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## The Relationship Between The Health of Mangrove Forests and The Level of Community Welfare

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# The Relationship Between The Health of Mangrove Forests and The Level of Community Welfare

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**Abstract.** An assessment of the forest health condition needs to be carried out to ensure that the condition of mangrove forest health is maintained. Margasari Village is where the average community works as fishermen and utilizes the mangrove forest as ecotourism. Therefore, the condition of the mangrove forest needs to be in good condition. This research was conducted in Margasari Village, Labuhan Maringgai District, East Lampung Regency. This study aims to obtain the value of mangrove forest health status and determine the relationship between mangrove forest health indicators and community welfare. Research methods to determine the value of forest health status using Forest Health Monitoring (FHM). SPSS 20 statistical spearman rank correlation test was used to determine the relationship between mangrove forest health and community welfare, with 44 respondents using village communities who operate mangrove forests. The results showed that the average value of mangrove forest health status in Margasari Village was 5.40 (moderate category). Indicators of the level of community welfare related to the health level of mangrove forests in Margasari Village are health and nutrition, education, and indicators of housing and environment.

## 1. Introduction

Mangrove forests are forests that grow in river estuaries, tidal areas, or the edge of the sea and are highly productive ecosystems with the same primary production level as humid tropical forests that are evergreen throughout the year [1]. Mangrove forest in Margasari Village is a mangrove forest ecosystem with potential both physically, economically, and ecologically [2]. The mangrove forest in Margasari village has an area of 817.59 ha [3]. The site has increased because it only had an area of 700 ha [4]. The functions of mangrove forests can be categorized into three, namely biological/ecological functions, physical functions, and socio-economic functions [5]. One of the benefits of mangrove forests in Margasari Village is to increase people's standard of living. This can be seen from two conditions, namely the condition of the mangrove ecosystem as a whole (pond land, agricultural land, salt ponds, ecotourism) and the condition of the ecosystem components as a primary biotic component (flora and fauna) [6]. Based on this, the existence of mangrove forests in Margasari Village is vital for the life around them, especially for the welfare of coastal communities, so there is a need for forest health management. The community in Margasari Village is very dependent on the existence of mangrove forests as an increase in community welfare. Furthermore, the various benefits of mangrove forests



impact the community's economy, especially in improving the welfare of rural communities, so that mangrove forests need to be maintained to maintain the community's economy [4].

Forest health management is an effort to integrate knowledge about the ecosystem, dynamics, and genetics of disturbing organisms with economic considerations, so that the risk of damage is below the threshold of loss through monitoring forest health [7]. Forest health monitoring is a method of monitoring, assessing, and reporting on the current status, changes, and long-term trends of forest ecosystem health [8]. A healthy forest is formed, where biotic and abiotic factors are not limiting factors in achieving forest management objectives [9]. Forest health monitoring is carried out to anticipate concerns that climate change could cause new types of damage that were never previously discovered [10]. In addition, forest health monitoring is carried out to protect a mangrove forest conditions from damage caused by biotic and abiotic factors. According to [11], the function of mangrove forests on the biological environment is considerable, considering that these forests are primary ecosystems that are crucial for supporting life in coastal and ocean areas. According to [12], forest health monitoring aims to find out the current forest condition, changes, and trends that may occur. This problem makes forest health monitoring essential to be applied in various types of woods, one of which is mangrove forests in Margasari Village, which uses mangrove forests to fulfill needs.

The relationship between mangrove forests and community welfare cannot be separated so that the community around the mangrove forest needs to maintain and use the mangrove forest optimally to preserve the forest so that it remains healthy and can improve the welfare of the surrounding community. In addition, research on the relationship between forest health and community welfare in Margasari Village has not been carried out. This research is expected to optimize forest use for community welfare while maintaining good forest conditions. This research was conducted to determine the relationship between the level of community welfare through the health condition of mangrove forests in Margasari Village, Labuhan Maringgai District, East Lampung Regency.

## 2. Research Methodology

### 2.1. Time and study site

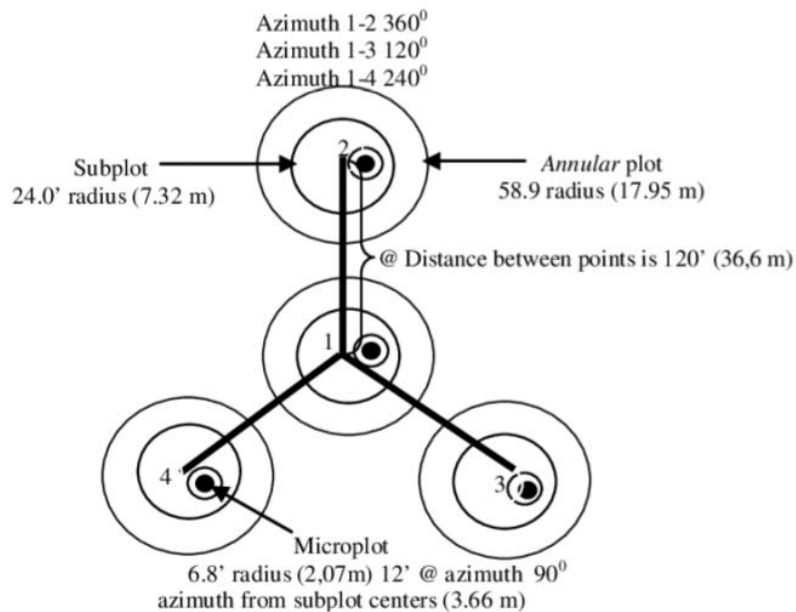
This research was conducted in August-September 2020 in the mangrove forests of Margasari Village, Labuhan Maringgai Subdistrict, East Lampung District.

### 2.2. Materials

The tools used consisted of a forest health tally sheet, colored mica plastic, tacks, paralon (1.5 inches), compass, permanent marker, density scale card, and tree canopy transparency, Global Positioning System (GPS), binoculars, meter, forest health book, welfare level questionnaire, and digital camera.

### 2.3. Methods

**2.3.1 Making clusters-plot of Forest Health Monitoring (FHM).** The determination of the number of cluster-plots to be made is based on a Regulation of the Director General of Forestry Planning and Environmental Management No P.1/PKTL/IPSDH/PLA.1/1/2017 regarding Technical Guidelines for Forest Inventory in Protected Forest Management Units (KPHL) and Production Forest Management Unit (KPHP). The number of sampling plots is carried out proportionally to the number of sampling plots considering the size of the dominant stratum (strata B and C) and the dominant type of mangrove in Margasari Village (the types are *Avicennia marina* and *Rhizophora mucronata*), so there are 4 cluster-plots. The shape of the FHM cluster-plot can be seen in Figure 1.



**Figure 1.** FHM cluster-plot design (USDA Forest Service, 1999).

Field data collection was obtained by measuring the parameters of the ecological indicators of forest health using the FHM method. Ecological indicators of forest health used include productivity through measuring stem diameter, vitality through measuring tree damage and crown conditions, and site quality through measuring the Cation Exchange Capacity (CEC) [13][14].

Three indicators of forest health measurement are used, namely productivity, vitality, and site quality. The data obtained were used to determine the health status of the forest as measured by FHM. The mangrove forest health assessment is obtained from the final value of the forest health condition, which results from the multiplication of the weighted value and the score value of each forest health indicator. The formula for the final value of forest health [15], namely:

$$NKH = NT \times NS$$

Where, NKH is the final value of forest health condition, NT is the parameter weighted value of each forest health indicator, NS is the parameter score value of each forest health indicator.

**2.3.2. Data Collection of Community Welfare Indicator.** The community welfare data was collected by direct interviews with respondents who are determined based on the purposive sampling method through a questionnaire. Interviews were conducted to obtain data on indicators of community welfare to determine their relationship with forest health. The parameters used to determine the levels are according to [16], which states that knowing the level of community welfare is through indicators of health and nutrition, education, employment, housing, and the environment. The selected variables are directly related to the condition of the community in utilizing the mangrove forest and affect the health of the mangrove forest. The selection of Margasari Village because this village operates the mangrove forest they have by increasing their household, the use of welfare is feared to threaten the condition of the existing mangrove forest. Therefore, village selection was carried out to determine whether the relationship between community welfare and mangrove forest health was optimal or not.

The number of respondents is determined by taking 15% of the population in Margasari Village. The size of the sample depends on the level of accuracy or error tolerance desired by the researcher. However, if the error tolerance level in the study is 15%, the maximum error rate taken is 5% (0.05).

The more significant the error rate, the smaller the number of samples, and conversely, the smaller the error rate, the greater the number of pieces obtained. With a selection of 44 respondents, it requires a smaller error rate [17]. According to [18], the population of Margasari Village is 2,106 households. Based on this population, the number of samples to be taken in Margasari Village is 44 respondents, especially in the community who carry out management and utilization around the mangrove forest. The determination of the number of samples is calculated using the Slovin formula, namely:

$$n = \frac{N}{N(e^2) + 1}$$

Explanation:

n : Number of respondents

N : The total number of family leaders (kepala keluarga/KK) in Margasari Village

e : Precision 15%

*2.3.3. Determining the Relationship Between Forest Health Indicators and Community Welfare Indicators.* The method of analyzing data on the relationship between forest health and community welfare around the mangrove forest in Margasari Village used in this study was inferential analysis using Rank Spearman analysis using the SPSS Statistical 20. According to [17], Spearman Rank correlation is used to find a relationship or test the significance of the hypothesis if each variable is ordinal, and the data sources between variables do not have to be the same, so use this instrument to determine the relationship between two existing variables. that is, the difference between the health of mangrove forests and the level of community welfare. Variable Y is obtained from welfare indicators (health and nutrition, education, employment, and level of housing and environment). Then variable X is the health of the forest which is obtained from internal factors of forest health (productivity, tree damage / CLI Cluster Plot Index, damage to the canopy / Voliage Crown Ratio (VCR), and soil CEC). That data is obtained from the calculation of ecological indicators on each cluster-plot. Then interpret the strength of the relationship of each variable can be determined through the following values [19]:

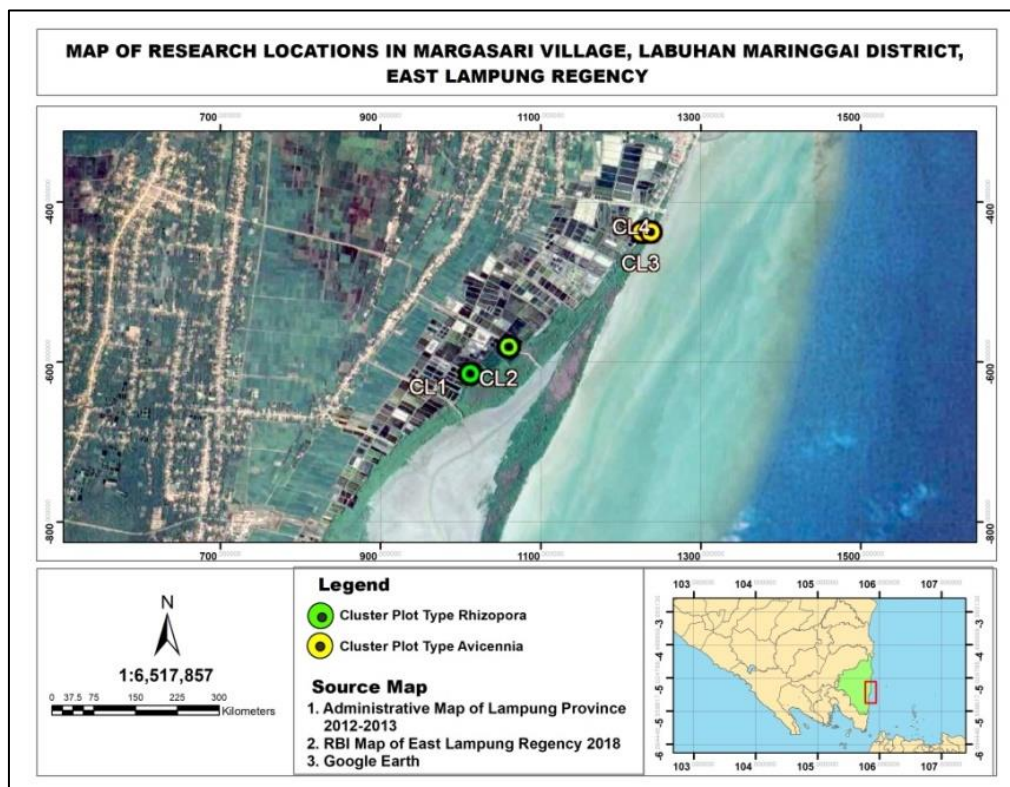
**Table 1.** Guidelines for the strength of the relationship for each variable

<b>Coefficient</b>	<b>Strength of the relationship</b>
0.00 – 0.25	Very weak correlation
0.26 – 0.50	Sufficient correlation
0.51 – 0.75	Strong correlation
0.76 – 0.99	Very strong correlation
1.00	Perfect Correlation

### 3. Results and Discussions

#### 3.1. General Condition of the Location

Margasari Village is located in Labuhan Maringgai subdistrict, East Lampung District, Lampung Province. This village has an area of ± 1,702 hectares [6]. The total population in Margasari Village is 8,784 people with 2,106 family heads consisting of 12 hamlets and 48 RT [18]. Margasari Village is a coastal or coastal village typology. The village, which is located at an altitude of 1.5 meters above sea level, has a flat landscape and is one of the coastal villages. Margasari Village has a sandy soil texture, with the color of the soil mainly being gray [18]. Margasari Village has natural potential in the form of mangrove forests which are currently being developed into an ecotourism area.



**Figure 2.** Map of the research location and the location for the formation of the FHM plot cluster.

The mangrove forest in Margasari village has an area of 817.59 ha [3]. This area has increased because previously, it only had an area of 700 ha [4]. The tourism management by the community is managed by a combination of fishermen groups, the Margajaya group, pamswakarsa, and a group of women farmers who love maritime. The community plays an active role in ecotourism management due to their awareness that mangrove forests play an essential role in the lives of the surrounding community [20].

The types of mangroves in this village include white fires (*Avicennia marina*), oil mangroves (*Rhizophora apiculata*), jeruju (*Acanthus ilicifolius*), and red pidada (*Sonneratia caseolaris*). The mangrove forest in this village is dominated by white fire mangroves (*Avicennia marina*) and oil mangroves (*Rhizophora apiculata*) [21]. This forest health assessment was conducted in an area dominated by both types of mangroves in the village. Most of the residents work as fishermen. There are also shrimp paste processing groups, fish processing groups, farmer groups, and mangrove groups in this village [22]. The Cinta Bahari Women's Group also carries out the utilization and processing of mangrove forest products [23]. This group uses mangrove forest products to make various forms of food and drink while still paying attention to its sustainability aspects.

### 3.2. Respondents Characteristics

Age affects the physical ability of people in an area to do work. Productive age is the age with an age range between 15-64 years. Ages under 15 years and over 64 years are categorized as unproductive and no longer productive [24]. The average age of community respondents around the mangrove forest in Margasari Village is in the productive category (Table 2).

**Table 2.** Age distribution of respondents in villages around the mangrove forest based on the economically productive age group in Margasari Village

Age Group (years)	Number (People)	Percentage (%)
0-14	0	0.00
15-64	42	95.45
> 64	2	4.55
Total	44	100

Source: Processed from field data

The majority of community respondents in Margasari Village are in the 15-64 year age group whose jobs depend on the existence of mangrove forests. This age group shows that people whose jobs are related to mangrove forests are people of productive age to carry out their work. The majority of the productive age allows people to optimize their work in improving the welfare of the community's household. According to [16], the productive working age is 15-64 years old. The practical age level of the community can optimize their work for household welfare. The community can also understand the importance of optimally utilizing the forest [25].

Education is one aspect that can be used as an indicator in measuring the quality of human resources. A higher level of education will promote the rational thinking pattern of a person in the community around the forest. The knowledge that farmers have can affect the factors of sustainable forest management [26]. The distribution of respondents to the village community around the mangrove forest based on the level of education can be seen in Table 3.

**Table 3.** Distribution of community respondents around mangrove forests based on the level of education in Margasari Village

No	Education level	Amount (people)	Percentage (%)
1	No school	1	2.27
2	Elementary School	15	34.10
3	Junior High School	11	25.00
4	Senior High School	16	36.36
5	Undergraduate/Graduate	1	2.27
Total		44	100

Source: Processed from field data

The majority of respondents' education level is Senior High School with a percentage of 36.36%, and the second highest level of education is Elementary School with a percentage of 34.10%. The high level of education shows that education is necessary for the communities around the mangrove forest. However, not all people have the ability to get higher education. Higher education can also better influence a job and adopt technology, innovation to get a higher income.

The number of family members is the total number of family members who live under one roof and are the family's responsibility. The distribution of respondents in the number of family members of the village community around the mangrove forest of Margasari Village can be seen in Table 4.

**Table 4.** Distribution of respondents the number of family members of the community around the mangrove forest in Margasari Village

Number of Family Members (people)	Amount (people)	Percentage (%)
1-2	16	36.37
3-4	22	50.00
5-6	6	13.63
Total	44	100

Source: Processed from field data

The majority of respondents' families around the mangrove forest of Margasari Village have between 3 and 4 family members. The number of family members affects the level of the daily cost of a family. The more members of a family will affect the more costs incurred to meet family needs.

### 3.3. Assessment of forest health condition based on ecological indicators

Ecological indicators of mangrove forest health used in this study include productivity through measurement of LBDs, vitality by measuring tree damage and canopy conditions, and site quality through measuring soil CEC. The results of measuring the health condition of the forest are shown in Table 5.

**Table 5.** Results of measurement of mangrove forest health value for each indicator

Cluster-plot FHM	LBDs (m <sup>2</sup> /ha)	CLI	VCRc	Soil CEC (me/100g)
1	0,031	2,80	2,52	15,79
2	0,028	1,96	2,99	16,76
3	0,045	2,70	2,70	16,68
4	0,51	1,58	3,58	13,39

Source: Processed from field data

Ecological indicators of mangrove forest health used in this study include productivity through measurement of LBDs, vitality by measuring tree damage and canopy conditions, and site quality. The highest productivity value is found in cluster-plot 3 (0.045 m<sup>2</sup> / ha), while the lowest productivity value is in cluster-plot 2 (0.028 m<sup>2</sup> / ha) (Table 5). One of the factors that determine the size of the diameter is the age and distance of the plant. A wide spacing will make plants more adaptable to the environment [27, 28]. The mangrove forest in Margasari Village has quite a tight spacing, especially in plot clusters 1 and 2, to protect the coastline from being attacked by waves while reducing the risk of abrasion. The level of productivity needs to be considered in forest management, as stated by [15], stated that the high or low productivity in the forest indicates the success rate of forest management rough measuring soil CEC. The results of measuring the health condition of the forest are shown in Table 5.

The highest tree damage (CLI) occurred in clusters 1 (2.80), and the lowest occurred in cluster-4 plots. The level of tree damage depends on the location where the damage was found, the type of damage, and the severity of a tree. Damage that occurs to trees in the mangrove forest can occur due to biotic and abiotic factors. Several biotic factors can cause tree damage in mangrove forests, namely pathogens, pests, and fungi. In contrast, abiotic factors can cause tree damage in mangrove forests, such as human activities, natural disasters, and environmental conditions [29]. In addition, climate change causes increased forest destruction and tree mortality from direct and indirect causes [30].

The greatest canopy damage occurred in cluster plot 5 (3.58), while the lowest occurred in cluster plot 1 (2.52). The highest VCR value indicates that the canopy condition has a good crown density. The high density of a tree can be interpreted that the tree has a canopy cover with lush foliage so that the need for photosynthesis to support tree growth can be met [31].



The results showed that the highest CEC value was in cluster plot 2 (16.76). According to [31], in mangrove forests in East Lampung district, the CEC value of land is included in clay illite and Clay Klorite, having CEC values of 16.53-20.19 me / 100g with medium low capacity. Soils with high CEC can absorb and provide nutrients better than soils with low CEC. Because nutrient elements are present in the colloid absorption complex, these nutrient elements are not easily washed away by water [32].

### 3.4. The final value of mangrove forest health

Based on the multiplication result between the weighted value and the value of the ecological indicator parameter score for forest health in each FHM plot, the final value of mangrove forest health is obtained. Weighted values of tree growth (productivity), soil fertility, and tree damage conditions used to assess the health of mangrove forests refer to research conducted by Apriyani et al. [31] shown in Table 6.

**Table 6.** Weighted values on indicators of mangrove forest health

Indicators	Weighted values
Productivity	0.00
Canopy condition	0.32
Tree damage	0.27
Soil fertility	0.36

Source : Apriyani *et al* [33]

The forest health value is obtained from the multiplication of the score and the weighted value. The weighted values used to assess forest health are shown in Table 6. The health condition category of mangrove forests is determined by calculating the forest health status threshold, which is divided into three criteria for the health condition of conservation forests, which include good, moderate, and bad conditions [33]. The threshold value of forest health status is based on the parameter values of forest health indicators (Table 7).

**Table 7.** Health threshold values for mangrove forests

The threshold value for mangrove forest health	Mangrove forest health condition criteria
6.17 – 7.08	Good
5.26 – 6.16	Moderate
4.33 – 5.25	Bad

Source: Processed from field data

Value of mangrove forest health condition in each cluster-plot with mangrove forest health condition category (Table 8).

**Table 8.** Value of mangrove forest health status in East Lampung Distric

FHM cluster-plots	The final value of mangrove forest health	Mangrove forest health condition category
1	5.99	Moderate
2	6.55	Good
3	7.08	Good
4	4.33	Bad
Average	5.99	Moderate

Source: Processed from field data

The average forest health condition in the Mangrove Forest of Margasari Village, Labuhan Maringgai subdistrict, is moderate, or it can be quite good (5.99). This medium category indicates that

the level of forest health in Margasari Village still needs to be further improved to provide more optimal benefits and maintain its sustainability. The high level of forest health indicates that forest management has been carried out well. Each forest health indicator (productivity, vitality, biodiversity, and site quality) is in good condition [34]. Meanwhile, the low level of forest health indicates that the management of mangrove forests is not good. The mangrove forest in East Lampung Regency is a protected forest, so this forest area is naturally intended to regulate water management, prevent floods, and erosion and maintain soil fertility. So far, the government and the community have worked together to conserve mangrove forests. However, the surrounding community does not fully understand the importance of maintaining the condition of mangrove forests. Some people take advantage of mangrove forests but ignore their sustainability. Many people, especially tourists who litter around mangrove tourism, commit acts of vandalism against mangrove trees that cause damage to these trees. This understanding still needs to be improved to maintain the health condition of mangrove forests in order to stay good.

### 3.5. Determination of The Relationship Between The Level of Welfare Indicators and The Health Level of Mangrove Forests

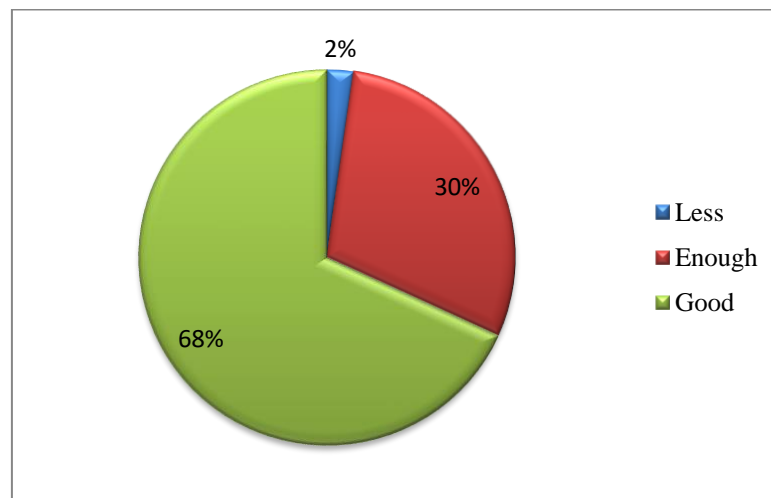
The parameters used to determine the level of welfare are according to [16], which states that the determination of the level of community welfare is through indicators of health and nutrition, education, employment, housing, and the environment. The chosen variable is because it is directly related to the condition of the community in utilizing the mangrove forest and affects the health of the mangrove forest. Indicators of community welfare and forest health are related if the limit of the opportunity value is not less than the number 0 and the significant correlation is less than the value of 0.05, which means that the two variables have a significant relationship. The strength of the correlation is determined based on the value of the correlation coefficient based on the value of the interval in table 1. Based on the Spearman rank correlation analysis, the indicators of community welfare are related to the health level of mangrove forests. The related indicators are the level of health and nutrition, education, level of housing, and environment (Table 9).

**Table 9.** The relationship between the health of the mangrove forest and the indicators of the level of welfare of the people of Margasari Village around the mangrove forest

Forest Health	Welfare Level Indicator			
	Health and Nutrition	Education	Employment	Housing and the Environment
Correlation coefficient	0.904*	0.833*	0.211	0.822*
Opportunity Value	0.013	0.039	0.688	0.045

Information: \*. Significant correlation at 0.05 level of significance (2-tailed)

Health and nutrition have a strong positive relationship with the health of mangrove forests, with a correlation value of 0.904 at a significance level of 0.05 (Table 9). This relationship shows that the higher the health level of mangrove forests, the higher the community's health and nutrition. A good forest health condition can indicate the level of stability of the ecological environment in a forest area to help maintain the ecological balance of the environment, including the surrounding community [35]. The state of good forest health shows that the presence of pollutants is relatively low. However, pollutants are the leading cause of soil quality decline, which can affect the health condition of mangrove forests, affecting the surrounding community's health. Most of the people's health and nutrition are in good condition. The distribution of the level of health and nutrition of the community around the mangrove forest is presented in Figure 3.

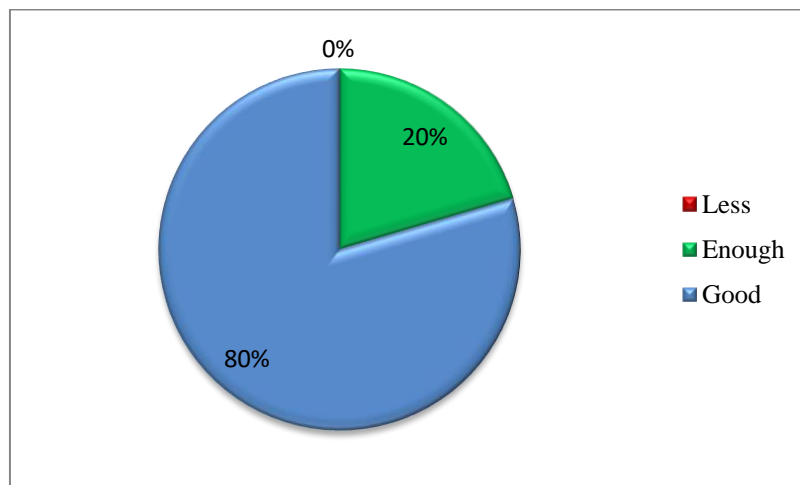


**Figure 3.** Distribution of community health and nutrition levels

The people around the mangrove forest in Margasari Village do not complain about the existence of mangrove forests as a cause of health problems experienced by the community. The existence of mangrove forests is felt to impact their health and nutrition, especially for life positively. Mangrove forests provide a food source because they are the home of marine animals consumed by the surrounding community and have high nutritional value. It can be an additional income to meet their daily needs. One of the forest health indicators that affect the health conditions of the people around the mangrove forest is the site quality indicator. According to [36], the condition of polluted soil will indirectly affect the health condition of the community, so that the community needs to prevent contamination of soil condition. Soil conditions, especially water quality, which is not affected by the surrounding polluting conditions, among others, due to changes in soil physical. The presence of these pollutants is the leading cause of the decline in soil quality which can affect the health condition of mangrove forests and public health [35].

Good site quality conditions indicate that the availability of nutrients for mangrove forests and for plant cultivation activities is sufficient; from this, the community is very concerned about soil quality conditions. Contaminated soil conditions will indirectly affect public health conditions, so people need to prevent contamination of soil conditions [36]. The people of Margasari Village apply concern for soil conditions, one of which is by not disposing of waste carelessly, which can damage soil nutrients. Various hazardous and toxic chemicals that contaminate the soil are sourced from seepage of garbage accumulations, wastewater treatment plants, and other sources. The presence of these pollutants is the leading cause of soil quality decline, which can affect the health condition of mangrove forests [35, 37].

The education indicator has a strong positive/unidirectional relationship with the health of the mangrove forest, with a correlation value of 0.833 at a significance level of 0.05 (Table 9). This relationship shows that the higher the level of education, the higher the level of forest health. Community education here is intended as a parameter of community adoption of the knowledge and insights possessed by the community. The community carries out management and utilization of mangrove forests as an effort to increase income and production of forest products. Most community education is in good condition. The distribution of the education level of the community around the mangrove forest is presented in Figure 4.

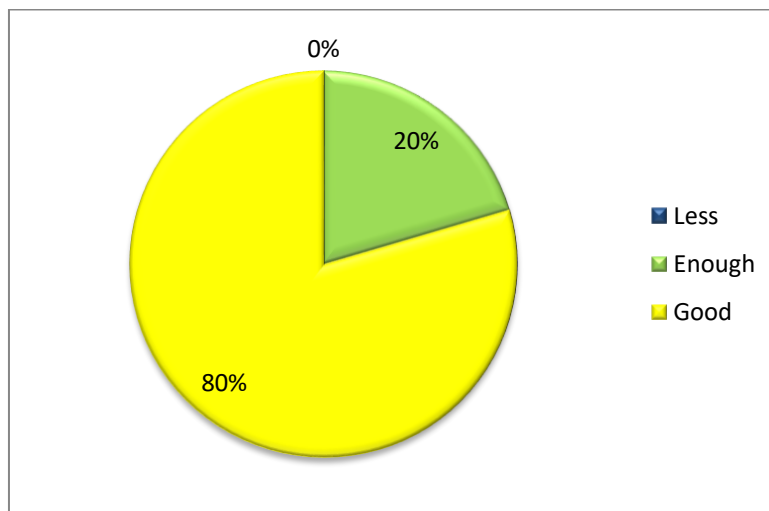


**Figure 4.** Distribution of community education levels

A high level of education can have a broader understanding of the benefits and ways of optimizing mangrove forests. According to [38], the education factor is one of the socio-economic factors that influence people's perceptions of forests and their functions, forest and land rehabilitation programs, and the level of participation. The high level of education allows the community to optimize the source of their livelihoods while maintaining forest sustainability. Communities with a high level of knowledge tend to have a high level of concern for protected forests. This shows that community knowledge affects one's view; if one's knowledge is high, the better one judges something, and the better one understands. This means that a person's level of knowledge can affect his mindset or level of consciousness, especially in maintaining good forest conditions in line with [39]; the higher the level of public knowledge, the better and higher the level of public awareness. The excellent health condition of mangrove forests can also provide the development of various kinds of products from mangrove forests. According to [40], the state of a healthy mangrove forest can provide potential that can be developed, one of which is the use of environmental services. Communities can have an understanding that mangrove forests provide many benefits for the environment and their lives. Mangroves also play an essential role in protecting the coast from storms, sea animal spawning grounds, abrasion barriers, and so on [41].

Community knowledge is intended as how much knowledge and insight are possessed by people who are active in managing and utilizing mangrove forests. According to [39], the higher the level of public knowledge, the better and higher the level of public awareness. The community around the forest who actively participates in extension activities and discussions will have an open insight into the management decisions made in managing forest land. People who have high knowledge can preserve the forest so that the health condition of the forest becomes healthy [42]. The experience and habits of managing forests from generation to generation by the community are also a factor in the wise use of mangrove forests [43].

Housing and environmental indicators have a strong positive relationship with forest health, with a correlation value of 0.822 at a significance level of 0.05 (Table 9). This relationship shows that the higher the housing and environmental indicators, the better the health condition of the forest, and vice versa, the higher the health condition of the forest will affect the housing and environmental conditions of the community around the mangrove forest. According to [44] that the Utilization of forest resources is generally for their own needs or interests and public buildings in the village and community craft materials. Most of the housing and community levels are in good condition. The distribution of housing and community levels around the mangrove forest is presented in Figure 5.



**Figure 5.** Distribution of housing and neighborhood levels

The community views the forest as a business land and provider of various daily needs. It maintains a stable environmental condition so that the condition of the forest must be well preserved. Good housing conditions and the environment around the mangrove forest also affect the health condition of the mangrove forest. This is in line with [45] the community's interaction with the forest has been going on for quite a long time because the existence of the forest has provided many benefits for people's lives. The surrounding community depends on the resources in the mangrove forest and can provide added value to their lives. These natural products can come from the natural environment and come from the environment cultivated by humans [46]. The community views the mangrove forest in Margasari Village as business land and a provider of various daily needs.

#### 4. Conclusion

The conclusions of this research are, indicators of the level of community welfare that positively affect the health of mangrove forests are indicators of health and nutrition, education, and indicators of housing and environment. This positive relationship occurs because the existence of the community around the mangrove forest is inseparable from the health condition of the mangrove forest, as well as the existence of mangrove forest, which cannot be separated from the condition of the surrounding community that uses its forest products, both animal and vegetable. This shows that people's dependence on forests needs to pay attention to their forests' health condition to be maintained.

#### Authorships

All authors in this paper are main authors.

#### References

- [1] Carugati, L., Gatto, B., Rastelli, E., Lo Martire, M., Coral, C., Greco, S., & Danovaro, R. 2018 Impact of mangrove forests degradation on biodiversity and ecosystem functioning *Scientific Reports* **8** 1 pp 1–11
- [2] Ariftia, R.I., Qurniati, R., & Hermawati, S. 2014 Nilai ekonomi total hutan mangrove Desa Margasari Kecamatan Labuhan Maringgai Kabupaten Lampung Timur *Jurnal Sylva Lestari* **2** 3 pp 19-28
- [3] Putra, A.K., Bakri, S., & Kurniawan, B. 2015 Peranan ekosistem hutan mangrove pada imunitas terhadap malaria: studi di Kecamatan Labuhan Maringgai Kabupaten Lampung Timur *Jurnal Sylva Lestari* **3** 2 pp 67-78

- [4] Kustanti, A., Nugroho, B.M., Nurrochmat, D.R., & Okimoto, Y. 2014 Evolusi hak kepemilikan dalam pengelolaan ekosistem hutan mangrove di Lampung Mangrove Center *Jurnal Risalah Kebijakan Pertanian dan Lingkungan* **1** 3 pp 143-158
- [5] Giri, C., Pengra, B., Zhu, Z., Singh, A., & Tieszen, L.L. 2007 Monitoring mangrove forest dynamics of the Sundarbans in Bangladesh and India using multi-temporal satellite data from 1973 to 2000 *Estuar. Coast. Shelf Sci* **73** pp 91–100.
- [6] Kustanti, A. 2011 *Manajemen Hutan Mangrove*. Buku. Institut Pertanian Bogor Press. Bogor. 248 hlm.
- [7] Sumardi dan Widyastuti, S. M. 2007 *Dasar-Dasar Perlindungan Hutan*. Buku. Gadjah Mada University Press. Yogyakarta. 228 hlm.
- [8] Ardiansyah, F. and Safe'i, R. 2021 Analysis of Changes in Health of Coastal Mangrove Forest on the East Coast of Lampung. *Annual Conference on Health and Food Science Technology 2020*. pp 1-7.
- [9] Rikto. 2010 Tipe Kerusakan Pohon Hutan Kota (Studi Kasus: Hutan Kota Bentuk Jalur Hijau, Kota Bogor-Jawa Barat). Skripsi. Departemen Konservasi Sumberdaya Hutan dan Ekowisata, Fakultas Kehutanan. IPB. Bogor. 128 hlm.
- [10] Wulf S., Cornelia, R, Anna, H. R, Soren, H., Goran, S. 2013 On the possibility to monitor and assess forest damage with in largescale monitoring programmes –Asimulation study. *Journal of Silva Fennica*. **47** 3 pp 1–18.
- [11] Ritohardoyo, S., & Ardi, B.G. 2014. Arahan kebijakan pengelolaan hutan mangrove: kasus Pesisir Kecamatan Teluk Pakedai, Kabupaten Kuburaya, Provinsi Kalimantan Barat. *Jurnal Geografi* **11** 1 pp 43-57
- [12] Mangold, R. 1997 *Forest Health Monitoring: Field Method Guide*. Book. USDA Forest Service. New York. 197 hlm.
- [13] Woodall, C.W., Michael, C. A., William, A. B., John, W. C., Sarah J., Charles, H. P., Kadonna, C. R., Beth, K. S., Gretchen, C. S., Borys, T., & Susan, W. 2011 Status and future of the forest health indicators program of the USA *Journal Environ Monit Assess* **177** 1 pp 419–436
- [14] Safe'i, R., Hardjanto, Supriyanto and Sundawati, L. 2014 Value of Vitality Status in Monoculture and Agroforestry Planting Systems of the Community Forests *International Journal of Sciences: Basic and Applied Research* **18** 1 pp 340–353
- [15] Safe'i, R., Hardjanto., Supriyanto., Sundawati, L. 2015 Pengembangan metode penilaian kesehatan hutan rakyat sengon (*Falcataria moluccana* (miq.) barneby & j.w. grimes) *Jurnal Penelitian Hutan Tanaman* **12** 3 pp 175-187
- [16] Badan Pusat Statistik. 2014 *Lampung Tengah dalam Angka*. Book. Badan Pusat Statistik Provinsi Lampung. Bandar Lampung.
- [17] Sugiyono. 2007. *Statistik Non Parametrik untuk Penelitian*. Book. Cetakan kelima. CV Alfabeta. Bandung. 403 hlm
- [18] Hartati, F. 2020. *Nilai Manfaat Langsung dan Eksistensi Ekosistem Mangrove di Provinsi Lampung*. Skripsi. Fakultas Pertanian Universitas Lampung. Lampung. 76 hlm.
- [19] Sarwono, J. 2006. *Analisis Data Penelitian Menggunakan SPSS*. Buku. Andi. Yogyakarta. 248 hlm.
- [20] Prasetyo, D., Darmawan, A., and Dewi, B.S. 2019 Persepsi wisatawan dan individu kunci tentang pengelolaan ekowisata di *Lampung Mangrove Center*. *Jurnal Sylva Lestari* **7** 1 pp 22-29
- [21] Supriyanto., Indiyanto., Bintoro, A. 2014 Inventarisasi jenis tumbuhan obat di hutan mangrove Desa Margasari Kecamatan Labuhan Maringgai Kabupaten Lampung Timur *Jurnal Sylva Lestari* **2** 1 pp 67-76
- [22] Cesario, A.E., Yuwono, S.B., and Qurniati, R. 2015 Partisipasi kelompok masyarakat dalam pelestarian hutan mangrove di Desa Margasari Kecamatan Labuhan Maringgai Kabupaten Lampung Timur *Jurnal Sylva Lestari* **3** 2 pp 21-30
- [23] Desmania, D., Harianto, S.P., and Herwanti, S. 2018 Partisipasi kelompok wanita cinta bahari dalam upaya konservasi mangrove. *Jurnal Sylva Lestari* **6** 3 pp 28-35

- [24] Alfrida, A., and Noor, T. I. 2017 Analisis pendapatan dan tingkat kesejahteraan rumah tangga petani padi sawah berdasarkan luas lahan *Jurnal Ilmiah Mahasiswa Agroinfo Galuh* **4** 3 pp 426-433
- [25] Pratama, A.B., Yuwono, S.B., & Hilmanto, R. 2015 Pengelolaan hutan rakyat oleh kelompok pemilik hutan rakyat di Desa Bandar Dalam Kecamatan Sidomulyo Kabupaten Lampung Selatan *Journal Sylva Lestari* **3** 2 pp 99-112
- [26] Rochmah, S.F., Safe'i, R., Bintoro, A., Kaskoyo, H. and Rahmat, A. 2021 The effect of forest health on social conditions of the community *The 1st Universitas Lampung International Conference on Science, Technology and Environment 2020* pp 1-7
- [27] Marliah, A., Hidayat, T. & Husna, N. 2012 Pengaruh Varietas dan Jarak Tanam Terhadap Pertumbuhan Kedelai (*Glycine max* (L.) Merrill) *J. Agrista* **16** pp 22-28
- [28] Dung, B. X., & Thanh, D. T. K. 2021 Runoff and Soil Erosion Response to Clear Cutting Period of Acacia Plantation in A Headwater Mountain of Vietnam *Applied Research in Science and Technology* **11** pp 12–25
- [29] Safe'i, R., Latumahina, F. S., Suroso, E., & Warsono. 2020 Identification of durian tree health (*Durio zibethinus*) in the prospective nusantara garden wan Abdul Rachman Lampung Indonesia *Plant Cell Biotechnology and Molecular Biology* **21** 42 pp 103–110
- [30] Solbergh S., Naeset, E., Lange, H., & Bollandsas, O. 2015 Remote sensing of forest health *Journal Remote Sensing and Spatial Information* **36** 4 pp 161-166
- [31] Apriliyani, Y., Safe'i, R., Kaskoyo, H. Wulandari, C., Febryano, G.I. 2020 Analisis penilaian kesehatan hutan mangrove di Kabupaten Lampung Timur *Jurnal Hutan Tropis* **8** 2 pp 123-130
- [32] Nursin, A., Wardah., Yusran. 2014 Sifat kimia tanah pada berbagai zonasi hutan mangrove di Desa Tumpapa Kecamatan Balinggi Kabupaten Parigi Moutong *Jurnal Warta Rimba* **2** 1 pp 17-23.
- [33] Safe'i, R., Latumahina, F.S., Dewi, B.S., & Ardiansyah, F. 2021. Short communication: Assessing the state and change of forest health of the proposed arboretum in Wan Abdul Rachman Grand Forest Park, Lampung, Indonesia. *Journal of Biodiversitas*, 22(4), 2072-2077.
- [34] Arwanda, E.R., Safe'i, R., Kaskoyo, H., & Herwanti, S. 2021. Identifikasi Kerusakan Pohon pada Hutan Tanaman Rakyat PIL, Kabupaten Bangka, Provinsi Kepulauan Bangka Belitung, Indonesia. *Agro Bali: Agricultural Journal*. 4(3): 351-361.
- [35] Mulia, R. M. 2005. *Kesehatan Lingkungan*. Book. Penerbit Graha Ilmu. Yogyakarta. 132 hlm.
- [36] Widyanto, A.F., Yuniarno, S., Kuswanto. 2015. Polusi air tanah akibat limbah industry dan limbah rumah tangga. *Jurnal Kesehatan Masyarakat*. 10(2): 246-254.
- [37] Egwu, O.C., Jennifer, U.O., Goretti, A.C.M., Uchechukwu, O., & Marks Sydney E.U. 2021. Toxic Elements and microbial Loads in African Giant Land Snail (*Archachatina marginata*) Reared with Waste Contaminated Soil. *Applied Research in Science and Technology*, 1(1), 26–35.
- [38] Suraimah, Thamrin, E., & Iskandar, A.M. 2019 Persepsi masyarakat terhadap keberadaan hutan mangrove di Dusun Setingga Asin Desa Sebus Kecamatan Paloh Kabupaten Sambas. *Jurnal Hutan Lestari*. **7** 1 pp 482-491
- [39] Saputra, D.K., Zainal, S., Riyono, J.K. 2015 Studi tingkat kepedulian masyarakat sekitar hutan terhadap hutan lindung gunung pemancing - gunung ambawang Kabupaten Kubu Raya. *Jurnal Hutan Lestari*. **3** 4 pp 569-578
- [40] Norsidi., Suherdiyanto., & Manu, H, Y. 2021 Persepsi masyarakat mengenal pengembangan ekowisata hutan mangrove di Desa Pasir Kecamatan Mempawah Hilir. *Jurnal Kajian Ilmu dan Pendidikan Geografi*. **5** 1 pp 94-102
- [41] Siahaya, M.E., Salampessy, M.L., Febryano, I.G., Rositah, E., Silamon, R.F. dan Ichsan, A.C. 2016 Partisipasi masyarakat lokal dalam konservasi hutan mangrove di Wilayah Tarakan, Kalimantan Utara. *Jurnal Nusa Sylva*. **16** 1 pp 12-17

- [42] Harimurti C.S. 2016 *Analisis Pengetahuan Kognitif Petani Hutan dalam Pelaksanakan Program Pengelolaan Hutan Bersama Masyarakat (PHBM) di Desa Jomblang, Kecamatan Jepon, Kabupaten Blora*. Tesis. Universitas Brawijaya.
- [43] Safira, G. C., Wulandari, C., Kaskoyo, H. 2017 Kajian pengetahuan ekologi lokal dalam konservasi tanah dan air di sekitar Taman Hutan Raya Wan Abdul Rachman (Studi kasus di Desa Bogorejo Kecamatan Gedong Tataan). *Jurnal Sylva Lestari*. **5** 2 pp 23-29
- [44] Baharuddin. 2006 *Kajian Interaksi Masyarakat Desa sekitar Taman Nasional Gunung Rinjani Provinsi Nusa Tenggara Barat (Studi Kasus di Desa Panggalangan, Desa Loloan, Desa Sembalun Lawang)*. Thesis. Sekolah Pasca Sarjana Institut Pertanian Bogor. Bogor.
- [45] Girsang, R.E. 2006 *Pemanfaatan Sumberdaya Hutan oleh Masyarakat Sekitar Hutan Jati di BPKH Bancar, KPH Jatirogo, Peum Perhutani Unit II Jawa Timur*. Skripsi. Fakultas Kehutanan Institut Pertanian Bogor.
- [46] Ningrum, N.H.S. 2014 *Kajian Interaksi Masyarakat Sekitar Dengan Sumberdaya Hutan di Hutan Lindung Gunung Slamet KPH Banyumas Timur*. Skripsi. Fakultas Kehutanan Institut Pertanian Bogor.