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Environmental Knowledge and Attitude of Coastal Community in Decision Making to Participate in Mangrove Rehabilitation in Sinjai District South Sulawesi Indonesia

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ABSTRACT

Adversity in the past has provided lessons, information, and understanding of coastal communities about the importance of adequately conserving and managing mangrove forests and encouraged their attitude towards mangrove rehabilitation. The study aims are to analyse the influence of knowledge and attitude of coastal communities on the decision to participate in mangrove rehabilitation in Tongke-Tongke village, Sinjai district, South Sulawesi. A household survey was conducted in August 2019. Structured questionnaires were administered to 150 respondents who were selected through random sampling. The socioeconomic demographic characteristics of households were described using qualitative descriptive statistics, and a multiple regression equation examined the decision to participate with a logit model estimation. The majority of the coastal communities have a low-level education and rely on fishing and shrimp farming as their primary source of income. Knowledge and attitude play a critical role in determining their understanding and behaviour concerning mangrove rehabilitation, with positive and significant effects.

1. INTRODUCTION

Mangroves are one of the most useful coastal ecosystems in the tropics and subtropics, providing many ecosystem goods (such as fuelwood, charcoal, food, medicines, and construction materials) and services (such as carbon sequestration, coastal protection, prevention of saltwater intrusion, provision of breeding and nursery grounds for marine and pelagic species, education and scientific research, and ecotourism) for human well-being [1, 2].

There are a total of 15.2 million hectares of mangrove forests worldwide, distributed among the regions of Asia (38%), Africa (21%), North and Central America (15%), Oceania (13%), and South America (13%) [3]. In addition, Richards and Friess [4] reported that more than one-third of the world's mangroves are found in Southeast Asia, and Indonesia is the largest mangrove area (more than 2.7 million hectares; observed 2000). However, in recent decades, communities around the mangrove area have been highly dependent on the mangroves, resulting in heavy exploitation and deforestation [5, 6]. Therefore, it is crucial to conserve and rehabilitate the mangrove areas to preserve their products for the livelihood of the communities.

Sinjai district, in South Sulawesi province, Indonesia, is one of the hotspots of mangrove areas and has become a popular tourist destination [7]. However, mangrove exploitation, mainly for the expansion of aquaculture ponds, began in the 1930s [8], with the most prominent development occurring in the last three decades [9]. Mangrove rehabilitation has been carried out on the initiative of the local community since 1984 [8]. The local community's environmental knowledge and attitudes toward mangrove protection and sustainable management are thought to be the trigger [10, 11]. Sugandini et al. [12] revealed that environmental knowledge and perceived environmental responsibility influence attitudes and decisions to protect mangroves.

Tejada et al. [13] found that good community knowledge plays an important role and affects their appreciation of mangrove resources and their willingness to participate in conservation activities. The local community's knowledge about mangroves, attitude, and practice in mangrove rehabilitation is critical for successful mangrove rehabilitation.

Therefore, the objective of this study is to analyze the influence of the coastal community knowledge and attitudes on decision-making regarding mangrove rehabilitation in Tongke-Tongke Village in Sinjai District, South Sulawesi. The study highlights the socioeconomic demographic characteristics of the coastal community, as well as their level of knowledge and attitude toward mangrove rehabilitation and why the community chooses to participate in mangrove rehabilitation. A household survey using structured questionnaires is used in fieldwork. Then, to test participation decisions, qualitative descriptive statistical descriptions are implemented to examine households' socioeconomic and demographic features, and multiple regression equations and Logit model estimations are used. This study contributes to mangroves and manages their sustainable use.

2. METHODOLOGY

2.1 Study area

The study was conducted in the Sinjai District mangrove area of South Sulawesi, Indonesia, focusing on communities living around the mangrove rehabilitation area in Tongke-Tongke village. The study area is placed between latitude 5°8' - 5°11' and longitude 120°14' - 120°17' (Figure 1).

The study site is approximately 220 kilometers from Makassar City, the capital of South Sulawesi Province, and five kilometers from Sinjai District Center. In 2016, mangroves covered approximately 688 hectares and were dispersed in the coastal and riverine zones [7]. In 2018, Tongke-Tongke village had 4,287 people, the majority of whom worked as fishermen and shrimp farmers [14].

2.2 Data collection and analysis

A household survey in Tongke-Tongke village was used to conduct fieldwork in August 2019. Random sampling was used to identify 150 respondents who lived near mangrove areas and relied on mangrove services to complete structured questionnaires. The questionnaire contains information about the respondents' socioeconomic demographics (such as their age, education, occupation, household income), respondents' knowledge of mangrove functioning, benefits of mangrove goods and services, and attitudes toward mangrove rehabilitation initiatives. The authors and trained enumerators questioned the household heads.

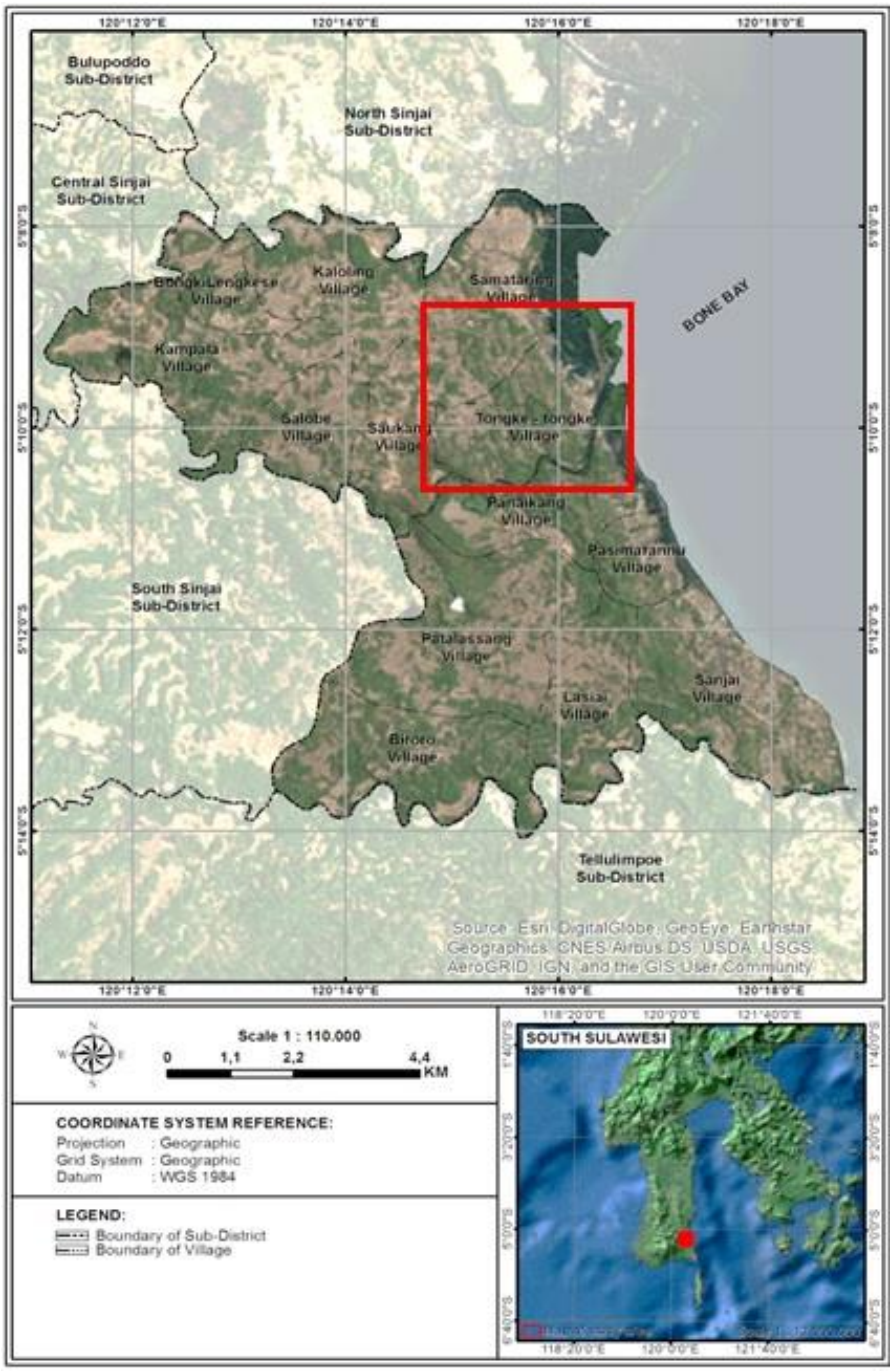

Figure 1. Study area: Tongke-Tongke Village, Sinjai District, South Sulawesi, Indonesia

Data were analyzed using qualitative descriptive statistics to describe the socioeconomic demographic characteristics, knowledge level, communities' attitude towards mangrove functions, and benefits of products and services and rehabilitation. Furthermore, the coastal community's decisions on mangrove rehabilitation were represented by the response to the qualitative dependent variable or logit model [15]. The model is based on logistic distribution, which describes the dichotomous dependent variable model in most cases. The cumulative logistic probability function model is written as follows:

$$Z_i = Ln\left(\frac{Pi}{1-Pi}\right) = \beta_0 + \beta_i X_i \quad (1)$$

According to Eq. (1), multiple regression equation estimation model [15, 16] with logit model estimation [15] is used for the decision of coastal communities to rehabilitate mangroves as follows:

$$\frac{P_i}{1-P_i} = DCRM = \beta_0 + \beta_1 Ag + \beta_2 Edu + \beta_3 Kw + \beta_4 Att + \beta_5 \pi H + \mu \quad (2)$$

where, P_i: probabilities with values between 0 and 1. $DCRM$: Decision of the coastal community to rehabilitate mangroves (1, decided on participation; 0, for other). β_0 : intercept. $\beta_1, \dots, \beta_5$: regression coefficient of the independent variable. Ag: age (year). Edu: education (year). Kw: knowledge. Att: attitude. πH: household income. μ: error term.

The specification model Eqns. (1) and (2) were equipped with measurement of model accuracy (*adjusted* R^2) and hypothesis testing (F-test and t-test). The measurement of model accuracy or suitability (*goodness of fit*) was calculated by *adjusted* R^2, as follows [16, 17]:

$$Adjusted\ R^2 = 1 - (1 - R^2)\frac{(n-1)}{(k-1)} \quad (3)$$

where, *Adjusted* R^2: coefficient of determination adjusted. k: number of variables did not include intercept. n: number of samples.

Furthermore, the hypothesis testing on the regression coefficient is jointly used the F-test with a certain level of confidence, as follows [16, 17]:

$$F\ hitung = \frac{ESS/(k-1)}{RSS/(n-k)} \quad (4)$$

$$Ftabel\ [(k-1):(n-k);\alpha] \quad (5)$$

where, α: level of significance or specification error. k: number of variables did not include intercept. n: number of samples.

Testing of the regression coefficient individually (partially) used the t-test with a certain level of confidence, as follow [17, 18]:

$$t\ test = \frac{\beta i}{S\beta i} \quad (6)$$

$$t\ table\ [(n-k);\alpha/2] \quad (7)$$

where, β_i: regression coefficient of *i*. $S\beta_i$: standard error of regression coefficients to *i*.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic-demographic characteristics of Household

The summary results of socioeconomic-demographic characteristics of household respondents provide in Table 1. Based on gender, most of the respondent is dominated by male (64.67%). The high of the male sex is related to the dominance of livelihood in the fishery sector in this area.

Table 1. Summary of socioeconomic-demographic profiles of respondents

Variables	Frequency (f)	Percentage (%)
Gender		
Male	97	64.67
Female	53	35.33
Total	150	100.00
Age (in years)		
20 - 30	36	24.00
31 - 40	48	32.00
41 - 50	34	22.67
51 - 60	20	13.33
61 - 70	12	8.00
Total	150	100.00
Educational achievement		
No completed elementary school	62	41.33
Elementary school (SD)	47	31.33
Junior high school (SMP)	24	16.00
Senior high school (SMA)	13	8.67
University	4	2.67
Total	150	100.00
Occupation		
Fisherman	83	55.33
Shrimp farmer	26	17.33
Seaweed farmer	18	12.00
Firewood collector	6	4.00
Civil servant	4	2.67
Businessman	13	8.67
Total	150	100.00
Household income (in USD/month)		
34 - 69	41	27.33
76 - 138	42	28.00
145 - 207	30	20.00
214 - 276	15	10.00
283 - 345	13	8.67
352 - 414	9	6.00
Total	150	100.00

Currency rate on 25 March 2021: 1 USD = 14,500 Rupiahs

The age structure is crucial in identifying a person's status and role in the community and knowing and understanding their views on specific issues [13]. Age influences a person's decision-making and behaviors [18], and it is linked to responsibilities, rights, and duties [19], as well as the maturity level of an individual's response to mangrove functions and benefits, as well as rehabilitation [13]. The majority age brackets of the respondents in this area were between 31 and 40 years (32%), with 20-30 years coming in second (24%). As

a result, the productive ages of the population are the majority in this area.

When it comes to educational achievement, most of the respondents (41.33%) did not complete Elementary School, followed by Elementary School graduates (31.33%). It indicates that most coastal communities in this area have a poor education level. Besides, this finding confirms the widely held belief that most local coastal communities have a low education standard.

In terms of occupation, more than half of respondents (55.33%) work as fishermen, followed by shrimp farmers (17.33%). Furthermore, it reveals that the majority of communities living near the coastal area are highly dependent on fishery resources, with this sector becoming the predominant source of income for the coastal community in this area. According to the FAO [20], approximately six million people out of a population of 250 million work in fisheries and aquaculture in Indonesia, with small-scale fisheries accounting for nearly all fishery products.

Finally, in connection to the household income, most of the respondents (28%) earned between 76 USD and 138 USD per month, followed by 34 USD to 69 USD per month (27%). According to the 2020 Indonesian Statistics Agency report [21], most household income is less than 138 USD per month, implying that most household revenues are low and still in the poor category. This research backs up the findings of Malik et al. [22], who found that most coastal settlements in South Sulawesi are in poor condition and have a low household income.

3.2 The influencing factors of coastal community in the decision-making to participate in mangrove rehabilitation

After studying the coastal community's influencing elements (age, education, occupation, knowledge, and attitude) in determining to repair mangroves, Table 2 reveals that the model's accuracy value (adjusted R^2) is 0.266. The independent variables account for 26.60 percent of the total, whereas others (73.40%) have no influence.

Table 2. The influence factors of coastal communities on decision-making to participate in mangrove rehabilitation actions

Independent Variable	E.S	Coefficient (β_i)	t-test	Sig.
Age	+	0.081^{ns}	0.718	0.474
Education	+	0.144^{ns}	1.355	0.178
Knowledge	+	0.394***	3.238	0.001
Attitude	+	0.316***	2.550	0.012
Household income	+	0.003^{ns}	0.057	0.955
Intercept		-0.625		
F-test		11.811		
Adjusted R^2		0.266		
n		150		

*is a level error significance of 5 % (0,05), or confidence level 95 %. E.S is an expectation sign. ns is not significant.

Furthermore, the F-test showed that all independent variables, including age, education, knowledge of mangroves, attitudes, and household income, simultaneously significantly affect the coastal community's decisions to participate in mangrove rehabilitation. When the test is expanded with the t-test, knowledge and attitudes variables have a positive and significant effect with an error rate of 5% (0.05) and a confidence level of 95%, while other factors have no significant effects. It is in line with Hakim and Darusman's [23] finding that age, education, occupation, and income do not affect the coastal communities deciding on mangrove forest management in the Wonorejo Village East Java Indonesia.

Their knowledge and attitudes significantly influence the understanding and behavior of communities in mangrove rehabilitation issues. Public awareness based on knowledge and attitude is the key to mangrove rehabilitation and management success [24], and becomes a capacity basis for the coastal community to participate in pro-environmental behavior and is considered the first phase to a change towards acting pro environmentally, including participating in mangrove rehabilitation and Management [13]. Besides, the environmental problems considered serious are factors driving the protection and rehabilitation of mangrove areas among stakeholders [25].

In era 1980s, mangrove areas on the east coast of the Sinjai District, including the Tongke-Tongke coastal area, had experienced high exploitation due to logging and aquaculture ponds development. Abrasion and seawater intrusion has caused coastal lands to erode, ponds to be damaged, and people's water to become salty in many coastal areas. Many residential areas are inundated by rising seas, threatening settlements, and fishing boats destroy and lose when storms and large waves occur [8, 9]. Coastal communities have been encouraged to maintain and rehabilitate mangrove forests as a natural fortress defense against erosion, seawater incursion, storms, and large waves due to these experiences.

4. CONCLUSIONS

The influence of coastal community knowledge and attitudes on decision-making to participate in mangrove rehabilitation actions in Tongke-Tongke Village, Sinjai District, South Sulawesi has a positive and significant effect with an error rate of 5% (0.05) and a confidence level of 95%. In contrast, other factors (age, education, and household income) have no significant effects. The accurate model values (adjusted $R^2 = 0.266$) indicates that the independent variables account for 26.60 percent of the total, whereas other variables (73.40%) have no influence.

Some mangrove benefits and services are familiar to half of the coastal community, and they are typically supportive of mangrove rehabilitation activities. Past adversity has offered lessons, information, and understanding of the significance of adequately protecting and managing mangrove forests and encouraged their attitude to conduct mangrove conservation and rehabilitation. However, as mangrove cutting and extension of aquaculture ponds still occur in this area, local authorities should provide comprehensive counseling to the community about mangrove conservation and rehabilitation to improve their understanding and awareness.

The limitations of data on independent variables, such as length of stay, number of families supported by respondents, as well as the frequency of counseling and rehabilitation activities in this area, are thought to cause the Adjusted R^2 value to be low, despite the variables of knowledge and attitude having a significant influence. Therefore, future research is recommended to be able to cover it.

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