Promoting sustainable agricultural management through spatio temporal optimization of food crop land based on pedo-agroclimate at Kalalasi region, Southeast Sulawesi, Indonesia

A M Kandari1*, S Baja2, A Ala3, Kaimuddin4, S Kasim5, Y Taufik6

1Specifications Agro climatology, Department of Environmental Science, Faculty of Forestry and Environmental Science, Halu Oleo University, Southeast Sulawesi, Indonesia.
2Speccifications soil science, Department of Agro technology, Faculty of Agriculture, Hasanuddin University, Makassar, South Sulawesi, Indonesia
3Speccifications Agronomy, Department of Agro technology, Faculty of Agriculture, Hasanuddin University, Makassar, South Sulawesi, Indonesia.
4Speccifications Agro climatology, Department of Agro technology, Faculty of Agriculture, Hasanuddin University, Makassar, South Sulawesi, Indonesia.
5Speccification Agroforestry, Department of Environmental Science, Faculty of Forestry and Environmental Science, Halu Oleo University, Southeast Sulawesi, Indonesia.
6Speccification Agribusiness, Department of Social Economy, Faculty of Agriculture, Halu Oleo University, Kendari, Southeast Sulawesi, Indonesia.

*Corresponding author: manekandaria@yahoo.com

Abstract. The purposes of this research were to: (1) analyze the suboptimal land availability and its suitability for food crops; (2) to identify the major and prime food crops; (3) analyze the socio-cultural and economic characteristics of farmers in order to develop local based climate change adaptation strategy and to prioritize major food crops using multi-criteria approach; (4) to promote sustainable crop and land management, through the local specific technologies dealing with the constraints of the Kalalasi Region. As regional based study, this research used overlaid maps of thematic lands, undertaken on suboptimal-land area with dry-climate at Kalalasi Region, Southeast Sulawesi. This study employed a spatial analysis method using GIS. Data collection included data on land biophysics, climate, and farming-based socio-culture and economic, using biophysical and social economic survey method. Land evaluation was carried out using FAO method. The major food crops were identified and analyzed using LQ method. Then, Multi-Criteria Decision Method (MCDM) through an application of AHP was used to promote sustainable crop and land management at the Kalalasi Region. The results of this research showed that: (1) Kalalasi Region had relatively varied characteristics of land biophysical, climate, socio-culture and economic, (2) Potential land availability for the development of food crops was ha, where the land suitability level of S2 (moderately suitable) of ha, S3 (marginally suitable) of ha, and the rest was N1 and N2, (3) there were eight major food crops in the research area, namely: maize, cassava, upland rice, soy bean, sweet potato, ground nut, green bean, and paddy rice, (4) prime or excellent food crops in research area were varied among regions (sub-districts), however, in general, it was concluded that there were four prime food crops, namely: cassava, maize, upland rice, and paddy rice, (5) productive and sustainable crop pattern and land management can be achieved through the application of multiple cropping.
system, planting diversification, and appropriate planting date for the period of December, January, February, and March, using drought resistant cultivar, and several other efforts for adaptation and conservation, such as mulching and cover crops, to deal with climate change. These were conducted to maintain the land and crop productivity, and the sustainable food availability.

Keywords: Promoting, sustainable agriculture, pedo-agroclimate, suboptimal land

1. Introduction

Land is the basic capital and the main determining factor in the agricultural production system so it needs to be maintained. [1] elucidated that ineffective land use is closely related to climate change, but it can also happen otherwise that incorrect land use may cause climate change. Therefore, sensibility is needed in planning land use so that land optimization is truly effective and sustainable. [2] asserts that the goal of land use planning is to obtain the best use of land, through the achievement of three things, namely (a) efficiency, (b) equality and acceptance, (c) sustainability.

Land use optimization in terms of accurate and effective can be done, by means of land use planning considering many factors, especially land biophysics, applying remote sensing technology and GIS or geographic information system [3]. Furthermore, [4] emphasized that GIS applications have proven to be quite effective in determining crop land suitability. Land use planning by considering many factors or multi criteria results is better, using an analysis called AHP (Analytic Hierarchy Process) as one method of MCDM (Multiple Criteria Decision Making) [5].

Based on these various explanations, this study aimed to promote Spatio-temporal optimization of food land based on Pedo-agroclimate on suboptimal land with employing a multi-criteria approach, especially in Kalalasi Region District which dominated by marginal land.

2. Methods

This research was spatial based on a regional scale, applying quantitative and qualitative approach integrally (mixed approach) in two stages. Some of the important data used are the result of an overlay between thematic and informational map of previous researches [6].

The LQ value is calculated by using the following equation:

\[ LQ_{ij} = \frac{X_{ij}}{X_i} \]

LQij : quotient index sub district location i for food crops j
Xij : average size of food crop harvest j in sub district i
Xi : average total size of food crops in sub district i
X. j : average total size of food crops j in the Kalalasi Region
X. : average overall size of food crops in the Kalalasi Region

Notes:

a) LQ > 1; mainstay/basis, has comparative advantages, the results in addition to fulfilling the needs of said region, it can also be export outside the region
b) LQ = 1; non basis/not mainstay, does not have comparative advantage, only sufficient to fulfill the needs of its own region
c) LQ < 1; non basis/not mainstay, cannot fulfill the needs of its own region therefore needs supplies or imports from outside the region

The R/c rasio is calculated by using the following equation
The 1st International Conference on Agriculture and Rural Development
IOP Publishing
IOP Conf. Series: Earth and Environmental Science 383 (2019) 012005
doi:10.1088/1755-1315/383/1/012005

\[ \frac{R}{C} \text{ ratio} = \frac{TR}{TC} \text{ atau } \frac{TR}{TN + NTT} \]

R/C ratio: index of farming suitability
TR: Total income; TC: Total cost (Rp)
NT: fixed cost; NTT: inconsistent cost

Notes:
R/C ratio > 1, farming effort yields profit (suitable)
R/C ratio = 1, farming effort break even, input=output
R/C ratio < 1, farming effort incur losses (not suitable)

The workflow scheme of the research can be seen in Figure 1.

Figure 1. Analysis stage and main analysis parameter

The application of AHP in this research was intended to determine priority of selected food crops, based on factors that consists of 3 criteria: (1) social culture potential, which comprise of three sub criteria, which are policy (KJ), infrastructure (SP), farmer’s interest (AP); (2) pedo-agroclimate potential covers two sub criteria which are weighted land suitability (KL) and location quotient (LQ), and (3) social economy potential comprises of two sub cultures which are market opportunity/marketing (PP) and farmer net income or R/C ratio (NI). Whereas the alternative consists of
10 species of food crops which are paddy rice (PS), field rice (PL), corn (JG), cassava (UK), peanuts (KT), green beans (KH), taro (TL) and sorghum (SG). The AHP hierarchy is presented on Figure 2.

![AHP hierarchy](image)

**Figure 2.** AHP structure determining priority of select food crops in research areas

Note:
- Factors: (1) Socio Cultural, (2) Pedo-Agroclimate, (3) Socio Economic
- Criteria: KJ = Policy; SP = Infrastructure; AP = farmers’ interest
  - KL = Land suitability; LQ = Location Quotient
  - PP = Market opportunity; NI = Net Income (R/C ratio)
- Alternative: PS = Wet rice; PL = Rice field; JG = Corn
  - UK = Cassava; UJ = Sweet Potato; KT = Peanuts
  - KD = Soybean; KH = Green bean; TL = Taro; SG = Sorghum

3. Results and discussion
3.1. Results
3.1.1. Biophysical characteristic of Pedo-Agroclimate land
Result biophysical characteristic description of the land in the research area is presented in Table 1 and can be visually seen on Figure 2.

Table 1 shows the condition of 10 research areas with different sizes of potential land with a total of 74,664.64 ha (35.55%) from the total size of the Kallasi Region (210,030.00 ha). The research areas possessed diversity of land biophysics which consisted of physio-topography and land (Figure 3), along with the climate especially the rainfall (Figure 4), all these factors affected the species and class of food crop suitability, and the coverage of its development.
Table 1. Land Biophysical Characteristics based on Pedo-Agroclimatic

| No | Satuan lahan dan Karakteristiknya | Batauga | Sampolawa | Lapandewa | Wabula | Pasarwajo | Wolowa | Siotapina | Lasalimu | Sel | Kapontori |
|----|---------------------------------|---------|-----------|-----------|--------|-----------|--------|-----------|----------|-----|-----------|
| 1  | a. Jumlah satuan lahan (59 uni)  | 26      | 25        | 40        | 31     | 34        | 65     | 32        | 41      | 66  | 73        |
| 2  | b. Luas lahan potential (7,864.64 ha) | 2.103   | 2.204     | 2.075     | 2.027  | 1.738     | 1.680  | 1.579     | 1.542   | 2.204| 2.103     |
|    | Zona agroekologi               | b2, b2 | b2, b2    | b2, b2    | b2, b2 | b2, b2    | b2, b2 | b2, b2    | b2, b2   | b2, b2| b2, b2    |

Kompren-Tipe-biogragfis :

| 1  | a. Banyak lahan (landform)     | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan | Sis perbukitan |
|----|--------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|    | b. Geologi tanah               | WadupiKoso   | Sampolakosa   | Rendolls       | LektBasahKering | LektBasahKering | LektBasahKering | LektBasahKering | LektBasahKering | LektBasahKering | LektBasahKering |
|    | c. Kelerengan (%)              | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) | 20-50 (dangkal) |

5. Kesimpulan / Klasifikasi :

| No | Satuan lahan dan Karakteristiknya | Batauga | Sampolawa | Lapandewa | Wabula | Pasarwajo | Wolowa | Siotapina | Lasalimu | Sel | Kapontori |
|----|---------------------------------|---------|-----------|-----------|--------|-----------|--------|-----------|----------|-----|-----------|
| 1  | a. Suhu udara (°C)             | 25-30    | 25-30     | 25-30     | 25-30  | 25-30     | 25-30  | 25-30     | 25-30    | 25-30| 25-30     |
|    | b. Kelembaban udara (%)        | < 50 (%)  | < 50 (%)   | < 50 (%)   | < 50 (%) | < 50 (%)  | < 50 (%) | < 50 (%)  | < 50 (%)  | < 50 (%)| < 50 (%)  |
|    | c. C/N ratio (%)                | < 20 (%)  | < 20 (%)   | < 20 (%)   | < 20 (%) | < 20 (%)  | < 20 (%) | < 20 (%)  | < 20 (%)  | < 20 (%)| < 20 (%)  |

Figure 3 show the result of analysis land of general water scale in the research area, consists of four categories according to the information of climate factors from the local rain station particularly the potential evapotranspiration in the area of Betomanderi, Kaisabu, Kapontori, and Lawele station (Figure 5).
Figure 3. General water scale based on the climate condition from observation at the local climate station

Figure 3 shows that the research area around the Betoambari station namely the Batauga sub district, had experienced humid/wet months for 6 months (Dec, Jan, Feb, Mar, Apr, June), and 4 dry months (July-October). In the area of Kaisabu station, namely Pasarwajo, Wabula, Lapendewa, Sampolawa sub district and part of Wolowa and Kapontori sub district experienced 5 months of wet and dry months which are, Des, Jan, Feb, Mar, and Apr (wet months) and Mei, July-November (dry months), and wet months on June and November. In the area of Kapontori station which covers Kapontori sub district and part of Wolowa, Lasalimu, and Pasarwajo sub district undergo wet and dry months for 5 months each, Des, Jan, Feb, Mar, and Apr (wet months) and May, July-November (dry months), and wet months on June and November. In the coverage area of Lawele station which consisted of Lasalimu, South Lasalimu, Siotapina sub district and part of Wolowa sub district, shows that rainy season and dry season of the Lawele station area.

Figure 4. Some of the examples of the lands biophysical condition in the research area
Each occurred for 5 months which are February-April (rainy season), and July-November (dry season), and humid condition happens for two months December and January. Based on these descriptions, it generally shows that the research area have lower yearly rainfall than its potential evapotranspiration therefore it’s classified as a dry climate area, consequently farming activities must prioritize rainfall information usage cautiously for dry land agriculture, mainly to determine planting period, planting pattern, planning of irrigation system and selection of suitable variety.

Drainage capacity of the research area varies and consists of 4 categories: good, medium, slightly poor and poor. Space utilization and domination varies as well

![Figure 5](image-url)  
**Figure 5.** Monthly Rainfall fluctuation (mm) every 4 year based on observation at the Betoambari, Kaisabu, Lawele and Kapontori station in the period of 1999-2011.

Figure 5 shows that monthly rainfall rate every 4 year for the last 13 years in the Buton district have been subject to fluctuation and experiences shift in value every year. These circumstances imply on space utilization, farm planning, arrangement of planting pattern, determining planting period and crop productivity that the farmer developed.

### 3.1.2. Assessment of food crop soil suitability

Results of the suitability grade of actual land and food crop development potential evaluation in the research area are presented on table 2.
Table 2. Suitability grade of actual land and the potential of 10 species of food crop in the research area

| Research area (sub-district) | WET RICE | RICE FIELD | CORN | Cassava | S.Potato | Peanuts | Soybean | G. Beans | Taro | Sorghum |
|-----------------------------|-----------|------------|------|---------|----------|---------|---------|---------|------|---------|
| Batauga                     | N2        | N2         | N2   | S3 N    | N2       | N2      | N2      | N2      | N2   | N2      |
| Sampolaw a                  | S3 N2     | S3 N2      | N1 N2| S2 S3 N | S3 N1 N2 | N1 N2   | S3 N1 N2| N1 N2   | S3 N1 N2| S3 N1 N2|
| Lapandew a                  | S3 N2     | S3 N2      | N1 N2| S3 N    | N1 N2   | S3 N2   | N2      | N1 N2   | N1 N2| S3 N2   |
| Wabula                      | N2        | N2         | N2   | N      | N2      | N2      | N2      | N2      | N2   | N2      |
| Pasarwajo                   | N2        | N2         | N2   | N      | N2      | N2      | N2      | N2      | N2   | N2      |
| Wotowa                      | N2        | N2         | N2   | N      | N2      | N2      | N2      | N2      | N2   | N2      |
| Siontapina                  | S3 N1 N2  | N1 N2      | N1 N2| S2 S3 N | S3 N1 N2| N1 N2   | S3 N1 N2| N1 N2   | S3 N1 N2| S3 N1 N2|
| Lasalimu Selatan            | S3 N1 N2  | N1 N2      | N1 N2| S2 S3 N | N1 N2   | S3 N1 N2| N1 N2   | N1 N2   | S3 N1 N2| S3 N1 N2|
| Lasalimu                    | S3 N1 N2  | N1 N2      | N1 N2| S2 S3 N | N1 N2   | S3 N1 N2| N1 N2   | N1 N2   | S3 N1 N2| S3 N1 N2|
| Kapontori                   | S3 N1 N2  | N1 N2      | S3 N1 N2| S2 S3 N | S3 N1 N2| N1 N2   | S3 N1 N2| N1 N2   | S3 N1 N2| S3 N1 N2|

Table 2 shows that from the 10 food crop species that were evaluated whether it has long been planned or just been planned, the highest suitability grade is S2 (suitable enough) next is S3 grade (marginal fit), and the rest are N1 grade (temporarily unsuitable) and N2 (permanently unsuitable). Suitability grade varies relatively varies, whether it’s between plants in the same region or between the same species of plants on different regions. This distinctness indicates that growth and productivity potential of plants in each region will be diverse.

3.1.3. Determining mainstay/basis food crop

Results of the LQ value calculation from 10 different species of food crops in the research area based on the size of the harvest in the last six years (2006-2011) are presented on Table 3.
Table 3. Average harvest size and Location Quotient (LQ) value result of 10 species of food crop on the research area

| No. | Research areas (sub-districts) | Average harvest area (ha) of food crops (ha) in the study area | Total |
|-----|-------------------------------|---------------------------------------------------------------|-------|
|     | Wet Rice | Rice fields | Corn | Cassava | S. Potato | Peanuts | Soybean | G.Beans | Taro | Sorghum |
| 1   | Batauga   | -          | 113.83 | 270.21 | 455.17 | 32.61 | -       | -       | -    | 874.31 |
| 2   | Sampolawa | -          | 147.66 | 412.20 | 377.77 | 57.22 | 272.98 | -       | -    | 1,272.07 |
| 3   | Lapandewa | -          | 518.96 | 142.03 | 1.00   | 8.17  | 1.67   | -       | -    | 671.83 |
| 4   | Wabula    | -          | 93.16  | 63.83  | 455.17 | 12.33 | -       | -       | -    | 169.50 |
| 5   | Pasarwajo | -          | 275.94 | 628.03 | 167.87 | 2.50  | -       | -       | -    | 1,177.68 |
| 6   | Wolowa    | -          | 109.60 | 130.98 | 84.30  | 6.32  | 4.26   | -       | -    | 354.18 |
| 7   | Siontapina| -          | 449.78 | 122.36 | 71.07  | 330.16| 8.55   | -       | -    | 852.46 |
| 8   | Lasalimu S| 297.00     | 747.41 | 371.59 | 518.96 | 257.96| 109.60 | 1,497.55| -    | 1,913.00 |
| 9   | Lasalimu  | 458.83     | 214.70 | 252.81 | 50.97  | 28.24 | 15.11  | 156.90  | -    | 1,046.05 |
| 10  | Kapontori | 657.17     | 257.96 | 234.79 | 167.87 | 140.83| 5.61   | 14.23   | -    | 1,440.96 |

| No. | Average of harvest area (%) of food crops (ha) in the study area | Deviation standard of harvest areas |
|-----|---------------------------------------------------------------|-----------------------------------|
|     | Wet rice | Rice fields | Corn | Cassava | S. Potato | Peanuts | Soybean | G.Beans | Taro | Sorghum |
| 1   | 1,70     | 4.71        | 4.87 | 0.41    | 1.93    | 1.47    | 6.39    | 1.45    | 3.80 | 1,93 |
| 2   | 1,09     | 1,15        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 3   | 0.94     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 4   | 0.77     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 5   | 0.96     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 6   | 0.94     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 7   | 0.47     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 8   | 0.47     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 9   | 0.47     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |
| 10  | 0.47     | 0.47        | 0.47 | 0.15    | 0.93    | 0.47    | 0.15    | 0.93    | 1,15 | 1,15 |

Note:
LQ: index whether or not it’s a mainstay/basis food crop in a region
LQ > 1: mainstay/basis, haves komparatif advantages, the results in addition to fulfilling the needs of said region, it can also be export outside the region
LQ = 1: non basis/not mainstay, does not have komparatif advantage, only sufficient to fulfill the needs of its own region
LQ < 1: non basis/not mainstay, cannot fulfill the needs of its own region therefore needs supplies or imports from outside the region

Table 3 points out that harvest size of each plant varies and not every plant based on its harvest size can become a mainstay plant in a region, being classified as a mainstay plant in a region does not necessarily make it a mainstay plant in a different region. These cases can happen due to LQ value closely relates to the plants ability to grow and reproduce, related to the degree of land suitability for plant development and harvest size, the larger the size of suitable land the production amount also increased, in consequence the LQ value increase or larger than 1.
3.1.4. Social culture and economy characteristic identification
Results of Social culture and economy characteristic identification in the research area are presented on Table 4.

**Tabel 4.** The result of recapitulation of socio, cultural and economic aspects in the research areas

| No  | Karakteristik Sosial Budaya | Rekap Hasil Deskripsi Karakteristik Sosial Budaya yang Dominan di Wilayah Penelitian |
|-----|-----------------------------|-------------------------------------------------------------------------------------|
|     |                             | Baluag | Sampolea | Lapanera | Wabula | Pasarwajo | Wolowaja | Siotapina | Lasalimu Sel | Lasalimu | Kapontor |
| 1   | Identitas petani             |        |          |          |        |           |          |           |              |          |          |
| a   | Umur (tahun)                | 30-72  | (33.7)   | 34-72    | (46.5) | 36-63     | (52.3)   | 37-68     | (56.2)      | 36-68    | (55.5)  |
| b   | Lama bertani (tahun)        | 3-36   | (25.3)   | 9-40     | (23.1) | 9-42      | (26.4)   | 5-38      | (29.1)      | 10-31    | (8.8)   |
| c   | Tingkat pendidikan          | SD     | (SD)     | SD       | (SD)   | SD        | (SD)     | TSI/TT   | (SD)        | SD       | (SD)    |

2. Kepemilikan lahan :

| a   | Luas Kepemilikan (ha)       | > 0.5-1| > 0.5-1  | > 0.5-1  | > 0.5-1 | > 0.5-1   | > 0.5-1  | < 0.5     | ≤ 0.5       | ≤ 0.5    | ≤ 0.5   |
| b   | Status kepemilikan (ha)     | Hak milik | Hak milik | Hak milik | Hak milik | Hak milik-prjan | Hak milik | Hak milik | Hak milik-prjan | Hak milik |

3. Luas dan pola tanam existing :

| a   | Luas tanam (ha)             | > 0.5-1| > 0.5-1  | > 0.5-1  | > 0.5-1 | > 0.5-1   | > 0.5-1  | ≤ 0.5     | ≤ 0.5       | ≤ 0.5    | ≤ 0.5   |
| b   | Pola tanam                  | Monokultur | Monokultur | Monokultur | Monokultur | Monokultur | Monokultur | Monokultur | Monokultur |

4. Animo/preferensi petani

| a   | Jagung/U kayu               | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu | Jagung/U kayu |
| b   | Ladang/Jagung               | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung | Ladang/Jagung |
| c   | Sawah/Jagung                | Sawah/Jagung |

5. Kebiasaan/tradisi petani

| a   | Nama acara ritual            | Hara   | Hara     | Hara     | Pe Bante | Pe Gandos  | Karingkuta | Tambure   | Pertu panen | Tidak aktif | Tidak aktif |
| b   | Nama Lembaga ritual          | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica | Parabela Parica |
| c   | Waktu tanam                 | DES/JAN | DES/JAN  | DES/JAN  | DES/JAN  | DES/JAN   | DES/JAN  | DES/JAN   | DES/JAN   | DES/JAN   | DES/JAN   |
| d   | Ujibadi adaptasi            | Rubah W’aran | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam | Rubah P tanam |
| e   | Pelitian pokubat herbivoran | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH |
| f   | Pelitian pokubat plutarian  | Pergesaran MH | Tidak aktif | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH | Pergesaran MH |
| g   | Pelitian wpanen             | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah | Warna buah |

Notes:
- R/C ratio : index of farming suitability
- R/C ratio > 1 farming yields profit
- R/C ratio = 1 farming breaks even
- R/C ratio < 1 farming incur loss

3.1.5. Determining priority of select food crop
Results of AHP sub criteria weighting based on pair comparison between sub criteria in its relation with determining select food crop priority in the research area are presented in Table 5 and its spread in Figure 6.
Table 5. Recapitulation Results of AHP sub criteria weighting based on pair comparison between sub criteria in its relation with determining select food crop priority in the research area are presented in and its spread (Picture.6) in the research area.

AHP results in determining select food crop priority on each region by involving by applying ample criteria are presented on Figure 7.

Figure 6. Hierarchy of determining select food crop priority

Figure 6 shows that social culture reached first place with a value of 0.465, next in second place is the pedo-agroclimate criteria with a score of 0.341, and the third or last place is social economy criteria with a score of (0.194). In sub criteria level, policy direction sits in first place (0.216), then in sequence is weighted land suitability in second place (0.204), infrastructure in third place (0.144), LQ fourth place (0.137), farmer net income (R/C ratio) fifth place (0.110), farmer interest/preference sixth place (0.105), and market opportunity/marketing seventh place (0.084)
AHP result according to Figure 7, we identified the spread of value of select food crop priority ranking in each research region (sub district) as presented on Table 6, and diagrammatically on Figure 8.

Table 6. Recapitulation spread of weighted select food crop priority in research areas and results of priority ranking on each research area based on the whole AHP sub criteria that are taken into consideration.

| No. | Jenis Tanaman Pangan | Keunggulan | Sampola | Lasalimu Sel | Lasalimu S | Lasalimu | Wabula | Pasarwajo | Wolowa | Siotapina | Lasalimu | Wolowa | Batauga | Sampolawa | Lapandewa |
|-----|----------------------|------------|---------|-------------|-------------|----------|--------|-----------|--------|-----------|----------|--------|---------|-----------|-----------|
| 1   | Padi Sawah           | 1          | 0.60    | 0.63       | 0.63        | 0.60     | 0.63   | 0.63      | 0.63   | 0.63      | 0.63     | 0.63   | 0.63    | 0.60      | 0.63      |
| 2   | Kedelai              | 2          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 3   | Kacang Hijau         | 3          | 0.71    | 0.71       | 0.71        | 0.71     | 0.71   | 0.71      | 0.71   | 0.71      | 0.71     | 0.71   | 0.71    | 0.71      | 0.71      |
| 4   | Ubi Jalar            | 4          | 0.64    | 0.64       | 0.64        | 0.64     | 0.64   | 0.64      | 0.64   | 0.64      | 0.64     | 0.64   | 0.64    | 0.64      | 0.64      |
| 5   | Kacang Tanah         | 5          | 0.64    | 0.64       | 0.64        | 0.64     | 0.64   | 0.64      | 0.64   | 0.64      | 0.64     | 0.64   | 0.64    | 0.64      | 0.64      |
| 6   | Padi Ladang          | 6          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 7   | Kedelai              | 7          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 8   | Kacang Hijau         | 8          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 9   | Padi Ladang          | 9          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 10  | Kacang Tanah         | 10         | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |

Urutan Prioritas

| No. | Jenis Tanaman Pangan | Keunggulan | Sampola | Lasalimu Sel | Lasalimu S | Lasalimu | Wabula | Pasarwajo | Wolowa | Siotapina | Lasalimu | Wolowa | Batauga | Sampolawa | Lapandewa |
|-----|----------------------|------------|---------|-------------|-------------|----------|--------|-----------|--------|-----------|----------|--------|---------|-----------|-----------|
| 1   | Padi Sawah           | 1          | 0.60    | 0.63       | 0.63        | 0.60     | 0.63   | 0.63      | 0.63   | 0.63      | 0.63     | 0.63   | 0.63    | 0.60      | 0.63      |
| 2   | Kedelai              | 2          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 3   | Kacang Hijau         | 3          | 0.71    | 0.71       | 0.71        | 0.71     | 0.71   | 0.71      | 0.71   | 0.71      | 0.71     | 0.71   | 0.71    | 0.71      | 0.71      |
| 4   | Ubi Jalar            | 4          | 0.64    | 0.64       | 0.64        | 0.64     | 0.64   | 0.64      | 0.64   | 0.64      | 0.64     | 0.64   | 0.64    | 0.64      | 0.64      |
| 5   | Kacang Tanah         | 5          | 0.64    | 0.64       | 0.64        | 0.64     | 0.64   | 0.64      | 0.64   | 0.64      | 0.64     | 0.64   | 0.64    | 0.64      | 0.64      |
| 6   | Padi Ladang          | 6          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 7   | Kedelai              | 7          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 8   | Kacang Hijau         | 8          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 9   | Padi Ladang          | 9          | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |
| 10  | Kacang Tanah         | 10         | 0.66    | 0.66       | 0.66        | 0.66     | 0.66   | 0.66      | 0.66   | 0.66      | 0.66     | 0.66   | 0.66    | 0.66      | 0.66      |

Table 6 and the diagram on figure 7 indicates that the distribution of select food crop priority value in the research area are relatively homogeneous with a very low deviation standard (0.003 ≤ St.D ≤ 0.035), both between regions and between food crop species. This fact is relevant with the index inconsistency value which is quite small (0.05) from priority value of superior food crop on the research area.
Figure 7. Weight diagram of select food crop priority based on all considered sub criteria. Source: Kandari, 2014.

Table 6 shows that the some ranking of select food crop priority (1-9) in each research region (sub district) are the same and some of them differ. For instance on priority 1, mainstay food crop in Batauga region is cassava same with Sampolawa, Lapendewa, Pasarwajo, Wolowa, dan Siotapina, while in Kapontori and Lasalimu the mainstay food crop is paddy rice, in South Lasalimu field rice and on Wabula is corn. These facts indicates the existence of varying roles of each criteria that are classified by its sub criteria in the process of determining select food crop priority

3.1.6. Land resources management in an effort to guarantee sustainable food crop availability

Land resources management on each research regions are based upon the types of limiting factors found. Result of the research shows there are many combined limiting factors on each research area, which are generally divided into 7 factors: (1) condition of the slope/terrain (s), (2) level of erosion hazard (e), (3) water availability (w), (4) surface rock (p), (5) rooting media and condition (r), (6) nutrient retention (f), (7) nutrient availability (n).

Based upon these limiting factors, land resources management activities needed to be done are generically summarized in these efforts [12]:

a) Management of land based on soil and water conservation principle
b) Utilization of water and climate resources optimally
c) Management of forest and food vegetation
d) Coaching of human resources wisely  
e) Choosing commodity according to agro ecology

4. Conclusions

Based on result and discussion, such points can be concluded:

1. The Kalalasi Region has land biophysical diversity, which consists of physio-topography, soil and climate that affects the types and class of food crop land suitability, and the coverage of its development

2. From the extent of the Kalalasi Region mainland 210,030.00 ha, there is only 74,664.64 ha (35.55%) suboptimal land that has the potential of food crop cultivation with highest suitability grade of S2 (suitable enough) specifically 5,096.52 ha, S3 grade (according to margin) 44,521.38 ha, and the rest are N1 grade (temporarily unsuitable) and N2 (permanently unsuitable)

3. Select food crops that are economically worth to cultivate in the Kalalasi Region, comprises of cassava (66,205.33 ha), soy (14,423.34 ha), field rice (14,296.50), sweet potato (13,758.67 ha), peanut (13,478.90 ha), corn (13,428.27 ha), green bean (12,339.57 ha), and paddy rice (11,278.87 ha)

4. From the social and cultural aspect farmer in the research area as a community are classified as subsistent farmer, and have strong cultural asset in plant cultivation system

5. Need to follow up through field experiments for the advancement of science and technology, especially the development of superior food crops in each region by making conservation efforts and site-specific technology input.

5. References

[1] Ronselvell M.D.A., and D.S. Reay. 2009. *Land Use and Climate Change in UK*. Land Use Policy 26S, S160-S169. Elsevier.

[2] Food and Agriculture Organization. 1976. *A Framework for Land Evaluation*. FAO Soils Bulletin No.32. Food and Agriculture Organisation of the United Nations, Rome. Rome.

[3] Baja, S. 2012a. *Perencanaan Tata Gunanya Lahan dalam Pengembangan Wilayah. Pendekatan Spasial dan Aplikasinya*. Penerbit ANDI, Yogyakarta. 378p.

[4] Wirosoedarmo R., A. T. Sutanhaji, E.Kurniati dan R. Wijayanti. 2011. *Evaluasi Kesesuaian Lahan Untuk Tanaman Jagung Menggunakan Metode Analisis Spasial*. Journal AGRITECH, Vol. 31, No. 1, Februari 2011. Fakultas Teknologi Pertanian, Jurusan Keteknikan Pertanian, Universitas Brawijaya, Malang.

[5] Baja, S. 2012b. *Metode Analitik Evaluasi Sumber Daya Lahan : Aplikasi GIS, Fuzzy Set, dan MCDM*. Penerbit: IDENTITAS. Universitas Hasanuddin, Makassar. 242p.

[6] RePPProT, 1990. *The Land Resources of Indonesian*: a National Over View Regional Physical Planning Programme for Transmigration, Jakarta. Ministry of Transmigration and Land Resources, Departement NRI, UK. OverSears Development Administration.

[7] Hendayana R. 2003. *Aplikasi Metode Location Quotient (LQ) dalam Penentuan Komoditas Unggulan Nasional*. Informatika Pertanian 12 (1) : 658-675.