



RESEARCH PAPER

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## Community utilization and knowledge on the importance of Mangroves in Barangay Ata-Atahon, Nasipit, Agusan Del Norte

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### Abstract

Investigations about some issues of mangrove forests' importance have been taken not seriously and some people were not aware of it. This study determined the community utilization and knowledge of mangroves importance in Barangay Ata-Atahon, Nasipit, Agusan del Norte. There were 290 respondents interviewed using sets of questionnaires adapted. Data were analyzed using frequency and percentages and were assessed using a 4-point Likert scale. Results showed that most of the respondents were highly aware of the presence of mangroves in the area. The community average utilization of the mangroves was extremely low which indicates that the community was not dependent on the mangroves for livelihood. Most of the respondents was also highly aware on the government programs and activities implemented to protect and conserve the mangroves species. The awareness of the significance of the mangrove and the intervention programs made by the government were sustained by the people and resulted in a positive outcome that could sustain the ecosystem of the area.

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## Introduction

Mangroves are a community of plants made of numerous species considered to be environmentally robust since they can thrive in harsh situations such as hyper salinity and sun radiation (Adame *et al.*, 2021). They provide a variety of ecological services, including support for local lives via the supply of fuel, food, and building materials (Vo *et al.*, 2012). Mangroves support a diverse range of biodiversity, including aquatic and terrestrial insects, fish, crustaceans, mammalian, amphibian, reptilian, and avian species (Nagelkerken, 2008). However, despite their importance for local livelihood, biodiversity, and carbon sequestration, mangroves are still affected by anthropogenic factors (Thomas *et al.*, 2017). Mangroves loss was estimated to be more than 3 million hectares between 1980 and 2005 - with the rate of deterioration estimated to be 1% per year between 1990 and 2000 - double the rate of terrestrial rainforests (Thomas *et al.*, 2017). The first attempt to quantify global mangrove acreage was in 1980 as part of the FAO/UNEP Tropical Forest Resources Assessment - the total area was estimated to be 15.6 million hectares (American South, 1995). Recent estimates range from 12 to 20 million hectares, occupying 121 countries and areas identified as having one or more mangrove species (Tomlinson, 1986). In 2000, the world's total mangrove forest area was 137,760 square kilometers across 118 countries and territories (Giri, 2015). Generally, the area of mangroves accounts for 0.7% of the world's total tropical forest area (Donato *et al.* 2011). This aerial estimate does not include information on forest quality.

The Philippines is rich in biodiversity in terms of number and percentage because of its geographical isolation, diverse habitats, and high rates of endemism; it is considered one of the 17 mega biodiversity countries (Garcia *et al.*, 2014). For plant species diversity, it ranks fifth in the world and is home to 5% of the flora in the world (Alcala, 1998). In terms of mangroves alone, the country is home to at least half of the world's approximately 65 species (Garcia *et al.*, 2014). However, the country's rich biological resources, particularly mangroves, are being depleted because of anthropogenic and natural disturbances.

The rehabilitation, conservation, and protection of mangrove forests along coastal areas of the Philippines should be a collaborative effort between the Local Government Units and the Department of Environment and Natural Resources (DENR) as the principal agencies for the environment in the Philippines to make sustainable long-term plans. According to the study of Goloran *et al.* (2020), some parts of the Caraga Region particularly in Agusan del Norte showed that the mangrove communities were under ecological threat due to many identified anthropogenic factors (Garcia *et al.*, 2014). Getting all the relevant data would help the concerned organizations and authorities to make informed decisions on the mangrove management and conservation efforts.

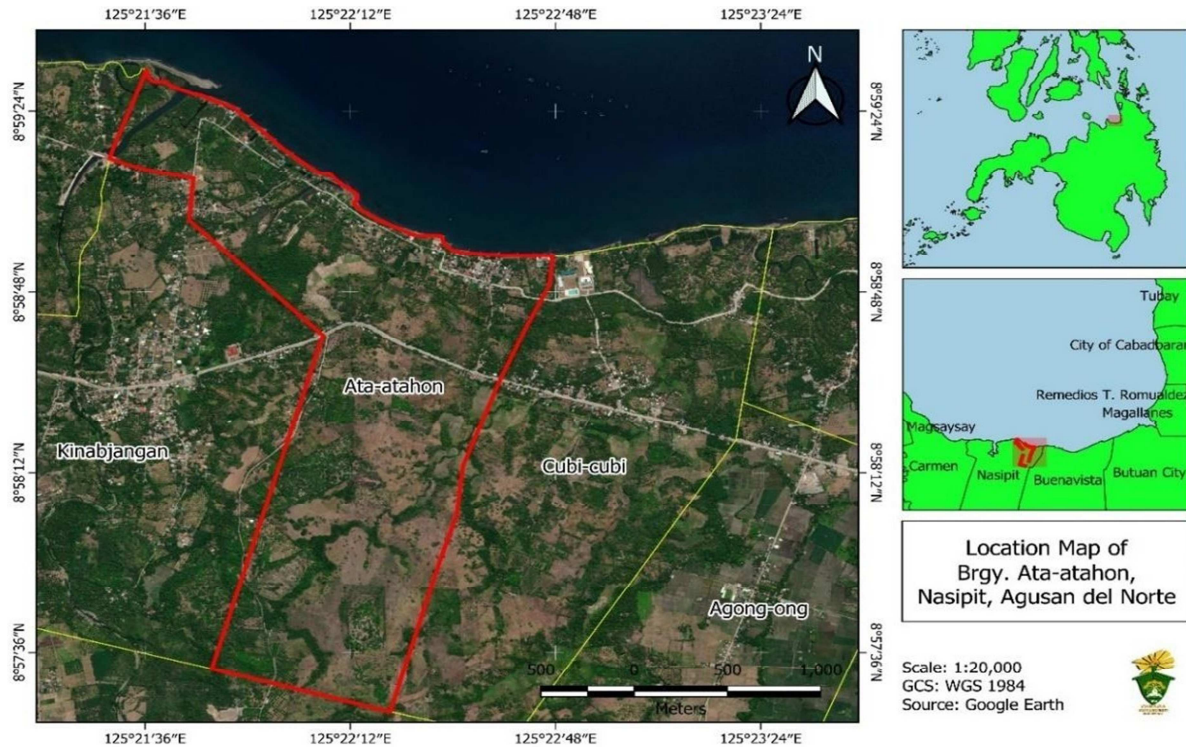
This study aimed to determine how the community in Barangay Ata-atahon, Nasipit, Agusan del Norte utilize the mangrove resources and their awareness on its importance. Barangay Ata-atahon is a community near a coastal area and was affected by the tropical storm "Auring" last 2021. This study could contribute to their awareness of the importance of mangroves when it comes to protection against calamities.

## Materials and methods

### Study area

The study was conducted in Barangay Ata-atahon, Nasipit, Agusan del Norte where mangroves are abundant along the seashore (fig. 1). Nasipit is a coastal municipality which has a land area of 144.40 square kilometers or 55.75 square miles that constitutes 5.53% of Agusan del Norte's total area. Its population as determined by the 2020 Census was 44,822.

The mangroves ecosystem in Barangay Ata-atahon are surrounded by different beaches which are more likely prone to destruction if some owners of the beach wanted to expand the area for their beaches. Most common species found in the area are Bakauan lalaki (*Rhizophora apiculata*) and Bakuan babae (*Rhizophora mucronata*).



**Fig. 1.** Map of the study area

*Research design*

This study is a quantitative type of research using survey research design to assess the people utilization and knowledge of mangroves in the area.

*Research respondents determined using Cochran’s (1963) formula:*

$$n_0 = \frac{Z^2pq}{e^2}$$

The participants of this study were the resident’s ages 18 years old and above inhabiting near or adjacent to the mangrove forest. In the 2021 Census conducted by the Barangay Health Worker, the total population of barangay Ata-Atahon is 2086 with 1157 aged 18 and above. A total of 290 respondents were selected using random sampling. This sample size was determined using Cochran’s (1963) formula is the new adjusted sample size:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Where e is the margin of error set at 0.05%, p is the estimated proportion of the population that has the attribute in question (0.5%), and q is 1 – p.

Hence, the population being studied was small, the sample size was modified using the Cochran Formula Modification equation. Here n<sub>0</sub> is Cochran’s sample size recommendation, N is the population size, and n is the new adjusted sample size.

*Research instruments*

This study utilized a structured questionnaire adapted from the studies of Alimbon and Manseguiao (2021) and Gomez and Baldago (2016). It designed to determine (1) the demographic profile of respondents, (2) community knowledge and awareness (3) community utilization (4) respondents’ awareness of government’s interventions in managing the mangroves. The questionnaire was translated into a local dialect spoken in Nasipit, Agusan del Norte for locals to understand it. Indicators for people utilization and knowledge on the importance of mangrove forests were assessed using a 4- point Likert scale.

**Results and discussions**

*Demographic Profile*

Table 1 shows the demographic profile of the respondents. More male respondents were available to answer the questionnaires, getting 50.3% of them. On the other hand, females were 49.7%.

For the age, many of the respondents (26.2%) were between the ages of 36 to 41. The married respondents had the highest number with 71.7% while single respondents were in the second rank with 22.8%, and the widowed respondents are the lowest with 5.5%. Most of the educational attainment of the respondents were high school graduate (45.2%), followed by college level (21%), college graduate (17.6%), elementary (13.8%), and vocational has the lowest percentage (2.4%).

**Table 1.** Demographic profile of the respondents

Demographic variables	Frequency	(%)
	Percentage	
Gender		
Male	146	50.3
Female	144	49.7
Age		
18 - 25	34	11.7
26 - 33	50	17.2
34 - 41	76	26.2
42 - 49	48	16.6
50 - 57	56	19.3
58 - 65	21	7.2
66 - up	5	1.7
Civil Status		
Single	66	22.8
Married	208	71.7
Widowed	16	5.5
Educational Attainment		
Elementary	40	13.8
High school	131	45.2
College Level	61	21.0
College Graduate	51	17.6
Vocational	7	2.4
Duration in Residence (years)		
5 - 15	49	16.9
16 - 25	89	30.7
26 - 35	42	14.5
36 - 45	60	20.7
46 - 55	30	10.3
56 - 65	14	4.8
66 - 75	6	2.1
Occupation		
Fisherman	81	27.9
Farmer	10	3.4
Housewife	43	14.8
Fish Vendor	33	11.4
Government Employee	53	18.3
Business/Self-employed	21	7.24
Others (i.e., skilled workers)	52	17.9
Monthly Income		
1,000 - 5,000	70	24.1
6,000 - 10,000	75	25.9
11,000 - 15,000	29	10.0
16,000 - 20,000	16	5.5
21,000 - 25,000	7	2.4
26,000-30,000	16	5.5
Didn't mention	77	26.6

For the duration of residency, most respondents have lived 16-25 years in the area (30.7%), while only 2.1% of them who had lived for 66-75 years in the area. In terms of occupation, there were more fishermen respondents which comprise 27.9%, followed by business/self-employed (25.2%), government employees (18.3%), housewives (14.8%), fish vendors (11.4%), and the lowest was farmers (3.4%). Furthermore, majority of the respondents (26.6%) did not mention their monthly income. There were 24.1% who has lowest monthly income of 1000 to 5000 pesos only. Only 2.4% of the respondents' monthly income ranges from 21,000 to 25,000 pesos.

*Level of Community Knowledge and Awareness*

Table 2 shows the level of knowledge and awareness of the respondents toward mangroves. Most respondents (91.4%) were aware of the presence of mangroves in the area, followed by a total of 6.4% whose moderately aware, 1% were less aware and only 1.4% were not aware of its presence. This observation is quite similar to the findings of Alimbon & Manseguiao (2021) and this could be because some of the respondents recently moved into the area. Public awareness of both the biological and economic importance of natural resources and the need for proper management is necessary to improve the environmental quality (Jusoff & Dahlan, 2008). There were 6.6% of the respondents aware that mangroves serve as a food source, 13.8% were moderately aware, 21.4% were less aware and 58.3% of them were not aware. Furthermore, there were 80.7% of the respondents knew that mangroves offer protection against coastal erosion and intensive wind. An identical result was recorded that mangroves provide protection (Gomez *et al.*, 2010).

On the topic of mangrove services, more respondents (61%) were aware that mangroves are a source of fuel resources. Moreover, 19% of the respondents were moderately aware of its service, 12.1% were less aware of its service, and 7.9% of respondents showed no knowledge and awareness of mangroves as a fuel resource. Awareness that mangroves provide this benefit was documented in several studies (e.g., Dencer-Brown *et al.*, 2019; Alimbon & Manseguiao 2021).

There were 81% of the respondents who were knowledgeable about the mangroves serving as habitats for other organisms. Moreover, 75.9% of respondents were very aware that mangroves are a nursery ground for fish, mollusks, crabs, and shrimps, quite similar observations to the studies of Dencer-Brown *et al.* (2019). Regarding the knowledge of supporting and regulating mangroves, 66.2% of respondents were aware that mangroves release oxygen and absorb carbon dioxide, followed by a total of 19% who were moderately knowledgeable.

Then, 12.1% were less informed. Furthermore, 2.8% of the respondents showed no idea about mangroves' function. A total of 82.1% of the respondents were idealistic that mangroves establish a good image of the sea. On the other side, only 1.7% of respondents did not appreciate it. Continuously, (77.6%) of the respondents were very aware and knowledgeable

about mangroves serving as a recreational ground and for wildlife enthusiasts.

There were 7.6% of the respondents who were not aware that mangroves can be a source of medicine. 12.4% of the respondents were moderately aware of it, 27.9% of them were less aware of its help, and 52.1% were not well informed that mangroves can be a source of medicine. A similar study reported wherein respondents demonstrated a doubtful knowledge about the medicinal use of mangroves (Sulaiman *et al.*, 2019; Alimbon & Manseguiiao 2021).

The overall results display (Table 2) an average of 3.28, indicating that the community's awareness and knowledge were rated as high, indicating that respondents have a high level of awareness and knowledge of mangroves in their area, based on the Usual Ranging of Likert Scale.

**Table 2.** Community knowledge and awareness

Community Knowledge and Awareness	Very Aware		Moderately Aware		Less Aware		Not Aware		Average	Remarks	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%			
1. Mangroves exist in my area	265	91.4	18	6.2	3	1.0	4	1.4	3.88	Very Aware	
2. Mangroves serves as a food source	19	6.6	40	13.8	62	21.4	169	58.3	1.69	Less Aware	
3. Mangroves offer protection from coastal erosion and intense wind and waves during storms	234	80.7	41	14.1	8	2.8	7	2.4	3.73	Very Aware	
4. Mangroves provide fuel resources (e.g., firewood, charcoal)	177	61.0	55	19.0	35	12.1	23	7.9	3.33	Moderately Aware	
5. Mangroves serves as habitats for other organisms	235	81.0	45	15.5	8	2.8	2	0.7	3.77	Very Aware	
6. Mangroves serve as a nursery ground for fish, mollusk, crabs, and shrimps.	220	75.9	51	17.6	11	3.8	8	2.8	3.67	Very Aware	
7. Mangroves release oxygen and absorbs carbon dioxide	192	66.2	55	19.0	35	12.1	8	2.8	3.49	Moderately Aware	
8. Mangroves can establish a good image of the sea	238	82.1	43	14.8	4	1.4	5	1.7	3.77	Very Aware	
9. Mangroves serves as recreational grounds for wildlife enthusiast	225	77.6	48	16.6	11	3.8	6	2.1	3.7	Very Aware	
10. Mangroves can be a source of medicine	22	7.6	36	12.4	81	27.9	151	52.1	1.76	Less Aware	
									Overall	3.28	High

*Level of Community Utilization*

Table 3 shows the community utilization of the mangroves. There were 87.6% of respondents claimed that they have never used mangroves as a food source, while there were only 2.4% of the respondents

honestly claimed that they have been using mangroves as a source of food. A total of 85.2% of the respondents claimed that they have never used mangroves as a source of income and this is because most of the respondents were working as a fisherman



(Table 1), which explains why they do not rely on mangroves as a source of food and income. In terms of home material utilization, a majority of 83.1% of the respondents claimed that they have never used mangroves as house furniture, while there was only 0.7% claimed that they used them as house furniture. There were also 86.2% of the respondents who claimed that they have never used mangroves as a construction material for houses; while there was only 0.7% who honestly answered that they used mangroves as a construction material. Many of the respondents claimed that they have never used mangroves as charcoal (74.8%) and firewood (73.8%).

Furthermore, 82.4% of the respondents claimed that they have never used mangroves as a fishing material and only 1% claimed that they have used mangroves as a fishing material. Continuously, most of the respondents claimed that they have never used mangroves to attain the following services: medicine (84.1%), and a coloring agent (84.5%). Even more, many respondents (90.7%) have claimed that they have never exploited mangroves for lumber to earn a living. Generally, the results revealed that the average utilization of mangroves in the area is just 1.23, which is extremely low based on the Usual Ranging of Likert Scale.

**Table 3.** Community utilization

Community Utilization	Always		Sometimes		Rarely		Never		Average	Remarks
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1. Used mangroves as a food source	7	2.4	11	3.8	18	6.2	254	87.6	1.21	Never
2. Used mangroves as source of income	3	1.0	10	3.4	30	10.3	247	85.2	1.20	Never
3. Use mangroves as house furniture (e.g., chairs, tables) and household items (e.g., baskets, mortar, tools, and handles)	2	0.7	12	4.1	35	12.1	241	93.1	1.22	Never
4. Used mangroves as construction materials for houses	2	0.7	6	2.1	32	11.0	250	86.2	1.17	Never
5. Use mangroves as charcoal	4	1.4	2	7.9	46	15.9	217	74.8	1.36	Never
6. Used mangroves as firewood	10	3.4	11	3.8	55	19.0	214	73.8	1.37	Never
7. Used mangroves as fishing materials (e.g., poles for fish traps, rafts, and boats)	3	1.0	15	5.2	33	11.4	239	82.4	1.25	Never
8. Used mangroves as medicine	3	1.0	6	2.1	37	12.8	244	84.1	1.20	Never
9. Used mangroves as a dyeing agent	1	0.3	4	1.4	40	13.8	245	84.5	1.18	Never
10. Used mangroves as commercial lumber	2	0.7	7	2.4	18	6.2	263	90.7	1.13	Never
	Overall								1.23	Very Low

*Community's Awareness of Government Intervention*

Table 4 shows how well the community was informed of the government's intervention. Many respondents reported being well-versed in the following government programs and activities: the government has specific programs or policies in place to manage mangroves (76.9 percent), and there are clear-cut laws and policies in place to prohibit the cutting of trees in mangroves (79.3 percent), there is a government employee who conducts regular monitoring in the use of mangroves (59.7 percent), and there have been various seminars and training programs (72.4 percent). Based on the results, there were only 2.4% of the respondents who were not aware of the government's programs for managing mangroves, and in terms of policies established to prohibit the cutting of mangroves, there are only 1.7%

of the respondents who were not aware about it. Only 6.65 of the total respondents were not aware about the regular monitoring conducted by the government about the mangroves in the area. There were 5.9% of the respondents who were not aware about the seminars conducted by the government in managing the mangroves. And 4.5% of the respondents were not aware about the strict imposed penalties by the government in illegal usage of mangroves. This could be because the government limits the number of people who can participate in their programs. In addition, the table 4 displays the mean (3.54), which indicates that the level of community knowledge of government intervention is very high, a result similar to that of Gomez & Baldago (2016), which also indicates that the majority of respondents who participated were very aware of the intervention

carried out by the government, particularly the Community Environment and Natural Resources

Office (CENRO) of Nasipit and the Local Government Unit (LGU) of Baranggay Ata-atahon.

**Table 4.** Government’s Intervention.

Community Awareness of Government’s Intervention	Very Aware		Moderately Aware		Less Aware		Not aware		Average	Remarks
	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
1. The government has certain programs or policies for managing mangroves	223	76.9	49	16.9	11	3.8	7	2.4	3.68	Very aware
2. There is clear-cut laws and policies of the government to prohibit cutting of trees in the mangroves	230	79.3	47	16.2	8	2.8	5	1.7	3.73	Very Aware
3. There are government employees who are conducting regular monitoring in the use of mangroves.	173	59.7	64	22.1	34	11.7	19	6.6	3.35	Moderately Aware
4. There have been various seminars and trainings conducted about managing the mangroves ecosystems.	168	57.9	66	22.8	39	13.4	17	5.9	3.33	Moderately Aware
5. The government has strictly imposing penalties to individuals illegally utilizing mangroves.	210	72.4	54	18.6	13	4.5	13	4.5	3.59	Very Aware

**Conclusion**

Based on the results and findings of the study, mangrove areas of Barangay Ata-atahon are well handled by the local government of Nasipit. The awareness of the significance of the mangrove and the intervention programs made by the government in the management of the mangrove ecosystem are maintained by the people and resulted in a positive outcome that could sustain the ecosystem of the area.

These government efforts in controlling the use of mangrove resources have had a significant impact both on the people and on the environment. The results of this study infer to maintain and further strengthen the need to preserve mangrove forests and restore those degraded areas to ensure the provision of good and services needed to support the biodiversity and functioning of wide portions of its ecosystem.

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**Conflict of interest**

The authors declare no conflicts of interest regarding the publication of this manuscript.

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