Strategy for improving sustainable cocoa (*Theobroma cacao* L) plant productivity in South Sulawesi based on land suitability

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**Abstract.** This study aimed to establish land suitability classes in South Sulawesi for cocoa plant development, determine the productivity potential of South Sulawesi cocoa, and determine efforts to optimize cocoa productivity in South Sulawesi. The method used was a mixed qualitative and quantitative. The study was conducted in three cocoa producing districts with different climate types. 18 units of soil profiles were analyzed and interviews with farmers was carried out to obtain information on the actual cocoa yield and implemented management. Land suitability analysis was conducted using a parametric approach (square root method), farming analysis (B/C ratio), Analytical Hierarchy Process (AHP) for decision making, and correlation analysis to determine the relationship of suitability index with cocoa yield. The results show that the climate suitability analysis at the location was S3 (marginally suitable) and S2 (moderately suitable). The results of land suitability in Bantaeng Regency are mostly S3 (marginally suitable) with limiting factors for soil depth and humidity. Whereas in the districts of East Luwu and Pinrang, land suitability classes obtained were S3 (marginally suitable) and S2 class (moderately suitable). The limiting factors included climate (rainfall and humidity), soil depth, pH and slope. Overall cocoa farming in South Sulawesi is feasible to be developed with an R/C value > 1, NPV of IDR13,495,268; Net B/C 1.1, and IRR of 15.8%. Correlation analysis between land suitability index and cocoa productivity was not statistically significant (P <0.05). The priority strategy for increasing cocoa crop productivity is the addition of organic fertilizer.

1. **Introduction**

Indonesia is one of the biggest producers of cocoa (*Theobroma cacao* L) in the world. Based on information from Food and Agriculture [1], Indonesia ranks third as the largest cocoa producer in the world with total cocoa production of 656,817 tons. Data from the Central Statistics Agency [2] shows that of the 34 provinces in Indonesia, South Sulawesi is the second largest cocoa producer compared to other provinces.
As the second largest cocoa production center in Indonesia, South Sulawesi contribution is 16.59% [3]. The average cocoa productivity in South Sulawesi over the past 5 years (2014 - 2018) is 0.6 tons/ha [4]. Cocoa plantations in South Sulawesi in the last 5 years (2014 - 2018) in several regions experienced a decline and increased productivity. As for who experienced a decrease in productivity was Pinrang Regency from 0.65 tons/ha down to 0.56 tons/ha [5]. In contrast, the productivity of cocoa in the Regencies of East Luwu and Bantaeng have increased. The productivity of East Luwu Regency 0.49 tons/ha increased to 0.56 tons/ha [6], while in Bantaeng Regency increased from 0.51 tons/ha to 0.61 tons/ha [7]. However, if it is related to the optimal productivity of cocoa plants according to Sys et al. [8], in the range of 1.5 tons/ha, the productivity of cocoa in South Sulawesi is still relatively low.

The problem in managing community cocoa plantations is the high use of chemicals in an effort to increase land productivity. Due to the high intensity of the use of fertilizers, pesticides and herbicides, increasing pest resistance to pesticides due to higher spraying and pollution of ground or river water by nitrate compounds due to excessive use of fertilizers. Expansion of the area of cocoa plantations that do not pay attention to the rules of conservation that result in environmental damage. In addition there is a relationship between inputs, land boundary factors, and output as a measure of profit. The heavier the limiting factor of a land, the land requires a large input, so the benefits obtained will be minimal.

Land suitability evaluation is the process of estimating land suitability classes and potential land for certain uses, both for agriculture and non-agriculture. The land suitability class of an area for an agricultural development is basically determined by the compatibility between the physical characteristics of the environment including climate, soil, terrain including slopes, topography/relief, rocks on the surface and in the soil and rock outcrops, hydrology and land use requirements or growth requirements plant. The compatibility between the physical environment of an area and the terms of use or the commodity being evaluated provides an illustration or information that the land has the potential to be developed for that commodity.

One approach commonly used in land evaluation is the parametric approach. The parametric approach has several advantages, namely the criteria can be quantified, can be chosen so that the data can be more objective and less dependent on the results of subjective interpretations of land forms. It is also more statistical in measuring diversity, formulating rational sampling and stating the limits of opportunity for the findings.

It is hoped that with this research, land suitability classes and the efforts that can be made to improve the productivity of sustainable cocoa in South Sulawesi can be known. In addition, it can provide information on farm analysis and hierarchical analysis of the process of decision making at that location.

2. Materials and method

2.1. Locations
The study was conducted in three cocoa-producing locations with different climate types in South Sulawesi, namely Bantaeng, East Luwu and Pinrang Regencies from November 2018 to May 2019.

2.2. Methods and sample collection
This study used mixed qualitative and quantitative methods. Soil profiles of 18 units were dug to analyze land characteristics. Soil samplings were taken based on purposive sampling method, ie. sampling based on the consideration of certain conditions. In addition, interviews were conducted with farmers, extension workers, experts and related agencies to obtain information on the actual cocoa yields and the management that has been carried out. Analysis of soil samples was carried out in the Laboratory. Land suitability analysis was carried out using a parametric approach.
2.3. Data analysis

2.3.1. Retrieval of land characteristics to be observed. The characteristics of the land to be observed in the field consist of: climate (rainfall, temperature, humidity) slope, drainage, inundation, texture, structure, soil depth, surface rock, CEC, the number of bases can be exchanged and C-organic. Work map making was based on the results of overlay maps of soil types, slope maps, land use maps and rainfall maps.

2.3.2. Determination of climate conformity level. Level of the climate conformity was determined by following steps:

a. Determination of climate and soil requirements for plants taken based on literature [9].
b. Weighting for each climate characteristic
c. Weighting for each climate characteristic
d. Calculation of the climate index based on the Khiddir method [10],

\[ I_c = R_{min} \sqrt{ \frac{A}{100} \times \frac{B}{100} \times \frac{C}{100} \times \frac{D}{100} \times \frac{E}{100} \times \frac{F}{100} \times \frac{G}{100} \times \ldots} \]

\[ R_c = (0.9 \times I_c) + 16.67 \] (If $25 < I_c < 92.5$)

\[ R_c = (1.6 \times I_c) \] (If $I_c < 25$)

where:
- \( I_c \) = Climate Index
- \( R_c \) = Climate Rating
- \( R_{min} \) = Minimum Rating
- \( A, B, C, \ldots \) = Climate Rating

2.3.3. Determination of Land Suitability. Level of the procedure for determining the index and land class is as follows:

a. Determination of the characteristics of the study area
b. Determination of land requirements for cocoa [11],
c. Weighting for each land characteristic
d. The land index calculation is based on the Khiddir method
e. Determination of land class based on land index

\[ I = R_{min} \sqrt{ \frac{A}{100} \times \frac{B}{100} \times \frac{C}{100} \times \frac{D}{100} \times \frac{E}{100} \times \frac{F}{100} \times \frac{G}{100} \times \ldots} \]

where:
- \( I \) = Land Index
- \( R_{min} \) = Rating Minimum
- \( A, B, C, D, \ldots \) = Ratings of soil and climate characteristics

2.3.4. Farming analysis farming. Analysis is carried out to determine the feasibility of a cacao farm at that location consisting of:

1) Net Present Value

\[ NPV = \sum_{t=1}^{T} \frac{C_t}{(1 + r)^t} - C_0 \]

where:
NPV = Net Present Value (in rupiah)

C_t = Cash flow per year in period t

C_0 = Initial investment value in year 0 (in IDR)

r = interest rate or discount rate (in %)

Feasibility analysis:
a. If NPV > 0 then the farm is feasible
b. If NPV < 0 then the farm is not feasible

2) Net Benefit Cost Ratio (Net B/C)
This criterion provides guidelines that a farm will be selected if Net B/C > 1. If the Net B/C results < 1 then the farm will not be accepted.

\[
\text{NETB/C} = \frac{\sum B_t - C_t}{\sum C_t - B_t} \frac{1}{1+i}\]

B_t = Benefits in the t year
C_t = Cost in the t year
i = Discount Factor
t = Age of the project

3) Internal Rate of Return (IRR)
Used to determine the percentage of profits of a project each year and term is a measure of the project's ability to repay loans. Criteria that indicate that an interest rate is in effect at the time the investment is implemented.

\[
\text{IRR} = i_1 + \frac{\text{NPV}_1 - \text{NPV}_2}{\text{NPV}_1 - \text{NPV}_2} X (i_2 - i_1)
\]

where:
IRR = Internal Rate of Return

i_1 = The highest discount factor that still gives a positive NPV value

i_2 = The highest discount factor that still gives a negative NPV

NPV NPV_1 = Positive Net Present Value

NPV_2 = Negative Net Present Value

i_1 - i_2 = Difference in discount factors

2.3.5. Analysis of land improvement efforts. The analysis of land improvement efforts was conducted using the Analytical Hierarchy Process (AHP). AHP is an analysis used in decision making with a systems approach, where decision makers try to understand a system condition and help make predictions in making decisions.

2.3.6. Correlation relationship analysis land suitability index with cocoa productivity. Productivity data from interviews with farmers at each observation point were made in relation to land suitability index shown in one x-axis chart represented by land index and y-axis represented by land productivity (ton/ha).

3. Results and discussion

3.1. Land characteristics of research sites
The land characteristics of research sites can be seen in table 1.
Table 1. Land Characteristics of Research Sites

| Profile | Coordinate | Slope (°) | Ordo | Sub Grub | Drainage | PH | CEC cmol/kg clay | Organic Carbon (%) | Base Saturation (%) | Basic Cation cmol/kg clay | Texture |
|---------|------------|----------|------|----------|----------|----|-----------------|-------------------|-------------------|------------------------|---------|
| 1       | 0° 30'32'' | 0 - 8    | Inceptisol | Eutrudepts | Moderately Well Drained | 6.3 | 56.12 | 2.3 | 49.4 | 10 | SiL |
|         | 120° 02' 12.36'' | | | | | | | | | | |
|         | 5° 28' 27.35'' | | | | | | | | | | |
|         | 120° 10.77'' | | | | | | | | | | |
|         | 5° 31' 00'' | | | | | | | | | | |
|         | 120° 02' 18.12'' | | | | | | | | | | |
|         | 5° 30'32'' | | | | | | | | | | |
| 2       | 0° 23' 19.9'' | 0 - 8 | Inceptisol | Eutrudepts | Moderately Well Drained | 6.4 | 46.91 | 2.5 | 57 | 12.4 | SiCm |
|         | 120° 53' 57.5 | | | | | | | | | | |
|         | 0° 30' 13.43'' | | | | | | | | | | |
|         | 120° 38' 59.5'' | | | | | | | | | | |
| 3       | 0° 32'40.3'' | 0 - 8 | Inceptisol | Eutrudepts | Moderately Well Drained | 6.5 | 51.2 | 1.2 | 44 | 6.9 | L |
|         | 120° 46' 20 | | | | | | | | | | |
| 4       | 0° 23'26.1'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 6.6 | 46.8 | 2.3 | 46.28 | 12.18 | C>60s |
|         | 120° 48' 29.2'' | | | | | | | | | | |
| 5       | 0° 23'26.1'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 6.7 | 102.05 | 0.95 | 38 | 6.9 | L |
|         | 120° 47'33.7'' | | | | | | | | | | |
| 6       | 0° 23'26.1'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 6.8 | 111.3 | 1.9 | 69.8 | 13.9 | SiC |
|         | 120° 47' 13.3'' | | | | | | | | | | |
| 7       | 0° 29'37.3'' | 0 - 8 | Inceptisol | Eutrudepts | Moderately Well Drained | 6.9 | 304.6 | 2.65 | 47 | 7.3 | L |
|         | 120° 47' 13.3'' | | | | | | | | | | |
| 8       | 0° 29'21.3'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 7.0 | 181.44 | 2.01 | 45 | 7.83 | L |
|         | 0° 29'21.3'' | | | | | | | | | | |
| 9       | 0° 30'28.5'' | 0 - 8 | Inceptisol | Enduaquepts | Well Drained | 7.1 | 101.39 | 2.1 | 36.6 | 7.25 | L |
|         | 119° 30' 23'' | | | | | | | | | | |
| 10      | 0° 28'51.3'' | 8 - 15 | Inceptisol | Dystrudepts | Moderately Well Drained | 7.2 | 49.07 | 2.37 | 41.8 | 6.46 | CL |
|         | 119° 32' 12.39'' | | | | | | | | | | |
| 11      | 0° 44'40.6'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 7.3 | 79.07 | 1.52 | 55.64 | 11.25 | SiC |
|         | 119° 38' 44.0'' | | | | | | | | | | |
| 12      | 0° 40'10.6'' | 8 - 15 | Inceptisol | Dystrudepts | Somewhat Poorly Drained | 7.4 | 57.73 | 1.65 | 56.72 | 12.38 | CL |
|         | 119° 48' 27.4'' | | | | | | | | | | |
| 13      | 0° 40'03.6'' | 0 - 8 | Inceptisol | Enduaquepts | Moderately Well Drained | 7.5 | 71.92 | 2.28 | 32.6 | 5.93 | CL |
|         | 119° 44'08.21'' | | | | | | | | | | |
| 14      | 0° 41'02.4'' | 15 - 25 | Inceptisol | Dystrudepts | Moderately Well Drained | 7.6 | 46.69 | 0.94 | 46.6 | 9.8 | CL |
|         | 119° 45'31.82'' | | | | | | | | | | |
3.2. Land suitability
Based on climatic data for the last 10 years at the research location generally obtained class climate suitability index S3 (marginally suitable) and partly S2 (moderately suitable). Whereas the land suitability class in the study site consisted of S3 (marginally suitable) and S2 (moderately suitable) classes with limiting factors for soil depth, humidity, rainfall, c-organic, slope, texture and pH. Land Suitability Classes, limiting factors, and corrective actions at the study location are presented in table 2.

Table 2. Land suitability classes, limiting factors, and corrective actions at the study site

| Point | Land Suitability Index | Actual Land Suitability Class | Limiting Factor | Improvement | Potential Land Suitability Class |
|-------|------------------------|-------------------------------|-----------------|-------------|---------------------------------|
| 1     | 26.56                  | S3sc                          | Soil Depth      | Cannot Be Improved | S3sc                            |
| 2     | 35.9                   | S3cs                          | Climate (Humidity) | Cannot Be Improved | S3cs                            |
| 3     | 33.57                  | S3sc                          | Climate (Humidity) | Cannot Be Improved | S3cc                            |
| 4     | 25.26                  | S3sc                          | Climate (Humidity) | Cannot Be Improved | S3sc                            |
| 5     | 25.87                  | S3sc                          | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 6     | 35.1                   | S3cs                          | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 7     | 33.37                  | S3sc                          | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 8     | 25.92                  | S3scf                         | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 9     | 50.31                  | S2cts                         | Organic Carbon   | Application of Organic | S3c                            |
| 10    | 29.1                   | S3scf                         | Climate (Rainfall) | Contour Terrace | S2c                            |
| 11    | 51.95                  | S2stc                         | Climate (Rainfall) | Contour Terrace | S2c                            |
| 12    | 27.7                   | S3sc                          | Climate (Humidity) | Cannot Be Improved | S3sc                            |
| 13    | 25.46                  | S3cs                          | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 14    | 25.09                  | S3sc                          | Climate (Rainfall) | Cannot Be Improved | S3sc                            |
| 15    | 50.58                  | S2sc                          | Climate (Humidity) | Cannot Be Improved | S2c                            |
| 16    | 25.64                  | S3sc                          | Climate (Humidity) | Cannot Be Improved | S3sc                            |
| 17    | 25.36                  | S3scf                         | Climate (Humidity) | Contour Terrace | S3sc                            |
| 18    | 25.41                  | S3stc                         | Climate (Humidity) | Contour Terrace | S3sc                            |

According to Pujianto [12], that permanent limiting factors are relatively difficult to change including climate, texture and the effective depth of the rest of the temporary limiting factor. In
limiting pH factors can be improved by the addition of lime. According to Rosyid [13], that to raise 1 point the soil pH requires 2 tons of agricultural lime per ha. In profile 10 it has a pH of 5.6 so it takes the addition of lime as much as 1600 kg / ha lime to increase the rating weight from 65 to 100 and raise the subclass from S3sc to S3sc. Furthermore, for limiting the slope on profiles 9 and 11, remedial action can be taken by making contour terraces. According to Hardjowigeno and Widiatmaka [14], that improvement efforts that can be done for erosion factors are by undertaking soil conservation measures / actions, for example reducing erosion rates by making terraces or ridges, contour planting parallel, tillage according to contours, planting ground cover, etc..

3.3. Analysis of farming economy
The results of farm analysis on the cultivation of cocoa plants in three research locations namely Bantaeng, East Luwu and Pinrang Districts show that cocoa farming is profitable and feasible to be developed. The results of the average revenue, production costs and income can be seen in table 3.

Table 3. The results of the average analysis of the costs of revenue, production and income of cocoa farming in South Sulawesi, 2019

| No. | Regency     | Revenues IDR | Production Costs IDR | Income IDR | Profits IDR | R/C |
|-----|-------------|--------------|----------------------|------------|-------------|-----|
| 1   | Bantaeng    | 16,638,000.- | 1,738,000.-          | 14,900,000.- | 10          |     |
| 2   | Luwu Timur  | 13,044,000.- | 1,728,800.-          | 11,315,200.- | 8           |     |
| 3   | Pinrang     | 7,371,333.-  | 1,524,133.-          | 5,847,200.-  | 5           |     |

Based on the table above shows that in Bantaeng Regency the average income is IDR16,638,000.- production costs of IDR1,738,000.- and annual income of IDR14,900,000.- with R/C profit 10. Whereas in East Luwu Regency the receipt was IDR13,044,000.- production costs of IDR1,728,800.- and income of IDR11,315,200.- with R/C profit 8. In contrast to Bantaeng and East Luwu Regencies, Pinrang Regency received IDR7,371,333.- production costs of IDR1,524,133.- and income of IDR5,847,200.- with R/C profit 5.

Net Present Value is the net cash flow in each year which is carried out with a factor of 14% discount. Based on interest rates on government and private bank deposits at the time of the analysis. Analysis carried out until the age of 20 years. Net Present Value analysis results can be seen in table 4. Net Benefit Cost Ratio (Net B/C) is one method to see the comparison between profits and costs used in a business. Based on the calculation results show that the B/C ratio is 4.5. Because the value is> 1, it can be stated that for the next 20 years the management of cocoa development is feasible. For the each use of cost IDR1.- will provide benefits or benefits of IDR4.5.-.

Another method used to evaluate the feasibility of a project or business is to use the Internal Rate of Return (IRR) analysis method. This method is used to calculate the interest rate that equates the present value of net cash receipts in the future. The IRR value is expressed as a percentage. In the IRR analysis, first look for positive and negative NPV values at Discount Factors certain. Based on table 4 above, a positive NPV value of IDR5,326,418.- at a Discount Factor 15% and a negative NPV value of IDR-1,313,489.- at a Discount Factor 16%. The analysis of both NPV and Discount Factor values obtained an IRR of 15.8%. This value shows that cocoa farming benefits up to an interest rate of 15.8%.

3.4. Analysis of land improvement efforts
The results of AHP synthesis analysis from the combined respondents based on priority order are the addition of organic fertilizer with a weight of 0.544, calcification 0.191, pruning 0.103, irrigation / drainage 0.097 and soil conservation 0.065. Based on the above it shows that the priority strategy that needs to be done in increasing cocoa productivity in the location is the addition of organic fertilizer. This is consistent with Kononova's opinion in Nursia [15], that organic fertilizer can improve soil
physical properties through the establishment of solid soil structures and aggregates and is closely related to the ability of soil to bind water, infiltrate water, reduce the risk of erosion threat, increase capacity ion exchange and as a regulator of soil temperature all of which affect both plant growth.

**Table 4.** Net Present Value Analysis Results for 20 Years.

| Year | Benefit | Productions Costs | Net Benefit | DF 14 % | NPV 14% | DF 15 % | NPV 15% | DF 16 % | NPV 16% |
|------|---------|------------------|-------------|---------|---------|---------|---------|---------|---------|
| 0    | 5       | 4 = 2 + 3        | 6 = 5 - 4   | 7       | 8 = 6 x 7 | 9       | 10 = 6 x 9 | 11      | 12 = 6 x 11 |
| 0    | 92,428,200 | -92,428,200     | 1           | -92,428,200 | 1       | -92,428,200 | 1       | -92,428,200 |
| 1    | 1,065,000 | -1,065,000       | 0.877       | -934,211 | 0.870   | -926,087 | 0.862   | -918,103 |
| 2    | 935,000  | -935,000         | 0.769       | -719,452 | 0.756   | -706,994 | 0.743   | -694,857 |
| 3    | 11,200,000 | 1,595,000        | 0.675       | 6,483,101 | 0.658   | 6,315,443 | 0.641   | 6,153,517 |
| 4    | 16,800,000 | 1,335,000        | 0.592       | 9,156,521 | 0.572   | 8,842,164 | 0.552   | 8,541,182 |
| 5    | 21,000,000 | 1,285,000        | 0.519       | 10,239,353 | 0.497   | 9,801,839 | 0.476   | 9,386,568 |
| 6    | 22,400,000 | 1,460,000        | 0.456       | 9,539,982 | 0.432   | 9,052,940 | 0.410   | 8,594,661 |
| 7    | 25,200,000 | 1,280,000        | 0.400       | 9,559,325 | 0.376   | 8,992,414 | 0.354   | 8,463,602 |
| 8    | 26,600,000 | 1,245,000        | 0.351       | 8,888,425 | 0.327   | 8,288,594 | 0.305   | 7,733,920 |
| 9    | 28,000,000 | 1,370,000        | 0.308       | 8,188,937 | 0.284   | 7,569,908 | 0.263   | 7,002,438 |
| 10   | 30,800,000 | 1,610,000        | 0.270       | 7,873,822 | 0.247   | 7,215,322 | 0.227   | 6,616,894 |
| 11   | 31,360,000 | 1,280,000        | 0.237       | 7,117,451 | 0.215   | 6,465,492 | 0.195   | 5,878,140 |
| 12   | 33,600,000 | 1,235,000        | 0.208       | 6,717,650 | 0.187   | 6,049,250 | 0.168   | 5,452,300 |
| 13   | 31,080,000 | 1,260,000        | 0.182       | 5,429,309 | 0.163   | 4,846,584 | 0.145   | 4,330,657 |
| 14   | 28,000,000 | 995,000          | 0.160       | 4,312,968 | 0.141   | 3,816,580 | 0.125   | 3,380,900 |
| 15   | 26,600,000 | 1,700,000        | 0.140       | 3,488,402 | 0.123   | 3,090,073 | 0.108   | 2,687,383 |
| 16   | 25,200,000 | 1,195,000        | 0.123       | 2,950,014 | 0.107   | 2,565,289 | 0.093   | 2,233,438 |
| 17   | 23,800,000 | 1,260,000        | 0.108       | 2,429,805 | 0.093   | 2,094,549 | 0.080   | 1,807,874 |
| 18   | 22,680,000 | 1,235,000        | 0.095       | 2,027,864 | 0.081   | 1,732,866 | 0.069   | 1,482,799 |
| 19   | 22,400,000 | 1,260,000        | 0.083       | 1,753,528 | 0.070   | 1,485,409 | 0.060   | 1,260,095 |
| 20   | 20,720,000 | 1,195,000        | 0.073       | 1,420,673 | 0.061   | 1,192,983 | 0.051   | 1,003,301 |

Source: Primary area after processing, 2019.

### 3.5. Correlation index analysis of land suitability

The prediction of potential land yields based on land suitability classes in the study location obtained class S3 (corresponding marginal) namely profiles 1,2,3,4,5,6,7,8,10,12,13, and 14 predicted able to produce 0.8 - 1.2 tons / ha but in reality the field is only able to produce an average of 0.4 tons / ha. As for the S2 class (quite appropriate) contained in profiles 9, 11 and 15 it is predicted to produce 1.2 - 1.6 tons / ha but at the observation site can only produce 0.4 - 0.5 tons / ha. This is due to improper land management. This is consistent with the opinion of Asrul [16], that the decline in cocoa productivity in South Sulawesi is due to several factors including poor crop management, relatively old plants, cocoa borer attack (CPB), vascular streak dieback (VSD) disease, short-term programs tend to unsustainable and extreme climate predictions.

Data on the productivity of cocoa plants in each farmer in each observation location in three different districts was then linked to the land suitability index value of each district profile. This relationship is analyzed using pearson correlation. Furthermore, it can be seen in figure1. Correlation analysis between land suitability index and cocoa productivity was not statistically significant (P <0.05). The priority strategy for increasing cocoa crop productivity is the addition of organic fertilizer.
4. Conclusions

1) Cocoa land suitability classes in South Sulawesi, especially in the study sites are generally classified as S3 class (marginally suitable) and some S2 classes (moderately suitable) with limiting factors for soil depth, humidity, rainfall, c-organic, slope, texture and pH.

2) Potential of cocoa productivity in South Sulawesi, especially in the research location, ranges from 0.8-1.6 tons / ha.

3) Based on the results of AHP based on land suitability carried out at the study site, it shows that efforts to increase cocoa productivity in South Sulawesi, especially at the research location are adding organic fertilizer, liming, pruning, making irrigation or drainage and conserving plantation land.

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