MAPPING MANGROVE COVER CHANGE USING PLANETSCOPE DATA (2017-2022) IN QUANG YEN TOWN, QUANG NINH PROVINCE TOWARD SUSTAINABLE MANGROVE MANAGEMENT

Nguyen Hai Hoa[1*], Pham Duy Quang[1], Vu Van Truong[1], Le Phu Tuan[1]
[1]*Vietnam National University of Forestry*

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SUMMARY

Mangroves are found along shallow shorelines with modest slope where they receive freshwater runoff and nutrients from rainfall. They have been globally recognized as their vital functions in preventing coastal erosion, mitigating effects of wave actions and protecting coastal habitats from extreme coastal events. By using PlanetScope imageries (3mx3m), the study has constructed the spatial distribution of mangrove forests from 2017 to 2022. This study defined and used the CMRI thresholds for coastal land covers (CMRI value > 0.835 for mangrove forests, CMRI <0.835 for non-mangrove forests). The overall accuracies assessments of land covers in 2022 (96.4% of accuracy, Kappa coefficient of 0.92) and land covers in 2017 (94.1% of accuracy, Kappa coefficient of 0.87) have confirmed using PlanetScope images were very reliable for mapping temporal changes in land use/cover and mangrove covers in Quang Yen town. The study also showed that mangrove forests in Quang Yen town decreased by 443.1 ha in 2022 (2745.1 ha) compared to 2017 (3114.4 ha) and main drivers for mangrove deforestation and degradation during the period of 2017 - 2022 were aquaculture development, socioeconomic development and other land use conversions. The study highly suggests that using PlanetScope imagery should be applied to estimate AGB and C-stocks of mangrove forests in Quang Yen town and expanded in other similar coastal areas in Quang Ninh province. A blue carbon approach should be taken into account toward sustainable mangrove management in Quang Yen.

Keywords: CMRI, mangrove forests, PlanetScope, Quang Yen, vegetation index.

1. INTRODUCTION

Mangroves forests have been found along shallow shorelines with modest slope where they have a high salinity concentration (e.g. Liang et al., 2008; River-Monroy et al., 2008). They are also subject to wave actions and storm surges (Baldwin et al., 2001) and are flushed by regular tides (Lugo and Snedaker, 1974). Significantly, mangroves have been globally recognized as their vital functions in preventing coastal erosion, mitigating effects of wave actions, currents and storm surges, and protecting coastal habitats and adjacent shoreline land-uses from extreme coastal events (e.g. Giri et al., 2008; Lee et al., 2014; Mazda et al., 1997; Tamin et al., 2011). Although these significantly functional values of mangroves are well-known, they are still being deforested and degraded for coastal settlement, aquaculture, resulting in a loss of ecosystem services and associated economic benefits (Thampanya et al., 2006; Hai-Hoa et al., 2013). Consequently, a rapid reduction of mangrove extent together with the impacts of increasing severity of storms has the potential to impact catastrophically on coastal communities (Gilman et al., 2008; Spalding et al., 2014).

**Corresponding author: hoanh@vnuf.edu.vn*

In Vietnam, mangroves are recently recognized as a highly valuable resource (Hai-Hoa et al., 2022; Hanh and Furukawa, 2007). They provide multiple ecosystem services, including carbon storage, wood production for building, fish trap construction and firewood, habitat for aquatic food resources, and most importantly shoreline stability and erosion control (Hai-Hoa et al., 2021; Hai-Hoa et al., 2020a; 2020b). However, the area of mangrove forests has rapidly declined over time; from an estimated 408,500 ha in 1943 to 290,000 ha in 1962, to 252,000 ha in 1982; and to 155,290 ha in 2000 (Government of Vietnam, 2005; Sam et al., 2005; Hai-Hoa et al., 2022). Remarkably, recent evidence have shown that the area of mangrove forests increased to 210,00 ha in 2008 due to a National Action Plan for Mangrove Protection and Development; other international mangrove restoration and rehabilitation programs (Government of Vietnam, 2005; Sam et al., 2005; Hai-Hoa, 2014). Despite this national increase, some areas are still experiencing with decline of mangrove covers. In Quang Yen, Quang Ninh province, increased fragmentation of mangroves has reduced their capacity to withstand coastal processes, such as coastal

currents, wave actions, semi-exposed coastline locations (Hai-Hoa, 2014; Hai-Hoa et al., 2013). In addition, underestimating the value of mangroves, weak management and protection have also led to severe degradation of mangroves over the years. This is resulting in the loss of key mangrove resources and associated ecosystem services, also threatening the local livelihoods by increased vulnerability of coastal communities to storm surges with large storms and typhoons. Therefore, an integrated approaches, including payments for carbon sequestration of mangrove forests should be adopted to restore and re-establish mangrove in Quang Yen, Quang Ninh province.

Currently, climate change has been affecting negatively the world-wide environment and Vietnam is one of the most severely affected countries, including Quang Yen, Quang Ninh province (Ward et al. 2016; Krauss, 2014). Therefore, it is necessary to assess trends of mangrove dynamics associated with the drivers of its changes in Quang Yen, Quang Ninh province. Various remote sensing technologies and techniques have extensively applied to monitor mangrove forests dynamics and estimate carbon stocks due to their large spatio-temporal coverage, cost effectiveness, ready availability and applicability (e.g. Zhang et al., 2016; Zhu et al., 2012; Akumu et al., 2010; Tuxen et al., 2011; Rajitha et al., 2007). Although the global extensive application of remote sensing, GIS technologies and techniques has been used to monitor spatio-temporal dynamics of mangrove forests, accurate and reliable information regarding estimation of mangrove biomass and carbon stocks based on remote sensing data in general are very limited in Quang Yen, Quang Ninh province.

The aim of this paper was to quantify spatio-temporal mangrove cover change along the coast of Quang Yen, Quang Ninh province using PlanetScope imageries from 2017 to 2022. It then identified the drivers of mangrove cover in the selected periods. These findings were used to inform coastal management planning and policy development, particularly related to sustainable management of mangrove forests and likelihood improvements in the face of a changing climate in Quang Ninh province.

2. RESEARCH METHODOLOGY

2.1. Study site

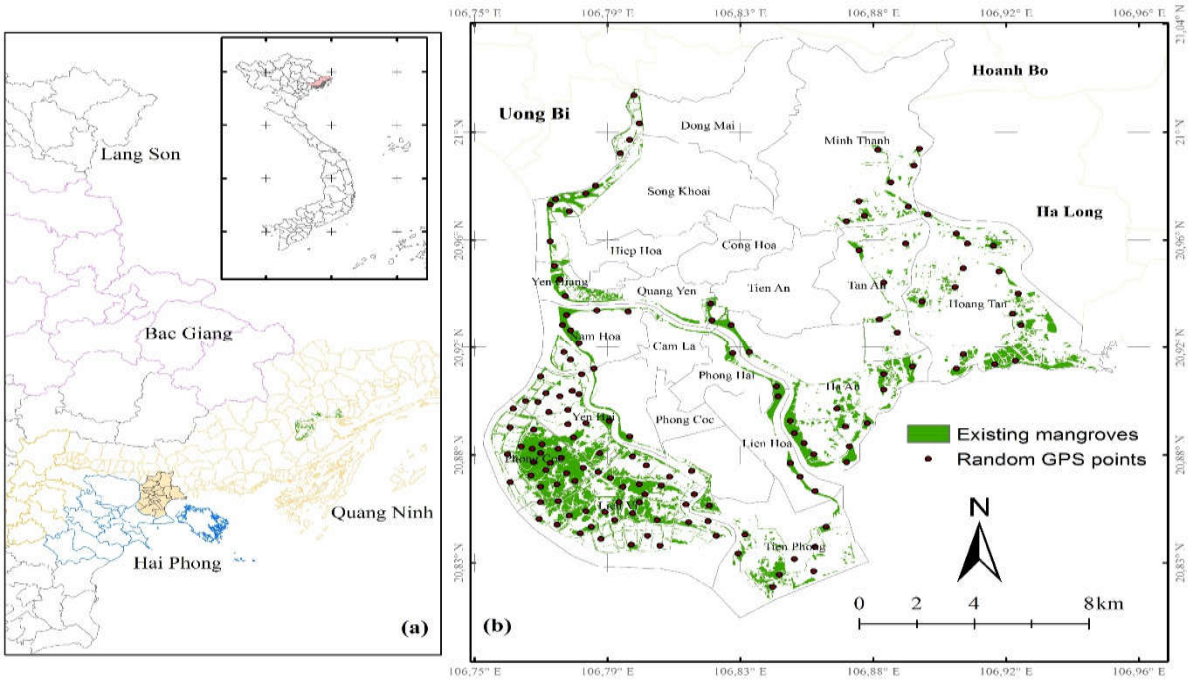

Fig. 1. Study site: (a) Geographic location of Quang Ninh in Vietnam; (b) Quang Yen with mangrove forests in Quang Ninh province

Quang Yen is the coastal town of Quang Ninh province and is located in the Red River Delta region of Vietnam that covers an area of 314.2 km². This town has population of 137,198 people. Our study selected the coast of Quang Yen as the targeted study site due to its

mangrove forests under the great pressure from nature and human-driven forces (Hai-Hoa et al., 2019). In particular, this area is currently under great pressure from urbanization and economic development; land use/cover conversion; and shrimp farming activities (Hai-Hoa et al., 2022). Mangrove forests are found with dominant species, known as *Sonneratia caseolaris, Aegiceras corniculatum, Avicennia*, and *Bruguiera gymnorrhiza* (Fig. 1).

2.2. Methods

2.2.1. Remote sensing data

In this study, the multi-temporal PlanetScope data (2017-2022) were used to detect mangrove cover each year; and then quantify mangrove cover change during three periods of 2017-2018, 2018-2019, 2019-2020, 2020-2021 and 2021-2022 (Table 1).

Table 1. Remotely sensed PlanetScope imageries used in this study

ID	Image codes	Date capture	Resolution (m)	Remarks
1	20220408_030219_79_248e_3B_AnalyticMS	08 April 2022	3x3	PlanetScope
	20220408_030217_46_248e_3B_AnalyticMS	08 April 2022	3x3	PlanetScope
2	20210619_023940_83_2449_3B_AnalyticMS	19 June 2021	3x3	PlanetScope
	20210619_023938_52_2449_3B_AnalyticMS	19 June 2021	3x3	PlanetScope
3	20200521_030957_0f17_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030956_0f17_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030857_0f15_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030856_0f15_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030855_0f15_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030958_0f17_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
	20200521_030955_0f17_3B_AnalyticMS	21 May 2020	3x3	PlanetScope
4	20190518_025505_0e20_3B_AnalyticMS	18 May 2019	3x3	PlanetScope
	20190518_025506_0e20_3B_AnalyticMS	18 May 2019	3x3	PlanetScope
	20190518_035729_36_106d_3B_AnalyticMS	18 May 2019	3x3	PlanetScope
	20190518_025507_0e20_3B_AnalyticMS	18 May 2019	3x3	PlanetScope
	20190518_025504_0e20_3B_AnalyticMS	18 May 2019	3x3	PlanetScope
5	20180310_025100_1018_3B_AnalyticMS	10 Mar 2018	3x3	PlanetScope
	20180703_025514_1035_3B_AnalyticMS	03 July 2018	3x3	PlanetScope
	20180703_025513_1035_3B_AnalyticMS	03 July 2018	3x3	PlanetScope
	20180703_025515_1035_3B_AnalyticMS	03 July 2018	3x3	PlanetScope
6	20170526_023900_1032_3B_AnalyticMS	26 May 2017	3x3	PlanetScope
	20170526_023859_1032_3B_AnalyticMS	26 May 2017	3x3	PlanetScope
	20170917_024558_0f25_3B_AnalyticMS	17 Sep 2017	3x3	PlanetScope
	20170729_024246_103a_3B_AnalyticMS	29 July 2017	3x3	PlanetScope
	20170526_023858_1032_3B_AnalyticMS	26 May 2017	3x3	PlanetScope
	20170729_024247_103a_3B_AnalyticMS	29 July 2017	3x3	PlanetScope
7	Forest status map in Quang Ninh	2020	1/50,000	

Source: https://www.planet.com

In addition, 2020 forest status map of Quang Ninh province was used for accuracy assessments of 2020 PlanetScope image in combination with Google Earth.

2.2.2. Field data collection

The field data survey extended to over the coast of Quang Yen where mangrove forests have been highly found. In this study, 220 GPS points were both collected for 2020, 2021 and 2022 for two classes, namely mangrove forests and non-mangrove forests for accuracy assessments.

2.2.3. Image pre-processing

PlanetScope images were already geo-referenced. To obtain a pixel-to-pixel match between two images, PlanetScope images in 2022 were used to register 2017, 2018, 2019, 2020, and 2021 to improve geometric accuracy. This geometric correction was required to improve the geo-location to a root mean square error of less than a pixel and accuracy of subsequent change analysis (Hai-Hoa et al., 2020a, 2020b; Hai-Hoa et al., 2022). All of the PlanetScope images were checked to ensure

they were all geo-referenced to UTM WGS 1984 Zone 48N projection and datum. In addition, all of the adjacent scenes of PlanetScope imagery each year in Quang Yen town were mosaicked to create the whole scene, which covers over the study site. The mask was then used to define mangrove cover in the pre-processed PlanetScope images (2017-2022). These images were clipped to extract only areas where mangrove covers were more likely to be present (e.g. low-lying areas and inter-tidal zones), and to exclude large coastal areas where mangroves did not occur (e.g. far inland, highlands and open ocean) before the image classification was undertaken (Hai-Hoa et al., 2022; Long and Giri, 2011).

2.2.4. Image classification

The data was gathered from two coastal land-use/covers along the coast of Quang Yen, Quang Ninh Province, including mangrove covers (including closed and open canopy), non-mangrove forests (including abandoned aquaculture pond, bare and wet land, mudflats, other non-mangrove vegetation, and water bodies). In this study, the Combined Mangrove Recognition Index (CMRI) was used for mapping mangrove covers, which is created by a combination of NDVI and NDWI for the spectral discrimination of mangrove covers from non-mangrove classes.

CMRI (Combined Mangrove Recognition Index) = NDVI - NDWI

NDVI (Normalized Difference Vegetation Index) = (NIR-RED) / (NIR+RED)

NDWI (Normalized Difference Water Index) = (GREEN-NIR) / (GREEN + NIR)

where GREEN is Band-2; RED is Band-3, and Band-4 is NIR in PlanetScope images.

2.2.5. Post classification and accuracy assessments

The quantitative validation was performed to evaluate mangrove cover classification accuracy derived from CMRI values and reference data. A total of 220 random GPS points (including 150 GPS points for mangrove forests; 70 points for non-mangrove forests) were collected from the field for 2020, 2021 and 2022; and 170 random GPS points (including 110 GPS points for mangrove forests; 60 points for non-mangrove forests) were randomly selected from Google Earth images for 2017, 2018, and 2019. These random points were used for accuracy assessments of each thematic mangrove cover map. The overall classification accuracy, producer's accuracy and Kappa statistics, were then estimated for quantitative classification performance analysis (Foody, 2013). To use the data correctly, we considered the minimum level of the overall interpretation accuracy in coastal and use and land cover map would be at least 85.0% as suggested by previous studies of Foody (2002).

In post-classification process, the filtering process was also applied to remove isolated pixels or noise from the classification output. The filtered classified image was then used as the final mangrove cover map for each year.

2.2.6. Change detection analysis and mangrove cover change

The post classification change detection is the most widely applied statistical technique to analyze the mangrove cover change. This analysis provides in-depth information about pixel transformation, class change and dynamics of converted mangrove cover. The mangrove cover maps for 2017, 2018, 2019, 2020, 2021, and 2022, were assessed and compared in terms of areas covered. The annual rate of change and cross-tabulated methods were used to identify mangrove cover change with a two-year intervals, namely 2017-2018, 2018-2019, 2019-2020, 2020-2021 and 2021-2022. This study also quantified the change detection statistics between 2017 and 2022 maps to understand the dimension of class-wise mangrove cover variation. The changes in mangrove covers were visually interpreted and further examined to understand the spatial-temporal gain and loss of mangrove cover over 6 years along the coast of Quang Yen, Quang Ninh province.

3. RESULTS AND DISCUSSION

3.1. Accuracy assessments

All of the PlanetScope images were used to produce the CMRI land cover classification maps for the whole coast of Quang Yen. CMRI threshold for each land cover was calculated from NDVI and NDWI values, as follows: mangrove forests with CMRI greater than 0.835, non-mangrove forests with CMRI less than 0.835. These thresholds were then used to construct a thematic land cover map for each

year in Quang Yen. The error matrices indicated that accuracy assessments of 2022, 2021, 2020, 2019, 2018, and 2017 classification have high rates of classification with user's accuracies, as follow: Mangrove forests (from 93.6% to 96.7%), non-mangrove forests (from 93.3% to 95.7%), giving an overall accuracy of 96.4%, 95.0%, 95.9%, 95.3%, 94.1%, 94.1% in 2022, 2021, 2020, 2019, 2018, and 2017, respectively (Table 2).

In addition, the Kappa coefficients of 0.92 in 2022, 0.89 in 2021, 0.91 in 2020, 0.90 in 2019, 0.87 in 2018, and 0.87 in 2017 indicated that there were more than substantial agreements between the classified images and referenced data. It was therefore assumed that using PlanetScope images with the CMRI were reliable and applicable for mapping temporal changes in mangrove forests in Quang Yen (Table 2).

Table 2. Summary of accuracy assessment of land use/cover classes along the coast of Quang Yen, Quang Ninh province from PlanetScope data

Accuracy assessment of PlanetScope classification in 2022

Classified image	Reference data in 2022				
		Man	**Non-man**	**Total**	**User's Accuracy (%)**
	Man	**145**	5	150	96.7
	Non-man	3	**67**	70	95.7
	Total	*148*	*72*	*220*	
	Producer's Accuracy (%)	98.0	93.1	Overall Accuracy: 96.4% Kappa coefficient = 0.92	

Accuracy assessment of PlanetScope classification in 2021

Classified image	Reference data in 2021				
		Man	**Non-man**	**Total**	**User's Accuracy (%)**
	Man	**143**	7	150	95.3
	Non-man	4	**66**	70	94.3
	Total	*147*	*73*	*220*	
	Producer's Accuracy (%)	97.3	90.4	Overall Accuracy: 95.0% Kappa coefficient = 0.89	

Accuracy assessment of PlanetScope classification in 2020

Classified image	Reference data in 2020				
		Man	**Non-man**	**Total**	**User's Accuracy (%)**
	Man	**144**	6	150	96.0
	Non-man	3	**67**	70	95.7
	Total	*147*	*73*	*220*	
	Producer's Accuracy (%)	98.0	91.8	Overall Accuracy: 95.9% Kappa coefficient = 0.91	

Accuracy assessment of PlanetScope classification in 2019

Classified image	Reference data in 2019				
		Man	**Non-man**	**Total**	**User's Accuracy (%)**
	Man	**106**	4	110	96.4
	Non-man	4	**56**	60	93.3
	Total	*110*	*60*	*170*	
	Producer's Accuracy (%)	96.4	93.3	Overall Accuracy: 95.3% Kappa coefficient = 0.90	

Accuracy assessment of PlanetScope classification in 2018

Classified image	Reference data in 2018				
		Man	**Non-man**	**Total**	**User's Accuracy (%)**
	Man	**103**	7	110	93.6
	Non-man	3	**57**	60	95.0
	Total	*110*	*60*	*170*	
	Producer's Accuracy (%)	97.2	89.1	Overall Accuracy: 94.1% Kappa coefficient = 0.87	

Table 2 (Conts). Summary of accuracy assessment of land use/cover classes along the coast of Quang Yen, Quang Ninh province from PlanetScope data

Accuracy assessment of PlanetScope classification in 2017

Classified image	Reference data in 2017			
	Man	**Non-man**	**Total**	**User's Accuracy (%)**
Man	**104**	6	110	94.5
Non-man	4	**56**	60	93.3
Total	*108*	*62*	*170*	
Producer's Accuracy (%)	96.3	90.3	Overall Accuracy: 94.1% Kappa coefficient = 0.87	

Man (Mangrove forests); Non-man (Non-mangrove forests).

3.2. LULC and mangrove cover change from 2017 to 2022

Temporal extent of mangrove forests in Quang Yen town from 2017 to 2022:

Multi-temporal changes of land use/cover in Quang Yen are presented in Table 3.

Table 3. Land use/cover, mangrove extent in Quang Yen town from 2017-2022 (ha)

Year	2017	2018	2019	2020	2021	2022
Man	3114.4	3032.7	2462.8	2852.5	3092.4	2745.1
Non-man	9723.4	9805.1	10375.0	9985.3	9745.4	10092.7
Total	**12837.8**	**12837.8**	**12837.8**	**12837.9**	**12837.8**	**12837.8**

Table 3 indicated that from 2017 to 2022, the overall extent of mangrove forests reduced from 3114.4 ha in 2017 to 2745.1 ha in 2022. In particular, the extent of mangrove forests decreased from 3114.4 ha in 2017 to 2462.8 ha in 2019, but increased to 2852.5 ha in 2020 and to 3092.4 ha in 2021, then again dropped to 2745.1 ha in 2022.

Changes in the extent of mangrove forests from 2017 to 2022

An estimation of mangrove loss and gain in different selected periods is presented in Table 4 and Fig. 2 across the coast of Quang Yen, Quang Ninh province.

Table 4. Mangrove loss and gain assessment based on PlanetScope data (2017-2022) over the coast of Quang Yen town, Quang Ninh province (ha)

Land use/cover	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2017-2022
Man	-81.7	-569.9	+389.7	+239.9	-359.7	-443.1
Non-man	+81.7	+569.9	-389.7	-239.9	+359.7	+443.1
Mangrove change: loss (-), gain (+)	-	-	+	+	-	-

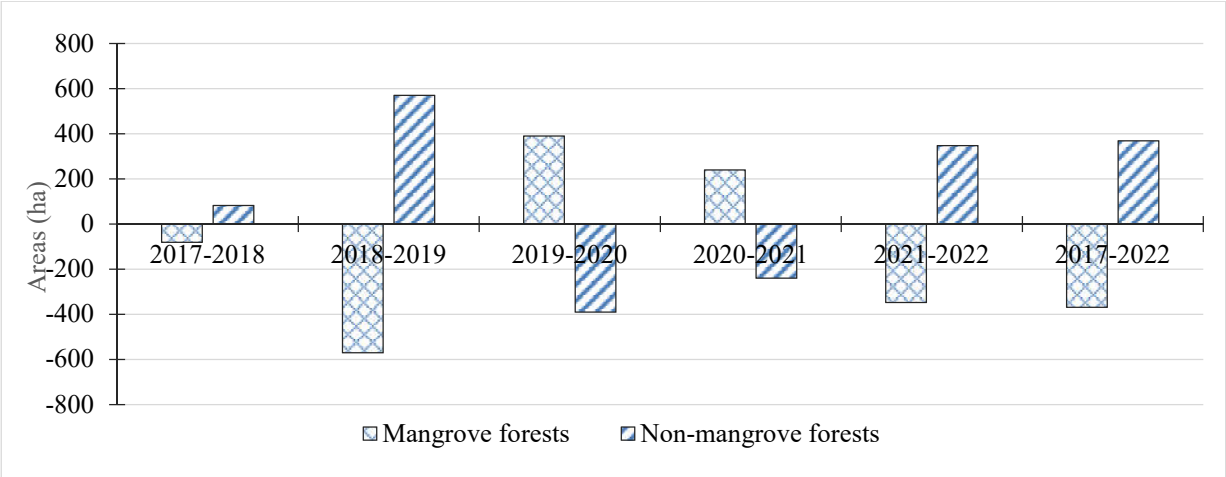

Fig. 2. Temporal changes in mangrove forests in the coast of Quang Yen, Quang Ninh province during the period of 2017-2022

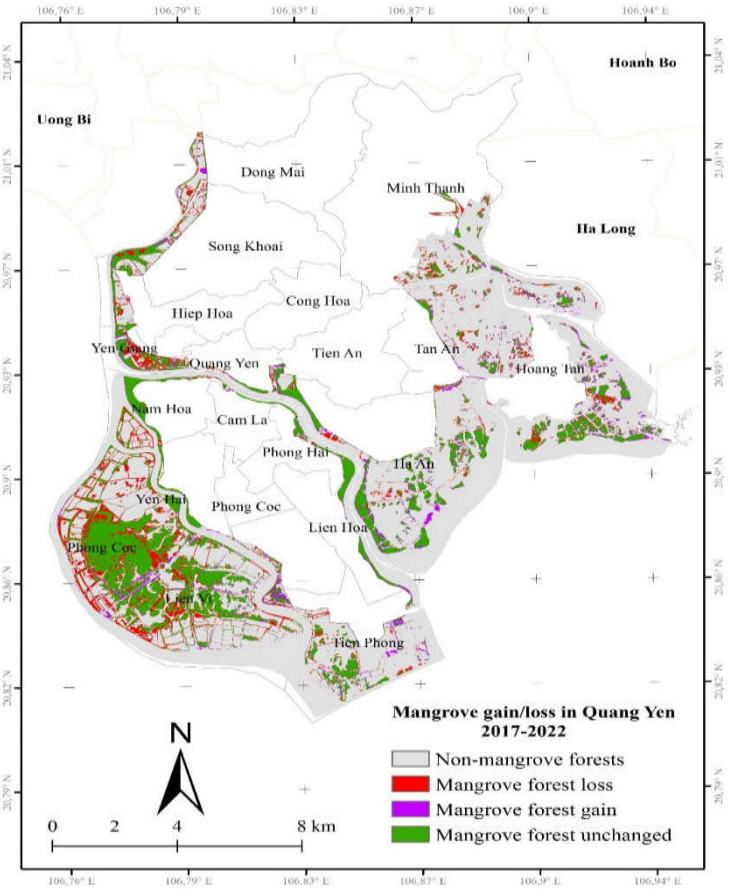

Fig. 3. Mangrove loss and gain along the coast of Quang Yen town, Quang Ninh province during the period of 2017-2022

As indicated in Table 4 and Fig. 2, the loss and gain of mangrove forests were recorded in the periods of 2017-2018, 2018-2019, 2019-2020, and 2021-2022. To be more specific, the largest areas of mangrove forests lost were recorded during 2018-2019 (569.9 ha lost), followed by 2021-2022 (359.7 ha lost), and 2017-2018 (81.7 ha lost). The estimation also shows the total extent of mangrove forests lost was recorded at 443.1 ha for the whole study period of 2017-2022 (Table 4). In contrast, some periods experienced an increase of mangrove forests, such as 2019-2020 (389.7 ha of mangrove gain), and 2020-2021 (239.9 ha gain).

3.3. Drivers of mangrove cover change, blue carbon approach toward sustainable mangrove management

Aquaculture development, shrimp farming-related to mangrove cover change:

Mangrove forests was under the great pressure of aquaculture and shrimp farming development, and socio-economic influences, which varied spatially and temporally along the coast of Quang Ninh province (Hai-Hoa et al., 2022). From 2017 to 2022, aquaculture and shrimp farming development had a large impact on the extent of mangrove forests (Hai-Hoa et al., 2019). In particular, the loss of mangrove forests was strongly associated with the expansion of aquaculture and urbanization and socio-economic development during the period of 2018-2019 (Table 4 and Fig. 4). The loss of mangrove forests generally resulted from the Doi Moi policy, which was implemented in 1986 (Hai-Hoa et al., 2013; Huong et al., 2021).

Mangrove forests converted into other land uses:

The expansion of other coastal land uses has contributed to the loss of the extent of mangrove forests. It is therefore considered as an important driver of mangrove degradation and deforestation. The study reveals that the expansion of other land uses (including agricultural land as rice production, coastal infrastructure and urbanization) took place and was estimated at an increase of 81.7 ha, 569.9 ha, and 359.7 ha in the periods of 2017-2018, 2018-2019 and 2021-2022, respectively (Table 4, Fig. 2).

Mangrove afforestation programs:

Both international and national mangrove afforestation programs have significantly contributed to the changes in mangrove forests in Quang Ninh province (Hai-Hoa et al., 2022; Hai-Hoa et al., 2019). By viewing the Google Earth images captured in 2017 and 2022, we have easily detected the success of new mangrove plantations in some parts of Quang Yen coast. The study also indicates that the largest increase of the extent of mangrove forests was revealed in Quang Yen from 2019 to 2020, about 389.7 ha, followed by 239.9 ha of mangrove forests afforested during the period of 2020-2021.

Blue carbon approach toward sustainable mangrove management:

Mangrove ecosystem services, including carbon sequestration and climate change mitigation, are benefits to coastal humans (e.g. Hai-Hoa et al., 2022; Hai-Hoa and Hien, 2021; Hai-Hoa et al., 2019). A blue carbon approach has been regarded as one of the most effective climate change mitigations (e.g. Nam et al., 2016; Howard et al., 2017). Such approach is more likely to reach a key sustainable management of mangrove forests and balance among environmental, social and economic dimensions (Mironenko et al., 2015; Hai-Hoa et al., 2022). Warner et al., (2016) has indicated the opportunities and challenges for mangrove carbon sequestration in Vietnam. Our study highly suggests that a blue carbon approach should be taken into account for sustainable mangrove management in Vietnam as key issues, including the economic development and social incentives to protect and restore mangrove forests, supportive law and policy mechanisms in a long-term financial establishment, are well addressed (Hai-Hoa et al., 2022; Hai-Hoa et al., 2021; Warner et al., 2016). Our study reveals that mangrove forests in Quang Yen town and Quang Ninh province in general have the potential to pursue a blue carbon approach as their ready availability of spatio-temporal data of mangrove forests and supportive policy mechanism.

4. CONCLUSION

By using PlanetScope imageries (3mx3m), the study has constructed the spatial distribution of mangrove forests in 2017 and 2022. This study used the CMRI thresholds for coastal land covers (CMRI value > 0.835 for mangrove forests, CMRI <0.835 for non-mangrove forests). The overall accuracies assessments of land covers in 2022 (96.4% of accuracy, Kappa coefficient of 0.92) and land covers in 2017 (94.1% of accuracy, Kappa coefficient of 0.87) have confirmed using PlanetScope images were very reliable for mapping temporal changes in land use/cover and mangrove covers in Quang Yen town. The study showed that there were 2745.1 ha of mangrove forests in 2022 and 3114.4 ha in 2017. Overall, mangrove forests in Quang Yen town decreased by 443.1 ha in 2022 compared to 2017 and main drivers for mangrove deforestation during the period of 2017- 2022 were aquaculture development, socio-economic development, other land use conversions, and mangrove afforestation programs. The study highly suggests that using PlanetScope imagery should be applied to estimate AGB and C stocks of mangrove forests in Quang Yen town and expanded in other similar coastal areas in Quang Ninh province. In addition, a blue carbon approach should be taken into account toward sustainable mangrove management in Quang Yen and Quang Ninh province.

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XÂY DỰNG BẢN ĐỒ BIẾN ĐỘNG RỪNG NGẬP MẶN DỰA VÀO ẢNH VIỄN THÁM PLANETSCOPE (2017-2022) KHU VỰC THỊ XÃ QUẢNG YÊN, TỈNH QUẢNG NINH HƯỚNG TỚI QUẢN LÝ RỪNG BỀN VỮNG

Nguyễn Hải Hoà[1*], Phạm Duy Quang[1], Vũ Văn Trường[1], Lê Phú Tuấn[1]

[1]Trường Đại học Lâm nghiệp

TÓM TẮT

Rừng ngập mặn phân bố dọc các bờ biển nông với độ dốc thấp, nơi đây chúng nhận được nguồn nước ngọt từ các con sông ở vùng thượng lưu và chất dinh dưỡng. Rừng ngập mặn được biết đến ở quy mô toàn cầu về chức năng quan trọng trong việc ngăn chặn xói mòn bờ biển, giảm thiểu tác động của sóng và bảo vệ môi trường sống ven biển khỏi các hiện tượng cực đoan ven biển. Bằng cách sử dụng hình ảnh của tư liệu ảnh viễn thám PlanetScope (3mx3m), nghiên cứu đã xây dựng bản đồ phân bổ không gian của rừng ngập mặn từ năm 2017 đến năm 2022. Nghiên cứu này đã xác định và sử dụng chỉ số CMRI cho lớp phủ đất ven biển (giá trị CMRI> 0,835 đối với rừng ngập mặn, CMRI <0,835 đối với không rừng ngập mặn). Kết quả đánh giá tổng thể về độ chính xác của lớp phủ đất vào năm 2022 (độ chính xác là 96,4%, hệ số Kappa là 0,92) và lớp phủ đất vào năm 2017 (độ chính xác 94,1%, hệ số Kappa là 0,87) đã khẳng định việc sử dụng tư liệu ảnh PlanetScope đáng tin cậy để lập bản đồ thay đổi lớp phủ và sử động đất, trong đó có rừng ngập mặn tại thị xã Quảng Yên. Nghiên cứu cũng chỉ ra rằng rừng ngập mặn ở thị xã Quảng Yên đã giảm 443,1 ha vào năm 2022 (2745,1 ha) so với năm 2017 (3114,4 ha), nguyên nhân chính dẫn đến mất và suy thoái rừng ngập mặn trong giai đoạn 2017-2022 là do các hoạt động liên quan đến phát triển nuôi trồng thủy sản, phát triển kinh tế xã hội và chuyển đổi mục đích sử dụng đất khác. Nghiên cứu cho rằng nên sử dụng hình ảnh PlanetScope để ước tính trữ lượng sinh khối và cácbon của rừng ngập mặn tại thị xã Quảng Yên và nên mở rộng ở các vùng ven biển tương tự khác tại tỉnh Quảng Ninh. Cách tiếp cận các bon xanh hướng tới quản lý bền vững rừng ngập mặn tại Quảng Yên nên được xem xét để áp dụng.

Từ khóa: CMRI, chỉ số thực vật, PlanetScope, Quảng Yên, rừng ngập mặn.

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