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Local People's Perception of a Mangrove Forest Plantation as a Carbon Sink, Chumphon Islands National Park, Thailand

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ABSTRACT

Forest plantation, either on ground or on wetland as mangrove forest plantation, is commonly and continually practiced to maintain or increase the forest area, but mostly it is done by environmentalists from public, state enterprises, community, and/or private sectors. Others may receive direct and/or indirect benefits from the forest with more or less participation. This practical resarch article presents the mangrove forest plantation project at Chumphon Islands National Park, Chumphon province, in southern peninsular Thailand, of about 1,057 Rai (169.12 hectares) supported by the state enterprise Electricity Generating Authority of Thailand (EGAT). To investigate the results from this investment activity, this study examined the local people's perceptions of the benefits from mangrove plantation project at Chumphon Islands National Park, Chumphon province, in southern peninsular Thailand. The face-to-face questionnaires developed for secondary data were reviewed, then responses were stratified collected from 339 local respondents of 21 villages in six sub-districts within a five-kilometer radius around the project. The results indicate that more than half of the respondents were uncertain about some direct benefits, while two-thirds of them received indirect benefits. Consequently, if the mangrove plantation project is organized in the prohibited area of the national park, the local people's perceptions of the direct benefits are minimal.

1. INTRODUCTION

Forest plantation is not a new concept to balance the size of forest area with other human land utilization areas [1-4]. Kamlang-Ek [5] explained numerous direct and indirect benefits from wetland forest plantation as follows: 1) direct benefits such as having ocean creatures, wild food, wood for construction; and 2) indirect benefits such as having seafood products, nutrition source for coastal creatures, avoiding coastal erosion, as well as life and personal possession protection, and having a carbon sink.

Carbon sinks are well-accepted and widely practical in many countries around the world [6], including Thailand [7], in order to balance the carbon dioxide (CO_2) release with its capture. An example of such sinks is the forest plantations earning carbon credits. Forest plantations in the tropical coastal areas of Thailand would consist of mangrove, called "blue carbon" and acknowledged as highly effective to capture carbon dioxide (CO_2), three to five times more so than forest plantations named "green carbon" in terrestrial areas [1, 8].

Electricity Generating Authority of Thailand (EGAT) – a state-owned enterprise under the supervision of Ministry of Energy and Ministry of Finance, Thailand, has as its major task to produce, acquire, and sell electricity to users. It has arranged forest plantation projects in many places in Thailand, in order to support Thailand's "carbon neutrality" by 2050 [9]. One of the recent projects is a mangrove plantation of 1,057 Rai area (about 169.12 hectares) or about 6.08 percent of the whole protected mangrove forest area at Chumphon Islands National Park, Thailand, during 2018 to 2022 (see Figure 1).

The mangrove forest plantation areas at Chumphon Islands National Park, Chumphon province, are situated in a coastal area called "Sawee-Thungka Bay". The Chumphon Islands National Park has to take care of the areas of water, land, mangrove, islands, mountains and others in totally 198,125 Rai (about 317,000 hectares). Before the announcement of Chumphon Islands National Park in 1999, the shrimp farming concession for private entrepreneurs was allowed since 1982. Noticeably, on one hand, the area was ruined by chemicals used in shrimp farming; and on the other hand, the economic incentives boosted this activity. After the end of shrimp farming concession, mangrove forest plantations have gradually replaced that activity, including the one supported by EGAT to serve ecology on- and off-shore [10].

Although there are recent related studies in a different context and using different methodologies [11-14] such as the attitude survey of the EGAT's officers in forest plantation projects [11], as well as the only 25-sample local people's attitudes survey on the EGAT forest plantation in the Chumphon province project zone [12], the study of this research article and its results are inevitable because the approach is able to present the local people's perceptions

focused on positive and negative impact levels from the contemporary "carbon sink" issue, and informs about what could be improved in the next activity based on the context and location of Chumphon Islands National Park.

Consequently, this practical research article seeks to answer the specific research questions on: 1) what are the local people's attitudes on direct and indirect benefits from mangrove forest plantation project at Chumphon Islands National Park, Thailand, supported by the EGAT; and 2) what are the local people's attitudes summarized regarding positive and negative impacts from mangrove forest plantation project at Chumphon Islands National Park, Thailand, supported by the EGAT.

Next, Section two presents a literature review on carbon sinks & sources, direct and indirect benefits from mangrove forest plantation, and background of the mangrove forest plantation project; Section three explains methodology; Section four describes results and discussion on basic information of respondents, perceptions about the project, positive impacts perception, summary of the positive and the negative impact perceptions; and lastly Section five summarizes the conclusions of the article.

2. LITERATURE REVIEW

2.1 Carbon sink and carbon source

"Carbon sink" is a forest that absorbs carbon dioxide (CO_2) and keeps it above-ground (as in trunks, branches, leaves, flowers, and fruit), below-ground (as in roots), in dead wood, dead organic matter (as in fallen trunks, branches, leaves, flowers, and fruit), soil, and in harvested wood [15]. At the same time the forest also releases CO_2 from decay processes and acts as a "carbon source". Generally, a forest sinks more carbon than it releases to the environment [16]. Examples of other carbon sinks are ocean, marine organisms, rocks, and fossil fuels [17]. However, this study focused only on the carbon sinks served by mangrove forests − one of Thailand's strategies to reach "carbon neutrality" by 2050. On the other hand, activities that release CO_2 into the environment include fossil fuel burning and raising cattle [16, 18].

2.2 Direct and indirect benefits from mangrove forest plantation

Mangrove forest plantation provides direct and indirect benefits that are assessed by the face-to-face questionnaires to the local respondents as shown in Table 1.

Table 1. Direct and indirect benefits from mangrove forest assessed from questionnaires in this study

No.	Direct	Indirect
1	Catching ocean seafood products [19-21]	Ecological biodiversity [2, 20]
2	Wild hunting [22]	Source of nutrition for coastal creatures [19]
3	Wood for construction [23]	Coastal erosion protection [20, 24]
4	Firewood [20, 25]	Life and personal possession protection [20, 21]
5	Wood for hunting tools [26]	Carbon sink [2, 25]
6	Source of education and cultural conservation [23, 24]	Waste filter [20]
7	Place for mangrove plantation activity [4]	Remains of mangrove forest [22]
8	Adding soil, soil nutrition, and reducing chemicals in soil [20]	Heritage for next generation [27]

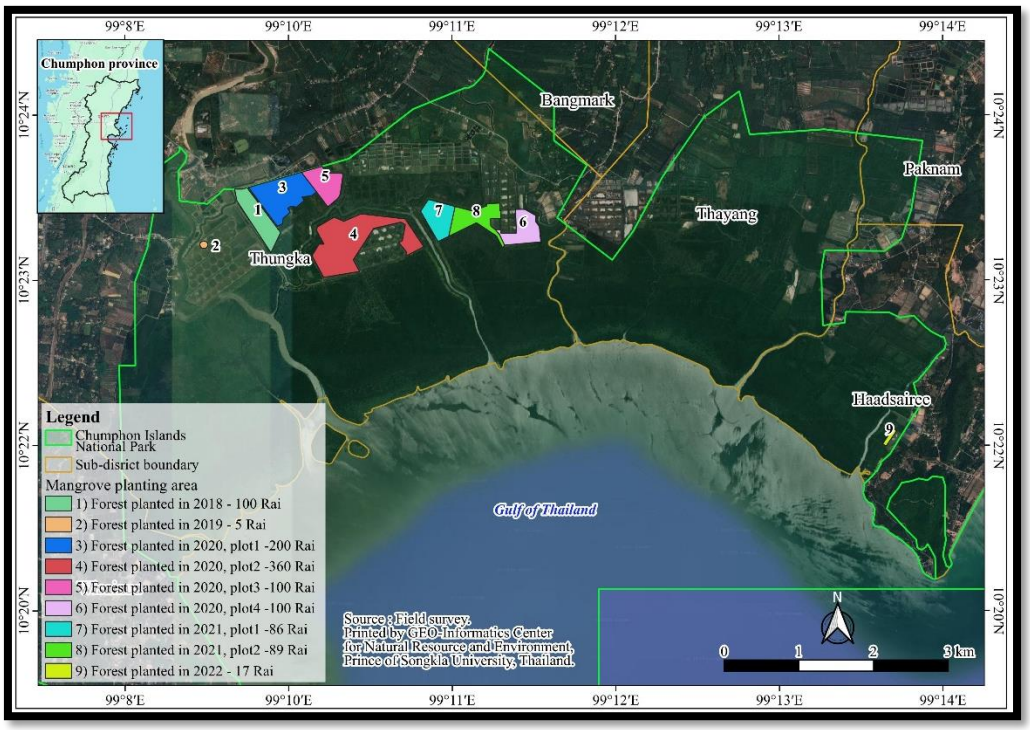


Figure 1. Area of mangrove forest plantation
Source: The authors' elaboration

2.3 Background of the mangrove forest plantation project

Electricity Generating Authority of Thailand (EGAT) conducted mangrove forest plantation project at Chumphon Islands National Park, Chumphon province, Thailand during 2018 to 2022 for totally 1,057 Rai or 169.12 hectares as a kind of corporate social responsibility (CSR) project, as well as for undeniably boosting sustainable development. The relevant areas were in 2018 100 Rai; in 2019 5 Rai; in 2020 760 Rai; in 2021 175 Rai; and in 2022 17 Rai (see Figure 1).

The mangrove forest plantation management in this article received funding supported by the EGAT; while the Chumphon Islands National Park, Chumphon province, Thailand contributed the places where there had previously been shrimp farming whose concession had now ended. They were co-managed due to the mangrove forest plantation sharing the same goals.

Skilled local people were hired to plant and restore the mangrove, while also local volunteers participated on special occations − such as local young students planting mangrove on Mother's day, and/or local volunteer communities gathering to plant mangrove on Earth day – sharing the same available locations of EGAT's mangrove forest plantation project.

Two years after the planting had ended, both EGAT and representatives from the Chumphon Islands National Park co-evaluated the results of the project in terms of mangrove survival rate, mangrove height development, and the mangrove forest expansion, before returning the output of the plantation project in the third year to be totally supervised by the Chumphon Islands National Park, and to sincerely provide transparency, but the local people's perception survey as in this article was not yet included.

3. METHODOLOGY

This quantitative study surveyed local people's benefit perceptions of EGAT mangrove forest plantation at Chumphon Islands National Park, Chumphon province, Southern Thailand, during the weekends of February to March 2024, to make sure that the possible respondents were at home; besides these were not during the monsoon season, for convenient and comfortable data collection.

Firstly, secondary data from previous studies, and basic data for field survey such as household size, and area boundary of the study, were reviewed. Then, attitudes were surveyed about local perceptions of benefits from the EGAT mangrove forest plantation at Chumphon Islands National Park. The face-to-face questionnaires were designed based on previous literature to address direct (8 questions) and indirect (8 questions) benefits (see Table 1), and they asked respondents for yes/no perceptions of benefit utilization or unsure responses. In addition, respondents rated their perceptions on mangrove forest plantation benefits from one to five (Likert scale: one for least, and five for most).

This study also applied the concept of social impact assessment [28-30] that generally involves surveying people's attitudes in about a five-kilometer radius around the project (see Figure 2).

There were totally six sub-districts with 21 villages situated around the project (see Table 2). Stratified sampling of finally n = 339 representatives, one from each household, was done from a total of 2,898 households for 95% confidence level and a ± 5% confidence interval. After that the data were subjected to descriptive analysis, analysis of frequencies, as well as of percentages.

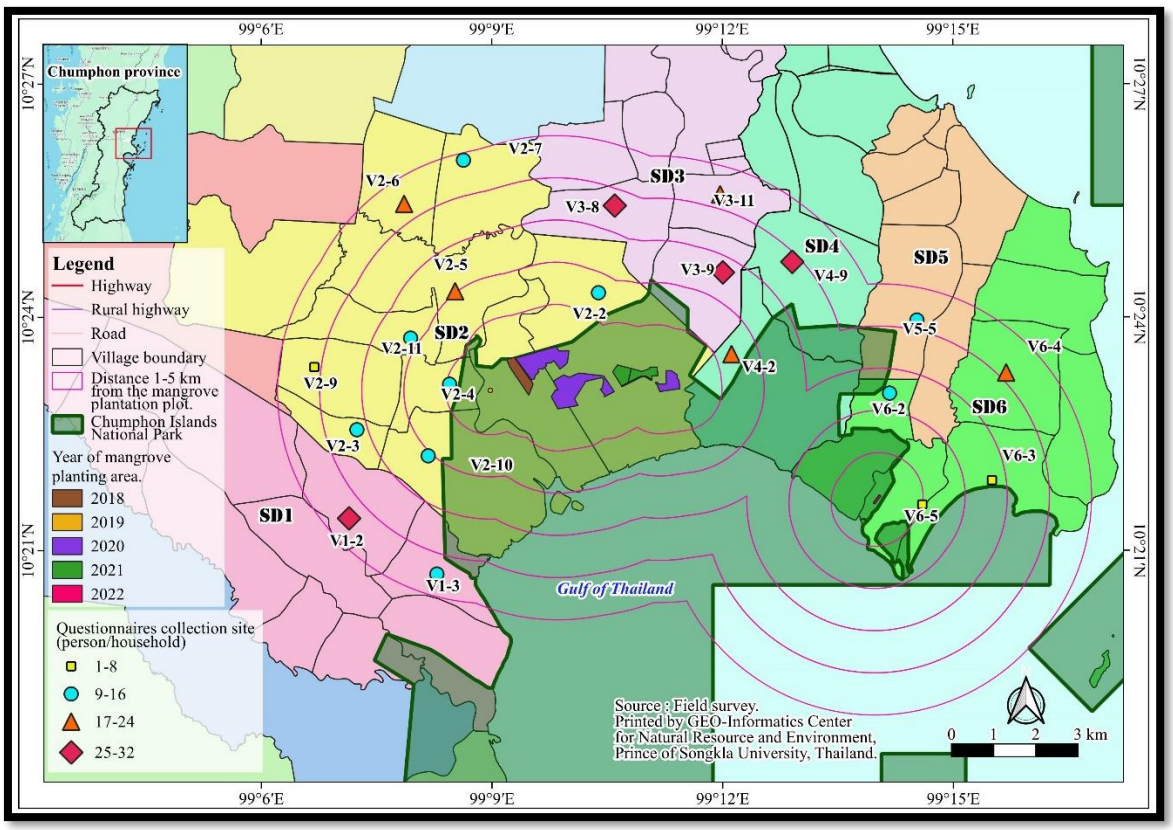


Figure 2. Study area for people's survey
Source: The authors' elaboration

Table 2. Statistics of population and household sizes in 2021, as well as sample sizes (n = 339)

Sub-District Code	Villages' Code In Five-Kilometer Radius					Population (Persons)	Households (Houses)	Sample Size (Persons)
	1	2	3	4	5			
SD1					V1-1	888	277	32
					V1-3	320	101	12
SD2		V2-2				668	103	12
				V2-3		430	84	10
	V2-4					676	131	15
		V2-5				793	147	17
					V2-6	632	147	17
					V2-7	623	118	14
					V2-9	504	66	8
			V2-10			567	136	16
			V2-11			435	75	9
SD3				V3-8		651	227	27
			V3-9			673	218	26
					V3-11	2,317	198	23
SD4		V4-2				352	151	18
				V4-9		696	262	31
SD5					V5-5	538	105	12
SD6			V6-2			606	85	10
			V6-3			506	12	1
					V6-4	446	183	21
		V6-5				652	72	8
SUM	**1**	**4**	**5**	**3**	**8**	**13,973**	**2,898**	**339**

Source: [31-36]

4. RESULTS AND DISCUSSION

4.1 Demographic data of respondents

Table 3 presents the 339 respondents' demographic data on gender, age, and time of residence. Female respondents (54.87%) were a bit higher than male respondents (45.13%). Respondents were mostly from 41 to 50 years old (28.91%), then 51 to 60 years old (26.84%), and over 60 years old (20.65%) in decreasing rank order. In the residence period the largest category was between 41 and 50 years (18.58%), next 51 to 60 years (18.29%), and 31 to 40 years (16.52%) in decreasing order.

The ethnic respondents originally from Laos PDR called "Tai Song Dam" in V2-2; V3-8; V3-9; and V4-9 villages have immigrated from central Thailand long ago, and lived in Chumphon province since 1909 [37].

4.2 Occupation

Figure 3 and Table 4 present the respondents' occupations separated into main occupation and secondary occupation. "Farmers" were the highest in both the main (28.96%) and the secondary (13.46%) occupations. Very few (2.33%) of them were unemployed; however more than 50.55 percent responded that they had only a main occupation, and no secondary occupation. These were also similar to the occupations from the sub-district reports on farmer, oil palm farmer, rubber tree farmer, fruit farmer, fisherfolk, fishing cage farmer, crab cage farmer, soft shell crabbing, chicken farmer, cow farmer, and labor [38-43]. Besides, the concordant result on the ones who had more than one occupation meant improved food security [44].

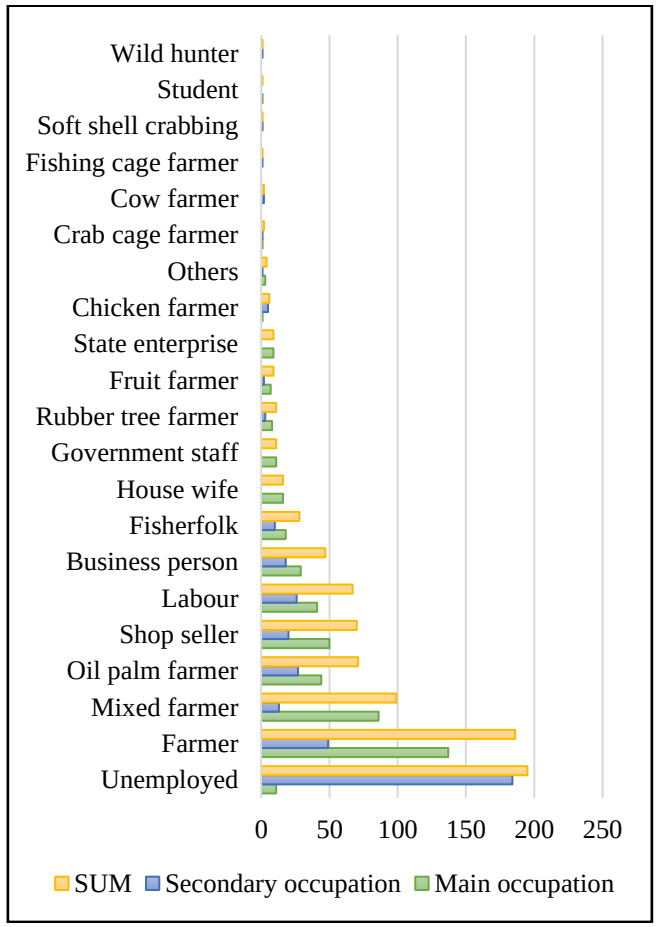


Figure 3. Respondents' occupations (for more than one cases)
Source: The authors' elaboration

Table 3. Respondents' demographic information (n = 339)

Demographic Category	Frequency	Percent	Cumulative Percentage
Gender			
Female	186	54.87	54.87
Male	153	45.13	100.00
SUM	**339**	**100.00**	
Age			
18-20 years old	1	0.29	0.29
21-30 years old	24	7.08	7.37
31-40 years old	55	16.22	23.60
41-50 years old	98	28.91	52.51
51-60 years old	91	26.84	79.35
Over 60 years old	70	20.65	100.00
SUM	**339**	**100.00**	
Time of residency			
Less than 10 years	33	9.73	9.73
11-20 years	33	9.73	19.47
21-30 year	44	12.98	32.45
31-40 year	56	16.52	48.97
41-50 years	63	18.58	67.55
51-60 years	62	18.29	85.84
Over 60 years	48	14.16	100.00
SUM	**339**	**100.00**	

Table 4. Respondents' occupations divided by sub-district

Occupation/Sub-District Code	SD1		SD2		SD3		SD4		SD5		SD6		SUM	
	M	S	M	S	M	S	M	S	M	S	M	S	M	S
Unemployed	4 (0.85)	7 (1.92)	6 (1.27)	50 (13.74)	1 (0.21)	52 (14.29)	0 (0.00)	35 (9.62)	0 (0.00)	9 (2.47)	0 (0.00)	31 (8.52)	11 (2.33)	184 (50.55)
Farmer	18 (3.81)	17 (4.67)	41 (8.67)	13 (3.57)	46 (9.73)	10 (2.75)	23 (4.86)	6 (1.65)	3 (0.63)	2 (0.55)	6 (1.27)	1 (0.27)	137 (28.96)	19 (13.46)
Mixed farmer	12 (2.54)	3 (0.82)	29 (6.13)	7 (1.92)	29 (6.13)	2 (0.55)	10 (2.11)	1 (0.27)	1 (0.21)	0 (0.00)	5 (1.06)	0 (0.00)	86 (18.18)	13 (3.57)
Oil palm farmer	8 (1.69)	8 (2.20)	10 (2.11)	7 (1.92)	13 (2.75)	6 (1.65)	9 (1.90)	5 (1.37)	1 (0.21)	1 (0.27)	3 (0.63)	0 (0.00)	44 (9.30)	27 (7.42)
Shop seller	4 (0.85)	3 (0.82)	20 (4.23)	10 (2.75)	6 (1.27)	3 (0.82)	8 (1.69)	1 (0.27)	1 (0.21)	1 (0.27)	11 (2.33)	2 (0.55)	50 (10.57)	20 (5.49)
Labour	3 (0.63)	6 (1.65)	10 (2.11)	9 (2.47)	10 (2.11)	6 (1.65)	12 (2.54)	2 (0.55)	3 (0.63)	0 (0.00)	3 (0.63)	3 (0.82)	41 (8.67)	26 (7.14)
Business person	5 (1.06)	1 (0.27)	11 (2.33)	13 (3.57)	7 (1.48)	2 (0.55)	2 (0.42)	1 (0.27)	3 (0.63)	0 (0.00)	1 (0.21)	1 (0.27)	29 (6.13)	18 (4.95)
Fishing	4 (0.85)	5 (1.37)	1 (0.21)	1 (0.27)	1 (0.21)	0 (0.00)	3 (0.63)	3 (0.82)	0 (0.00)	0 (0.00)	9 (1.90)	1 (0.27)	18 (3.81)	10 (2.75)
Housewife	1 (0.21)	0 (0.00)	9 (1.90)	0 (0.00)	1 (0.21)	0 (0.00)	1 (0.21)	0 (0.00)	1 (0.21)	0 (0.00)	3 (0.63)	0 (0.00)	16 (3.38)	0 (0.00)
Government staff	2 (0.42)	0 (0.00)	7 (1.48)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	0 (0.00)	1 (0.21)	0 (0.00)	11 (2.33)	0 (0.00)
Rubber tree farmer	4 (0.85)	2 (0.55)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.42)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	1 (0.27)	8 (1.69)	3 (0.82)
Fruits farmer	1 (0.21)	1 (0.27)	2 (0.42)	0 (0.00)	3 (0.63)	1 (0.27)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	7 (1.48)	2 (0.55)
State enterprise	1 (0.21)	0 (0.00)	3 (0.63)	0 (0.00)	3 (0.63)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.42)	0 (0.00)	9 (1.90)	0 (0.00)

Chicken farmer	0 (0.00)	1 (0.27)	0 (0.00)	2 (0.55)	0 (0.00)	2 (0.55)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	5 (1.37)
Crab cage farmer	1 (0.21)	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	1 (0.27)
Cow farmer	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.55)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.55)
Fishing cage farmer	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)
Soft shell crab farmer	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)
Student	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.21)	0 (0.00)
Wild hunter	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.27)
Others	1 (0.21)	1 (0.27)	1 (0.21)	0 (0.00)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.63)	1 (0.27)
SUM	69 (14.59)	55 (15.11)	151 (31.92)	116 (31.87)	122 (25.79)	85 (23.35)	72 (15.22)	55 (15.11)	14 (2.96)	13 (3.57)	45 (9.51)	40 (10.99)	473 (100.00)	364 (100.00)

Note: M means main occupation; and S means secondary occupation

4.3 Local perception about the project

Figure 4 shows attitude of respondents towards the EGAT's mangrove plantation project at Chumphon Islands National Park, Chumphon province, Thailand. More than half of the respondents (67.6%) replied that they knew about the project; in contrast, about 1/3 of them (26.5%) did not know about the project; and a few of them (5.9%) were not sure which organization was in charge as there had been many mangrove forest plantation projects at Chumphon Islands National Park.

Figure 5 shows age distributions by local people's attitudes regarding EGAT's mangrove plantation project, and respondents of ages between 41 to 50 years were the most uninformed group followed by those of age over 60 years. Respondents of ages between 31 and 40 years were dominant in the "not sure" group, followed by respondents of ages from 41 to 50 years and then those from 51 to 60 years in decreasing order. This could be useful for the future local public campaigns to inform groups about the project, by age ranges.

4.4 Benefit perceptions from the project

Figure 6 presents the local people's perceptions on eight issues of direct benefit from the EGAT's mangrove plantation project, and indicates that more than half of the respondents were unsure about the benefits to catching ocean seafood products; wild hunting; wood for construction; firewood; or wood for hunting tools (51.03%; 58.41%; 87.91%; 87.91%; and 89.38% respectively). This could be because the mentioned direct benefits mainly impact inside the Chumphon Islands National Park, while the local people do not reap such benefits due to the national park regulations.

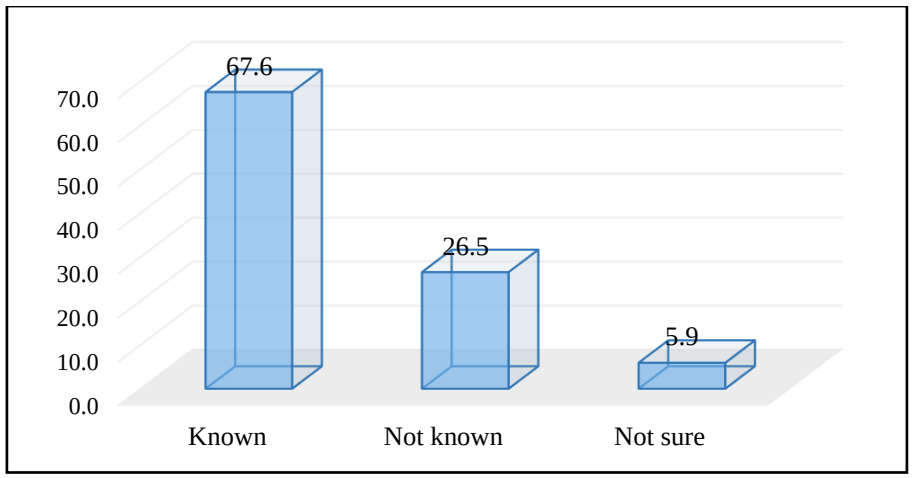


Figure 4. Local attitudes towards EGAT's mangrove plantation project (n = 339)
Source: The authors' elaboration

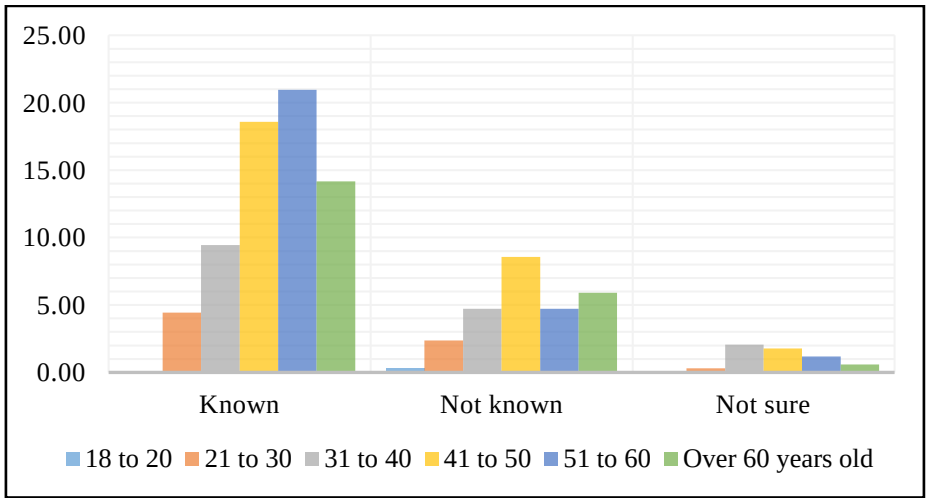
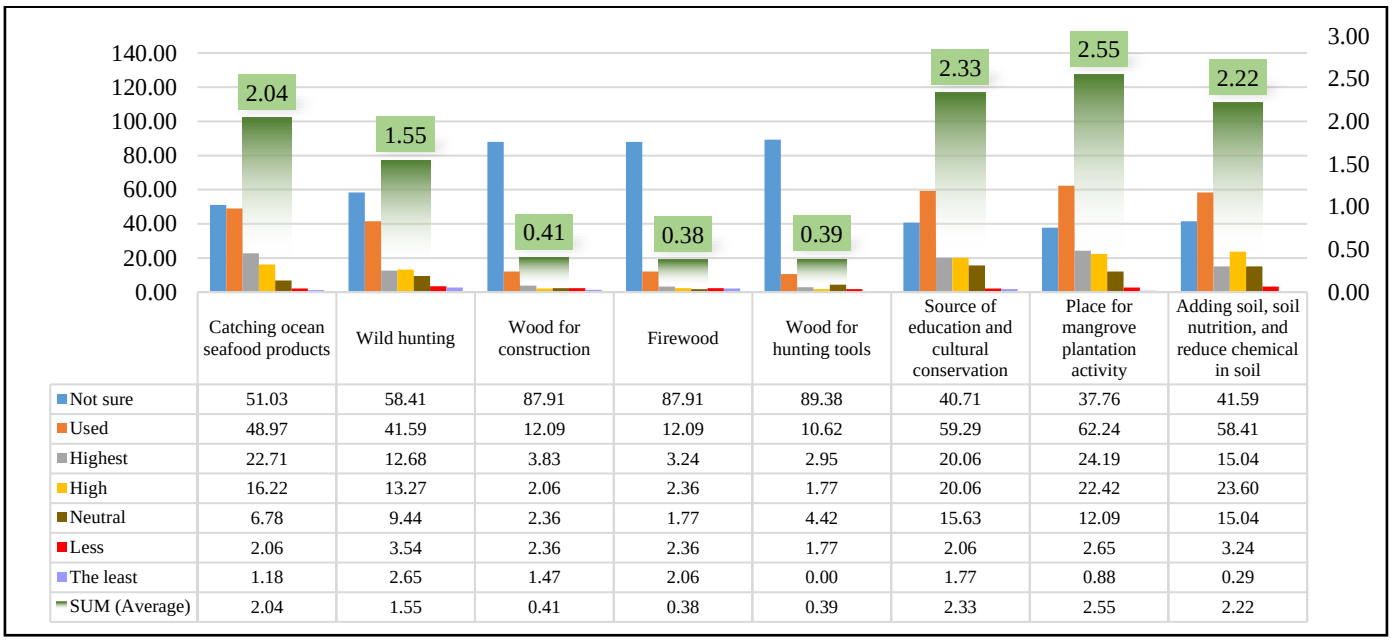


Figure 5. Crosstabulation between age and local attitudes (n = 339)
Source: The authors' elaboration



	Catching ocean seafood products	Wild hunting	Wood for construction	Firewood	Wood for hunting tools	Source of education and cultural conservation	Place for mangrove plantation activity	Adding soil, soil nutrition, and reduce chemical in soil
Not sure	51.03	58.41	87.91	87.91	89.38	40.71	37.76	41.59
Used	48.97	41.59	12.09	12.09	10.62	59.29	62.24	58.41
Highest	22.71	12.68	3.83	3.24	2.95	20.06	24.19	15.04
High	16.22	13.27	2.06	2.36	1.77	20.06	22.42	23.60
Neutral	6.78	9.44	2.36	1.77	4.42	15.63	12.09	15.04
Less	2.06	3.54	2.36	2.36	1.77	2.06	2.65	3.24
The least	1.18	2.65	1.47	2.06	0.00	1.77	0.88	0.29
SUM (Average)	2.04	1.55	0.41	0.38	0.39	2.33	2.55	2.22

Figure 6. Local perceptions about direct benefits from the EGAT's mangrove plantation project (n = 339)
Source: The authors' elaboration

Table 5. Activities prohibited in the National Park Act 2019 and the penalty

Section	Prohibited Activities	Section	Penalty
19	(1) Massively clearing	41	Imprisonment for 4-20 years, or 400,000.00 to 2,000,000.00 TH Baht fined, or both
	(2) Collecting, Taking away wood	42	Imprisonment for not exceeding 5 years, or Not exceeding 500,000.00 TH Baht fined, or both
	In case of seasonal renewable natural resources, and the cost does not exceed 2,000.00 TH Baht	42	Not exceeding 5,000.00 TH Baht fined
	(3) Luring, or Taking wild animals away, or Injuring wild animals	43	Imprisonment for not exceeding 5 years, or Not exceeding 500,000.00 TH Baht fined, or both
	(6) Making an entry for performing any activity with a view of seeking benefits	44	Imprisonment for not exceeding 2 years, or Not exceeding 200,000.00 TH Baht fined, or both
	(7) Bringing into it tools for hunting animals or catching animals or any weapons	45	Not exceeding 10,000.00 TH Baht fined

Source: Summarized from the National Park Act 2019, pages 8; 15-16 [45]

This is concordant with the National Park Act 2019; section 19; 41 to 45 as presented in Table 5 [45].

However, the rest of direct benefits such as source of education and cultural conservation; place for mangrove plantation activity; and adding soil, soil nutrition, and reducing chemicals in soil, were perceived useful by more than half of

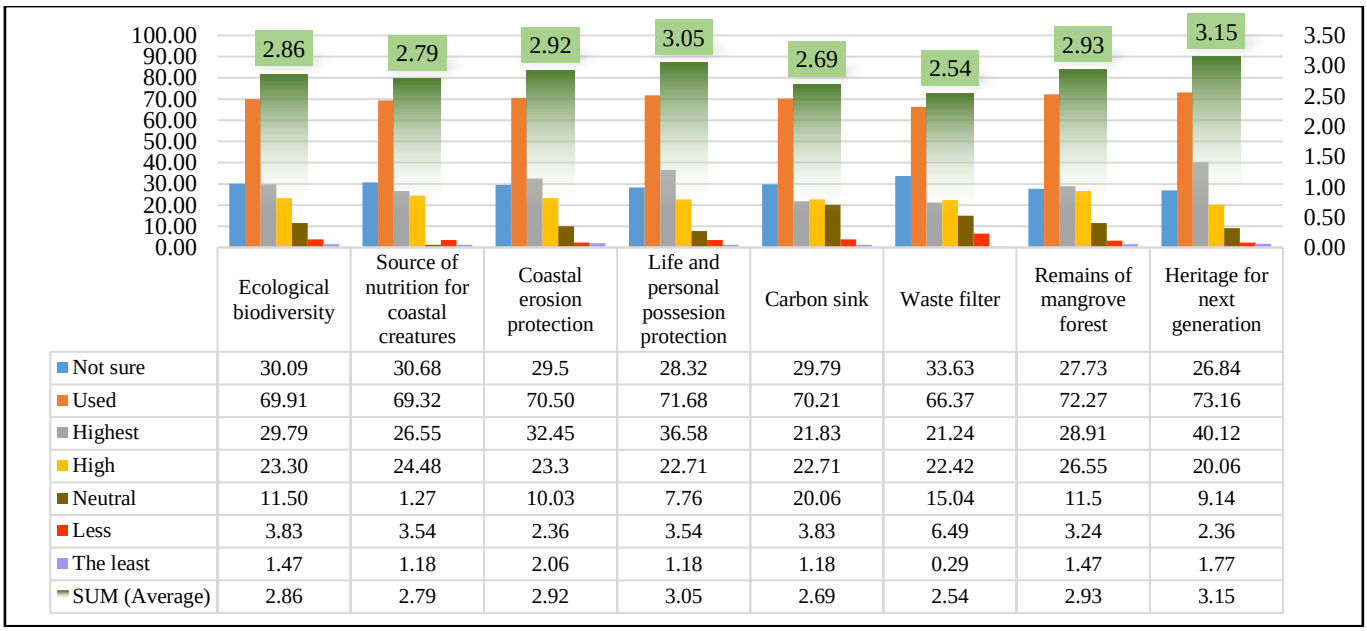
the respondents (59.29%; 62.24%; and 58.41% respectively). Similar results from Benin, Bangladesh, and India showed that local people perceived direct benefits to fishing, crabbing, firewood, and wood collection; and in addition, a small number of respondents believed that they can access the prohibited mangrove area to get some natural resources for living as they had a limited choice for economic livelihoods [19, 46, 47].

Figure 7 presents the local people's perceptions on eight issues of indirect benefits from EGAT's mangrove plantation project, indicating that two-thirds of respondents replied they receive these indirect benefits (69.91%; 69.32%; 70.50%; 71.68%; 70.21%; 66.37%; 72.27; and 73.16% respectively).

Almost all indirect benefits were perceived by most respondents at the highest level; exceptions are the indirect benefits of carbon sink, and place of waste filter (high level). This could be due to these two issues being quite difficult to understand for the local respondents. In addition, the average perception of life and personal possession protection ($\bar{x} = 3.05$), as well as heritage to next generation ($\bar{x} = 3.15$) were at medium level. Similar results from Bangladesh and India found that cyclone, storm and flood protection was highest; while carbon sequestration had the lowest benefit perception [19, 46].

4.5 Overall social impacts

Figure 8 presents the local respondents' perceptions on overall social impacts from the project, and there were 67.55 percent of respondents who perceived that they received positive impacts at 4.07 average level; 27.14 percent of respondents perceived no change from the project; and very few of them (5.60 percent) perceived that there were negative impacts from the project at 2.37 average level. Examples of negative impacts from the project were that the increased mangrove forest had wild animals which annoy nearby communities, such as monkeys and monitor lizards. Similar problems in Bangladesh and India were caused by tigers and crocodiles [19, 46].



	Ecological biodiversity	Source of nutrition for coastal creatures	Coastal erosion protection	Life and personal possesion protection	Carbon sink	Waste filter	Remains of mangrove forest	Heritage for next generation
Not sure	30.09	30.68	29.5	28.32	29.79	33.63	27.73	26.84
Used	69.91	69.32	70.50	71.68	70.21	66.37	72.27	73.16
Highest	29.79	26.55	32.45	36.58	21.83	21.24	28.91	40.12
High	23.30	24.48	23.3	22.71	22.71	22.42	26.55	20.06
Neutral	11.50	1.27	10.03	7.76	20.06	15.04	11.5	9.14
Less	3.83	3.54	2.36	3.54	3.83	6.49	3.24	2.36
The least	1.47	1.18	2.06	1.18	1.18	0.29	1.47	1.77
SUM (Average)	2.86	2.79	2.92	3.05	2.69	2.54	2.93	3.15

Figure 7. Local perceptions about indirect benefits from EGAT's mangrove plantation project (n = 339)
Source: The authors' elaboration

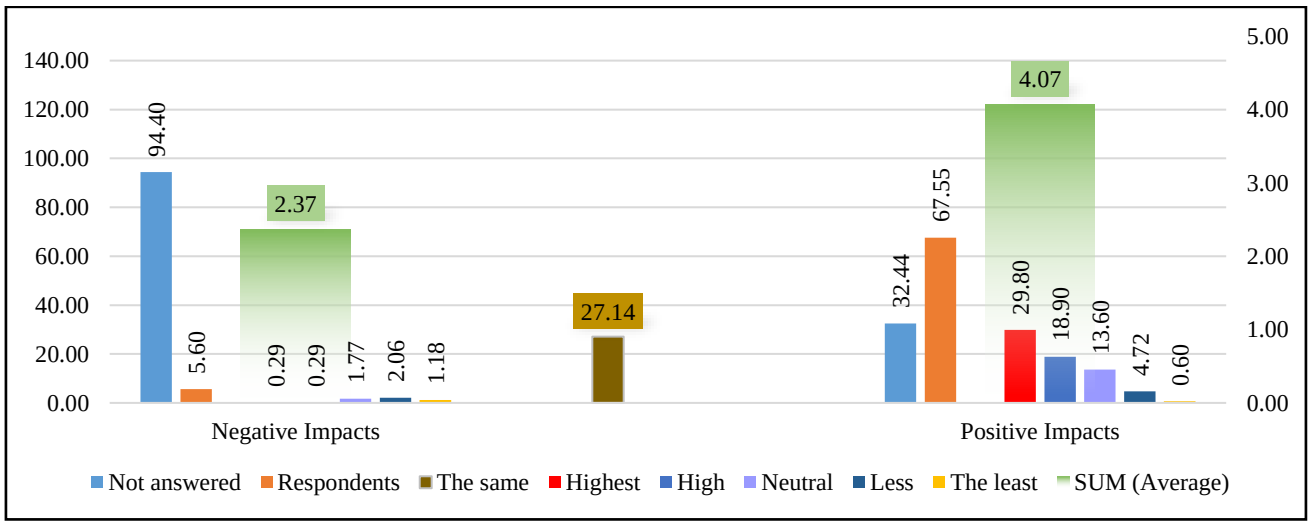


Figure 8. Local perceptions about indirect benefits from EGAT's mangrove plantation project (n = 339)
Source: The authors' elaboration

Besides, although this project was very good for the environment, the local people can't enter to take benefits inside the national park area as this is forbidden by the national park regulations and acts (see 1-5 of direct benefits). This could be related to the "sense of belonging" that Pipitone and Jović [48] mentioned, which will affect the participation in decision-making processes that change the society. However, having mangrove regulations is a way to protect against degradation of mangrove forests, and to maintain a carbon sink.

5. CONCLUSIONS

This study observed local people's attitudes via a survey focusing on EGAT's mangrove forest plantation to serve as a carbon sink at Chumphon Islands National Park, Chumphon province, Thailand, by using secondary data reviewed as well as face-to-face questionnaires with totally 339 respondents in a five kilometers radius around the project, and fortunately more than half of the respondents replied that they knew about the project.

Moreover, it was outstanding in this survey that more than half of the respondents were unsure about the five direct benefits to catching ocean seafood products; wild hunting; wood for construction; firewood; and wood for hunting tools. Activities inside the Chumphon Islands National Park that conflict with the National Park Act 2019 are prohibited, which is the main reason that the local people did not perceive much benefits.

Additionally, it was clear that the local people perceived both direct and indirect benefits as acceptably good for environment and society. In the answers, more than half of the respondents replied that they were receiving benefits from the mangrove plantation project. For example, the average ranking was more than three for benefits to life and personal possession protection, and mangrove forests could be maintained as heritage to the next generation. Two indirect benefits were still perceived at a high level, but with some lack of understanding towards the indirect benefits of carbon sink and place of waste filter.

Overall, more than half of the respondents felt that this project provided positive impacts rather than negative impacts, or no change.

The results from this study are similar to those by Limpimprorh [11], and Sriarun [12] who studied the EGAT forest plantation projects; as well as the studies by Muneenam [28], and Prince of Songkla University [29] in terms of methodology.

Contributions of this article confirm direct and indirect benefits, as well as negative impacts from forest plantation project. In addition, contribution to the EGAT or interested researcher for the future research in raising an awareness, giving education, changing perceptions and behaviors, especially on the benefit issues that occur outside the respondents' properties, or civic responsibility. Besides, future research could seek to boost the awareness about the sponsor organization based on the responses 'not known', and 'not sure' by respondents of ages ranging from 31 to 60 years old.

Finally, a scope limitation of this study is its lack of a further in-depth study regarding how to deal with the negative impacts in a future implementation.

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