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# Analysis of Relationships Between Forest Health Values and the Management System in the TAHURA WAR Utilization Block

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**ABSTRACT**

The existence of community activities in an area and the management carried out can determine whether the resulting Forest Health Value is good or bad. This research aims to analyze the relationship between Forest Health Values and the management system implemented in the TAHURA WAR (Wan Abdul Rachman Forest Park) Utilization Block. The methods used include measuring forest health using the FHM method and conducting interviews using a Likert scale. Data analysis of the relationship between forest health and management systems is conducted using Rank Spearmen. The results showed that the overall forest health condition was moderate, with a relatively high level of farmers' participation in its management was quite high, indicating effective management. The level of farmer participation at the implementation stage shows a significant relationship with forest health, as indicated by a coefficient of 0.049, while other stages such as planning (0.276), maintenance (0.379), utilization (0.485), and protection (0.307) show a lower relationship. Nevertheless, the value of 0.466 indicates a lack of a notable relationship between forest health and management effectiveness. One of the factors causing the insignificance is the internal factors of farmers, such as land ownership. Therefore, the relationship between forest health and the overall management system is not significant.

## 1. INTRODUCTION

Wan Abdul Rachman Forest Park (TAHURA WAR) is divided into six areas: protected area, utilization area, traditional area, collection area, special area, and rehabilitation area. TAHURA WAR is a life support system area, especially in regulating water management, keeping the soil fertile, preventing erosion, and keeping the microclimate in balance, producing clean air, maintaining food cycles and preserving biodiversity. This is as regulated in the Block Management Certificate in TAHURA WAR number 285 of 2017. The forest management approach has so far been carried out with the concept of sustainable forests, which involves balancing objectives among ecological, economic and socio-cultural aspects of management. Areas used for research materials and the utilization of forest products by communities around the forest are referred to as utilization areas [1, 2]. The surrounding community manages the utilization area using an agroforestry system [3, 4]. Management through agroforestry is carried out by collecting non-timber forest product such as fruits, spices, and other non-timber forest products with economic value. The results of this agroforestry system are then sold to collectors or processed to make products of higher economic value. The agroforestry system is used by communities around the forest in managing utilization areas, because most of the people work as farmers and own arable land within the TAHURA WAR utilization area [2, 5]. In addition, the more dominant economic benefits from forests encourage communities to participate in forest management [6]. Community Collaborative Forest Management (PHBM) is used as a form of management system carried out in the TAHURA WAR Utilization Block area. Community Collaborative Forest Management (PHBM) It is a forest resource management systems that involves many parties, therefore a clear measure of successful forest management is needed.

Currently, the condition of the forest in each region is different [7]. The condition of the TAHURA WAR forest can be influenced by community interaction with the forest, which can also determine the merits of the management system and the quality of the forest. Participatory forest management approaches are carried out by forest managers who work closely with the local government and communities in conducting forest management decisions [8]. Community empowerment programs in forest areas are carried out through social forestry programs, such as community forests, village forests, community plantation forests, and partnerships [9]. The form of community contribution in management, both from planning, implementing, maintaining, utilizing, and preventing the risk of damage, still needs to be developed. The provision of knowledge and skills, as well as easy access to management, can support local communities in becoming

forest protectors and guardians [10]. Moreover, forest monitoring activities were conducted to assess the state of the forest [2, 7]. This may impact the level of forest health created by the management system carried out by the community.

Efforts to integrate ecosystem information, population dynamics, and plant pest genetics through economic considerations to reduce the risk of damage experienced are called forest health [11, 12]. A forest can be said to be healthy if it fulfills the specified functions, namely production, protection, and conservation [13]. The state of forest health is a crucial factor in upholding the tenets of sustainable forest management and regulating forest functionalities [7, 12]. Forest health can be assessed through the condition of its trees, achieved by observing and categorizing their overall well-being. forest health is one of the criteria for achieving sustainable forest management. In general, sustainable forest management must take into account the special biophysical conditions of the forest, the economic and socio-cultural conditions of the community [12]. In agroforestry systems implemented in utilization areas, community participation plays an active role in selecting plant species composition, maintenance, and protection of the area. This, of course, affects the condition of the forest created within it. Measuring forest health conditions is a scientific development related to forest management [12]. The balance that occurs between forest components can create forest sustainability. Community role and participation in management are no exception to achieving sustainable forest management. The health level of a forest could determine whether a management system is good or bad [2]. Forest Health Monitoring (FHM) is a technique to monitor, evaluate, and report on the progress of current forest conditions, as well as the development of forest ecosystems that may occur by utilizing ecological indicators. A healthy forest shows that the management system applied is correct. And vice versa, an unhealthy forest indicates that the management system that is being implemented needs to be improved to achieve the goal of a sustainable forest, in terms of ecology, economy, and society. This study aims to analyse the relationship between the health of the forest values and the management system implemented in the TAHURA WAR Utilization Block.

## 2. LITERATURE REVIEW

Forests can also be said to be ecosystems that function as providers of goods and services, and the values contained therein, such as intrinsic value, economy, culture, and beauty, play a role in socio-culture and the welfare forest communities [14]. One type of forest is classified by function, namely forest for conservation, protection forest, and forest for production. A conservation forest is a forest area intended for the preservation of biodiversity and its ecosystem. In addition, conservation forest is also defined as an area intended to preserve SDH and maintain the balance of the ecosystem in it. In this case, it can support efforts to improve human welfare and quality of life [15].

TAHURA (Taman Hutan Raya) is a nature conservation zone with the aim of being a natural or non-natural distribution area of plants and animals, from domestic or invasive genera, which is used for scientific development, supporting culture, research, tourism, education and entertainment (Law No.5, 1990). Based on SK. Structuring the TAHURA WAR Management Block, namely SK. 285/KSDAE/SET/KSA.0/8/2017 dated August 14, 2017 the TAHURA WAR area is divided into 6 blocks, namely protection blocks, utilization blocks, collection blocks, traditional blocks, rehabilitation blocks and special blocks. A utilization block is an area used for research activities and land management, especially for communities around the TAHURA WAR forest [1].

Management in utilization blocks is carried out while considering aspects of forest health, so that the balance between ecosystem and utilization can be sustainable Forest health management involves integrating understanding of the dynamics, ecosystems, and genetics of disruptive organisms with economic factors to mitigate the potentially harmful impacts of damage [11]. Forest health is defined as something that describes the level of elasticity and flexibility of the forest in accepting repression and forest production power related to public values, needs and expectations. Therefore, a healthy forest condition occurs when the forest has sufficient flexibility to be responsive and healthy again from disturbance while still being able to maintain its capacity to provide ecological support and produce expected products and benefits. Forest health can help humans protect forests and the resources in them from disturbances that can interfere with the main function of forests. Improving forest quality is also greatly influenced by forest health [2].

The ultimate goal of forest health assessments is the creation of sustainable forests. This means that the forest is able to carry out its function and meet the needs of living things in it. Forest sustainability related to the level of forest health means that forest health meets three pillars of sustainability, namely in terms of economic, ecological and social. Forests that can be said to be healthy when they have good vegetation cover. In addition, forests can be said to be healthy when biotic and abiotic factors contained in forests do not interfere with meeting human needs. Furthermore, forests can be said to be healthy when communities within forests can function and interact well [16].

## 3. METHODS

### 3.1 Study site

The research was conducted during the month of October to November 2022 within the TAHURA WAR Utilization Area, situated in Sumber Agung Village, Kemiling District, Bandar Lampung City. The total area of TAHURA WAR utilization spans 1,137.32 hectares (Figure 1).

### 3.2 Materials and tools

Tools used are stationery, computer or laptop, a roll meter, a tape measure, paralon or stakes, thumbtacks, a location map, a compass, a camera, a handheld, and GPS. This research used materials, namely stands in the utilization area, tally sheets, questionnaires, and mica plastic [17].

### 3.3 Data collection

The study involved assessing the forest's health status and conducting interviews to gather insights into the management practices within the TAHURA WAR Utilization Block. Forest Health Values are determined by determining the number of cluster plots, creating cluster plots, and measuring forest

health indicators. The selection of cluster plot quantities is guided by the regulations outlined in P.67/Menhut-II/2006, which detail the criteria and standards for forest inventory, which states that in using the plot method (circles, squares, test points, or lines), the sampling intensity is at least 0.0025% of the total area [16]. The number of group plots created was seven, or 28 plots, in utilization areas. Cluster plots were created based on FHM in the form of several circular plots used to measure and collect data in the forest [7].

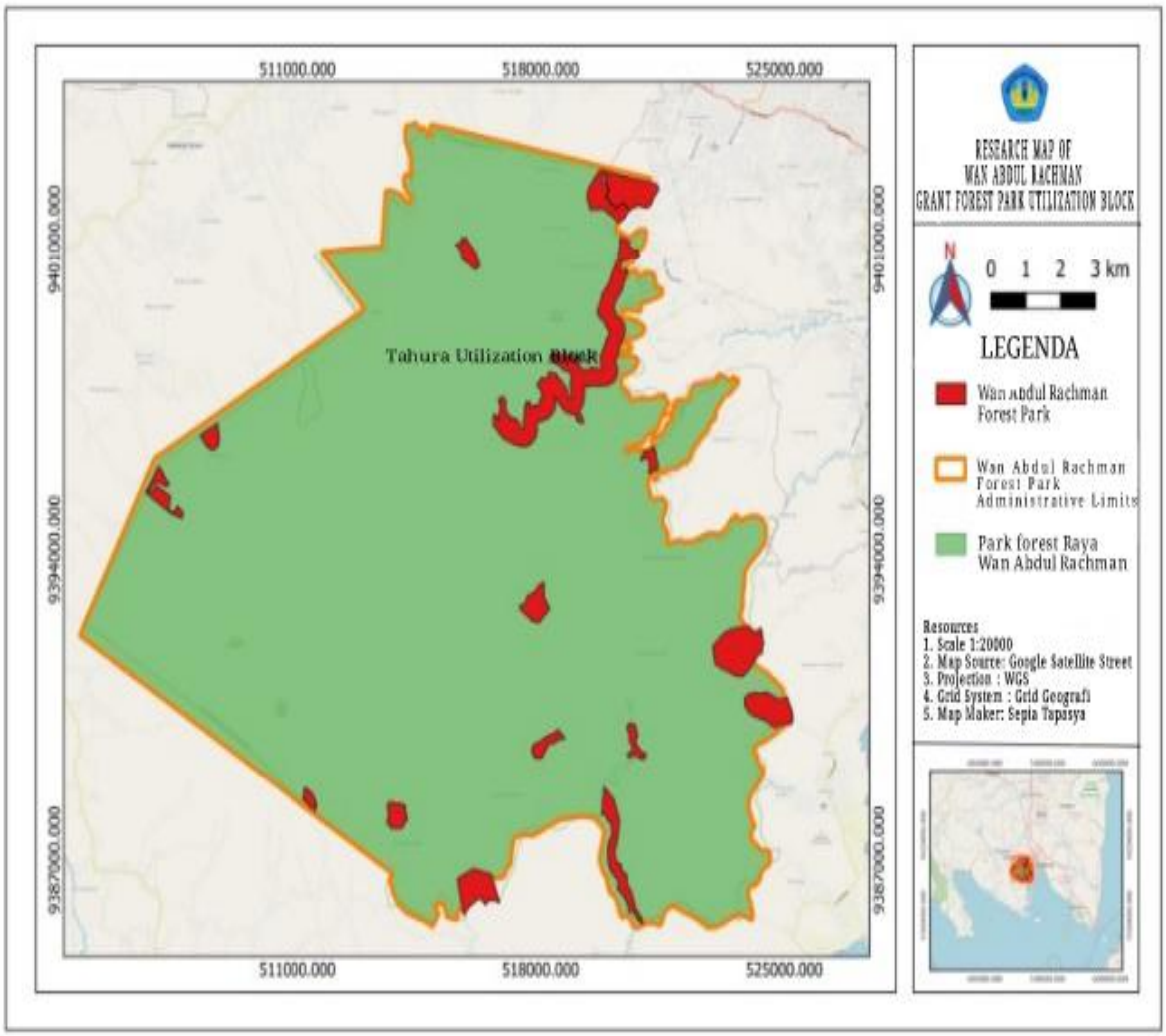


**Figure 1.** Location of TAHURA WAR utilisation block

### 3.4 Data analysis

Forest health is measured using three indicators: vitality, biodiversity, and site quality. Measurement of forest health in utilization blocks is carried out by measuring vitality, namely damage and crown condition of plants in the area. Determination of the value of biodiversity indicators after observation and data collection of tree species will then be measured using the formula Shannon Winner Index. The determination of site quality indicators involves measuring the soil pH level within the Utilization Block area administered by the Bandar Lampung Resort UPTD KPHK TAHURA WAR. The measurement results of the three indicators are then calculated and analyzed using the forest health level assessment formula. The following is the formula for calculating forest health levels [2].

$$\text{NKH} = \sum \cdot (\text{NT} \times \text{NS}) \quad (1)$$

Information:

NKH = Health end value condition forest

NT = Weighted value on the indicator vitality, biodiversity, and site quality

NS = Scores on indicators of biodiversity vitality and site quality

The interviews that have been conducted are analysed as follows: The results of interviews with farmers are measured by farmer participation level in each stage of forest area management in utilization areas. Negi et al. [18] explains that the participation variable used is related to community involvement in management activities. The level of participation is measured using a Likert scale to determine the number of farmers participating in each stage of management. Then an analysis of interviews with UPTD TAHURA WAR managers was carried out to find out the effectiveness of the forest management system carried out in the utilization area using a Likert scale by determining the scoring of each question and then categorizing it. Interview results related to

relationship between the value of forest health and the level of participation and Forest Health Values with the management effectiveness of UPTD KPHK TAHURA WAR managers were processed using Rank Spearmen [19].

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)} \quad (2)$$

Information:
$\rho$ = Spearmen's rank correlation coefficient
$d_i$ = Difference between two ratings from every observation
n = Number of observations

## 4. RESULTS

### 4.1 Measurement of Forest Health Value

In managing conservation forests, including TAHURA WAR, it is important to know the assessment of forest health [16]. Measuring forest health makes it easier to ascertain the forest benefits and functions [12]. The result of measuring final value of forest health is obtained after knowing the final value of each indicator used in the study, namely indicators of vitality, biodiversity, and soil quality. The ultimate Forest Health Value serves as variable 1 in analyzing the correlation between forest health and community-driven management effectiveness within the TAHURA WAR utilization zone. The final forest health score obtained is presented in Table 1.

### 4.2 Assessment of forest management system

The forest management system relates to the utilisation of forests as natural resources in an ecosystem by taking into account aspects of utilisation, supervision, and protection [20]. The evaluation of the management system within the TAHURA WAR Utilization Block incorporates parameters such as the extent of farmer involvement across various stages of forest area management and the effectiveness of management practices implemented by the forest manager namely the UPTD KPHK TAHURA WAR. The research findings reveal the level of involvement of farmers at each management stage, as illustrated in Table 2. Additionally, Table 3 demonstrates the level of management effectiveness within the implemented management system.

### 4.3 Linkages between Forest Health Values and forest management systems in Utilization Block

The management system is measured using interview data related to farmer participation and the level of effectiveness of the management system by managers. The results obtained from the relationship between Forest Health Values and farmer participation in the management of utilization blocks are shown in Table 4.

In addition to farmer participation in the management carried out in the utilization block, there is another parameter, namely the management system carried out by the UPTD KPHK TAHURA WAR manager. Management of the UPTD KPHK TAHURA WAR implements a management system, especially in utilization blocks, by implementing conservation partnerships to regulate and manage the area. Therefore, in this case, it is necessary to know the relationship between Forest Health Values and management effectiveness conducted in the Utilization Block of TAHURA WAR. The results obtained from the relationship between Forest Health Values and management effectiveness by UPTD KPHK TAHURA WAR managers in utilization blocks are shown in Table 5.

**Table 1.** Categories of Forest Health Values

| Plot Cluster | Forest Health Final Score | NKH Category |
|---|---|---|
| 1 | 2.53 | Bad |
| 2 | 5.5 | Moderate |
| 3 | 5.2 | Moderate |
| 4 | 7.78 | Good |
| 5 | 5.86 | Moderate |
| 6 | 2.72 | Bad |
| 7 | 4.69 | Moderate |

**Table 2.** The level of farmer participation in each stage of utilization block management TAHURA WAR

| Management Stages | Number of Respondents | | | Amount | Category |
|---|---|---|---|---|---|
| | Low | Currently | Tall | | |
| Planning | 11 | 1 4 | 5 | 30 | Moderate |
| Implementation | 17 | 8 | 5 | 30 | Low |
| Maintenance | 4 | 13 | 13 | 30 | High |
| Utilization | 1 | 16 | 13 | 30 | Moderate |
| Protection | 5 | 10 | 15 | 30 | High |

**Table 3.** Level of management effectiveness of TAHURA WAR Utilization Blocks

| Score Intervals | Category | Effectiveness Level | Percentage |
|---|---|---|---|
| 15-18 | Low | 2 | 20 |
| 19-21 | Medium | 2 | 20 |
| 22-25 | Tall | 6 | 60 |

**Table 4.** Relationship between Forest Health Value and farmer participation level management utilization block

| Management Parameters (Level of Farmer Participation) | Pearsion Correlation | Sig. |
|---|---|---|
| Planning | -0.113 | 0.276 |
| Implementation | -0.308 | 0.049* |
| Maintenance | -0.059 | 0.379 |
| Utilization | 0.007 | 0.485 |
| Protection | -0.096 | 0.307 |

**Table 5.** Relationship between Forest Health Values and management effectiveness by the UPTD WAR TAHURA KPHK manager

| Management Parameters | Pearsion Correlation | Sig. Mark |
|---|---|---|
| Manager | 0.031 | 0.466 |

## 5. DISCUSSIONS

The results in Table 1 show that the final score in cluster 4 is included in the medium category. Good forest conditions can support forest sustainability [7]. NKH in the medium category shows a fairly good level of health. Apart from that, the level of damage experienced was not extensive, and the canopy and humidity conditions were quite good. Soil quality and soil pH parameters have been able to support the growth and development of plants in cluster plots.

The final scores in clusters 2, 3, 5, and 7 fall into the medium category. This shows that the forest health condition in the plot cluster is quite good. However, forest health conditions that are classified as moderate mean that forests still require attention so that forest conditions remain at that level or better. Clusters 1 and 6 have poor Forest Health Value categories. Conditions that are classified as low or poor indicate that forest conditions have low levels of biodiversity, high levels of tree damage, and soil quality that is not suitable to favour tree growth in the area. The ultimate assessment of good forest health is influenced by the magnitude of the weight and score assigned to each parameter utilized in the evaluation. The higher this value, the greater the overall assessment of forest health conditions [16]. Research [16] elucidates that alterations in land cover may result in diminished biodiversity, consequently impacting forest health. The level of forest health characterizes the state of a forest ecosystem in fulfilling its primary functions [2]. FHM is no exception and can provide information regarding forest conditions so that it can be used as a reference in more sustainable forest management [7]. Forest sustainability is related to the level of forest health, meaning that forest health meets the three pillars of sustainability, namely from an economic, ecological and social perspective. The Forest Health Value obtained shows that in general the level of forest health in the Sumber Agung TAHURA WAR Village Utilization Block is included in the moderate category.

Table 2 shows that of the 30 farmer respondents, here are 14 people who are in the medium category at the plan stage, 17 people in the low category of implementation, 13 people in the high category of maintenance, 16 people in the medium category of utilization, and 15 people in the high category of protection. The summary above states that the participation level of farmers in various stages of management is proven to be good and in accordance with the system implemented by the UPTD KPHK TAHURA WAR manager. At relatively low intervals, there may be obstacles to the implementation of management participation. One of them is the difficulty for community members to take the time to participate in a series of management activities by managers [21]. Apart from that, quite a few farmers make the farming profession into an additional profession besides their main profession, so that farmers give less attention and time to managing and participate in the management implementation.

From the aforementioned findings, it seems evident that the level of public participation is notably high. The role of the community is involved in the forest management system, which also refers to the concept of participation. The concept of participation is defined as management that involves communities that are part of a forest area [22]. This concept undoubtedly necessitates the involvement of extension workers to ensure that participating communities are equipped with the necessary skills to effectively carry out proficient management practices [23]. Community participation is emphasized in community-based programmes, which are considered to be the cornerstone of the programme of successful forest management programs [24]. The level of community participation can be said to be ideal if participation is at level eight, which means community control or at least partnership and delegation of control. Community participation in partnerships means that leaders make decisions and community members are relatively equal partners [25].

Local community involvement in forest management shows that the approach applied management system is Community Forest Management (PHBM). This PHBM is a form of management activity that aims to maintain forest sustainability and community welfare, which go hand in hand with preserving life support [26]. Most of the people who live around the forest work as forest farmers who depend on harvesting forest products [27]. The PHBM program is carried out through two activities, namely outside and inside. The activities inside are related to planting, maintenance, and utilization systems. Outside activities are activities related to community empowerment, including training activities, counseling, repair of facilities and infrastructure, and others [28].

The TAHURA WAR management system is carried out by the UPTD KPHK TAHURA WAR management. Based on the study findings, it is evident that the management system in the TAHURA WAR area management system, especially in utilization blocks, is carried out with the community through a conservation partnership. A conservation partnership represents a collaborative arrangement between the head of forest area management unit and the local community using the principles of respect, mutual trust, and benefit. The partnership is carried out in the form of community empowerment by directing the community to utilize blocks by

considering accessibility, level of welfare, and natural potential that is not protected. Apart from that, another form of partnership is in ecosystem restoration through collaboration to restore forests [29]. This management activity is related to the level of community participation that cultivates the land in the area. The existence of a conservation partnership and community involvement in management are influenced by the level of counseling carried out by the UPTD KPHK TAHURA WAR manager. If counseling is still minimal, it can lead to negative opinions that the government is taking over cultivated land owned by farmers [30]. Therefore, it is necessary to know the level of effectiveness of the management system carried out by managers.

Based on Table 3, it is evident that the level of effectiveness in managing the utilization block is determined by filling out a questionnaire with 10 UPTD KPHK TAHURA WAR managers. The results showed that six managers stated that management was effective. Two other managers said management was quite effective, and two others said management was not yet effective. The managers who were used as research samples were extension officers and forest rangers, who often worked directly with the community for community empowerment activities. Research from Sukardi et al. [31], explained that one of the forms of local institutions that exist in the mount Rinjani Forest Zone is the Bayan Customary Institution. This institution regulates the pattern of the community's relationship with the forest, such as prohibiting use for personal gain, burning, hunting animals, and other things that are detrimental to common interests in forest areas. It is necessary to know the level of management effectiveness to ensure its implementation is in accordance with basic principles and to identify obstacles in implementing management to achieve goals [32].

The research interview results are shown in Table 4, it can be seen that there is a significant relationship between management parameters set by farmers and the resulting Forest Health Value, namely at the implementation stage. This is indicated by a value of 0.049, while the other stages have a significant value: planning with a value of 0.276; maintenance with a value of 0.379; utilization with a value of 0.485; and protection with a value of 0.307. Observations of the level of farmer participation indicated that the implementation of certain stages was rated low, a finding that is consistent with the assessment of correlations to the health of certain forests. In addition, it can be seen from the direction of the relationship that it has a negative value, namely a negative correlation value. This means that the relationship between Forest Health Values and farmer participation is not unidirectional or unrelated.

The community presence around the area is an aspect that must be considered in preparing an effective and functional nature conservation management plan [33]. The management and utilization system contained in the utilization block must tend to affect the health value of the resulting forest. This is due to changes in the system of cropping patterns, types, and ways of utilization by farmers. In general, the cropping pattern and types of plants found in the current utilization block tend to be homogeneous. This affects the Forest Health Value in terms of ecosystem balance and reduces the biodiversity within the utilisation block. Mainly because of community pressure due to increasing community economic needs [34]. However, the role of the community, especially farmers, in cultivating crops in the area can also help restore land in the area because the cultivated land is cared for and planted regularly by farmers. In addition, it can help protect forests and their ecosystems. This means that the role of the community or farmers who cultivate the land in the area are not entirely detrimental or negatively impacting the forest and its ecosystem. The results of the Forest Health Value, which is classified as good, mean that the use and collection of forest products by farmers do not damage the existing forest conditions.

Based on the results of interviews with managers shown in Table 5, the table shows that there is no relationship between management parameters set by managers and Forest Health Values resulting from measurements. This is indicated by a significance value of more than 0.05 or 0.466. In addition, it was found that the relationship between Forest Health Value and management effectiveness has a negative correlation. This indicates that there is no unidirectional relationship between the two factors. This condition is caused by the lack of optimal management support for the sustainability of forest health, partly because not all tenant farmers can follow the management scheme implemented by the TAHURA WAR manager. Failure to involve all stakeholders in decision-making can render decisions or regulations ineffective [35].

The lack of significance in the results of analyses of relationships between Forest Health Values and the utilized management parameters is attributed to various factors, both internal and external. A forest health condition assessment is an assessment that focuses on ecological indicators. Meanwhile, management parameters focus more on social and management indicators. Internal factors, which include personal data and information about farmers (age, dependents, area of land owned, etc.), cannot represent the results forest conditions obtained on the ground. Based on the results of deeper interview, internal data regarding farmers shows that the average age indicator for farmers is 35-67 years. In terms of land area indicators, the average area of cultivated land is 0.5-2.5 ha per farmer. In this case, internal data cannot guarantee the condition of the resulting forest. Because internal data cannot measure the level of mastery and knowledge of forest management carried out by farmers. External factors such as farmer motivation, level of counseling provided, farmer insight into management, and management effectiveness are also less supportive and do not really influence forest conditions [36]. Regarding external factors, the results of the interviews concluded that the extension provided was sufficient to increase farmers' knowledge. However, the motivation that farmers have for developing management systems is not enough to support effective management. The two factors above cannot guarantee forest health conditions in utilisation blocks. Apart from the management and systems used by the community, forest conditions can also be influenced by natural factors and other supporting conditions. The utilization blocks, which are widely spread in TAHURA WAR with farmer groups and management by different farmer groups, can also influence the factual condition of forests in the utilization blocks. The success rate of forest management does not depend on the amount of funds allocated for activities but depends on community participation and involvement [7].

## 6. CONCLUSIONS

Based on the conducted analysis, The significance value is only found in the relationship between Forest Health Value

and the level of farmer participation at the implementation stage. This is because the activities carried out at the implementation stage have a major impact on the condition of forest health in the utilization block. Meanwhile, other variables did not show significant results. A forest health condition assessment is an assessment that focuses on ecological indicators. Meanwhile, management parameters focus more on social and management indicators. One of the reasons for this insignificance is due to internal factors among farmers, namely land ownership. Utilization blocks that are widely spread across TAHURA WAR with farmer groups and management by different farmer groups can also influence the factual condition of forests in utilization blocks. Thus, there is insignificance in several measurement variables.

To improve understanding and insight into forest health, further research is needed. This research could involve a wider area, including other sites, villages or blocks in the War Forest Park (TAHURA). In addition, the development of alternative research is also an option that could be explored. Thus, this effort is expected to provide a more in-depth and holistic understanding of forest health conditions and the factors that influence them.

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