicennia marina*	0.65	27.39	0.03	0.01
1013	P33T019		35.2	11.21	แสม	*Avicennia marina*	0.65	62.32	0.06	0.03
1014	P33T020		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01
1015	P33T021		25	7.96	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	33.88	0.03	0.02
1016	P33T022		24.2	7.71	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.28	0.03	0.02
1017	P33T023		24.3	7.74	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	31.60	0.03	0.02
1018	P33T024		31.5	10.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	59.83	0.06	0.03
1019	P33T025		22.2	7.07	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	25.30	0.03	0.01
1020	P33T026	10.8	26.1	8.31	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	37.67	0.04	0.02
1021	P33T027	10.7	24	7.64	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	30.65	0.03	0.02

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1022	P33T028	10.7	27	8.60	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	40.94	0.04	0.02
1023	P33T029		21	6.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.06	0.02	0.01
1024	P33T030		37.5	11.94	แสม	*Avicennia marina*	0.65	72.82	0.07	0.04
1025	P33T031		42.2	13.44	แสม	*Avicennia marina*	0.65	97.37	0.10	0.05
1026	P33T032		43	13.69	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	101.97	0.10	0.05
1027	P33T033		27.3	8.69	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	42.07	0.04	0.02
1028	P33T034		28.2	8.98	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	45.57	0.05	0.02
1029	P34T001		25.2	8.03	แสม	*Avicennia marina*	0.65	27.39	0.03	0.01
1030	P34T002		33.1	10.54	แสม	*Avicennia marina*	0.65	53.57	0.05	0.03
1031	P34T003		40.1	12.77	แสม	*Avicennia marina*	0.65	85.88	0.09	0.04
1032	P34T004		37.2	11.85	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	71.40	0.07	0.04
1033	P34T005		28.3	9.01	แสม	*Avicennia marina*	0.65	36.44	0.04	0.02
1034	P34T006		26	8.28	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	29.58	0.03	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1035	P34T007		33.3	10.61	แสม	*Avicennia marina*	0.65	54.37	0.05	0.03
1036	P34T008		23	7.32	โกงกางใบเล็ก	*Rhizophora apiculata*	0.85	28.61	0.03	0.01
1037	P34T009		50	15.92	แสม	*Avicennia marina*	0.65	147.78	0.15	0.07
1038	P34T010		50.6	16.11	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	152.18	0.15	0.08
1039	P34T011		38.1	12.13	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	75.72	0.08	0.04
1040	P34T012		47.4	15.10	แสม	*Avicennia marina*	0.65	129.59	0.13	0.06
1041	P34T013		43.5	13.85	แสม	*Avicennia marina*	0.65	104.91	0.10	0.05
1042	P34T014		33	10.51	แสม	*Avicennia marina*	0.65	53.17	0.05	0.03
1043	P34T015		25	7.96	แสม	*Avicennia marina*	0.65	26.86	0.03	0.01
1044	P34T016		22	7.01	โกงกางใบเล็ก	*Rhizophora apiculata*	0.85	25.65	0.03	0.01
1045	P34T017		36.1	11.50	แสม	*Avicennia marina*	0.65	66.31	0.07	0.03
1046	P34T018		25	7.96	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	26.86	0.03	0.01
1047	P34T019		25.1	7.99	โกงกางใบเล็ก	*Rhizophora apiculata*	0.85	35.47	0.04	0.02
1048	P34T020		23	7.32	แสม	*Avicennia marina*	0.65	21.88	0.02	0.01

Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1049	P34T021		33.2	10.57	แสม	*Avicennia marina*	0.65	53.97	0.05	0.03
1050	P34T022		25.3	8.06	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	34.89	0.03	0.02
1051	P34T023		27.4	8.73	แสม	*Avicennia marina*	0.65	33.65	0.03	0.02
1052	P34T024		22.3	7.10	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	20.28	0.02	0.01
1053	P34T025	8.9	37	11.78	แสม	*Avicennia marina*	0.65	70.46	0.07	0.04
1054	P34T026	11	44	14.01	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	107.90	0.11	0.05
1055	P34T027		49	15.61	แสม	*Avicennia marina*	0.65	140.61	0.14	0.07
1056	P34T028	9.4	22.5	7.17	โกงกางใบเล็ก	*Rhizophora apiculata*	0.85	27.10	0.03	0.01
1057	P35T001	11.7	29.2	9.30	แสม	*Avicennia marina*	0.65	39.35	0.04	0.02
1058	P35T002		31.5	10.03	แสม	*Avicennia marina*	0.65	47.42	0.05	0.02
1059	P35T003	7.8	23.5	7.48	แสม	*Avicennia marina*	0.65	23.07	0.02	0.01
1060	P35T004	8	12.1	3.85	แสม	*Avicennia marina*	0.65	4.51	0.00	0.00
1061	P35T005		22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
1062	P35T006		30	9.55	แสม	*Avicennia marina*	0.65	42.06	0.04	0.02
1063	P35T007		23.2	7.39	แสม (ลำต้นดำ)	*Avicennia marina*	0.65	22.35	0.02	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1064	P35T008		36.2	11.53	แสม	*Avicennia marina*	0.65	66.77	0.07	0.03
1065	P35T009		27.5	8.76	แสม	*Avicennia marina*	0.65	33.95	0.03	0.02
1066	P35T010		22.2	7.07	แสม	*Avicennia marina*	0.65	20.05	0.02	0.01
1067	P35T011		22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
1068	P35T012		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
1069	P35T013		21.5	6.85	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.38	0.02	0.01
1070	P35T014		22	7.01	แสม	*Avicennia marina*	0.65	19.61	0.02	0.01
1071	P35T015		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
1072	P35T016		20.5	6.53	โกงกางใบเล็ก	*Rhizophora apiculata*	0.85	21.56	0.02	0.01
1073	P35T017		21.2	6.75	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	22.59	0.02	0.01
1074	P35T018		28	8.92	แสม	*Avicennia marina*	0.65	35.49	0.04	0.02
1075	P35T019		27	8.60	แสม	*Avicennia marina*	0.65	32.46	0.03	0.02
1076	P35T020		27.3	8.69	แสม	*Avicennia marina*	0.65	33.35	0.03	0.02
1077	P35T021		30	9.55	แสม	*Avicennia marina*	0.65	42.06	0.04	0.02
1078	P35T022		25.1	7.99	แสม	*Avicennia marina*	0.65	27.12	0.03	0.01
1079	P36T001	15	20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1080	P36T002		33.1	10.54	แสม	*Avicennia marina*	0.65	53.57	0.05	0.03
1081	P36T003		25.2	8.03	แสม	*Avicennia marina*	0.65	27.39	0.03	0.01
1082	P36T004		25.3	8.06	แสม	*Avicennia marina*	0.65	27.66	0.03	0.01
1083	P36T005		29	9.24	แสม	*Avicennia marina*	0.65	38.69	0.04	0.02
1084	P36T006		21.5	6.85	แสม	*Avicennia marina*	0.65	18.53	0.02	0.01
1085	P36T007		32.5	10.35	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	64.61	0.06	0.03
1086	P36T008		29	9.24	แสม	*Avicennia marina*	0.65	38.69	0.04	0.02
1087	P36T009		24	7.64	แสม	*Avicennia marina*	0.65	24.29	0.02	0.01
1088	P36T010		32.2	10.25	แสม	*Avicennia marina*	0.65	50.06	0.05	0.03
1089	P36T011		35.2	11.21	แสม	*Avicennia marina*	0.65	62.32	0.06	0.03
1090	P36T012		22	7.01	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	24.74	0.02	0.01
1091	P36T013		30	9.55	แสม	*Avicennia marina*	0.65	42.06	0.04	0.02
1092	P36T014		20.5	6.53	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	20.79	0.02	0.01
1093	P36T015		64.5	20.54	แสม	*Avicennia marina*	0.65	276.48	0.28	0.14
1094	P36T016		21.5	6.85	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	23.38	0.02	0.01

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1095	P36T017		45.5	14.49	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	147.83	0.15	0.07
1096	P36T018		40	12.74	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	107.67	0.11	0.05
1097	P36T019		39.6	12.61	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	105.04	0.11	0.05
1098	P36T020		31.5	10.03	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	59.83	0.06	0.03
1099	P36T021		35	11.15	แสม	*Avicennia marina*	0.65	61.45	0.06	0.03
1100	P36T022		31	9.87	แสม	*Avicennia marina*	0.65	45.59	0.05	0.02
1101	P36T023		31	9.87	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	57.52	0.06	0.03
1102	P36T024		25.5	8.12	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	35.57	0.04	0.02
1103	P36T025	15.5	32	10.19	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	62.19	0.06	0.03
1104	P36T026	16	30	9.55	โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	53.06	0.05	0.03
1105	P37T001	1			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1106	P38T001	0.66			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1107	P39T001	0.7			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1108	P39T002	0.72			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1109	P40T001	1.1			แสม	*Avicennia marina*	0.65	0.00	0.00	0.00
1110	P41T001	1.2			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1111	P42T001	0.71			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1112	P43T001	0.35			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1113	P44T001	0.95			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1114	P45T001	0.96			แสม	*Avicennia marina*	0.65	0.00	0.00	0.00
1115	P46T001	1.1			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1116	P46T002	1			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00

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Table B (Continued).

No	Code	H (m)	Circumference (cm)	DBH (cm)	Note	Species	Wood density (g/cm^3)	AGB (kg)	AGB (ton)	Carbon Stock (ton)
1117	P47T001	1.3			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00
1118	P48T001	1.91			โกงกางใบใหญ่	*Rhizophora mucronata*	0.82	0.00	0.00	0.00

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APPENDIX C

STUDY PLOT COORDINATES:

Table C Plot coordinates in each study plot.

Plot	Latitude	Longitude	Note	transect	Size (m^2)	Plot type
1	8.609043	99.96682	Gray Mangrove	1	153.86	circular
2	8.608892	99.96694	Gray Mangrove	1	153.86	circular
3	8.608648	99.96703	Gray Mangrove	1	153.86	circular
4	8.608508	99.96719	Gray Mangrove	1	153.86	circular
5	8.608336	99.96732	Gray Mangrove	1	153.86	circular
6	8.608175	99.96746	Gray Mangrove	1	153.86	circular
7	8.610077	99.96802	Gray Mangrove	2	153.86	circular
8	8.610229	99.96791	Gray Mangrove	2	153.86	circular
9	8.610368	99.96774	Gray Mangrove	2	153.86	circular
10	8.610572	99.96769	Gray Mangrove	2	153.86	circular
11	8.610755	99.96748	Gray Mangrove	2	153.86	circular

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Table C (Continued).

Plot	Latitude	Longitude	Note	transect	Size (m^2)	Plot type
12	8.610908	99.96737	Gray Mangrove	2	153.86	circular
13	8.605498	99.96266	Loop-root Mangrove	3	153.86	circular
14	8.605637	99.96293	Loop-root Mangrove	3	153.86	circular
15	8.605685	99.96311	Loop-root Mangrove	3	153.86	circular
16	8.60574	99.96332	Loop-root Mangrove	3	153.86	circular
17	8.605848	99.96357	Loop-root Mangrove	3	153.86	circular
18	8.60595	99.96378	Loop-root Mangrove	3	153.86	circular
19	8.60824	99.96477	Loop-root Mangrove	4	153.86	circular
20	8.608331	99.96493	Loop-root Mangrove	4	153.86	circular
21	8.608338	99.96512	Loop-root Mangrove	4	153.86	circular
22	8.608397	99.96528	Loop-root Mangrove	4	153.86	circular
23	8.608462	99.96547	Loop-root Mangrove	4	153.86	circular
24	8.608519	99.96563	Loop-root Mangrove	4	153.86	circular
25	8.609961	99.95942	Gray Mangrove	5	153.86	circular
26	8.609995	99.95958	Gray Mangrove	5	153.86	circular
27	8.610076	99.95978	Gray Mangrove	5	153.86	circular

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table C (Continued).

Plot	Latitude	Longitude	Note	transect	Size (m^2)	Plot type
28	8.610068	99.95996	Gray Mangrove	5	153.86	circular
29	8.610141	99.96011	Gray Mangrove	5	153.86	circular
30	8.610271	99.96023	Gray Mangrove	5	153.86	circular
31	8.611065	99.96213	Loop-root Mangrove	6	153.86	circular
32	8.611104	99.96226	Loop-root Mangrove	6	153.86	circular
33	8.611117	99.96238	Loop-root Mangrove	6	153.86	circular
34	8.611218	99.9626	Loop-root Mangrove	6	153.86	circular
35	8.611232	99.96282	Loop-root Mangrove	6	153.86	circular
36	8.611269	99.96298	Loop-root Mangrove	6	153.86	circular
37	8.611125	99.97182	Short_Mangrove_right	7	1	rectangular
38	8.611263	99.97195	Short_Mangrove_left	7	1	rectangular
39	8.611197	99.97219	Short_Mangrove_right	7	1	rectangular
40	8.611321	99.97236	Short_Mangrove_left	7	1	rectangular
41	8.611321	99.97253	Short_Mangrove_right	7	1	rectangular
42	8.611502	99.97267	Short_Mangrove_left	7	1	rectangular
43	8.611284	99.97281	Short_Mangrove_right	8	1	rectangular

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table C (Continued).

Plot	Latitude	Longitude	Note	transect	Size (m^2)	Plot type
44	8.611288	99.97256	Short_Mangrove_left	8	1	rectangular
45	8.611161	99.97242	Short_Mangrove_right	8	1	rectangular
46	8.611168	99.97221	Short_Mangrove_left	8	1	rectangular
47	8.611053	99.97203	Short_Mangrove_right	8	1	rectangular
48	8.611083	99.97185	Short_Mangrove_left	8	1	rectangular

มหาวิทยาลัยเทคโนโลยีสุรนารี

APPENDIX D

REMOTE SENSING DATA:

Table D The summary of remote sensing data in this study.

Transect	Plot	CHM (m)	UAV NDVI	UAV SAVI	UAV GNDVI
1	1	4.35	-0.04	-0.06	-0.09
1	2	4.90	-0.11	-0.16	-0.15
1	3	4.96	-0.23	-0.34	-0.26
1	4	5.68	-0.19	-0.29	-0.23
1	5	4.27	-0.17	-0.25	-0.20
1	6	3.20	-0.19	-0.29	-0.22
2	7	5.09	-0.19	-0.28	-0.24
2	8	3.47	-0.18	-0.27	-0.23
2	9	4.09	-0.17	-0.25	-0.22
2	10	4.60	-0.20	-0.30	-0.25
2	11	5.18	-0.18	-0.27	-0.22

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Table D (Continued).

Transect	Plot	CHM (m)	UAV NDVI	UAV SAVI	UAV GNDVI
2	12	3.92	-0.25	-0.38	-0.29
3	13	airport_problem	airport_problem	airport_problem	airport_problem
3	14	airport_problem	airport_problem	airport_problem	airport_problem
3	15	airport_problem	airport_problem	airport_problem	airport_problem
3	16	airport_problem	airport_problem	airport_problem	airport_problem
3	17	airport_problem	airport_problem	airport_problem	airport_problem
3	18	airport_problem	airport_problem	airport_problem	airport_problem
4	19	3.98	0.41	0.61	0.37
4	20	5.15	0.41	0.61	0.37
4	21	4.92	0.39	0.58	0.36
4	22	5.85	0.37	0.55	0.34
4	23	5.58	0.39	0.58	0.36
4	24	5.09	0.42	0.63	0.39
5	25	14.06	0.15	0.22	0.12
5	26	7.68	0.16	0.25	0.16
5	27	4.42	0.22	0.33	0.21

มหาวิทยาลัยเทคโนโลยีสุรนารี

Table D (Continued).

Transect	Plot	CHM (m)	UAV NDVI	UAV SAVI	UAV GNDVI
5	28	4.16	0.30	0.45	0.29
5	29	3.97	0.23	0.34	0.22
5	30	4.51	0.30	0.46	0.30
6	31	6.41	0.47	0.70	0.43
6	32	6.25	0.47	0.71	0.43
6	33	5.48	0.45	0.67	0.41
6	34	8.17	0.35	0.52	0.32
6	35	5.60	0.38	0.57	0.35
6	36	7.05	0.39	0.58	0.34
7	37	0.11	0.39	0.59	0.43
7	38	0.38	0.41	0.62	0.45
7	39	0.04	0.33	0.49	0.34
7	40	0.04	0.31	0.46	0.31
7	41	0.03	0.26	0.39	0.27
7	42	0.03	0.36	0.55	0.37
8	43	0.04	0.30	0.46	0.32

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Table D (Continued).

Transect	Plot	CHM (m)	UAV NDVI	UAV SAVI	UAV GNDVI
8	44	0.04	0.25	0.37	0.26
8	45	0.03	0.30	0.46	0.31
8	46	0.03	0.29	0.44	0.30
8	47	0.98	0.30	0.45	0.30
8	48	0.13	0.45	0.68	0.48

มหาวิทยาลัยเทคโนโลยีสุรนารี

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