Forest Chemicals Review
www.forestchemicalsreview.com
ISSN: 1520-0191
September-October 2022 Page No. 1321 – 1343
Article History: Received: 06 April 2022, Revised: 28 April 2022, Accepted: 04 May 2022, Publication: 15 May 2022

Analysis of Sustainability Level Agro Forestry in Ulusaddang Village, Pinrang Regency

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Abstract. This study aims to analyze the level of sustainability of Agroforestry in Ulusaddang Village, Pinrang Regency. The sampling method used is the census method involving KTH which is considered representative of the entire population, namely KTH Sipatuo and KTH Chulande Sipatuo. The analytical method used is MDS (multidimensional scaling) analysis with the RAP-AFS approach. The results of the study using Multidimensional scaling (MDS) analysis showed that the sustainability status of agroforestry in Ulusaddang Village in each KTH was in the less sustainable category for Chulande KTH with an index value of 48.51. Meanwhile, KTH Sipatuo is also in the less sustainable category with an index value of 48.28.

Keyworlds : *Agroforestry, KTH, Multidimensional scalling*

INTRODUCTION

The conversion of forest land into agricultural land is increasingly causing many problems such as decreased soil fertility, erosion, extinction of flora and fauna, floods, droughts and even global climate change, so that this problem continues to get worse from time to time in line with the increase in the area of forest converted to agriculture. use it as another business area (Riease and Abdi, 2010). As for traditional agricultural efforts, which are carried out by converting forests into agricultural land, they are often the cause of critical land. Farming practices and land use that do not or do not pay attention to soil and water conservation principles, as well as shifting cultivation practices cause critical land, erosion, drought disasters, and a decrease in the quality and quantity of agricultural products (Bukhari and Febryano, 2010).

Pinrang Regency Of the 72,831 ha of forest land area, 16,243 ha of which is critical land, especially in villages or hamlets where most of the livelihoods are cultivators or planters (KPH Sawitto). It seems that the critical land area leaves only 9,315 ha of productive forest which is included in the protected forest area. The expansion of critical land in Pinrang Regency is caused by the actions of farmers who cut down trees for plantation land clearing (Forest and Plantation Service). Ulusaddang Village in Pinrang Regency is one of the villages included in the forest area with active community participation in managing the forest area as a life support.

Most forms of land management are managed in a simple manner and the main constituents are multi-purpose annual plants (Multi Purpose Tree Species). This has become a community tradition for generations that most people prefer to plant MPTS as the main crop because it is considered to have high economic value, routinely receives monthly or annual or seasonal results, is easy to maintain and has a good ecological function. Only a small number of people choose to combine it with seasonal or horticultural crops. In addition, the majority of the community (KTH) are less interested in planting forestry crops because the harvest period is very long. However, there are a

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small number of farmers who have begun to be interested in planting forestry crops on their agricultural land as hedges, but some farmer groups still plant monocultures or do not combine them with agricultural crops.

With the increase in the area of critical land, social problems arise due to the destruction of forest resources as a life support. In addition, the level of food demand also continues to increase, so there is a need for an adoption of technology by farmers who are able to utilize the land more optimally.

Agroforestry is an integrated land use solution to support the development of forestry plants in the context of soil and water conservation coupled with the cultivation of agricultural crops as food and economic added value. The agroforestry model can be a solution to increase the carrying capacity of human ecology, especially in rural areas (Indrianti & Ulfiasih, 2018), as well as to overcome environmental problems that arise due to land use change. Agroforestry is a form of optimizing land use by combining woody plants, agricultural crops, livestock and others on the same land unit to obtain various economic, ecological and social benefits.

In practice, agroforestry management cannot be separated from the concept of community-based forest management (A.Samsu, Millang, & Dassir, 2019). One of the great opportunities to strive for forest sustainability in Indonesia is the presence of community-based forest management schemes. Community empowerment as an effort to increase capacity and productivity towards self-reliance, will grow and develop groups (KTH) in the community as actors and supporters of forestry development.

Various KTH activities, one of which is Agroforestry. The presence of an agroforestry cropping system model is a form of sustainable land management system. The sustainability of agroforestry-based land management can be viewed from various aspects, ranging from economic, social, and ecological aspects. Therefore, it is necessary to conduct a study on the analysis of the level of sustainability of Agroforestry in Ulusaddang Village, Pinrang Regency.

Research Objectives

Analyzing the level of sustainability of Agroforestry with MDS (multi-dimensional scaling) analysis with the RAP-AFS approach.

Research Sites

The location of this research is in Ulusaddang Village, Pinrang Regency, which is the location of the current agroforestry development.

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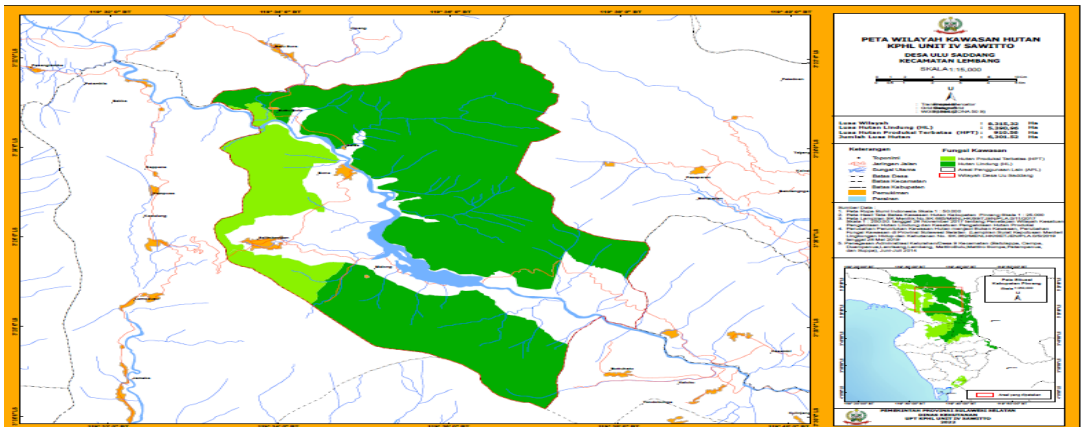

LITERATURE REVIEW

1. Agroforestry

Agroforestry studies focus not only on technical and biophysical issues but also on social, economic and cultural issues that always change from time to time, so that agroforestry is a dynamic branch of science (Widianto, Hairiah, Suharjito, & Sardjono, 2003). Nawir et al. (2017) stated that the agroforestry model is a productive farming pattern that not only emphasizes conservation principles but also benefits and benefits that can be obtained by the community.

Agroforestry is a model that combines forestry crops, with agricultural crops on the same land either at the same time or sequentially, with the aim of conserving soil and water to produce sustainable agricultural quality. In addition, there are also those that combine farming under stands. Agroforestry being a promising land use system, which involves the integration of trees or woody perennials with agricultural crops on the same land unit, has been considered as a viable option with the aim of conserving natural resources on the one hand and sustainable production on the other (Mishra, Kumar, Saurabh, & Bhatt, 2019).

Agroforestry is an alternative option for land use which is starting to become limited in size by planting various types of plants, both forestry, agricultural (annual, horticultural and seasonal) or providing animal feed on the same land). According to Muthmainnah & Sribianti (2018), the agroforestry system is an agricultural system in which trees are planted intercropping with one or more types of seasonal crops. In addition, in environmental conservation, agroforestry can play a role as a regulator of water management, reduce soil erosion, maintain biodiversity and sequester carbon (Junaidi et al, 2018). Agroforestry is a viable option for sequestering carbon in agricultural land because it can sequester large amounts of carbon while leaving most of the land for production agriculture (Vikrant, Chauhan, & Rizvi, 2014).

2. Agroforestry Sustainability Concept

The sustainability of agroforestry systems cannot be separated from considerations of productivity and ease of adoption and implementation. The agroforestry system that is oriented towards the conservation of natural resources and long-term productivity is one of the attractions for farmers. Within the agroforestry system there is considerable and very open opportunity for an approach that combines long-term sustainability goals with productivity gains in the short and

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medium term. One of the main goals of agroforestry is sustainable production, which is characterized by long-term production stability (Widianto et al, 2003).

Unique and creative tools must be used to support the innovative process of analysis and design of agroforestry systems in the context of pursuing sustainable landscapes. This must take into account the multidimensional nature of sustainable agroforestry (Plieninger, Rojas, Buck, & Scherr, 2020). With this in mind, the sustainability of agroforestry needs to be studied from the following dimensions:

a. Economic Dimension

There are seven attributes in the economic dimension that have the potential to affect the level of sustainability of agroforestry farming, namely the level of economic effectiveness, the stability of the selling price of crops, sources of farming capital, places to sell produce, diversification of income sources, crop sales systems and the contribution of agroforestry to farmers' total income (Ruhimat, 2010). 2015), Meanwhile (Kuvaini, Hidayat, Kusmana, & Basuni, 2019) added community income in managing land, availability of input and marketing facilities to support farmers' income, and ratios as an alternative to additional attributes.

b. Ecological Dimension

The ecological dimension consists of nine attributes that are thought to affect the level of sustainability of agroforestry farming, namely the level of plant pests and diseases, the level of understanding of farmers in soil and water conservation, land conservation actions, availability of organic fertilizer manufacturing technology, availability of organic material sources, yield productivity, land fertilization. , tillage and use of pesticides (Ruhimat, 2015). Meanwhile (Kuvaini, Hidayat, Kusmana, & Basuni, 2019) added several attributes such as the type of land criticality, and the type of land use.

c. Social Dimension

The level of sustainability of the social dimension includes farmer empowerment, community socio-cultural support and farmer regeneration (Nursidiq et al., 2019) while (Kuvaini, Hidayat, Kusmana, & Basuni, 2019) adds several attributes namely Education Level, social impact of forest management, and Society participation.

d. Technology Dimension

Technological change and innovation are two interrelated things. The progress of the agroforestry sub-sector is highly dependent on how much technological progress has been absorbed by farmers. The level of sustainability of the technological dimension in agroforestry includes technological innovation and production risk control (Nursidiq et al., 2019).

e. Institutional Dimension

Optimizing the benefits of Agroforestry can be achieved if the agroforestry farming is supported by strong farmer institutions. The sustainability performance of the institutional dimensions include group dynamics and the support and role of the government (Nursidiq et al., 2019), Meanwhile (Kuvaini, Hidayat, Kusmana, & Basuni, 2019) adding other institutional attributes such as farmer groups establishing partnerships to facilitate access to marketing, and The availability of forest management regulations.

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3. Multidimensional Scaling (MDS) Analysis Method With RAP-AFS Approach

MDS (Multidimensional Scaling) analysis is a method that represents the similarity or dissimilarity of the distance difference between objects. The more similar certain objects are to other objects, the closer the distance between the objects in question is, while the farther the distance between objects shows the less similar or different (Fauzi & Anna, 2002).

Analysis of the quantitative data carried out to assess the level of sustainability of Agroforestry in Pinrang Regency is using MDS analysis with the Rapid Appraisal for Agroforestry System (RAP-AFS) approach. The RAP-AFS method is used to determine the sustainability status of each dimension.

RAP-AFS is a modification of the Rapid Appraisal for Fisheries (RAPFISH) method developed by the University of British Columbia in measuring the sustainability of the capture fisheries sector, which consists of Ordinary Multidimensional Scaling (MDS) analysis, Monte Carlo analysis and Leverage analysis. Rahayu et al. (2013), Hidayanto (2010) and Hasan et al. (2011) defines the RAPFISH method as a statistical technique used to quickly and accurately describe the sustainability status of resources by transforming multidimensional attributes into simpler dimensions.

The stages of the analysis of the sustainability of agroforestry farming using the RAP-AFS method are as follows: First, determining the attributes/criteria for each dimension of sustainability through literature review, discussion and field observations, second, assessing the attributes/criteria for each dimension of sustainability, the assessment is carried out using a research questionnaire. and third, assessment of the index and sustainability status through ordinance analysis using MDS, sensitivity analysis (Leverage analysis) and anomaly analysis (Monte Carlo analysis) (Saida, 2011). The details are as follows:

a) Score Each Attribute

Each attribute in the sustainability dimension of Agroforestry is given a score, ranging from 1 – 5 which means from bad to good. The greater the value, it can be interpreted that the more it supports the sustainability of Agroforestry in Pinrang Regency.

b) The value of the sustainability index of agroforestry farming in the data analysis is grouped into four levels of sustainability status, namely:

Table 1. Sustainability Status Category

No	Index Value	Sustainability Status
1	0-25,00	Unsustainable
2	25,01-50,00	Less Sustainable
3	50,01-75,00	Sustainable Enough
4	75,01-100,00	Sustainable

Sumber: (Ruhimat, 2015)

c) Sensitivity Analysis (Leverage)

Leverage analysis is used to determine the attributes that sensitively affect the level of sustainability of agroforestry farming (Ruhimat, 2015).

d) Monte Carlo Analysis

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Monte Carlo analysis is a series in the RAP-AFS method which is carried out to estimate the random error rate in the model generated from the MDS analysis for all dimensions at a 95% confidence level. The smaller the difference in value between the results of the MDS analysis and the Monte Carlo analysis, the better the model produced by the RAP-AFS method (Ruhimat, 2015).

RESEARCH METHODS

The population in this study is the people who manage their agricultural land in this case the Forest Farmers Group (KTH). The sampling method used is the census method involving KTH which is considered representative of the entire population available in the research area, namely KTH Sipatuo and KTH Chulande Sipatuo with details of all KTH memb ers in filling out the questionnaire.

The types of data used are primary data and secondary data. Primary data is data obtained through observation or direct observation in the field. Secondary data is data obtained through literature study of various kinds of literature related to research objectives such as documents, articles, books, and other sources related to research problems and objectives. The data analysis method used is multidimensional scaling (MDS) analysis.

The data sources used are field research and library research. Techniques Data collection is done by observation and using a questionnaire. The questionnaire used is a closed questionnaire. A closed questionnaire is when the question is accompanied by answer choices that have been determined by the researcher, namely several choices that are determined based on the Likert scale.

According to Sugiyono (2012:93) the Likert scale is a scale used to measure attitudes, opinions, and perceptions of a person or group of people about social phenomena. For each answer choice given a score, the respondent must describe, support the statement (positive) or not support the statement (negative). In addition, data collection was also carried out by direct interviews and field documentation.

Table 2. Rating Scale for Positive Statements Using a Likert Skala Scale

No	Description	Positive Score
1	Very Good	5
2	Good	4
3	Enough	3
4	Not Good	2
5	Very Not Good	1

RESULTS AND DISCUSSION

1. Status of Agroforestry Sustainability in Ulusaddang Village

The results of the Multidimensional scaling (MDS) analysis show that the sustainability status of agroforestry in Ulusaddang Village in each KTH is in the less sustainable category for Chulande KTH with an index value of 48.51. Meanwhile, KTH Sipatuo is also in the less sustainable category with an index value of 48.28.

1) Results of Multidimensional Ordination Analysis on KTH Chulande Sipatuo

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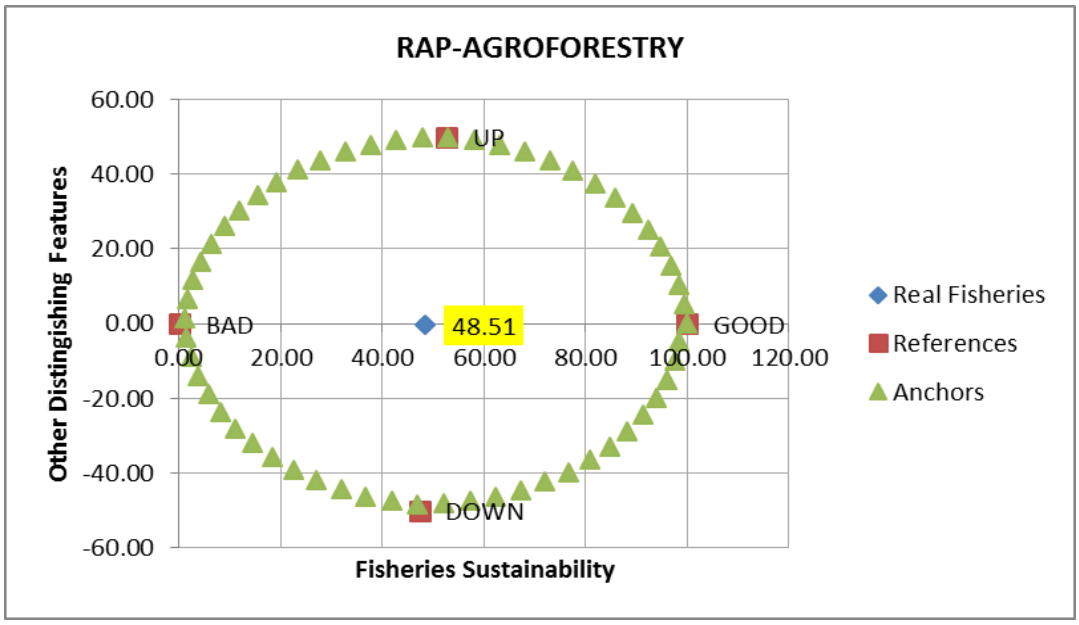

Figure 1. Results of Multidimensional Ordination Analysis on KTH Chulande Sipatuo

2) Results of Multidimensional Ordination Analysis on KTH Sipatuo

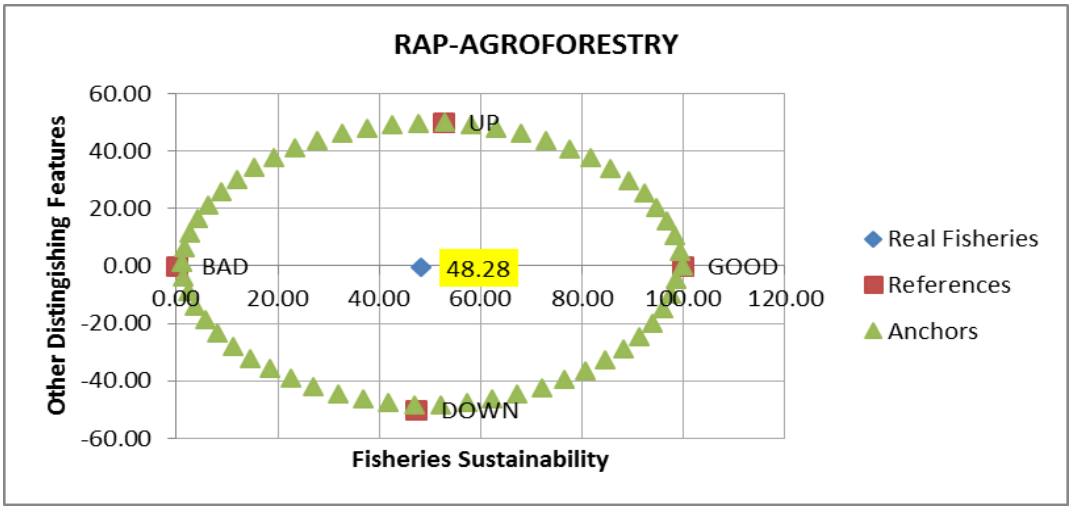

Figure 2. Results of Multidimensional Ordination Analysis at KTH Sipatuo

2. Sustainability Status and Attributes Sensitive to Each Dimension

1) Ecological Dimension

a) Sustainability Status

Based on the results of the MDS ordinance analysis for the ecological dimension, each KTH is in the moderately sustainable category with an index value of 51.00 for the Chulande KTH, and the less sustainable category with an index value of 48.73 for the Sipatuo KTH.

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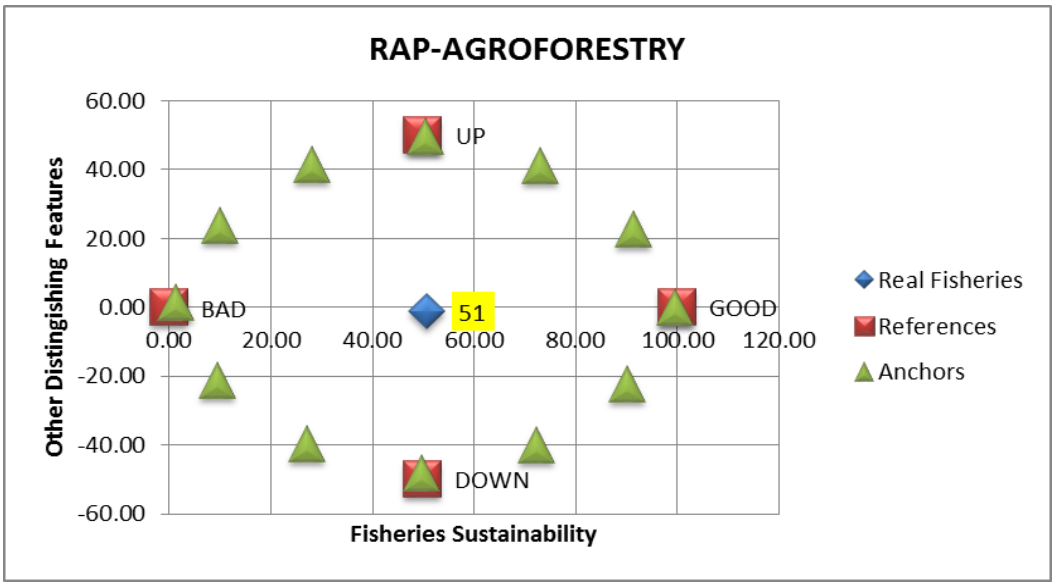

Figure 3. Results of the MDS Ordination Analysis of Ecological Dimensions at KTH Chulande

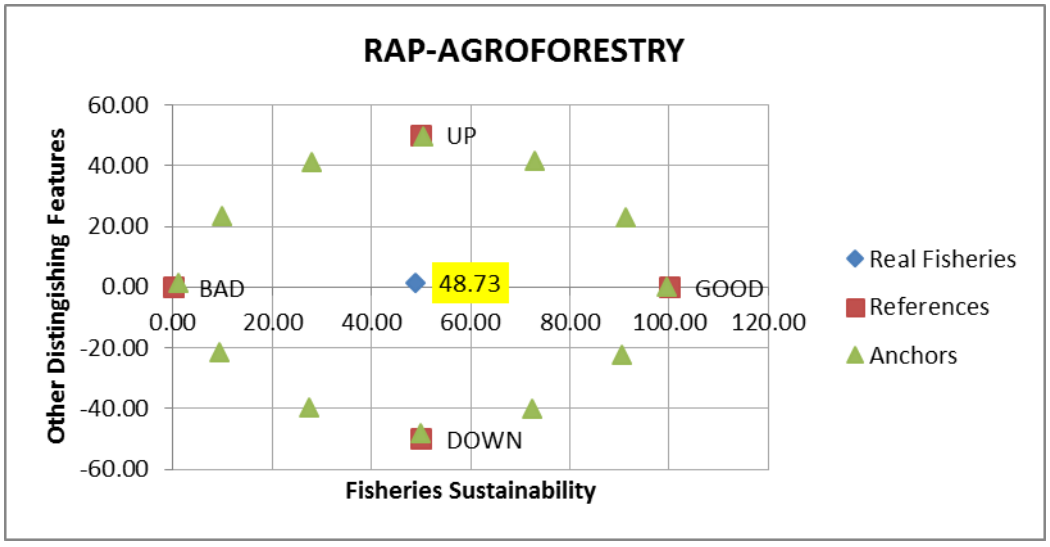

Figure 4. Results of the MDS Ordination Analysis on Ecological Dimensions at KTH Sipatuo

e) Ecological Dimension Sensitive Attribute

Sensitivity analysis was conducted to determine the attribute that contributed the most to the sustainability index value. The results of the sensitivity analysis on the ecological dimension are shown in the attribute that has the highest value in each KTH. In KTH Chulande, the most sensitive attribute is the understanding of farmers in soil and water conservation with a leverage value of 0.81. For KTH Sipatuo, the attribute that was found to be the most sensitive was Land Conservation Measures with a Leverage value of 2.01.

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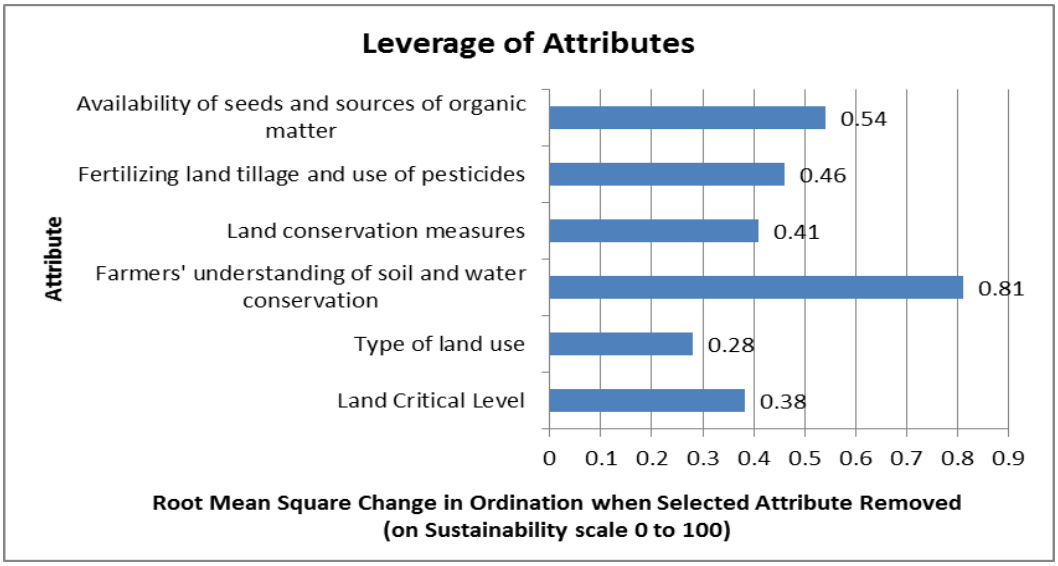

Figure 5. Results of Leverage Analysis of Ecological Dimensions at KTH Chulande

Based on the results of the Leverage MDS analysis on KTH Chulande, the most sensitive attribute is related to the level of understanding of farmers in soil and water conservation. This is evidenced by the conventional land management model. In addition, the lack of availability of seeds and organic matter and the use of pesticides in fertilizing the land were also found on farmers' lands. This is because farmers do not yet have the ability to make organic fertilizers and pesticides, including the ability to buy which is also limited due to lack of capital. However, there are also some successful farmers who have used only a small amount of organic fertilizer. This condition affects the sustainability status of Agroforestry in KTH Chulande, Ulusaddang.

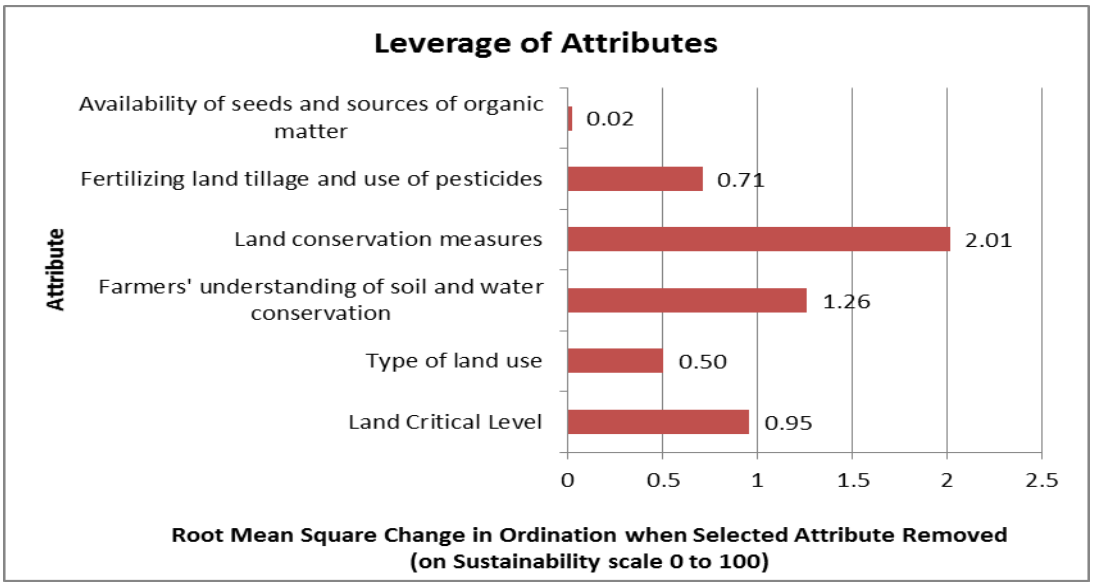

Figure 6. Results of Leverage Analysis of Ecological Dimensions at KTH Sipatuo

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Land conservation measures in KTH Sipatuo is the most sensitive attribute 2,01. Based on the analysis of data and conditions in the field, it shows that the land conservation measures applied by the community on each of their cultivated land are far from feasible. Some of the land cultivated by the community is almost dominated by only one type of commodity, one of which is corn. In addition, the level of land slope which is quite steep cannot be anticipated by farmers in their land management model. One of the influencing factors is the level of understanding of farmers in managing land which is also a sensitive attribute with an index value of 1,26. Due to the lack of anticipation in the form of land conservation, the level of land criticality in KTH Sipatuo is quite high, so that the results of research in the field have found many traces of landslides on farmer's land or KTH.

2) Economic Dimension

a) Sustainability Status

Based on the results of the MDS ordinance analysis for the economic dimension, each KTH is in the less sustainable category with an index value of 37.00 for Chulande KTH, and also in the less sustainable category with an index value of 47.41 for Sipatuo KTH.

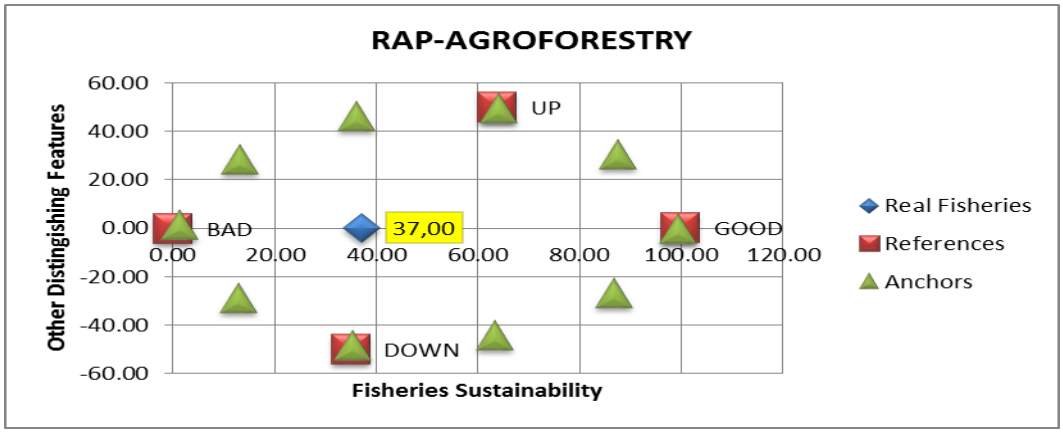

Figure 7. Results of the MDS Ordination Analysis of Economic Dimensions at KTH Chulande

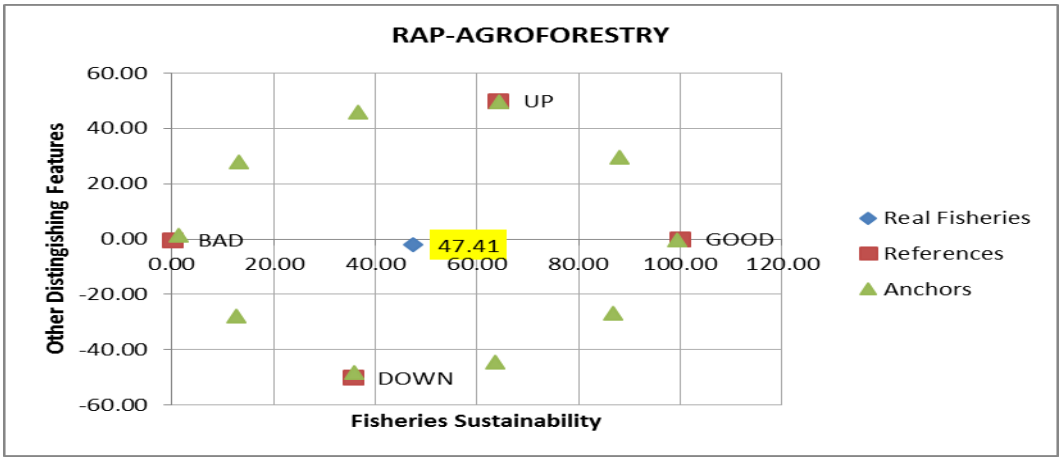

Figure 8. Results of the MDS Ordination Analysis of Economic Dimensions in KTH Sipatuo

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b) Economic Dimension Sensitive Attribute

The results of the sensitivity analysis on the economic dimension are shown in the attribute that has the highest value in each KTH. In KTH Chulande, the most sensitive attribute is the availability of production support input facilities with a leverage value of 5.89. And this happened to KTH Sipatuo, where the attributes found were the most sensitive regarding the availability of input facilities with a Leverage value of 1.61. Besides some of the most sensitive attributes, several other attributes are also considered to affect the sustainability of agroforestry in each KTH. For more details can be seen in the following image.

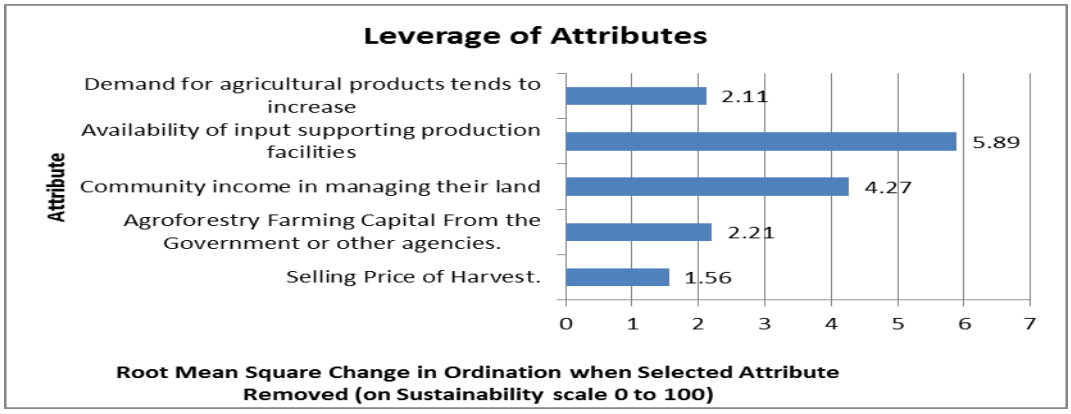

Figure 9. Results of Economic Dimension Leverage Analysis on KTH Chulande

Based on the analysis of leverage on the economic dimensions contained in KTH Chulande, one of the most sensitive attributes is the availability of production supporting input facilities (5.89). The lack of infrastructure that supports community farming greatly affects the level of community income in managing their land.

The results of field observations also show that some farmers who have tools or infrastructure as support must take turns with other farmers in processing their agricultural or forest products. It should be noted that, on average, the dominant commodities developed by KTH Chulande are candlenut, cocoa, sugar palm and corn. This requires infrastructure as a means of supporting the harvest. In addition, the lack of agroforestry farming capital from the government or other agencies also affects the level of sustainability of agroforestry developed by the community.

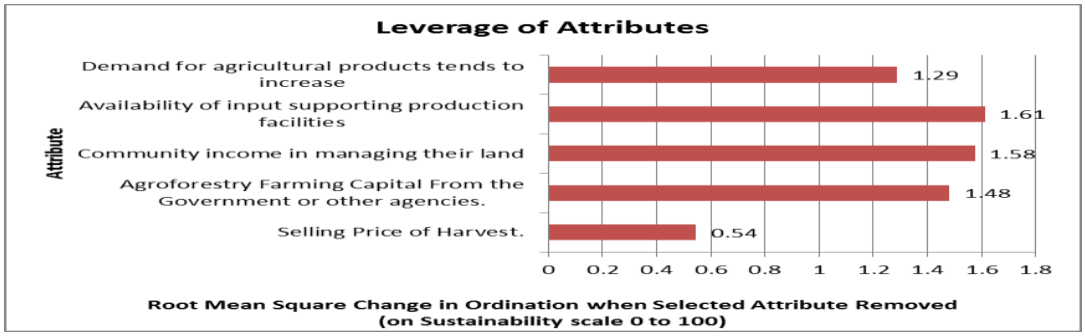

Figure 10. Results of Economic Dimension Leverage Analysis on KTH Sipatuo

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As is the case with KTH Chulande, the most sensitive attributes for the economic dimension of KTH Sipatuo are related to the availability of input facilities (1.61), community income (1.58), and lack of farming capital from the government or related agencies (1.48). Some of these attributes are closely related to each other. This condition is quite worrying, because some of the yields of commodities developed by farmers on each land are not supported by the availability of harvesting equipment and post-harvest processing. Farmers are more likely to use traditional methods rather than rely on the means of production. The lack of costs and business capital as well as assistance from the government greatly affects the income level of forest farmers from their agricultural products.

3) Social Dimension

a) Sustainability Status

Based on the results of the MDS ordinance analysis for the Social dimension, each KTH is in the moderately sustainable category with an index value of 52.10 for the Chulande KTH, and also the less sustainable category with an index value of 46.31 for the Sipatuo KTH.

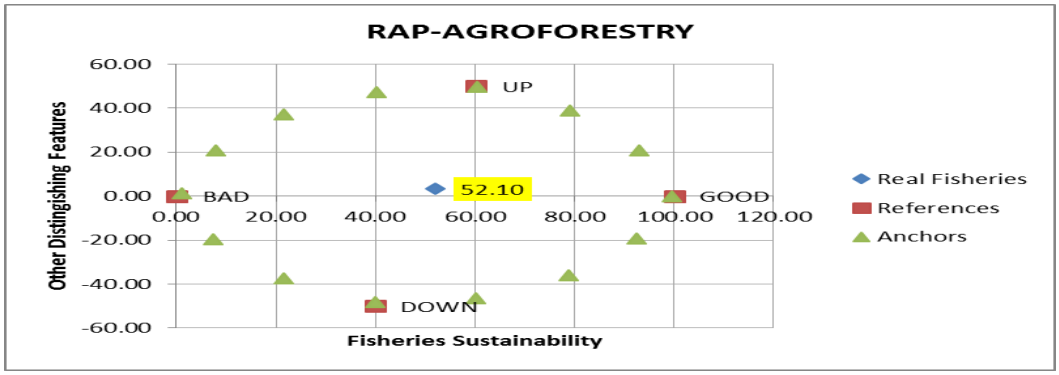

Figure 11. Results of the MDS Ordination Analysis of Social Dimensions at KTH Chulande

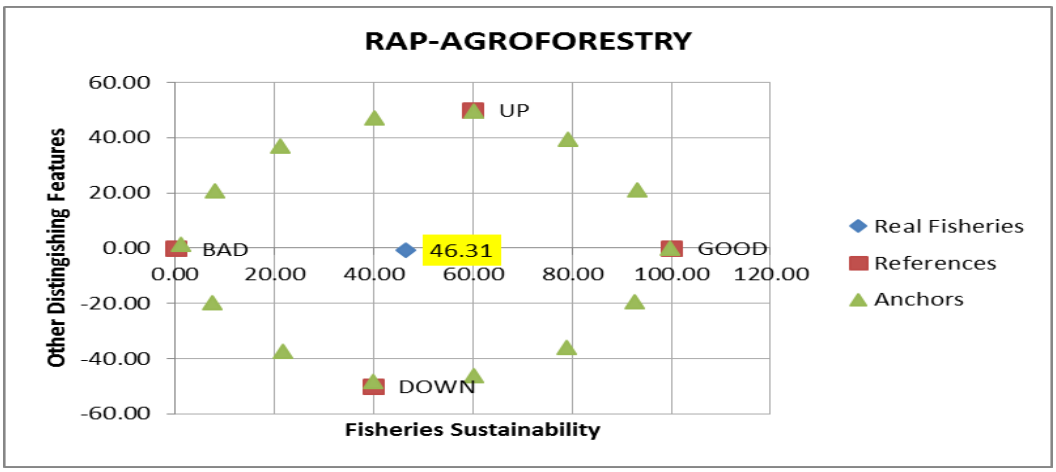

Figure 12. Results of the MDS Ordination Analysis of Social Dimensions at KTH Sipatuo

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b) Social Dimension Sensitive Attribute

The results of the sensitivity analysis on the Social dimension are shown in the attribute that has the highest value in each KTH. In KTH Chulande, the most sensitive attribute is the farmer's level of knowledge about protected forests and agroforestry models with a leverage value of 3.09. In addition, the level of public education is also quite sensitive with a score of 2.14.

In KTH Sipatuo, the attributes that were found to be the most sensitive were Farmers' knowledge level of protected forests and agroforestry models with a Leverage value of 2.52. Then several other attributes are also considered to have an effect on the sustainability of agroforestry in the community.

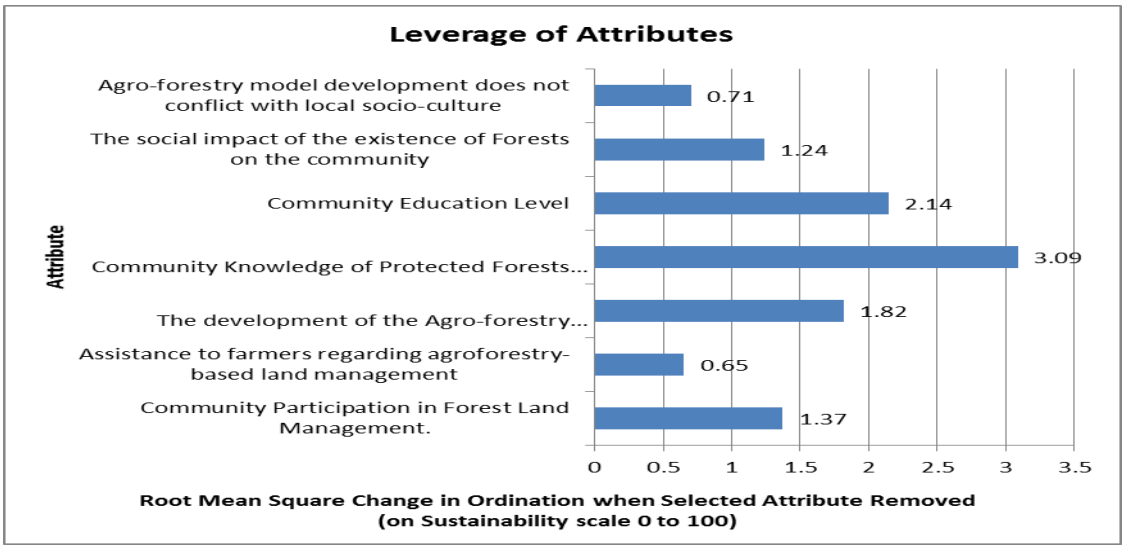

Figure 13. Results of Social Dimension Leverage Analysis on KTH Chulande

One of the most sensitive attributes for the social dimension of KTH Chulande is the lack of community knowledge about protected forest management and the application of agroforestry models (3.09). One of the influencing factors is the low level of education of farmers (2.14).

Based on the results of the analysis of respondent data in each KTH, 60% of the farmers in KTH Chulande only received education up to elementary school (SD). However, some farmers have started to develop agroforestry-based land management models on their land, although the numbers are still relatively small.

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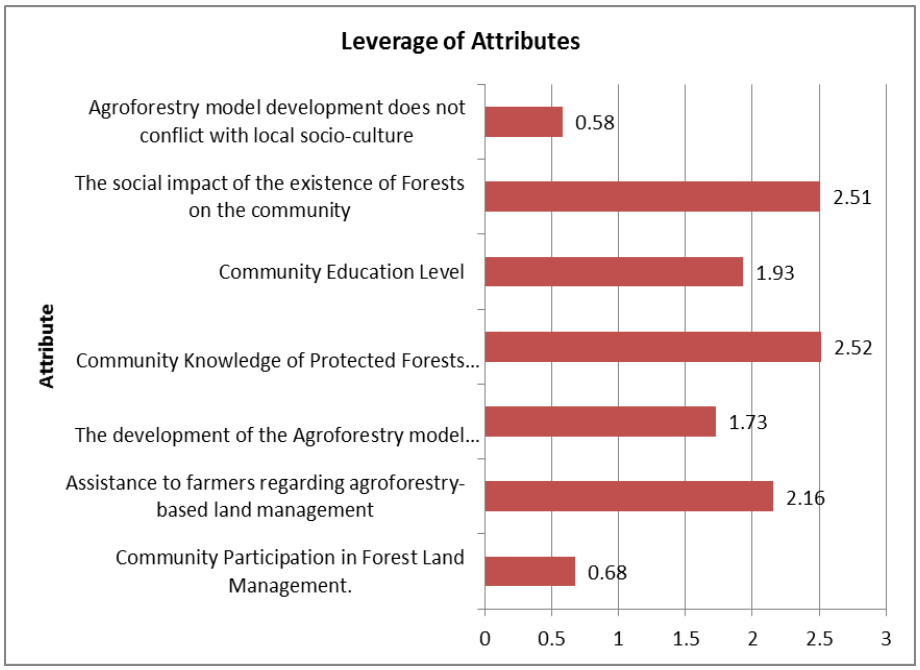

Figure 14. Results of Social Dimension Leverage Analysis on KTH Sipatuo

Some of the sensitive attributes found based on the leverage analysis are community knowledge of protected forests which is still low (2.52), education level is also still low (1.93), lack of assistance to farmers (2.16), and the social impact of the existence of forest to the community (2,51). Some of the attributes that are considered the most sensitive are closely related to each other.

Reinforced by the results of research in the field, it shows that although the level of community dependence on agricultural or forest products is quite high, it has not had a significant impact on the welfare of people's lives. This is shown by some farmers who prefer to work as laborers rather than just being farmers. The existence of forest products is considered not able to meet the needs of daily life. In addition to the factor of the low level of education and the lack of intensity of assistance in KTH, land management in the use of forest products is only sufficient to meet the needs of basic living. However, there are still some farmers who have started to develop agroforestry-based land management models with various combinations of types of commodities in them, although the number who develop them is still relatively small.

4) Technology Dimension

a) Sustainability Status

Based on the results of the MDS ordination analysis for the Technology dimension, each KTH is in the less sustainable category with an index value of 45.95 for Chulande KTH, and also the less sustainable category with an index value of 45.01 for Sipatuo KTH.

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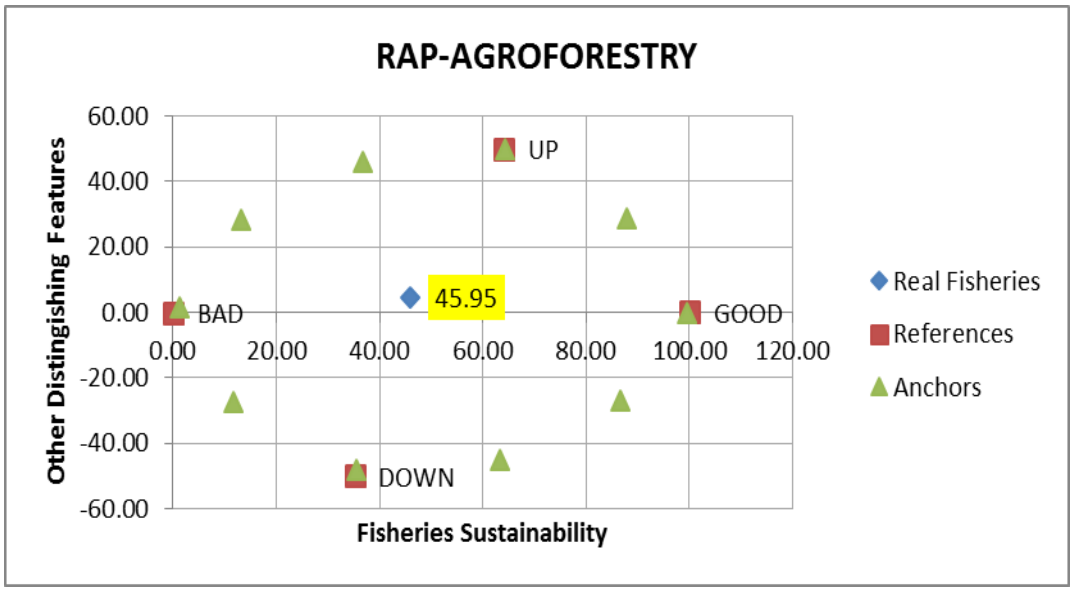

Figure 15. Results of the Technology Dimension Ordination Analysis at KTH Chulande

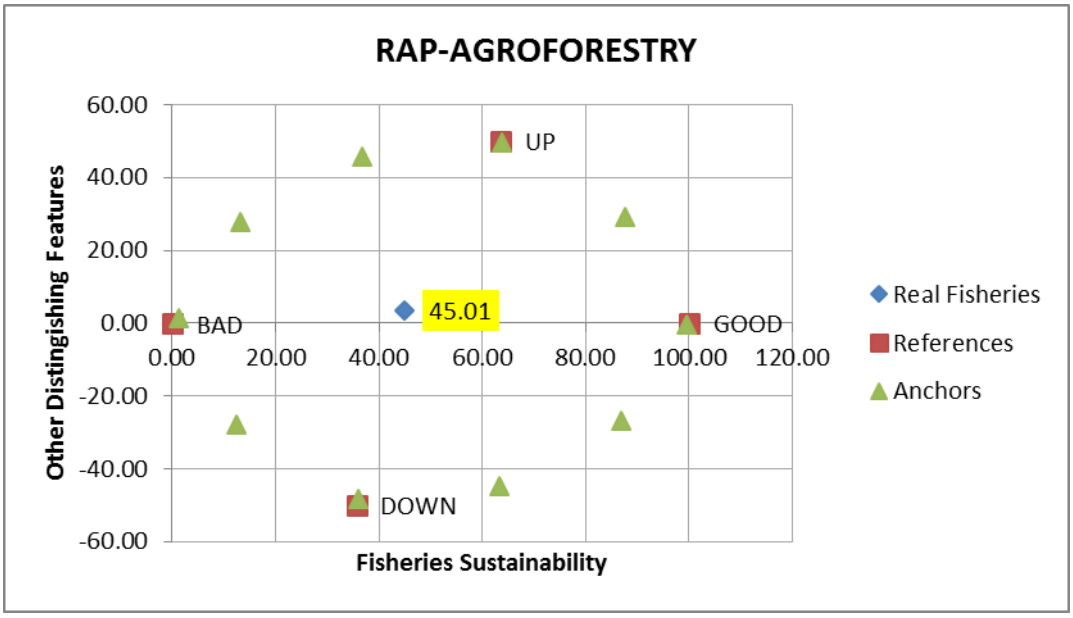

Figure 16. Result of Technology Dimension Ordination Analysis at KTH Sipatuo

b) Technology Dimension Sensitive Attribute

The results of the sensitivity analysis on the Technology dimension are shown in the attribute that has the highest value in each KTH. In KTH Chulande, the most sensitive attribute is about setting cropping patterns and agroforestry models with a leverage value of 2.44. As for KTH Sipatuo, the most sensitive attribute is always following the development of land management technology with a leverage value of 2.59.

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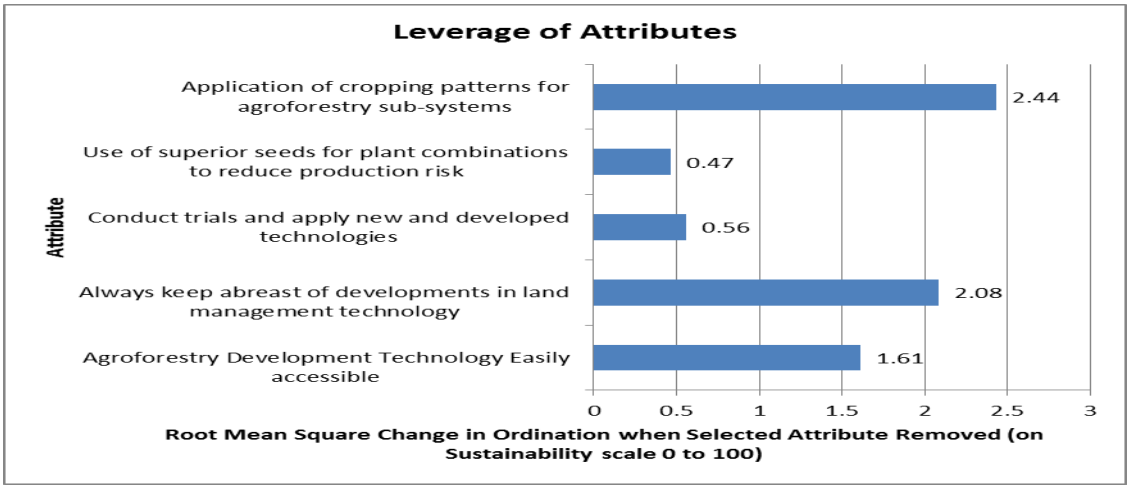

Figure 17. Results of Leverage Analysis of Technology Dimensions on KTH Chulande

The application of cropping patterns and the application of the agroforestry model is quite sensitive with an index value of 2.44. The arrangement of cropping patterns on farmers' lands is still conventional with random or mixed patterns. It is commonly found in farmers' fields in general. Although many land management models apply the agrosilvicultural model with various types of commodity combinations in it, this is not directly proportional to the effective crop regulation pattern and also the cropping pattern arrangement has not been widely socialized in each farmer group. In addition, forest farmers do not develop land management models other than agrosilvicultural systems.

In terms of supporting technology for land management and post-harvest management, most farmers still use traditional methods to manage their land. This is evidenced by the results of the analysis of leverage attributes that are the second most sensitive about the lack of farmers who follow the development of land management technology (2.08).

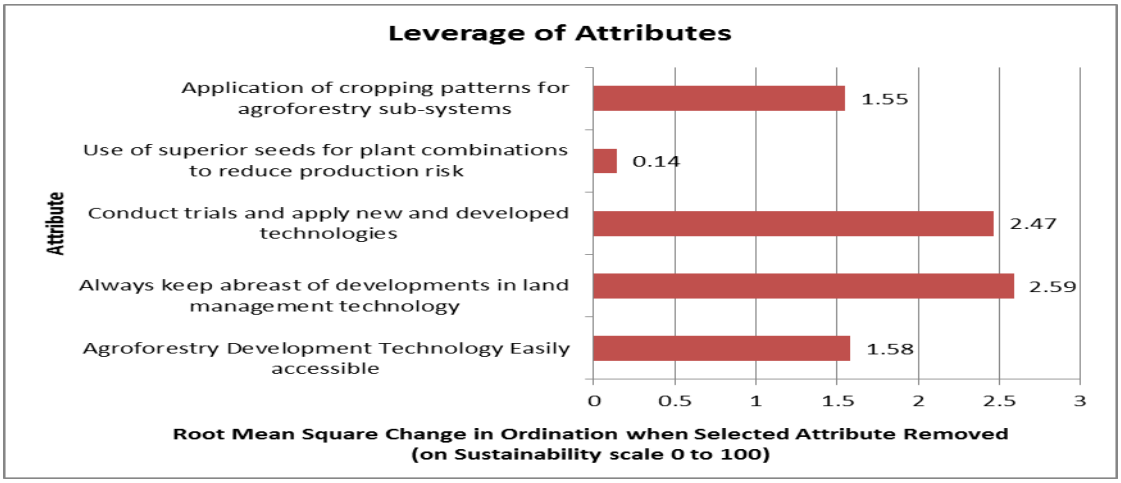

Figure 18. Result of Leverage Analysis of Technology Dimension at KTH Sipatuo

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As happened in KTH Chulande, KTH Sipatuo also had a similar case. Some of the commodities developed by farmers are processed in the traditional way. So this affects the effectiveness of post-harvest processing. In addition, the lack of initiative to develop and apply the latest technology makes land management less effective. However, the results of research in the field show that some farmers have tried to apply various agroforestry models in it such as agrosilvopastor, agrosilvofishery, and agrosilviculture. Although it has not been applied evenly by other farmers, this is considered quite positive in the midst of increasingly widespread critical land conditions coupled with the land management model applied by farmers in general only using a monoculture model with only one type of commodity.

5) Institutional Dimension

a) Sustainability Status

Based on the results of the MDS ordinance analysis for the institutional dimensions, each KTH is in the moderately sustainable category with an index value of 53.36 for the Chulande KTH, and the less sustainable category with an index value of 49.61 for the Sipatuo KTH.

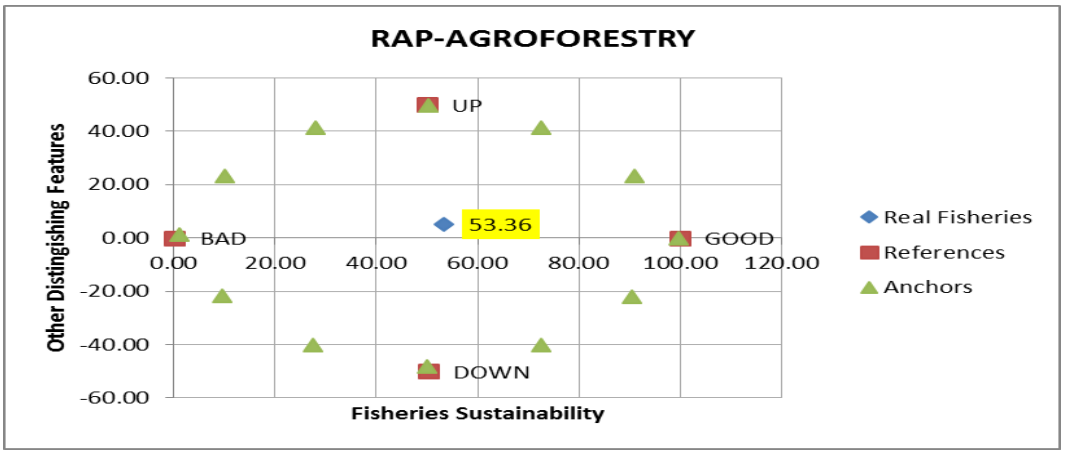

Figure 19. Results of the Ordination Analysis of Institutional Dimensions at KTH Chulande

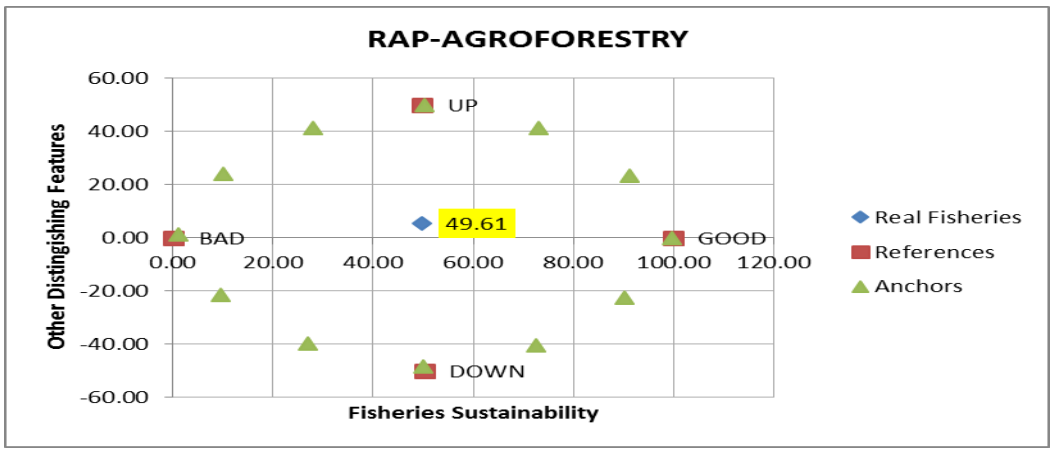

Figure 20. Results of the Ordination Analysis of Institutional Dimensions at KTH Sipatuo

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b) Institutional Dimensional Sensitive Attributes

The results of the sensitivity analysis on the institutional dimension are shown in the attribute that has the highest value in each KTH. In KTH Chulande, the most sensitive attribute is the government's attention to KTH in agroforestry development with a leverage value of 3.11. Meanwhile, for KTH Sipatuo, the most sensitive attribute is that farmer groups establish partnerships to facilitate access to marketing with a leverage value of 4.49.

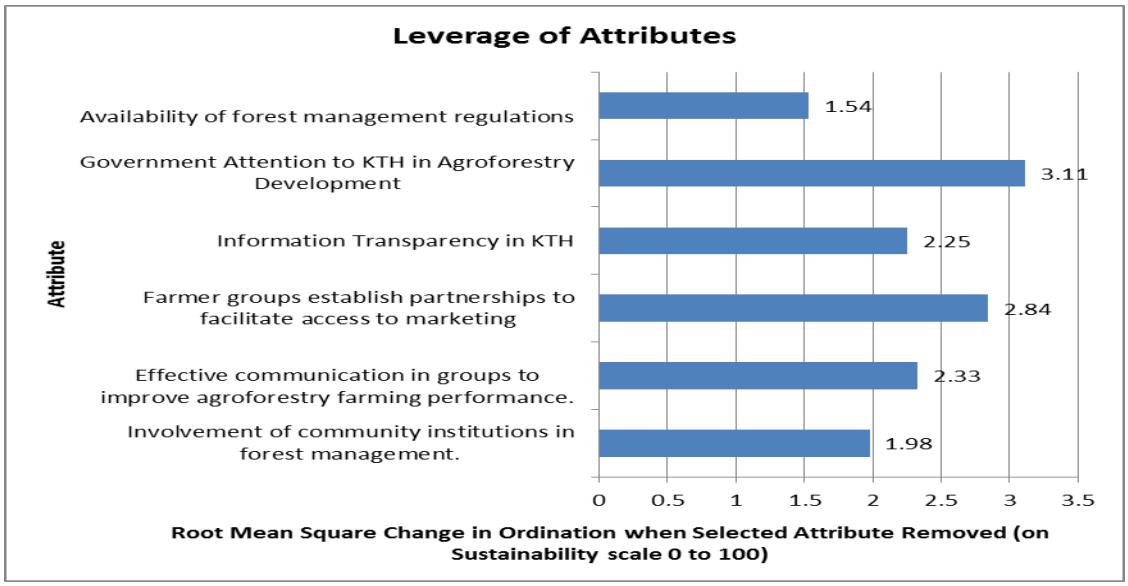

Figure 21. Results of Institutional Dimension Leverage Analysis at KTH Chulande

Based on the results of leverage analysis on KTH Chulande, one of the most sensitive attributes is the government's lack of attention in developing AFS with an index value of 3.11. Relying on traditional land management and supported by simple production equipment is not enough to improve the quality of production. One of the factors is the lack of assistance in KTH and the lack of access to information obtained, so that farmers do not have access to assistance for production facilities from the government and this certainly affects the effectiveness of land management and crop yields and has an impact on people's income levels. In addition, the government's attention to KTH regarding AFS-based land management is still lacking, even though the Agroforestry program is the right program in improving the social welfare of the community towards their dependence on forest areas.

The second most sensitive attribute is that KTH establishes partnerships to facilitate access to marketing (2,84). According to the results of field research, on average, farmers only market their forest or agricultural products to small collectors and there has been no attempt to establish cooperative partners with any cooperatives or forest product industries. This is the only choice for farmers to market their forest or agricultural products for several reasons. One of the causes is the lack of transparency and access to information among farmer groups and the KTH community in Ulusaddang village. In addition, several other farmers prefer to market their respective crops without the involvement of farmer groups in it.

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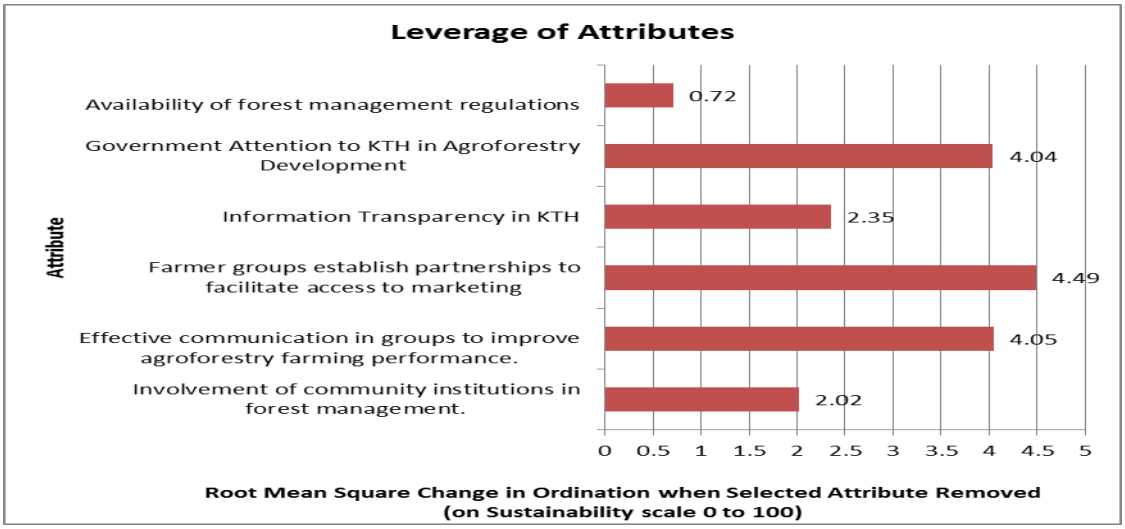

Figure 22. Results of Institutional Dimension Leverage Analysis at KTH Sipatuo

Some of the problems with KTH in Ulusaddang village are the lack of KT in cooperating with cooperatives as well as the agriculture and forestry industry. This is in accordance with the analysis of leverage on KTH Sipatuo regarding the most sensitive attribute, namely partnership cooperation with a leverage value of 4.49. Some KT members prefer to market their respective harvests rather than involving the group. In addition, another attribute that is quite sensitive is the government's attention in developing AFS with an index of 4.04. The government's lack of attention in agroforestry development programs in KTH shows that the level of dependence of farmers on one type of commodity (corn) is quite high in Sipatuo KTH. This is certainly an important issue in the midst of rampant land conversion and inefficient land management.

Lack of access to information obtained and assistance in KTH as well as effective communication between group members are factors that cause some of these attributes to be quite sensitive and affect the sustainability of agroforestry-based land management in KTH Sipatuo.

3. Summary of Sensitivity Analysis (Leverage) Results in Ulusaddang Desa Village

The results of the analysis of leverage on Agroforestry in Ulusaddang Village, Pinrang Regency, show differences in the sustainability status of each KTH from each dimension. For the ecological dimension, KTH Chulande is in the moderately sustainable category (51.00) while KTH Sipatuo is in the less sustainable category (48.73). The economic dimension of KTH Chulande is in the less sustainable category (37.00) while the Sipatuo KTH is also in the less sustainable category (47.41). The social dimension of KTH Chulande is in the fairly sustainable category (52.10), and KTH Sipatuo is in the less sustainable category (46.31). The Technology dimension in Chulande KTH is in the less sustainable category (45.95), while Sipatuo KTH is also in the less sustainable category (45.01). The institutional dimensions of KTH Chulande are in the moderately sustainable category (53.36), and KTH Sipatuo in the less sustainable category (49.61). The status of these five dimensions can be illustrated in the following kite diagram.

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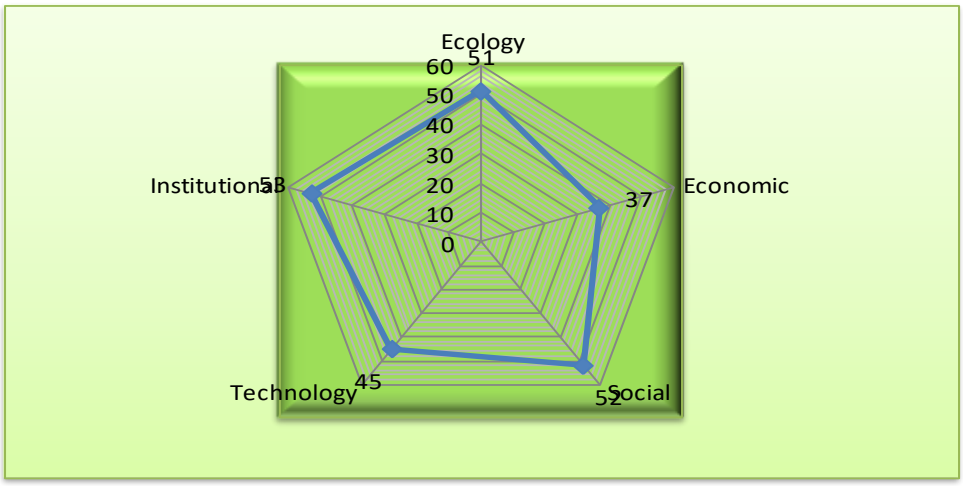

Figure 23. Kite Diagram of Agroforestry KTH Chulande

The results of the leverage analysis consist of Rap-AFS and Monte Carlo outputs. Rap-AFS analysis serves to determine the status of sustainability while Monte Carlo analysis is a tool to test the level of confidence in the leverage value on each dimension. Differences in the level of trust are usually caused by errors in procedures or understanding of the attributes used, variations in scoring due to differences of opinion, stability of the MDS analysis process, including data entry errors or missing data and stress values that are too high. The smaller the difference in the value of the Rap-AFS and Monte Carlo analysis means the results of the MDS analysis have a high level of confidence, in other words, the results of the analysis are included in the valid category (Fauzi and Anna, 2002). The difference in values between Rap-AFS and Monte Carlo analysis can be seen in Table 3.

Table 3. Differences in the value of Rap-AFS and Monte Carlo on KTH Chulande in Leverage Analysis

Results	Sustainability Dimension				
	A	**B**	**C**	**D**	**E**
RAP-AFS	51,00	37,00	52,10	45,95	53,36
Monte Carlo	50,28	36,92	51,83	45,76	52,77
Score difference	0,72	0,08	0,27	0,19	0,59

Information A= Ecological Dimension, B= Economic Dimension, C= Social Dimension, D= Technological Dimension, E= Institutional Dimension

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Table 4. Differences in the value of Rap-AFS and Monte Carlo on KTH Sipatuo in Leverage Analysis

Results	Sustainability Dimension				
	A	B	C	D	E
RAP-AFS	48,73	47,41	46,31	45,01	49,61
Monte Carlo	48,41	47,35	45,90	44,86	48,91
Score difference	0,32	0,06	0,41	0,15	0,70

Information A= Ecological Dimension, B= Economic Dimension, C= Social Dimension, D= Technological Dimension, E= Institutional Dimension

The kite diagram at KTH Sipatuo is depicted in the following picture:.

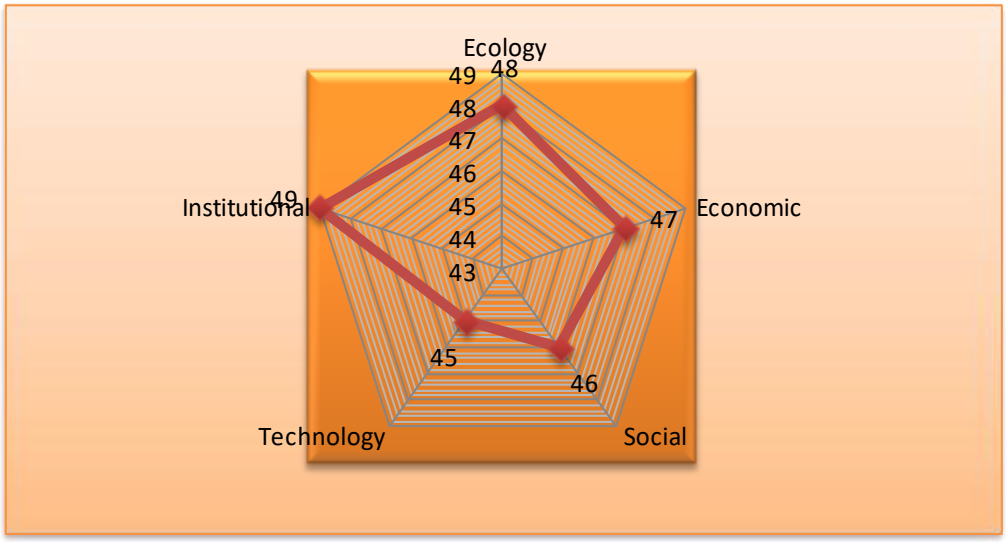

Figure 24. Kite Diagram of KTH Sipatuo Agroforestry

CONCLUSION

The results of the Multidimensional scaling (MDS) analysis show that the sustainability status of agroforestry in Ulusaddang Village in each KTH is in the less sustainable category for Chulande KTH with an index value of 48.51. Meanwhile, KTH Sipatuo is also in the less sustainable category with an index value of 48.28.

SUGGESTION

Agroforestry sustainability cannot be separated from several aspects, be it economic, ecological, social, technological and institutional aspects. Some of the influential attributes in this study cannot be separated from the imbalance in land management and serious attention from related elements. Agroforestry development must be supported by appropriate policy strategies. So that in the future it is necessary to have some appropriate alternative policies so that land management is able to produce superior and productive commodities so that they can have a positive impact on the survival of farmer groups.

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BIBLIOGRAPHY

1. A.Samsu, A. K., Millang, S., & Dassir, M. (2019). Peranan Modal Sosial Terhadap Pengembangan Sistem Agroforestri di Kabupaten Bulukumba. Jurnal Hutan dan Masyarakat., 11(1), 73-78.
2. Bukhari, & Febryano, I. G. (2010). Desain Agroforestry Pada Lahan Kritis (Studi Kasus Di Kecamatan Indrapuri Kabupaten Aceh Besar). Perennial, 6(1), 53–59. https://doi.org/10.24259/perennial.v6i1.198
3. Fauzi, a., & anna, s. (2002). Evaluasi status keberlanjutan pembangunan perikanan: aplikasi pendekatan rapfish (studi kasus perairan pesisir dki jakarta). European journal of biochemistry, 4(3), 43–55. Https://doi.org/10.1111/j.1432-1033.1968.tb00410.x
4. Hasan, M., Sapei, A., Purwanto, J., & Sukardi (2011). Kajian kebijakan pengelolaan sumberdaya air pada Daerah Aliran Sungai Citarum. Jurnal Sumberdaya Air, 7(2), 105- 118.
5. Indrianti, M. A., & Ulfiasih. (2018). Implementasi Sistem Agroforestri sebagai Solusi Pertanian Berkelanjutan di Gorontalo. Seminar Nasional.
6. Junaidi , Edi dan Yongky Indrajaya. 2018. Respon Hidrologi Akibat Penerapan Pola Agroforestri Pada Penggunaan Lahan Yang Tidak Ssesuai Kesesuaian Lahan. Jurnal Penelitian Kehutanan Wallacea. Tangerang.
7. Kuvaini, A., Hidayat, A., Kusmana, C., & Basuni, S. (2019). Teknik Penilaian Multidimensi untuk Mengevaluasi Keberlanjutan Pengelolaan Hutan Mangrove di Pulau Kangean Provinsi Jawa Timur. JURNAL WILAYAH DAN LINGKUNGAN, 7(3), 137-152.
8. Mishra, J., Kumar, R., Saurabh, K., & Bhatt, B. (2019). Conservation Agriculture for Climate Resilient Farming & Doubling Farmers' Income. ICAR Research Complex for Eastern Region, Patna, Bihar, 1-255.
9. Muthmainnah, I. S. (2018). Pendapatan Masyarakat pada Komponen Silvopasture dan Agrisilvikultur Kecamatan Parangloe Kabupaten gowa. Jurnal Hutan Dan Masyarakat, 10(1), 136–144.
10. Nawir, M., Taksirawati, I., & Baharuddin (2017). Pemanfaatan Tanaman Pangi (Pangium Edule Reinw) pada Lahan Agroforestri Desa Watu Toa Kecamatan Marioriwawo Kabupaten Soppeng. Jurnal Hutan dan Masyarakat 9 (2): 123-130.
11. Nursidiq, A., Noor, T. I., & Trimo, L. (2019). Analisis Keberlanjutan Agribisnis Paprika di Bandung Barat. Jurnal Penelitian Pertanian Terapan, 19(3), 184. https://doi.org/10.25181/jppt.v19i3.1317
12. Plieninger, T., Rojas, J. M., Buck, L. E., & Scherr, S. J. (2020). Agroforestry for sustainable landscape management. Sustainability Science, 1255–1266.
13. Rahayu, A., Bambang, A.N., & Hardiman, G. (2013). Strategi peningkatan status keberlanjutan kota Batu sebagai kawasan agropolitan. Jurnal Ekosains, 5(1), 21-34.
14. Riease U, Abdi. 2010. Agroforestri: Solusi Sosial dan Ekonomi Pengelolaan Sumber Daya Hutan. Bandung (ID): Alfabeta
15. Ruhimat, I. S. (2015). Status Keberlanjutan Usahatani Agroforestry Pada Lahan Masyarakat: Studi Kasus Di Kecamatan Rancah,Kabupaten Ciamis, Provinsi Jawa Barat. Jurnal Penelitian Sosial Dan Ekonomi Kehutanan, 12(2), 99-110.

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Article History: Received: 06 April 2022, Revised: 28 April 2022, Accepted: 04 May 2022, Publication: 15 May 2022

16. Saida. (2011).Analisis keberlanjutan usahatani hortikultura sayuran. JurnalMatematika, Sains dan Teknologi, 12(2), 101-112.
17. Vikrant, K., Chauhan , D., & Rizvi, R. (2014). Biomass and Carbon Potential in Agroforestry Systems along Altitudes in Tehri District of Uttarakhand. Agroforestry for Climate Resilience and Rural Livelihood.
18. Widianto, Hairiah, K., Suharjito, D., & Sardjono, M. A. (2003). Fungsi Dan Peran Agroforestri. Bogor, Indonesia: World Agroforestry Centre (ICRAF).
19. Widianto, Hairiah, K., Suharjito, D., & Sardjono, M. A. (2003). Fungsi Dan Peran Agroforestri. Bogor, Indonesia: World Agroforestry Centre (ICRAF).