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Sustainability Status Index of Simple Agroforestry of Magersaren (SAM) with RAP-SAS Method

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Abstract. *The simple agroforestry system of the Magersaren at the University of Brawijaya (UB) Forest is a source of livelihood for the community that has long inhabited the area. Unsustainable management increases the amount of damage incurred; therefore, information about the sustainability status of the simple agroforestry system of Magersaren on various dimensions with sustainable attribute criteria is needed. This study aims to analyze the sustainability status of the Magersaren agroforestry system in the UB forest area, Tawang Argo Village, Karangploso District, Malang Regency. Sustainability status was determined based on a sustainability index formulated through multidimensional scaling (MDS) analysis of the Rapid Appraisal for Simple Agroforestry System (RAP-SAS) Method. Based on the results of the sustainability status analysis, the simple agroforestry system in UB Forest is good or very sustainable, and the management and technology dimensions showed a sustainable status with sensitive attributes owned, namely business planning and processing with a Root Mean Square (RMS) value of 12.3. Therefore, it is necessary to improve the quality of human resources, namely, the awareness of the importance of using technology and good planning to ensure the sustainability of the simple Magersaren agroforestry system, especially in supporting its function as an educational forest area and the livelihoods of Magersaren people in UB Forest.*

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INTRODUCTION

University of Brawijaya (UB) Forest area as an educational forest has the main function, namely as a production and conservation forest. The main function of production forests is to produce forest products, while conservation forests protect plants, animal diversity, and their ecosystems. Kusumawati and Prayogo (2019) stated that the condition of the UB Forest area is dominated by the main crops in the form of *Pinus* (*Pinus merkusii)* and *Mahoni* (*Swietenia mahagoni*) covering an area of 392.58 ha while some plots have become agricultural areas (81.42 ha) and protected forests (50 ha) (Kusumawati and Prayogo 2019). The Magersaren people inhabit the UB Forest area. The Magersaren in the forest area is the Magersaren Sumbersari Community in Tawangaro Village and the Magersaren Sumberwangi Community in Donowarih Village. In

general, the average Magersaren has inhabited the UB Forest area for decades, some even since birth and generation. They had forest management rights from *Perhutani* before the inauguration of the UB Forest in 2015 but did not have property rights to the land they cultivated. Usually, the relationship between the Magersaren and *Perhutani* is managed by *Lembaga Masyarakat Desa Hutan* (LMDH), which was deliberately formed by *Perhutani* (Ambayoen et al. 2021).

However, it turns out that UB Forest forests have problems in forest management, especially related to bio-physical, socio-economic-cultural, educational, and environmental aspects. The approach used must be able to combine various interests, namely, forest rehabilitation, science and technology development, human resource capacity building, farmer income or community economic empowerment, and regulatory and institutional aspects (Fibrianingtyas 2020). Ram et al. (2020), land-use change is largely constrained by regulations that tend to be based on economic sustainability rather than concern for biodiversity, leading to habitat loss. Matilainen and Lähdesmäki (2023), there are also many policy tools designed to encourage communities living around forests to manage their forests in such a way that community goals for the utilization of forest resources can be fulfilled, such as the economics of timber production, provision of non-timber forest products, maintaining biodiversity, supporting water resources and preventing erosion and landslide. According to Wong et al. (2020), local communities living in and close to forests can manage forests effectively in the long term by becoming subject to sustainable forest management using various schemes.

The dominant problem in community forests is the awareness of the Magersaren in utilizing and maintaining forest resources as well as limited extension workers. One of the efforts made by Magersaren to manage forests is to implement a simple agroforestry system, which has been known as a branch of science in the fields of agriculture and forestry. Many Magersaren people in the UB Forest are currently farmers and have known simple agroforestry (*tumpang sari*). According to Pranoto (2011), agroforestry is defined as a sustainable land management system that increases variations in land by sequentially combining crops with trees or animals. Educational forest management involving communities can be used as an alternative to environmental conservation. Hence, it can suppress disturbances that can damage forest areas. Mulyana et al. (2017), stated that optimizing agroforestry development in *Taman Hutan Raya Wan Abdul Rahman* (*Tahura WAR*) requires community involvement. The application of agroforestry patterns has important implications for human lives. Ecologically, agroforestry also provides benefits in preventing erosion, while in terms of the economy, agroforestry helps the community's economy with forest products.

Cialdella et al. (2023), agroforestry provides technical solutions for farmers' incomes, exports, national richness, and well-being by reintroducing diversity in cropping systems (*tumpang sari*). Philipp and Zander (2023) agroforestry systems offer diverse benefits, including carbon sequestration, soil enrichment, and improved air and water quality, alongside food production. Plieninger et al. (2020), agroforestry practices provide multiple economic, environmental, social, and cultural benefits. Developing markets and businesses is crucial for sustaining these land use systems and preserving their values over time. Flinzberger et al. (2020) according to research agroforestry systems can promote various social and ecological values.

Agroforestry systems have a very good and promising impact on communities, especially in forested areas. The Magersaren in the UB Forest area plays an important role in maintaining the existing simple agroforestry management. Local knowledge can be used and inherited for generations for forest conservation by Magersaren. Therefore, it is necessary to have information about the sustainability status of the simple agroforestry system of Magersaren in several dimensions. In this study the value of the regional sustainability index formulated through the RAP-SAS (Rapid Appraisal for Simple Agroforestry System) method approach can be useful in reviewing existing management in the ecological, economic, socio-institutional, and management-technology dimensions. Thus, UB Forest can be a pilot for educational forests in which Magersaren communities are involved in managing the sustainability status of the Magersaren agroforestry system in the UB forest.

METHOD

Research Location and Time

The research location was the UB educational forest on the slopes of Mount Arjuno, Sumbersari Hamlet, Tawang Argo Village, Karangploso District, and Malang Regency. This research was carried out for 2 (two) months, from August to September 2022. The study locations are shown in Figure 1.

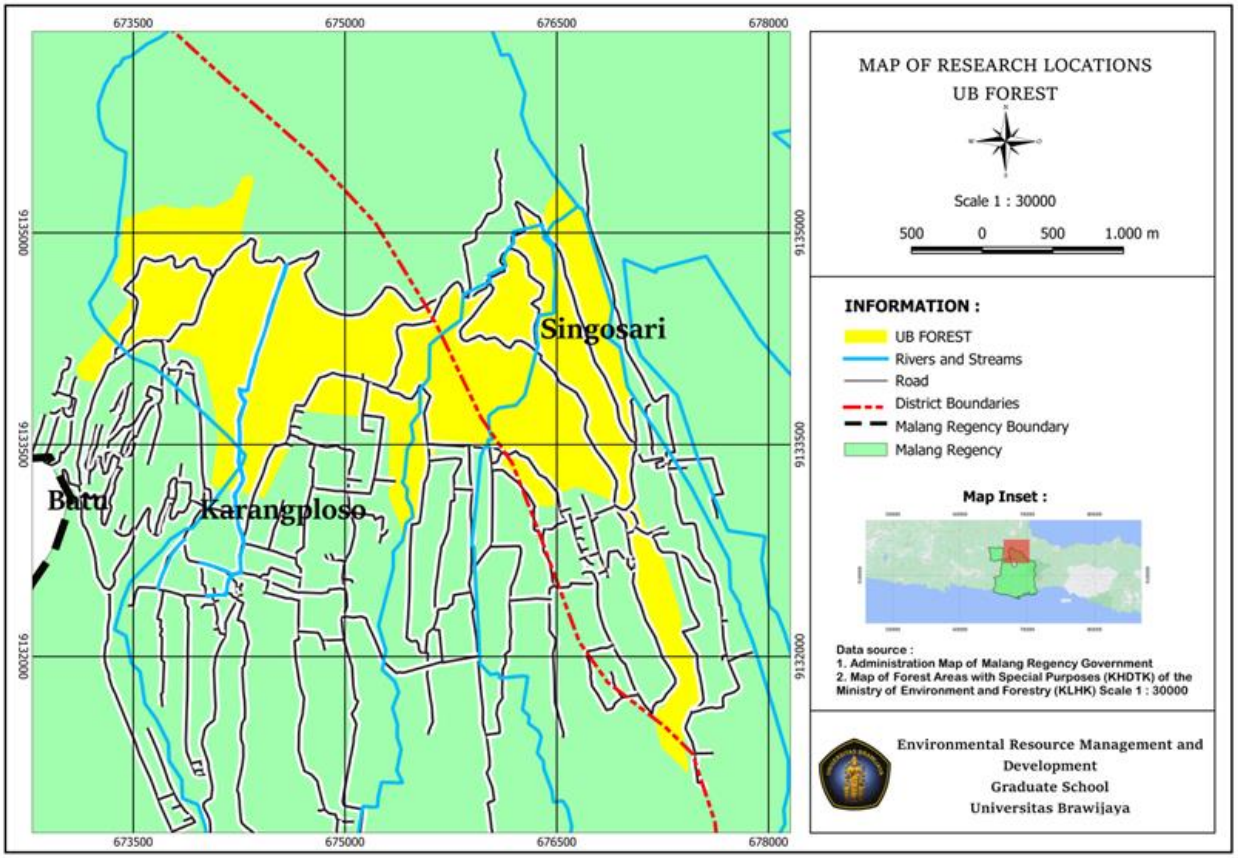


Figure 1 Research location in UB educational forest

Tools and Instruments

The tools in this study used a camera for documentation purposes and a cellphone/recorder for interviews. The instruments in this study were the tools needed or used to facilitate data collection. The questionnaire is an instrument used to explore respondents' opinions so that the results are more accurate, complete and systematic. Sugiyono (2019) questionnaires are used to collect data by providing written statements and questions to respondents.

Research Procedure

The types of data used in this study were primary and secondary data. Primary data collection was carried out by conducting interviews and providing questionnaires with questions about the management of simple agroforestry systems carried out by the Magersaren in UB Forest. Secondary data in the form of literature from related agencies, studies, maps, and other documentation were added. The selection of Magersaren respondents in this study was carried out using Purposive Sampling, with the criteria of respondents being Magersaren people in UB Forest.

Respondents in this study were selected from the Magersaren who managed simple agroforestry land in UB Forest, which was divided into three villages: Tawang Argo Village, Donowarih Village, Ngenep Village, Karangploso District, and Malang Regency. The number of respondents who would be included in the

population using the Slovin formula was 43 out of 824 people or 15% of the total number of respondents. Irawanata et al. (2021) stated that the number of respondents was set 10–15% of the total population. The number of respondents from each village was proportionally determined based on the number of inhabitants in each village.

Data Analysis

Determining the sustainability index on each dimension used in this study was carried out by MDS (Multidimensional Scaling) analysis using the RAP-SAS Method. Rapid Apraisal for Fisheries (RAPFISH) is a technique developed by the University of British Columbia around 1999 to evaluate capture fisheries in a multidisciplinary manner. Data analysis on the RAPFISH method is principally carried out by ordination techniques with Multi-Dimensional Scaling (MDS). MDS has been widely recognized as a statistical technique for transforming multidimensional objects into lower dimensions (Mulyana et al. 2017). The dimensions and attributes in RAP-SAS were determined through literature studies and adapted to the criteria of a simple agroforestry system of a sustainable Magersaren society. Thus, the dimensions and attributes used can describe the sustainability conditions of the UB Forest area in all the dimensions used in this study. The analysis was performed using the RAPFISH application that was added to Microsoft Excel (Figure 2).

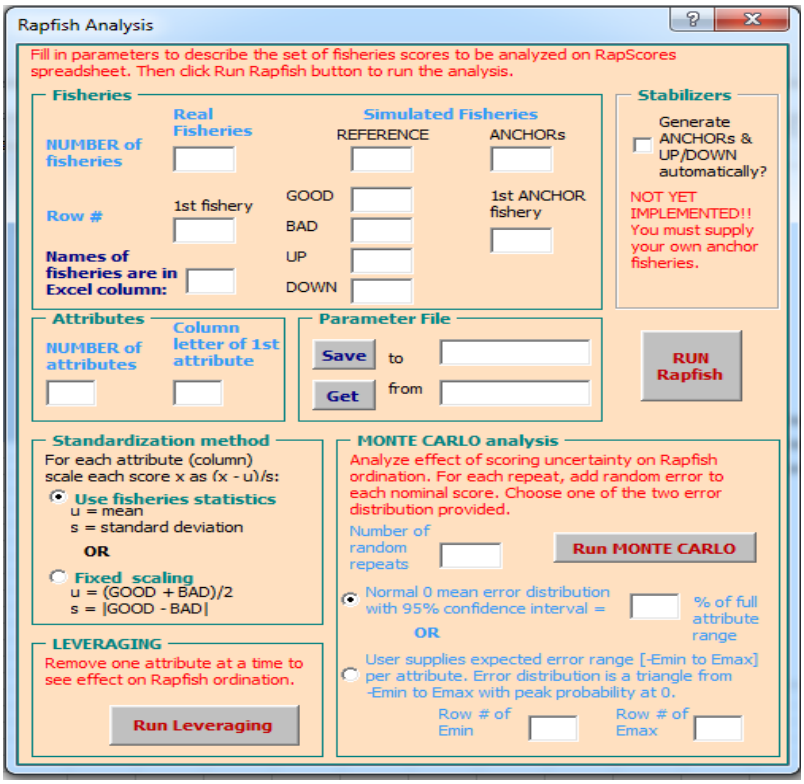


Figure 2 RAPFISH application

The determination of dimensions and attributes that have been carried out includes sustainability aspects of the ecological dimension, economic dimension, socio-institutional dimension, and management-technology dimension. The results will become the basic data for the assessment process. Furthermore, the assessment process was carried out by converting primary and secondary data into an ordinal scale because each dimension is non-metric. The attribute assessment stage on the ordinal scale ranges from 0 (bad) to 2 (good) or refers to the sustainability criteria for each dimension. The research variables in each dimension of the MDS analysis have attributes that can be seen in Table 1.

Table 1 Dimensions and attributes of the RAP-SAS method

Dimension	Attribute
Ecology	1. The degree of pest control of the disease
	2. The intensity of pest infestation
	3. The degree of density of the shade type
	4. Conservation measures
	5. Level of understanding of soil and water conservation
Economics	1. People's income level
	2. Job opportunities
	3. Coffee commodity prices
	4. The existence of a sales market
	5. Stability of selling value
	6. Independence of business capital
Socio-Institutional	1. Intensity of counselling
	2. Level of activity of farmer groups
	3. Frequency of conflicts
	4. Frequency of deliberations
	5. Partnerships with related institutions
Management - Technology	1. Accessibility of facilities and infrastructure
	2. The performance level of farmer groups
	3. Business planning and management
	4. Level of technological knowledge

The stage of compiling the index and sustainability status of the Simple Agroforestry System of the Magersaren uses MDS analysis through ordination analysis. From the analysis, it produces the sustainability index value in a two-dimensional Figure where there is a range of assessment scales of 0% to 100%, along with the value of R^2 (coefficient of determination) and the stress value. Reza et al. (2021), state that the value of R^2 (coefficient of determination) indicates the validity of the model, while the stress value indicates the proportion of variance not described by the model. The higher the stress value, the worse the MDS model produced and vice versa. If the S value < 0.25 % and the R^2 value is close to 1, it means the model is good or the data is normally distributed. The sustainability index produced in the coordination process was then used to determine the position of the sustainability status of the Magersaren Simple Agroforestry System on each dimension with sustainability categories, as shown in Table 2.

Table 2 Index value categories and simple agroforestry sustainability status (Mahida and Handayani 2019)

Index value	Category
0 – 25.00	Bad: Unsustainable
25.01 – 50.00	Less: Less sustainable
50.01 – 75.00	Fill: Fairly sustainable
75.01 – 100.00	Good: Very Sustainable

Leverage analysis is used to determine the sensitive attributes that affect the sustainability index value in each dimension by referring to the highest Root Mean Square (RMS) value. The final result of the leverage analysis is obtained by considering the influence of each attribute in the form of a change in the RMS value. The sustainability of the Magersaren simple agroforestry system is more sensitive to the value of RMS leverage when considering these attributes. Suwarno (2011) stated that the selected sensitive attribute has the highest RMS value, up to half of each sustainability dimension. In the ordination analysis process, errors occur. It is

necessary to evaluate the influence of errors on the process, so that a Monte Carlo analysis is carried out as a test of validity and accuracy. Furthermore, Monte Carlo analysis was used to test the validity and determination of the ordination results. Mahida and Handayani (2019) stated that the Monte Carlo analysis is a method for determining how random variations or errors affect the sensitivity, performance, and reliability (consistency) of the system being modeled.

Attributes of the RAP-SAS Method

The sustainability index was determined using the RAP-SAS Method in this study using attributes that have been adjusted to the criteria of a simple agroforestry system of sustainable Magersaren Communities. Changes to the attribute templates in the RAPFISH application that have been added to the Ms. Excel application were conducted manually by paying attention to adjustments to the anchors, so that the algorithm was executed accordingly. The template used in the RAP-SAS Method is shown in Figure 3.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Attributes > SIMPLE AGROFORESTRY SYSTEM	Abbreviation	ECOLOGY	Pest control level	Level of understanding soil and water conservation	Shade type density	Conservation action	Pest attack intensity	ECONOMY	The income level of the community	Employment opportunity	Coffee commodity prices	Presence of a sales market	Stability of the selling value	Business capital independence	SOCIAL AND INSTITUTIONAL	Intensity counseling	Farmer group activity level	Related to institutional partnerships	Deliberation frequency	Conflict frequency	MANAGEMENT AND TECHNOLOGY	Accessibility of facilities and infrastructure	Farmer group management level	Business planning and management	Tech knowledge level
2	Sustainability Status of Simple Agrofores	SAS		2	1	2	2	2		1	2	2	2	1	2		1	2	1	2	2		2	2	1	1
3																										
4	Reference Est:																									
5	GOOD	1		2	2	2	2	2		2	2	2	2	2	2		2	2	2	2	2		2	2	2	2
6	BAD	2		0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0		0	0	0	0
7	UP	3		2	2	0	0	0		2	2	2	0	0	0		2	2	0	0	0		2	2	0	0
8	DOWN	4		0	0	2	2	2		0	0	0	2	2	2		0	0	2	2	2		0	0	2	2
9	Anchor Est:	1		2	2	2	2	2		2	2	2	2	2	2		2	2	2	2	2		2	2	2	2
10		2		2	2	2	2	0		2	2	2	2	2	0		2	2	2	2	0		2	2	2	0
11		3		2	2	2	0	0		2	2	2	2	0	0		2	2	2	0	0		2	0	0	0
12		4		2	0	0	0	0		2	2	0	0	0	0		2	0	0	0	0		0	0	0	0
13		5		0	0	0	0	0		2	0	0	0	0	0		0	0	0	0	0		0	0	0	2
14		6		0	0	0	0	2		0	0	0	0	0	0		0	0	0	0	2		0	2	2	2
15		7		0	0	0	2	2		0	0	0	0	0	2		0	0	0	2	2		0	2	2	2
16		8		0	2	2	2	2		0	0	0	0	2	2		0	2	2	2	2					
17		9		0	2	2	2	2		0	0	2	2	2	2		0	2	2	2	2					
18		10								0	2	2	2	2	2											
19																										
20	DEFAULT 95% probability scoring error limits																									
21	set at 20% of full attribute scale																									
22	Error limit above or below score			0,2	0,2	0,2	0,2	0,2		0,2	0,2	0,2	0,2	0,2	0,2		0,2	0,2	0,2	0,2	0,2		0,2	0,2	0,2	0,2
23	(assumes 0 mean Normal error distribution)																									
24																										

RapScores | RapAnalysis | Distances | LeverageAttributes | MonteCarlo

Figure 3 MDS analysis on RAP-SAS

In this study, 20 attributes were spread across each dimension to analyze the sustainability index of the simple agroforestry system of the Magersaren. Based on the highest scoring results generated by the economic dimension with an average value of two score attributes, which were obtained from the calculation results of the mode on the tabulation of MDS data.

RESULTS AND DISCUSSION

Sustainability Status Index Value

Based on the results of the sustainability status index of the simple agroforestry system of the Magersaren, most of the dimensions are in the very sustainable category, namely in the ecological dimension at 85.16%, in the economic dimension at 79.70%, and the social and institutional dimensions at 72.91%, while in the management and technology dimension at 66.94%, it is in the fairly sustainable category. Figure 4 presents the results of the ordination analysis.

The management and technology dimension are the only dimension with a fairly sustainable category, with a sustainability status index value of 66.94%. This shows that, in the management and technology dimensions, it is necessary to pay special attention to the managers of the UB Forest Area and related stakeholders if they want the simple agroforestry system of the Magersaren to remain sustainable. Furthermore, the output of the results of the ordination analysis shows the feasibility test of the model, provided that if the stress value < 0.25 and the R^2 value is close to 1, then the model is declared good. The results of the sustainability status analysis for each dimension are presented in Table 3.

Based on the results of the RAP-SAS analysis on all dimensions studied, the stress value obtained ranged from 0.14–0.16 while the value of the coefficient of determination R^2 ranged from 0.936 to 0.949, which showed quite accurate and accountable results; thus, based on the results of stress and R^2 on all dimensions studied, it showed that the model studied in this study was good (good of fit). This is because it qualifies as S < 0.25, and R^2 is close to 1; therefore, there is no need to add attributes to approach the actual state.

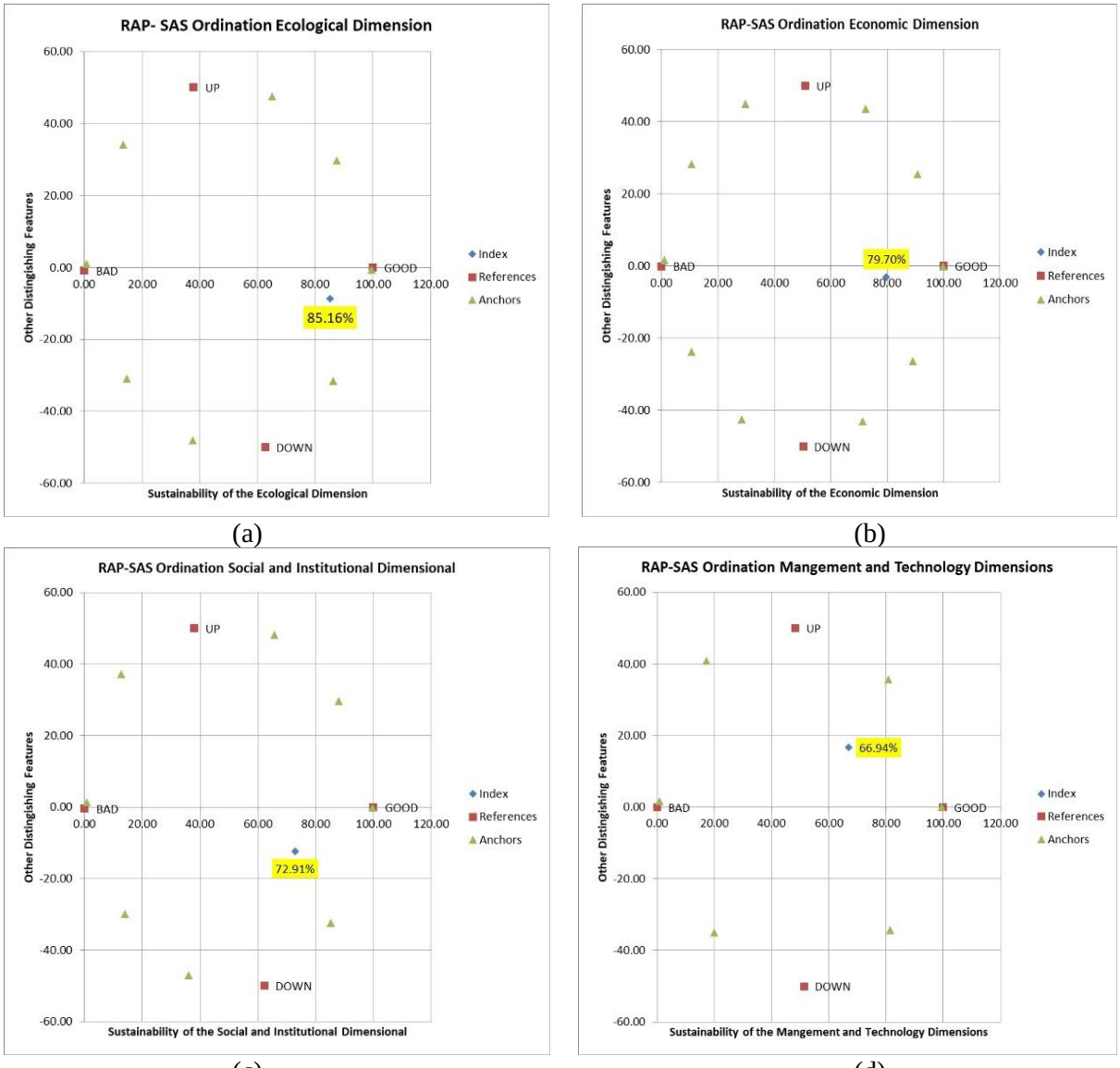


Figure 4 Sustainability ordination index values (a = ecological dimensions; b = economic dimension; c = social and institutional dimensions; d = management and technology dimensions)

Table 3 Results of sustainability status analysis using RAP-SAS

Dimension	Value Ordination Index (%)	Values-stress	Coefficient of determination (R^2)	Status Sustainability
Ecology	85.16	0.14	0.9420	Good
Economics	79.70	0.14	0.9498	Good
Socio-Institutional	72.91	0.14	0.9447	Good
Technology-Management	66.94	0.16	0.9368	Fill

The kite diagram presented in Figure 5 shows that the dimensions of management and technology are not yet top priorities. Other dimensions had priority sustainability index values. Based on the kite diagram in Figure 5, the results of data analysis from the four dimensions show that the ecological dimension has the best sustainability index value at 85.16%, followed by the economic dimension with a value of 79.70%, and the social and institutional dimensions, while the management and technology dimension had the lowest value at 66.94%.

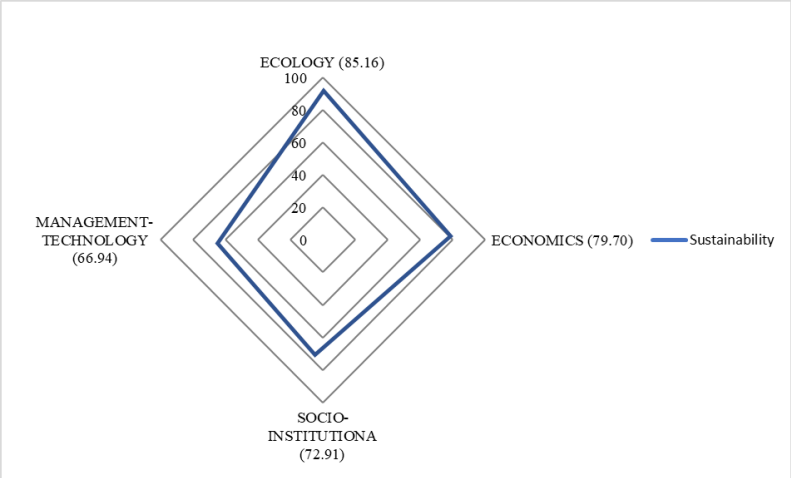


Figure 5 Kite Diagram of simple agroforestry system sustainability index values

Leverage Analysis

A leverage analysis was used to identify sensitive attributes in each sustainability dimension. The leverage analysis is presented using a bar chart, where each attribute that has the greatest value is the attribute that has the greatest influence on the sustainability status of a dimension. Therefore, the attribute with the greatest leverage value is the most decisive aspect of the simple agroforestry sustainability of the Magersaren in the UB Forest. Figure 6 shows the results of the leverage analysis for each dimension.

Based on the results of the attribute leverage analysis on the ecological dimension (Figure 6), there was a sensitive attribute that could influence the simple agroforestry of the Magersaren in UB Forest. A sensitive attribute in the ecological dimension was the level of understanding of soil and water conservation, with an RMS value of 15.24. This indicates that these sensitive attributes are closely related to ecological sustainability. Therefore, it is necessary to intervene in these attributes to ensure the sustainability of the ecological dimension for simple agroforestry of the Magersaren people. Soil and water conservation has a significant influence on the sustainability of ecosystems, especially for the Magersaren.

Based on the field situation, it is known that water is a basic requirement for every daily activity in the Magersaren. For the simple agroforestry sustainability of the Magersaren in the UB Forest in this ecological dimension to increase, the existence of these sensitive attributes needs to be considered properly. This is

supported by Karyati and Sarminah (2018), who stated that the conservation of soil and water resources is very important for maintaining the continuity of the production of foodstuffs that are useful for meeting the increasing needs of human life, in addition to securing the environment. The implementation of reforestation carried out on logged forests and bare soils with selected plants, allowing the growth of natural plants (grasses, shrubs, etc.) under these selected plants, will greatly help the realization of the ecosystem of the forest area, and thus the forest can play a role following its function, namely as a soil and water preservative.

As shown by the results of the analysis of leverage attributes in the economic dimension in Figure 6, out of the six attributes of the economic dimension, there are two sensitive attributes, namely the stability of the selling value with an RMS value of 8.44, and the income level of the community with an RMS value of 5.48. This is in line with the condition of the Magersaren people who work as *pesanggem* are people who live in forest areas on UB Forest land, where the Magersaren in selling their simple agroforestry products still follows the market price, so the income of the Magersaren is not stable. There needs to be special attention to this attribute, such as by preparing a farm cooperative for the Magersaren by setting a stable and even selling price value. So that simple agroforestry results can later be improved and influence the economy of the Magersaren in UB Forest. The results of this study were supported by Ariestiyanti and Adrison (2020), who state that at the level of collecting traders or middlemen who are relatively few tend to form an *oligopoly* market. So, it has the power to influence prices. Often these collecting traders/middlemen form a cartel that can make deals and form market prices.

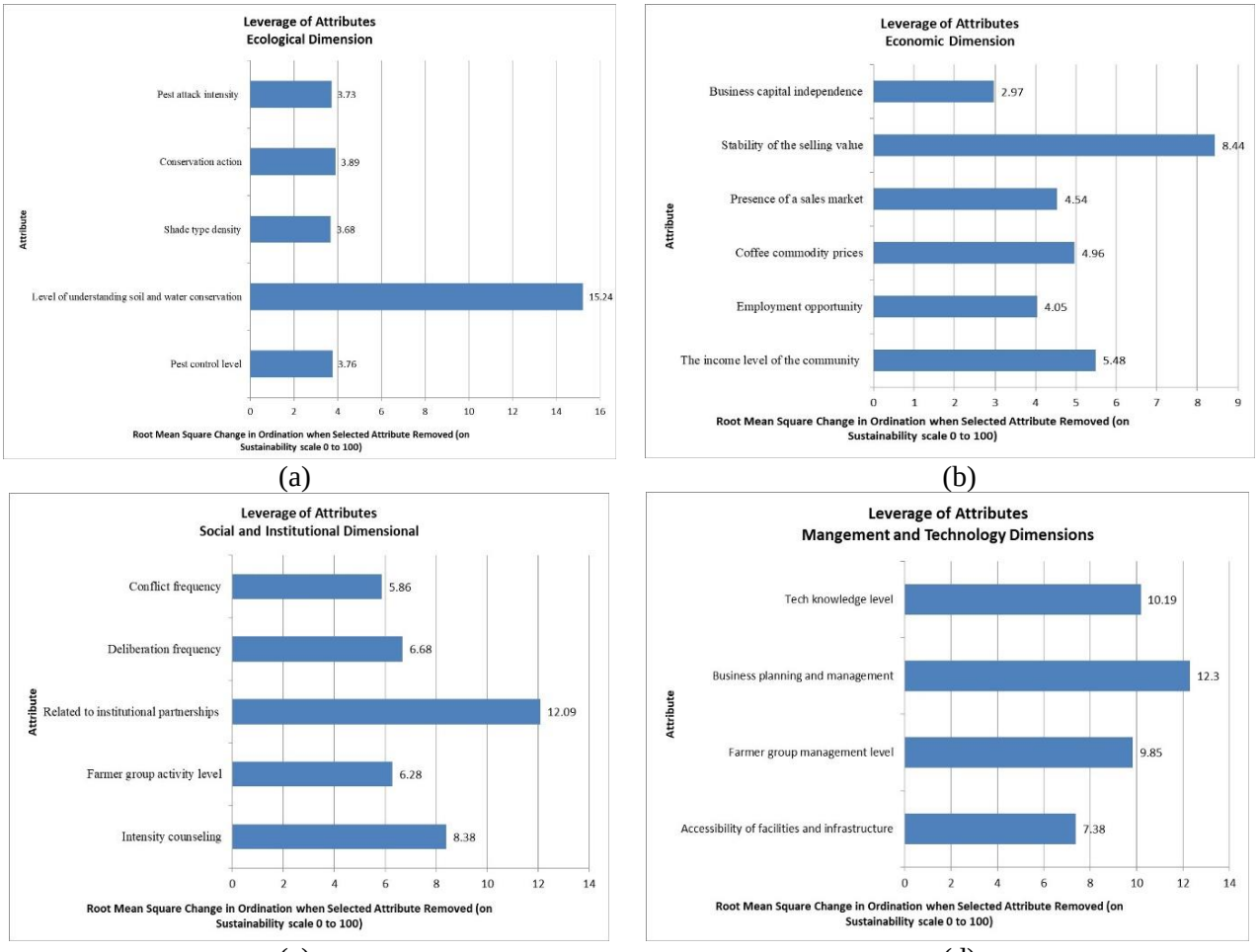


Figure 6 Results of leverage analysis of sensitive attributes on the sustainability index (a = ecological dimension; b = economic dimension; c = social and institutional dimensions; d = management and technology dimensions)

In the social and institutional dimensions of the 5 attributes presented in Figure 6. Two sensitive attributes greatly affect the sustainability of the simple agroforestry of the Magersaren in UB Forest. Sensitive attributes in the social and institutional dimensions were related to institutional partnerships with an RMS value of 12.09 and intensity counseling with an RMS value of 8.38. The highest attribute in the social and institutional dimensions is the partnership of related institutions. This follows the real conditions of observation in the field, where there is a great opportunity for agencies, institutions, or stakeholders to become partners in supporting the progress of simple agroforestry of the Magersaren.

Therefore, the attributes of institutional partnerships are the main aspects that make UB Forest and the Community run well. Thus, with improvements in partnership attributes, such as savings and loan cooperatives, it is not impossible to support the opening of wider and more sustainable partnerships. Novianti et al. (2018), stated that the partnership in the Cocoa Field School program, with parties involved in the cooperation, namely *Lembaga Swadaya Masyarakat (LSM) Wahana Visi Indonesia* as the initiator and organizer of the program, elements of the village community, the church as an active partner acting as a motivator for the community, and the field extension officer who acts as a facilitator. The purpose of the partnership is to create an information system and network that leads to *sustainability* programs and other forms of program development that can empower the community, particularly in the economic field.

The results of the analysis of attribute leverage on the management and technology dimensions in Figure 6 show that of the four attributes that were analyzed, there are sensitive attributes that can influence the simple agroforestry of the Magersaren in UB Forest. The most sensitive attribute is business planning and management, which has the largest value, with an RMS value of 12.3. This means that an intervention on these attributes can affect the value of the sustainability index. These sensitive attributes are closely related to the sustainability of management and technology, whereas in a simple agroforestry system, the Magersaren in the UB Forest requires good planning, adequate technology, and qualified human resources. This is supported by the results of research by Maharsi (2000) in which stated that the presence of information technology benefits companies by simplifying complex business activities and producing trustworthy, relevant, timely, complete, and understandable information for management decisions. Based on the results of the leverage analysis, each dimension has sensitive attributes with the highest value and the largest leverage factor, which greatly affects the sustainability of the simple agroforestry system of the Magersaren in UB Forest. The attributes with the greatest leverage factor for each dimension are listed in Table 4.

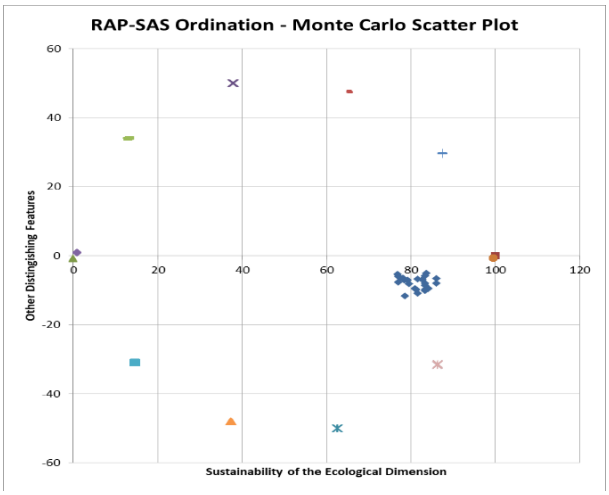
Table 4 Sensitive attributes affecting the Simple Agroforestry Sustainability Index

Dimension	Sensitive attributes	Value RMS
Ecology	Level of understanding of soil and water conservation	15.24
Economics	Selling value stability	8.44
Socio-Institutional	Related institution partnerships	12.09
Technology-Management	Business planning and management	12.3

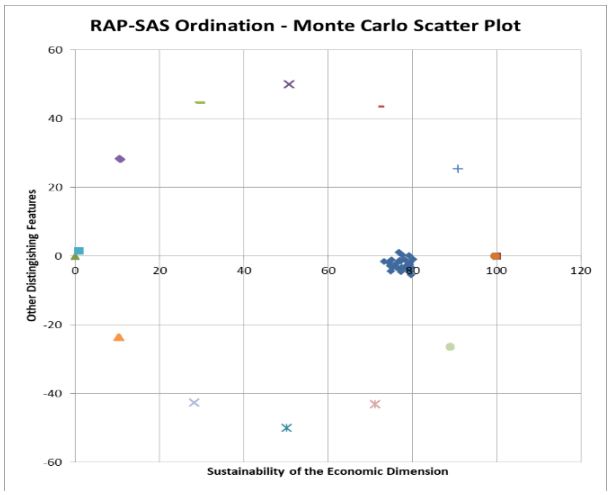
The results of the leverage analysis for each dimension produce five sensitive attributes that are useful as leverage factors. These sensitive attributes form the basis of information about the attributes or factors that need to be maintained and improved. Based on this, the dimension with the highest RMS value is the ecological dimension, which needs to be maintained for sustainability, while the dimension with the lowest RMS value is the management and technology dimension, which needs to be improved in quality to support the sustainability of the management system.

Monte Carlo Analysis

Monte Carlo analysis was carried out to determine the impact of random errors with the "scatter plot" method, in each dimension 25 repetitions were carried out at a 95% confidence level. The results of the Monte Carlo analysis showed that the sustainability index value was slightly different from the MDS analysis results. This means that the errors in the analysis and data analysis processes are very small. The results of the Monte Carlo analysis are presented in the form of a scatter plot for each dimension in Figure 7.



(a)



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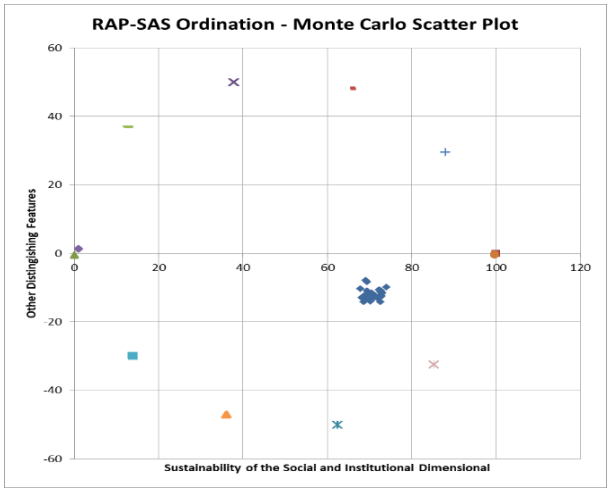
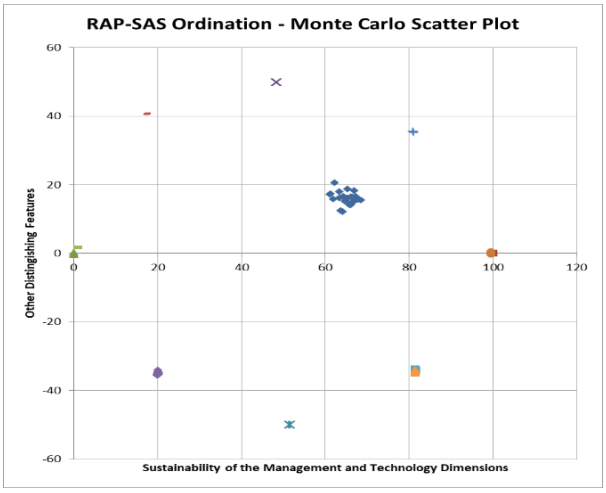


(c)



(d)

Figure 7 Monte carlo analysis results (a = ecological dimensions; b = economic dimension; c = social-institutional dimensions; d = management-technology dimensions)

Table 5 Differences in ordination values and monte carlo values

Dimension	Ordination Index (%)	Monte Carlo Index (%)	Difference (%)
Ecology	85.16	81.62	3.24
Economics	79.70	77.35	2.35
Socio-Institutional	72.91	71.12	1.79
Technology-Management	66.94	65.33	1.61

Based on the Monte Carlo results for the ecological dimension (Figure 7), showing an average result of 81.62% when compared to the results of the ordination index on the ecological dimension of 85.16%, it can be seen that the value did not experience a significant difference. The results of the Monte Carlo analysis show that the value of sustainability status in the simple agroforestry of the Magersaren in UB Forest at a 95% confidence interval did not change significantly. The following is a comparison of the difference between the ordination index value and Monte Carlo value, as shown in Table 5.

The comparison of the results of the Monte Carlo analysis with the results of ordination was very small, as shown in Table 5. The difference between the results of the ordination analysis with Monte Carlo shows a small difference or difference, which can be interpreted as the error in making scores for each attribute, and the error in the analysis method procedure is very small. This is followed and reinforced by the results of research by Dzikrillah et al. (2017), who stated that a small difference in the values of the MDS and Monte Carlo sustainability indices showed that (1) the error in scoring each attribute was relatively small, (2) variations in scoring due to differences in opinion were relatively small, (3) the repeated MDS analysis process was relatively stable, and (4) data entry errors and lost data could be avoided. Therefore, the researchers can conclude that the analysis that has been studied has a high level of confidence. The RAP-SAS method showed that several parameters produced test results that were sufficiently good to be used as a tool for evaluating the sustainability of the simple agroforestry system of the Magersaren in UB Forest quantitatively and quickly (rapid appraisal).

CONCLUSION

The analysis of the sustainability status of simple agroforestry Magersaren (SAM) in UB Forest using the RAP-SAS method showed a highly sustainable category, namely the ecological and economic dimensions, followed by the social and institutional dimensions. Meanwhile, the management and technology dimensions indicate a fairly sustainable status with sensitive attributes affecting the sustainability of SAM, namely business planning and processing. This means that an intervention on these attributes can affect the value of the sustainability index. This sensitive attribute is closely related to the sustainability of management and technology dimensions, wherein the management of a simple agroforestry system requires good planning using adequate technology. Therefore, it is necessary to improve the quality of human resources, namely, the awareness of the importance of using technology and good planning to ensure the sustainability of the simple Magersaren agroforestry system, especially in supporting its function as an educational forest area and the livelihoods of Magersaren people in UB Forest.

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