Integrated land suitability assessment and management strategies for sustainable agriculture on mohupomba island, Indonesia

Ayu Rosandi Dg. Mansyur[11], Nurdin[1], *Fitria S.* Bagu[1], *Sutrisno Hadi* Purnomo[1]

[1]Master's Program in Agrotechnology, Universitas Negeri Gorontalo, Gorontalo, Indonesia

Abstract. Land suitability assessment is fundamental to ensuring productive and sustainable agricultural development. This study aimed to evaluate land characteristics, determine land suitability, and formulate strategic management directions for sustainable agriculture on Mohupomba Island, Boalemo Regency. Field surveys were conducted using a grid sampling technique at 11 observation points. Soil physicochemical properties were analyzed in the laboratory, and climatic data were incorporated into the assessment. Land suitability was evaluated using two approaches: the Khiddir method (1986) and the Rabia method (2013). The results reveal heterogeneous land characteristics across the island. Soil texture ranges from sandy to clay loam, with moderately rapid to slow drainage conditions. Soil chemical analysis indicates neutral to slightly acidic pH, low salinity, variable organic matter content (low to high), low to moderate nitrogen, moderate phosphorus, and low to moderate available potassium (K_2O). Land suitability classification based on the Khiddir method identified categories ranging from Unsuitable (N) to Very Suitable (S1), with soil fertility (f) as the primary limiting factor. In contrast, the Rabia method classified land into Marginally Suitable (S3) to Very Suitable (S1), with climate (c) identified as the main constraint. Overall, Mohupomba Island demonstrates significant potential for sustainable agricultural development, although suitability levels vary depending on land characteristics and climatic conditions. Recommended management strategies include site-specific organic and inorganic amendments to enhance soil fertility, implementation of soil and water conservation practices, and the development of climate-adaptive, agro-ecotourism-based farming systems.

1 Introduction

Mohupomba Island, located in Boalemo Regency, Gorontalo Province, is one of a small island group with potential agricultural land resources that have not been optimally managed. As an archipelago, the island faces challenges such as limited infrastructure, land degradation, and vulnerability to climate change. Meanwhile, the need for sustainable agriculture is increasingly pressing to ensure food security and the well-being of local communities. Meanwhile, agricultural land is decreasing, accompanied by a decline in land quality.

The increasing need for food has also led to an increasing need for land. On the other hand, the rate of conversion of agricultural land to non-agricultural land is increasing (Nurdin

[1] Corresponding author: ayurosandidgmansyur01709@gmail.com

et al. 2025) . Sustainable land optimization can increase agricultural productivity and community food security. Characterization of land resources is needed to support island-based agricultural planning to increase productivity, food security, sustainable agriculture, and environmental sustainability. This research is in line with sustainable development targets, particularly environmentally responsive agriculture and sustainable land management in island regions. This research aims to identify the physical and chemical characteristics of agricultural land and develop sustainable agricultural management strategies. Previous studies have shown that Data on land characteristics is still lacking on small islands in Indonesia, so this study can serve as a reference for sustainable agricultural management policies. The study used a field survey and laboratory analysis approach. Parameters analyzed included physical and chemical properties, as well as economic, social, and cultural aspects. Data were processed using a Geographic Information System (GIS) for land suitability mapping. The results of the study include maps of land characteristics, levels of agricultural commodity suitability, land capability classes, and sustainable agricultural development management strategies. These recommendations are expected to serve as a reference for relevant parties and farmers in optimizing agricultural land resources sustainably.

Sustainable agricultural development on islands requires a special approach due to the different land characteristics compared to the mainland. To determine the potential and capacity of land for specific uses, such as agriculture, pastures, and nature reserves, a land evaluation is necessary. Furthermore, land use that aligns with its potential maintains land quality and optimizes sustainable agricultural development. Land evaluation requires a good method, one of which is the parametric approach, to obtain accurate data. The parametric approach has the advantage of quantifiable and selectable criteria, allowing for objective data, including reliability, reproducibility, and high accuracy compared to non- parametric methods (Hardjowigeno, 2015). Furthermore, Nurdin et al. (2022) state that parametric methods provide a more realistic assessment of land characteristics compared to limiting factor methods. Sustainable agricultural development on small islands requires a special approach due to the different land characteristics from those on the mainland. Sustainable land optimization can increase agricultural productivity and community food security. Therefore, identification and evaluation of land potential through land resource characterization and land suitability analysis are necessary. This research aims to plan land use in accordance with the land's potential and capabilities, thereby supporting the development of adaptive and sustainable agriculture.

2 Literature Review

2.1 Agricultural Land Fertility

Soil fertility status is one way to evaluate the potential of agricultural land. Assessment of soil fertility can serve as a method that can be done and produces more effective results in supporting crop productivity by considering soil characteristics, especially chemical properties that can affect the balance of plant needs, especially nutrients. The results of research conducted in the rice fields of Pak Bulu Village indicate that the condition of soil fertility is relatively low, it is known that the low level of soil fertility is caused by the minimal percentage of base saturation. Research conducted by (Wati et al ., 2024) indicates that this makes the soil in the rice fields less able to retain the nutrients needed by plants.

2.2 The Relationship between Land Suitability and Land Use Concepts

Land evaluation is a step taken to assess the potential of a land for a particular use, including in identifying new areas for sustainable agricultural land development. Next, an analysis of the characteristics and suitability of lowland rice fields is carried out using a parametric approach. Research by Pakaya et al ., (2024) shows that the characteristics and quality of land in Moliliulo are very diverse, ranging from climate factors to soil and nutrient availability that vary from low to high. The results obtained are 4 classes of land suitability for lowland rice plants, namely class 1 (very good) covering an area of 17.52 ha or 2.15%, class 2 (good) covering an area of 3.08 ha or 0.38%, class 3 (moderate) covering an area of 710.44 ha or 87.15% and class 4 (poor) covering an area of 58.15 ha or 7.13%.

Soil has diverse properties, including physical, chemical, and biological properties. The main challenges in developing small islands are limited water availability, low socioeconomic conditions of the population, difficult accessibility, high risk of natural disasters, low environmental carrying capacity, lack of infrastructure and institutions, and vulnerability to pollution. Land suitability for agricultural development in an area is determined by the compatibility between the chemical and physical properties of the environment, including climate, soil, topography, surface rocks, and land use requirements or plant growth needs. Assessment of environmental conditions and the application of technology in crop management, as well as determining land suitability classes, contribute significantly to agricultural crop cultivation (Gubali et al., 2023).

2.3 Relationship between Characteristics and Land Suitability Indicators on the Island

Small islands have unique agricultural characteristics due to their specific biophysical environmental conditions, which influence farming practices tailored to the conditions on the island. For example, crop cultivation on small islands focuses more on agricultural resource management to ensure the sustainability of natural resources, which are limited by the island's land area. By implementing sustainable agricultural practices, the sustainability of these natural resources can be maintained (Joisangadji et al., 2023) .

Research by Irawan (2021) shows that the assessment of land suitability for red chili plants on Rempang Island produces two categories, namely actual land suitability and potential land suitability. The land suitability evaluation method is carried out through matching and is based on Leibeg's minimum law. In actual land suitability, the suitability class was found to be Marginally Suitable/S3 covering an area of 8,946.82 Ha, and not suitable/N covering an area of 3,225.27 Ha. This indicates suboptimal results for growing red chilies. Parameters with these limiting factors include nutrient retention, water availability, and erosion risk. If land improvement efforts are attempted, these limiting factors can be improved, which will bring the land suitability classification to a better level, namely potential land suitability with a very suitable class/S1 covering an area of 4,088.50 Ha and quite suitable/S2 covering an area of 7,993.56 Ha. 4.

2.4 The Relationship between Conservation Techniques and Land Management on Islands

Indonesia is an archipelagic country consisting of many islands, totaling 16,065 with a total area of 1,916,862 km 2 (excluding the EEZ) and has a coastline of 99,093 km (Geospatial Information Agency, 2018). This demonstrates the abundance of resources found in coastal areas and small islands. These areas are rich in natural resources. These include renewable resources such as fish, seaweed, coral reefs, and mangroves, as well as non-renewable resources such as oil and gas, tin, sand, and other minerals. In addition to their significant physical potential, coastal areas and small islands also offer environmental services with potential for development, such as the tourism sector (Hidayatullah et al ., 2021).

Efforts to improve environmental conditions and maintain the preservation of natural resources need to be carried out so that the ecosystem can be managed well and sustainably. Conservation areas in island areas are planned to maintain and preserve the diversity of both biological and non-biological resources, in order to support the development of the area, especially in the tourism sector and environmentally friendly agriculture as an effort to keep the ecosystem controlled and sustainable. Conservation areas in island areas are managed to maintain and preserve the diversity of biological and non-biological resources, to support the progress of regional development, especially in the field of tourism and sustainable agriculture. Research conducted by Wisata, (2025) has successfully combined land suitability analysis with environmental carrying capacity using Geographic Information Systems in the Morotai Island Conservation Area. The results of this analysis show a mapping of zones that are very suitable for tourism development by paying attention to the number of visitors so as not to damage the ecosystem. This approach is expected to be used as a guide for sustainable tourism management in other conservation areas.

3 Methodology

3.1 *Place and Time of Research*

This research was conducted on Mohupomba Island, Bajo Village, Tilamuta District, Boalemo Regency, Gorontalo Province (0.474558° N, 122.362365° E). The study was carried out from May to October 2025.

3.2 *Research Methods and Design*

This study employed a field survey method with a descriptive analytical approach. The research was conducted through the following stages:

a. Preparation of a work map (Figure 1).
b. Collection of primary data through field surveys and soil sampling, and secondary data, including climate data obtained from the Sulawesi II River Basin Center.
c. Soil sampling using a grid sampling technique at 11 sampling points.
d. Laboratory analysis of soil physical and chemical properties at the Soil Chemistry and Fertility Laboratory, Hasanuddin University, Makassar.
e. Land suitability evaluation using two parametric approaches:
    - Khiddir Method (1986) using the minimum rating approach.
    - Rabia Method (2013) using the maximum rating approach.

3.3 *Population and Sample*

Soil samples were collected from the topsoil layer (0–20 cm) at 11 grid points representing dryland areas with slopes of <15% and elevations ranging from 0 to 100 m above sea level.

3.4 *Data Collection Techniques*

Data were collected using the following techniques:

1. Field surveys to observe soil profiles and site physical conditions.
2. Laboratory analyses of soil physical parameters (texture, color, drainage, and moisture content) and chemical properties (pH, salinity, organic C, total N, P_2O_5, CEC, exchangeable bases, and K_2O).
3. Secondary climate data (2015–2024) obtained from the Sulawesi II River Basin Center.

3.5 *Data Analysis*

1. Land Suitability Analysis
   a. Khiddir Method (1986): $I = R_{min} \times \sqrt{(A/100 \times B/100 \times ... n/100)} \times 100\%$
   b. Rabia Method (2013): $Si = W_{max} \times \sqrt{(A/100 \times B/100 \times C/100 \times ... n/100)} \times 100\%$
   c. The resulting land index values were classified into land suitability classes following Sys et al. (1993): S1 (Highly Suitable), S2 (Moderately Suitable), S3 (Marginally Suitable), N1 (Currently Unsuitable), and N2 (Permanently Unsuitable).
2. Supporting Data Analysis
3. Supporting data were analyzed descriptively and presented in tablesand figures.

4 Result and Discussion

4.1 Description of the Research Area

Mohupomba Island (formerly known as Idaman Island) is a small white-sand island located in Tomini Bay, to the east of the Sulawesi Peninsula, and is one of Boalemo Regency's flagship tourism destinations. Administratively, the island belongs to Bajo Village, Tilamuta District, Boalemo Regency, Gorontalo Province. Mohupomba Island can be reached by boat within approximately 15–20 minutes from the mainland of Bajo Village. The island is well known for its tree-roosting bats that emerge at dusk to forage. In the local language, *Mohupomba* means "bat," reflecting the island's distinctive fauna. The bright sandy and coral seabed. Vegetation cover is relatively sparse and is dominated by mangrove stands, coconut trees, shrubs, and other coastal vegetation. The coral reef
ecosystem surrounding the island remains in relatively good condition and provides habitat for various reef fish species.

Mohupomba Island is uninhabited and has no permanent residential areas, resulting in a natural and tranquil environment. However, tourism-supporting infrastructure is still limited; for example, public toilets and freshwater sources are not available on the island. The island exhibits typical characteristics of a coral island, including extensive stretches of fine, clean white sand. The topography is relatively gentle. The surrounding seawater is exceptionally clear, displaying a striking turquoise-blue gradation enhanced by

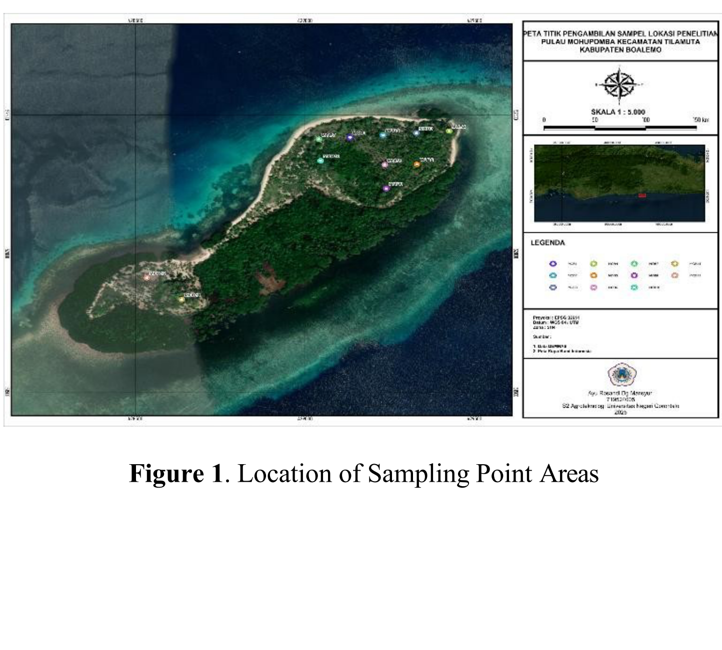

Figure 1. Location of Sampling Point Areas

4.2 Climate Characteristic (2015-2024)

Based on 10-year climate records (2015–2024) obtained from the Bongo I Watershed Climate Station (Harapan Village, Wonosari District, Boalemo Regency) and supporting rainfall data from the Tilamuta–Hungayona and Tilamuta–Piloliyanga watershed datasets (Tilamuta District, Boalemo Regency), the climate characteristics of the study area are summarized in Table 1.

Table 1. Climate Characteristics of Mohupomba Island (2015–2024)

Climate Parameters	Annual Average	Description and Variability
Relative Humidity (%)	90.97%	Very high and relatively stable throughout the year, with minor monthly variation.
Air Temperature (°C)	28.84°C	Tropical conditions, relatively constant with limited monthly fluctuation.
Evaporation (mm)	3.49 mm	Low evaporation rate and generally consistent across months.
Wind Speed (km/h)	34.68 km/h	Moderate wind speed, with peaks typically occurring in August–September.
Sunlight (hours)	46.37 hours	Relatively high, with seasonal variation.
Piloliyanga Rainfall (mm/month)	12.59 mm/month	Moderate monthly rainfall, showing clear wet and dry season patterns.
Hungayona Rainfall (mm/month)	9.68 mm/month	Lower than Piloliyanga rainfall, with greater month-to-month variability.

4.3 Results of Observations of Profile Layers and Soil Depth

Based on the sampling grid points (Figure 1) and field observations, the geographic coordinates, soil profile horizons, and soil depth at each grid point on Mohupomba Island are presented in Table 2.

Table 2. Soil Profile Horizons and Depth at Each Grid Point

Grid Point	Site Information	Geographic Coordinates	Horizon	Depth (cm)
MOB 1-1	Mohupomba Boalemo Grid 1, layer 1	0°28'27.3"N; 122°21'47.2"E	OA	0–12
MOB 1-2	Mohupomba Boalemo Grid 1, layer 2	—	B	12–23
MOB 2-1	Mohupomba Boalemo Grid 2, layer 1	0°28'27.1"N; 122°21'50.5"E	OA	0–16
MOB 2-2	Mohupomba Boalemo Grid 2, layer 2	—	B	16–25
MOB 3-1	Mohupomba Boalemo Grid 3, layer 1	0°28'27.6"N; 122°21'53.6"E	OA	0–10
MOB 4-1	Mohupomba Boalemo Grid 4, layer 1	0°28'28.0"N; 122°21'56.7"E	A	0–10
MOB 5-1	Mohupomba Boalemo Grid 5, layer 1	0°28'24.2"N; 122°21'53.4"E	OA	0–10
MOB 6-1	Mohupomba Boalemo Grid 6, layer 1	0°28'24.0"N; 122°21'50.6"E	OA	0–10
MOB 7-1	Mohupomba Boalemo Grid 7, layer 1	0°28'27.0"N; 122°21'44.3"E	OA	0–10
MOB 7-2	Mohupomba Boalemo Grid 7, layer 2	—	B	10–15
MOB 8-1	Mohupomba Boalemo Grid 8, layer 1	0°28'21.1"N; 122°21'50.4"E	A	0–10

MOB 10-1	Mohupomba Boalemo Grid 10, layer 1	0°28'24.5"N; 122°21'44.3"E	OA	0–10
MOB 11-1	Mohupomba Boalemo Grid 11, layer 1	0°28'08.2"N; 122°21'31.2"E	A	0–10
MOB 12-1	Mohupomba Boalemo Grid 12, layer 1	0°28'10.7"N; 122°21'27.8"E	OA	0–11
MOB 12-2	Mohupomba Boalemo Grid 12, layer 2	—	B	11–19

Source: Field observations and map interpretation (2025).

4.4 Soil Physical Characteristics of Mohupomba Island

Based on field observations and laboratory analyses, the soil physical properties of Mohupomba Island are summarized in **Table 3**.

Table 3. Physical Soil Properties of Mohupomba Island

Grid Point	Matrix Soil Color (Munsell)	Sand (%)	Silt (%)	Clay (%)	Texture Class	Water Content (%)	Drainage (Class)
MOB1-1	10YR 2/2	85	6	9	Clayey sand	9.6	Moderately rapid
MOB1-2	7YR 2.5/1	84	3	13	Clayey sand	10.6	Moderately rapid
MOB2-1	10YR 2/1	85	10	5	Clayey sand	9.6	Moderately rapid
MOB2-2	7.5YR 2/3	70	16	14	Sandy loam	10.6	Moderately rapid
MOB3-1	10YR 2/2	36	30	34	Clay loam	7.4	Moderately rapid
MOB4-1	5YR 4/4	45	26	29	Clay	15.0	Rapid
MOB5-1	10YR 2/1	11	38	51	**Clay** *(or silty clay)*	10.6	Moderate
MOB6-1	10YR 2/2	36	26	38	Clay loam	9.2	Moderate
MOB7-1	10YR 2/2	26	24	50	**Clay**	9.8	Moderate
MOB7-2	7YR 2.5/2	49	36	15	Loam	10.6	Moderate
MOB8-1	5YR 6/3	54	28	18	Sandy loam	9.6	Rapid
MOB10-1	10YR 2/2	82	8	10	Clayey sand	10.2	Rapid
MOB11-1	10YR 4/3	36	30	34	Clay loam	9.8	**Slow**
MOB12-1	7.5YR 2.5/2	**42**	**42**	**42**	**Clay** *(check values)*	9.0	**Slow**
MOB12-2	10YR 3/3	87	6	8	Clayey sand	10.8	**Slow**

4.5 Chemical Properties of Mohupomba Island Soils

Based on laboratory analyses, the chemical properties of the soils on Mohupomba Island are presented in Table 4.

Table 4. Chemical Properties of Soils on Mohupomba Island

Chemical properties	MOB1-1	MOB1-2	MOB2-1	MOB2-2	MOB3	MOB4	MOB5	MOB6	MOB7-1	MOB7-2	MOB8	MOB10	MOB11	MOB12-1	MOB12-2
pH	7.3	7.2	7.0	7.3	7.2	7.1	7.0	7.2	7.0	7.3	7.0	7.0	7.0	6.9	7.4
Salinity	2.1	1.8	1.0	2.0	2.2	1.2	2.0	1.8	0.8	2.0	1.9	1.8	1.6	1.0	2.3
Walley & Black Organic Matter C	3.5	2.2	3.4	2.9	3.5	1.6	2.3	3.0	3.6	2.4	1.9	3.8	1.2	2.6	1.2
Kjeldahl Organic Matter N	0.3	0.2	0.3	0.2	0.3	0.2	0.1	0.2	0.3	0.2	0.1	0.3	0.1	0.2	0.2
C/N	14.0	14.0	12.0	15.0	11.0	8.0	17.0	15.0	14.0	17.0	16.0	15.0	11.0	13.0	10.0
p-Olsen P_2O_5	13.3	14.3	10.4	14.8	12.3	11.6	12.3	14.3	11.0	12.7	11.0	10.5	13.1	10.5	12.3
Ca (cmol(+)/kg)	9.2	9.0	8.5	10.5	11.2	10.0	11.0	9.0	9.5	10.1	9.0	10.5	10.5	9.8	9.0
Mg (cmol(+)/kg)	2.3	2.0	2.1	3.5	4.1	6.0	5.5	6.2	4.0	3.9	3.2	2.0	4.2	3.6	2.1
K (cmol(+)/kg)	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4
Na (cmol(+)/kg)	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.2	0.2
Amount	12.0	12.0	11.0	15.0	16.0	17.0	17.0	16.0	14.0	15.0	13.0	14.0	15.0	14.0	12.0
KTK (CEC)	16.0	15.0	16.5	20.1	22.1	24.1	24.0	23.8	21.6	22.1	18.8	16.7	22.1	20.3	15.9
KB (%)	73.0	74.0	68.0	74.0	73.0	69.0	72.0	67.0	65.0	66.0	68.0	79.0	70.0	69.0	74.0
K_2O	25.3	20.5	40.2	26.3	31.1	16.3	19.6	21.1	23.5	24.2	16.3	20.3	21.4	19.6	20.3

4.6 Land Index and Land Suitability Class of Mohupomba Island

Land suitability evaluation is essential for land-use planning on Mohupomba Island as a basis for sustainable agricultural development. The land quality index values were used to calculate the land index using parametric approaches, which help reduce bias from interactions among individual land characteristics. The results of the land suitability assessment based on land index values are summarized in **Table 5**.

Table 5. Land Suitability Class and Limiting Factors on Mohupomba Island

Grid Points	Khiddir Method (1986)	Limiting Factors	Rabia Method (2013)	Limiting Factors
MOB1-1 & MOB1-2	N (Not suitable)	f (Soil fertility)	S3 (Marginally suitable)	c (Climate)
MOB2-1 & MOB2-2; MOB4-1; MOB5-1; MOB12-1 & MOB12-2	S3 (Marginally suitable)	f (Soil fertility)	S1–S2 *(as reported)*	c (Climate) / –
MOB3-1	S1 (Highly suitable)	–	S1 (Highly suitable)	–
MOB6-1; MOB7-1; MOB10-1	S2 (Moderately suitable)	f (Soil fertility)	S1 (Highly suitable)	–
MOB8-1; MOB11-1	N (Not suitable)	f (Soil fertility)	S2 (Moderately suitable)	c (Climate)

Information:

- The Khiddir method is more conservative, placing stronger emphasis on soil fertility constraints (particularly nitrogen) as the primary limiting factor.
- The Rabia method is relatively more optimistic, highlighting climatic constraints (especially rainfall) and generally producing higher suitability classes.

4.7 Land Suitability Class on Mohupomba Island

The differences between the two evaluation methods reflect developments in land evaluation approaches over time. The Khiddir (1986) method is suitable for cautious land-use planning because it prioritizes soil fertility improvement as a prerequisite for agricultural development.

In contrast, the Rabia (2013) method is more appropriate for assessing the land's maximum potential, while explicitly considering climate-related limitations and the need for adaptation.

Based on the combined interpretation of both methods, the following conclusions can be drawn:

a. Mohupomba Island has potential for sustainable agricultural development, provided that limiting factors are managed appropriately.
b. Suitability levels vary across grid points, with the main limiting factors being soil fertility (notably N and K availability) and climate (rainfall).
c. Climate change should be incorporated into planning, as it may influence water availability, erosion risk, and salinity dynamics.

4.8 Recommendations for Land Use Type (TPL)

Based on the analysis results, the following strategic land management directions are recommended:

a. Highly Suitable Zone (S1 – Rabia Method)
- Grid points: MOB2-1, MOB3-1, MOB4-1, MOB5-1, MOB6-1, MOB7-1, MOB10-1
- TPL: Sustainable agricultural area with controlled inputs.
- Recommended commodities: Coconut, banana, mango.
- Management strategy: Crop rotation; application of organic matter; and site-specific inorganic fertilization, particularly N and K, to address fertility constraints.

b. Moderately to Marginally Suitable Zone (S2/S3)
- Grid points: MOB1-1, MOB8-1, MOB11-1, MOB12-1
- TPL: Climate-adaptive agriculture combined with conservation functions.
- Recommended commodities: Crops tolerant to drought or periodic waterlogging (depending on the dominant limitation).
- Management strategy: Soil and water conservation (e.g., terracing, mulching/ground cover); and selection of commodities matched to site limitations.

c. General Recommendations for the Entire Island
- Marine agro-ecotourism development: Integrating the island's natural attractions with organic or low-input farming activities, involving local communities.
- Water infrastructure development: Establishing a clean-water storage and distribution system.
- Climate-smart agriculture: Selecting commodities and cropping patterns that are adaptive to climate variability.

If areas share the same suitability class and index value, final prioritization should consider regional commodity development policies at the regency, provincial, and national levels, as well as the current distribution of leading commodities. In addition, according to Bayu and Anisia (2021), plains to undulating plains with slopes of approximately 15–30% may be utilized for agriculture, plantations, and reserves for settlement/transmigration development.

4.9 Recommended Land Use Type (TPL) for Mohupomba Island

TPL recommendations are grouped into three categories:

1. Aeas recommended for agricultural land development,
2. Areas recommended with additional inputs (fertilization to improve fertility, soil and water conservation measures, and climate stress-tolerant crops), and
3. Areas not recommended for agricultural expansion.

Table 6. Recommended Land Use Types on Mohupomba Island

Grid Point	Khiddir (1986)	Rabia (2013)	Recommended Land Use Type (TPL)
AMB1	Nf	S3c	Cultivation of climate stress-tolerant crops
AMB2	S3f	S1	Agricultural development with fertility improvement inputs (especially N and K)
AMB3	S1	S1	Agricultural land development
AMB4	—	—	Agricultural development with fertilizer inputs to improve soil fertility
AMB5	—	—	Agricultural development with fertilizer inputs to improve soil fertility
AMB6	S2f	S1	Agricultural development with fertility improvement inputs
AMB7	—	—	Agricultural development with fertilizer inputs to improve soil fertility
AMB8	Nf	S2c	Cultivation with soil and water conservation practices
AMB10	—	—	Agricultural development with fertility improvement inputs
AMB11	—	—	Cultivation with soil and water conservation practices
AMB12	S3f	S2c	Cultivation with an integrated soil and water conservation system

5 Conclusion

Land resource characteristics on Mohupomba Island vary considerably. Soil textures range from sandy **to** clay loam, with moderate to rapid drainage. Soil chemical conditions are generally neutral**,** with low salinity**,** variable organic matter and nitrogen (low to high), moderate phosphorus, low to moderate potassium, and high base saturation. The humid tropical climate with variable rainfall is a major influencing factor.

Land suitability assessment results differ substantially between methods. The Khiddir (1986) method produces N (Not suitable), S3 (Marginally suitable), and S2 (Moderately suitable) classes, primarily limited by soil fertility (f)**.** The Rabia (2013**)** method produces S3, S2, and S1 (Highly suitable) classes, with climate (c) as the dominant limiting factor.

Land-use planning should prioritize sustainable agricultural development with controlled inputs in highly suitable zones, climate-adaptive agriculture and conservation practices in moderately suitable zones, and the development of community-based marine agro-ecotourism across the island.

References

1. D. Bayu, H. Anisia, Analisis kesesuaian lahan kawasan lahan basah (wetland) untuk perencanaan tata guna lahan berkelanjutan di Kabupaten Tulang Bawang. *[Nama jurnal belum dicantumkan]*, **5**, 58–67 (2021).
2. H. Gubali, A. Mamonto, N. Nurdin, Analisis kesesuaian lahan untuk tanaman ubi kayu (*Manihot utilissima* L.) di Desa Bumela Kecamatan Bilato. *J. Lahan Pertan. Trop. (JLPT)*, **2**, 119–127 (2023). https://doi.org/10.56722/jlpt.v2i2.23767

3. H. Hidayatullah, N. Khakhim, A. Kurniawan, Evaluasi kesesuaian dan daya dukung lahan untuk pengembangan pariwisata di wilayah kepesisiran Pulau Breuh. *Media Komun. Geogr.*, **22**, 19 (2021). https://doi.org/10.23887/mkg.v22i1.30502
4. S. Irawan, Penentuan kesesuaian lahan untuk tanaman cabai merah di Pulau Rempang menggunakan sistem informasi geografis. *ABEC Indones.*, 98–109 (2021).
5. Z.I. Joisangadji, R. Melati, S. Sudjud, A.R. Mandea, Karakterisasi pertanian berkelanjutan di pulau kecil. *J. Ilmu Pertan. Indones.*, **29**, 54–58 (2023). https://doi.org/10.18343/jipi.29.1.54
6. Nurdin, S.A.R. Rahman, Sebaran spasial tingkat kesesuaian lahan tanaman pangan pada beberapa sub daerah aliran sungai (DAS) di kawasan Teluk Tomini Kabupaten Boalemo. *J. Pertan. Presisi*, **9**, 17–34 (2025).
7. Nurdin, F. Zakaria, M.A. Azis, Y. Rahim, R. Rahman, M. Kasim, Comparison of land suitability class for endemic *Coffea liberica* Pinogu HP acquired using different methods and recommendations for land management in Pinogu Plateau, Bone Bolango Regency, Indonesia. *Sains Tanah*, **19**, 42–51 (2022). https://doi.org/10.20961/stjssa.v19i1.56441
8. M.R. Pakaya, Nurdin, I. Dunggio, R. Rahman, Parametric land evaluation for paddy plants in Moliliulo Hamlet, Tangga Barito Village, Dulupi District, Boalemo Regency. *J. Ilm. Mhs. Fak. Pertan.*, **4**, 435–443 (2024). https://doi.org/10.52045/jimfp.v4i2.700
9. K.R. Wati, R. Hazriani, R. Manurung, Kajian status kesuburan tanah pada lahan persawahan di Desa Pak Bulu Kecamatan Anjongan Kabupaten Mempawah. *J. Sains Pertan. Equator*, **13**, 992 (2024). https://doi.org/10.26418/jspe.v13i3.81239