

The Utilization of Geographic Information Systems (GIS) for the Suitability of Agro-tourism Land

Sukri Nyompa^{1*}, Rosmini Maru², Wahyuddin², and Gufran Darma³

¹ *Geography Department, Mathematics and Science Faculty,
Universitas Negeri Makassar, Makassar, Indonesia*

² *Geography Education Study Program, Post Graduated Program,
Universitas Negeri Makassar, Makassar, Indonesia*

³ *Environmental Education Studies, Post Graduated Program,
Universitas Negeri Makassar, Makassar, Indonesia*

*Corresponding author: sukrinyompa@unm.ac.id

Received: September 4, 2022; Revised: October 27, 2022; Accepted: December 14, 2022

Abstract

Development of environmentally friendly tourism can be interpreted as development that does not damage the environment and uses land wisely. In terms, agrotourism is a tourism activity that explore and utilize the potential of the environment in it as a tourist attraction. This study aims to determine the agrotourism area by the physical conditions of the environment in Soppeng Regency, South Sulawesi, Indonesia. Determining the suitability of agrotourism areas using quantitative descriptive methods using overlay analysis techniques or stacking parameter maps (land use, soil type, and slope) that have been scored and weighted beforehand using the Arcgis 10.8 application. The results of the overlay produce a composite map and divide the area into three classifications, namely areas that are suitable, quite suitable, and not suitable. The suitable area is 72794 Ha (53.52%), the suitable area is 34726.96 Ha (25.61%) and the unsuitable area is 28269.02 Ha (20.87%). Based on the results of the analysis of several parameters above, it shows that Soppeng Regency has the potential to be used as an agrotourism area which is also supported by the various types of agricultural activities in Soppeng Regency.

Keywords: Land Suitability; Geographic Information System (GIS); Land Suitability; Agrotourism

1. Introduction

The development of the tourism industry without paying attention to environmental impacts will certainly harm humans themselves. Therefore, environmental development needs to be developed not to damage the environment and provide knowledge to the wider community (Díez-Gutiérrez and Babri, 2020). The greater public knowledge about the environment, the better the impact will be felt (Gautam, 2020). This is because tourism can be a threat in the form of conservation area expansion that can damage protected ecosystems to disrupt the sustainability of tourism potentials (Canteiro *et al.*, 2018).

Indonesia's diversity of tourism potential includes natural resource-based tourism, including rural and agricultural landscapes where tourism has its charm as a destination that can provoke an increase and turn the wheels of the economy, especially for the government and society (Situmorang *et al.*, 2019). Rural tourism has now developed following the times where the main focus is locations that are the main icons of natural scenery, agricultural land, and culture (Xiang *et al.*, 2020). In simple terms, agrotourism is a tourism activity that utilizes the capabilities of agricultural land, processing production processes, and distributing production

products in which there are activities to introduce the rural culture and preserve the environment (Kaswanto, 2015).

Various previous studies raised almost the same theme, namely agrotourism – traditional knowledge and rural biotechnology (Ciolac *et al.*, 2015) and Agrotourism as prospects, interests, goals, and challenges in Nepal (Khanal and Shrestha, 2019). Meanwhile, in Soppeng regency, there was a study about the agrotourism to study and to analyze the potential and attractiveness of natural tourism in the Bulu Dua area and formulated a community-based nature tourism management strategy in the Bulu Dua area, Soppeng Regency (Muhammad and Darmawan, 2019). Diez-Gutierrez and Babri (2020) studied the development of tourism that can harm the environment. One of the factors causing increased pollution around tourist attractions comes from tourist behavior. One way to provide information to tourists is by determining the right tourist route. This study concludes that policymakers should consider improving the transportation system.

Canteiro *et al.* (2018) revealed that the threat of environmental expansion would impact the tourism sector. This study uses the Tourism Impact Assessment (TIA) method by evaluating the environmental impacts associated with nature conservation areas. The result is that fifteen tourism activities affect four biological components (biodiversity, land cover, soil, and water).

Xiang *et al.* (2020) stated that rural eco-tourism focuses on development by utilizing natural resources. Determination of standards using survey and evaluation methods in determining rural eco-tourism. This study uses the Decision Alternative Ratio Evaluation System (DARE) and the Delphi method. The research results in this scientific research show that natural conditions and the human condition are the core elements of rural eco-tourism resources.

Kaswanto (2015) studied the evaluation of agro-tourism based on four aspects, namely agriculture, tourism, beauty, and amenities (ATBA). That is, the development of natural tourism focuses on agriculture that is right for tourism. Spatial distribution of land use using Landsat image. Spatial distribution

of land use using Landsat imagery. The spatial approach is used by combining the element values of each landscape. This study aims to design a land management scenario for agro-tourism using the ATBA method. At the same time, Chen (2020) discusses the environmental impacts caused by changes in environmental ecosystems. The method used to determine environmental changes using (ESV) is to assess each ecosystem.

Exploring the potential of agrotourism in Soppeng Regency, South Sulawesi province, Indonesia has been explained about the intensity of spatial use aimed at planning and developing agrotourism areas and integrating tourism activities to support the preservation of technically irrigated agricultural land (Soppeng Regency Government, 2012). Some of the objects in Soppeng that can be identified as an agricultural site such as rice fields, corn plantation, cocoa plantation, mango plantation, cashew plantation, dragon fruit plantation, watermelon plantation, peanut plantation, livestock farms, and cocoa seedling sites. This has become one of the drivers of research on agrotourism development in the Soppeng Regency. Thus, the potential for agricultural tourism, nature conservation, and culture can be maintained to preserve nature and culture as a gift from God Almighty. It is an effort to promote general welfare for the community through the development of village tourism potential by utilizing the potential of the environment and land for the benefit of tourist attractions for the welfare of the local community (Soppeng Regency Government, 2019).

In this research, the researchers intend to present information about the use of geographic information systems (GIS) to identify the suitability of agrotourism in Soppeng Regency, which is viewed from the physical aspect of the environment using the Overlay analysis technique (overlapping parameter maps) with the scoring and weighting method using the application. Arcgis 10.8.

2. Materials and Methods

The type of research used in this research is descriptive quantitative research.

Quantitative descriptive research is a research method based on the philosophy of positivism or a perspective when understanding a fact-based on empirical data, where data analysis is more statistical (Creswell and Creswell, 2017). Quantitative descriptive research is also a conscious and systematic effort to provide answers to a problem and or obtain more in-depth and broad-based information on an incident phenomenon using the stages of a quantitative approach. Moreover, the land use data that derived from Landsat, it needs to be validated through confusion matrix. Based on the ground check and the matrix analysis, the error percentage is 15%. Hence, the land use data can be used for further analysis.

2.1 Research sites

Soppeng Regency is located in South Sulawesi Province. It is divided into 8 sub-districts: Marioriwawo District,

Lalabata District, Liliriaja District, Ganra District, Citta District, Lilirilau Donri-Donri District, and Marioriawa District. Marioriawa District is the largest sub-district, with an area of 320 km² or about 21.3% of the total area of Soppeng Regency. Meanwhile, the Citta sub-district is the sub-district with the smallest area, which is only 40 km² or 2.7 percent of the total area of Soppeng Regency. Soppeng Regency is geographically located at coordinates 4° 6'00" - 4° 32'00" South Latitude and 119° 47'18" - 120° 06'13" East Longitude as shown in Figure 1 below.

Soppeng Regency is surrounded by a vast mountainous landscape and a topography that varies from flat to steep with natural characteristics typical of the countryside. The research location has various agricultural and plantation resources and natural and artificial landscapes that have high enough potential to be used as agro-tourism objects.

Table 1. Types and sources of research data

No	Data	Data Type	Data Source
1	Administration Map	Primary Data	Related Agencies
2	Slope	Secondary Data	Observation and Dem Srtm
3	Type Of Soil	Secondary Data	Related Agencies
4	Land Use	Primary Data	Landsat 8 Image Of 2019

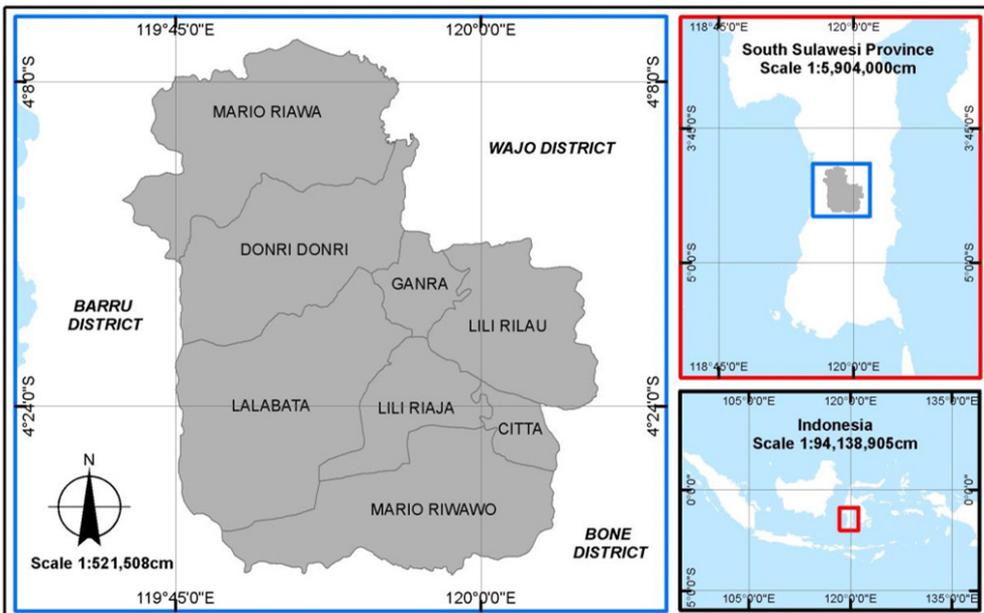


Figure 1. Research location map

2.2 Agro-tourism Land Suitability Zone Analysis

In the context of tourism areas, planning is a systematic tool used to determine the initial moment of a situation and the best way to achieve it. Regional planning is carried out through several approaches, one of which is the natural resource approach, namely character determination and alternative recreation and tourism activities based on the results of monitoring the conditions and condition of the resources. In assessing physical conditions, land use, slope, and soil type can be important indicators in accordance with the recommendations of several experts and existing regulations.

Spatial analysis uses ArcGIS 10.8 software and overlay technique or parameter stacking after determining each criterion and scoring (Table 2 and Table 3). The spatial method is based on the slope, land use, and erosion sensitivity according to soil type.

Based on the assessment criteria and the score for the suitability of the recreation space above, a land suitability map for the designation of agrotourism areas in Soppeng

was compiled. The determination of the classification level is as follows:

$$\text{Classification of Potential Levels} = \frac{N \text{ Maximum} - N \text{ Minimum Scores}}{N \text{ Classification Levels}}$$

From the calculation of the scores for each parameter, the criteria for the suitability class were obtained. The results of the assessment of tourist areas are clarified as A (Appropriate), SA (Sufficiently Appropriate), and NA (Not Appropriate)

3. Results and Discussion

3.1 Analysis of the level of suitability of recreation space based on the slope of the slope

Slope data obtained from DEM SRTM 30 meters resolution. The results showed that the area that is suitable to be used as an agrotourism area has an area of 84429.42 Ha (61.91%), while the area that is not suitable has an area of 13099.35 Ha (9.61%) of the total area of Soppeng Regency. The results of the analysis can be seen in Table 4. The distribution can be seen in Figure 2, which generally shows the appropriate criteria.

Table 2. Assessment criteria and a recreational room suitability score

Aspects	Standards of Conformity	Criteria	Score
Land Use	There is no building structure and other vegetation other than the ground cover. The site is dominated by open land use.	fits	3
	The site is still quite dominated by open land use, but there are several structures and buildings and vegetation other than the ground cover.	Sufficiently Suitable	2
	Dominant site with Incompatible building	not suitable	1
Slope	0-8 % (Flat and Sloping)	Appropriate	3
	8-15 % (Slightly Steep)	Fairly Appropriate	2
	>15 % (Steep and Steep)	not suitable	1

*good = 3, moderate = 2, bad = 1, Source: (Hardjowigeno, 2007)

Table 3. Assessment criteria and conformity score sensitivity to erosion

Aspects	Standards of Conformity	Criteria	Score
Soil Type	Alluvial, Gleic Planosol Hydromorphic Gray Soil, Literita Groundwater, Suitable Latosol	Suitable Latosol (Not Erosion Sensitive)	3
	Brown Forest Soil, Non Calcis Brown, Mediteran, Andosol, Laterit, grumosol, podsol, podsolik	Sufficiently (Sensitive erosion)	2
	Regosol, Litosol, organosol, renzina	Incompatible (Sensitive erosion)	1

*good = 3, moderate = 2, bad = 1, Source: (Ministry of Agriculture, 1980)

Table 4. Level of suitability based on slope

No	Classification	Slope (%)	Large	
			(Ha)	(%)
1	Appropriate	0 - 8	84429.42	61.91
2	Sufficiently Appropriate	> 8 - 15	38838.08	28.48
3	Not Appropriate	> 15	13099.35	9.61
Total			136366	100

Source: Analysis results, 2021

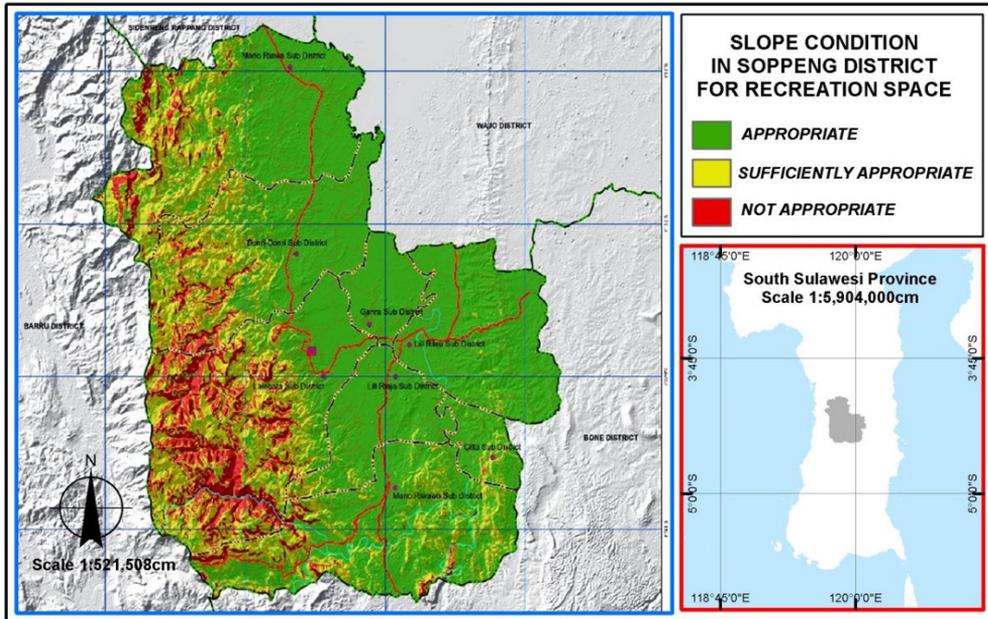


Figure 2. Suitability map of recreation space based on slope

3.2 Analysis of the level of suitability of recreation space based on soil type

Determination of recreation space based on soil type is used as one of the main parameters. Where the results of the analysis show that the classification is quite suitable, having the largest area, which is 106639.46 Ha (78.2%) and the unsuitable classification has the smallest area of 1415.2 (1.03%). More details can be seen in Table 5 and its spatial distribution in Figure. 3, where a fairly adequate classification dominates the level of suitability of the recreation space according to the gromusol and Mediterranean soil.

3.3 Analysis of the level of suitability of recreation space based on land use

Image interpretation was carried out using Landsat 8 image data in 2019. Where the results of the analysis of the suitability of recreation space based on land use, the classification was obtained according to the largest area of 96958.93 Ha (71.1%), and the criteria did not match the smallest area of 4877.7 Ha (3.6%). More details can be seen in Table 6 and its spatial distribution in Figure 4. The level of suitability of recreational spaces is generally dominated by appropriate classification, so that in essence, Soppeng Regency has the potential to become a sustainable agro-tourism area.

Table 5. Level of suitability by soil type

No	Classification	Type of Soil	Large	
			(Ha)	(%)
1	Appropriate	Aluvial	28311.79	20.76
2	Sufficiently Appropriate	Gromusol	17180.64	12.60
3		Mediteran	89458.82	65.60
4	Not Appropriate	Regosol	88.10	0.06
5		Litosol	1327.10	0.97
Total			136366	100

Source: Analysis results, 2021

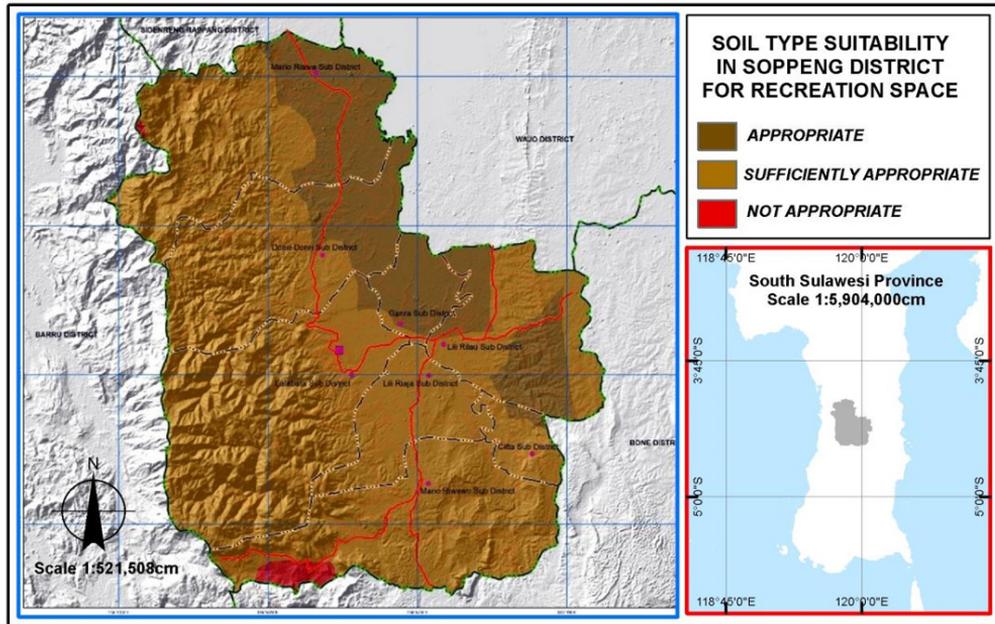


Figure 3. Recreation space suitability map by soil type

Table 6. Level of suitability by land use

No	Classification	Landuse	Large	
			(Ha)	(%)
1	Appropriate	Field	10001.97	7.33
2		Garden	17409.58	12.77
3		Rice field	28564.92	20.95
4		Mixed garden	40982.46	30.05
5	Sufficiently Appropriate	Bushes and shrubs	1280.54	0.94
6		Forest	33219.63	24.36
7	Not Appropriate	Body of water	1430.45	1.05
8		Settlement	3477.25	2.55
Total			136366	100

Source: Analysis results, 2021

3.4 Analysis of Land Suitability for Agrotourism Areas

Based on the results of the overlay analysis using the Arcgis 10.8 application using the three indicators above, the results of the suitability of agrotourism land were obtained, which were divided into three

suitability zones, namely appropriate, quite suitable, and not suitable. The area suitable for agrotourism has the widest distribution, which is 72794.28 Ha (53.52%), and the unsuitable classification has the smallest area of 28269.02 Ha (20.87%). The results of the overlay analysis can be seen in Table 7.

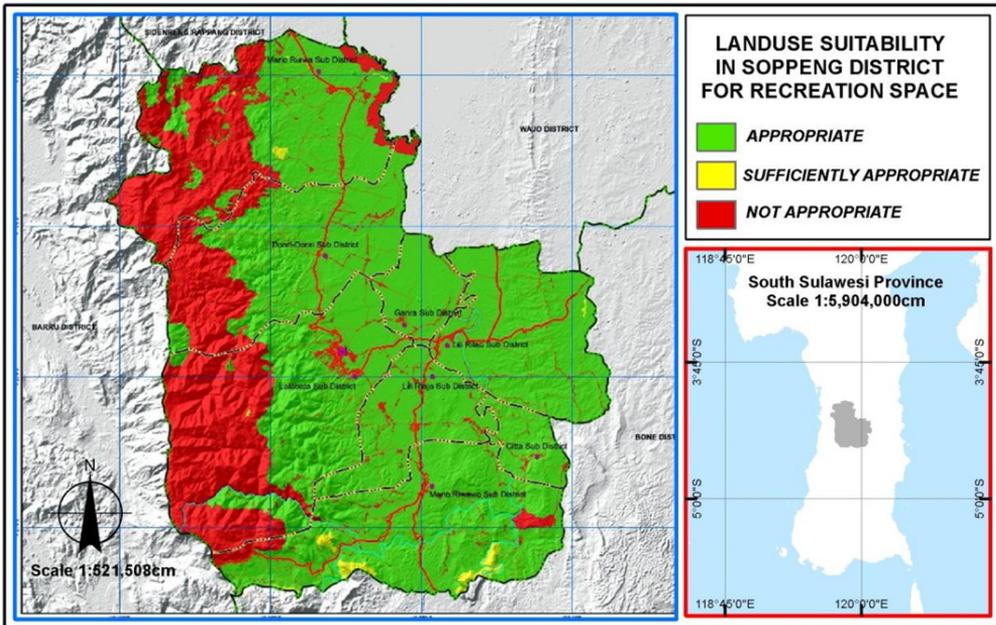


Figure 4. Recreation space suitability map by land use

Table 7. The wide distribution of overlaid agro-tourism areas

No	Classification	Large	
		(Ha)	(%)
1	Appropriate	72983.02	53.52
2	Sufficiently Appropriate	34918.65	25.61
3	Not Appropriate	28464.33	20.87
Total		136366	100

Source: Analysis results, 2021

The identification of the spatial distribution of land suitability for agrotourism in the Soppeng Regency can be seen in Figure 5. In general, the Soppeng Regency area is dominated by area criteria suitable for agrotourism. Based on the results of the analysis and field observations, it is shown that the existing conditions in Soppeng Regency are suitable as an agro-tourism planning area. Given the abundant agro-tourism potential of Soppeng Regency, and currently has received attention from the district government, as evidenced by the existence of the Soppeng Regency Regional Regulation (Soppeng Regency Government, 2012).

Identification of land suitability for agro-tourism is carried out to find out whether each area in Soppeng Regency has the potential for agrotourism development and to find out the various problems that exist. This is very important to study because,

in general, the land contained in the agrotourism area includes natural resources that have a lot of potential and benefits to accommodate the socio-economic activities of the community in maximizing the environment. The current rural environment is more likely to develop towards educational tourism. This is good so that the general public can know the life and activities of farmers and create a positive image of agriculture for the next generation (Petroman *et al.*, 2016). Thus, the results of this education can add to the public's knowledge about marketing strategies for agricultural products, of course, with the government and the community (Liang *et al.*, 2020).

The results of the suitability for agrotourism areas based on the slope show beautiful views, especially towards the hills, which provide more visual value to attract the attention of visitors. The area of Soppeng Regency,

especially in sloping to steep areas and close to resident villages, has a great opportunity to develop development and cultivation activities related to agrotourism (Gunarto, 2017). At the same time, the steep area is very important to pay attention to because this area is very prone to erosion to landslides which can endanger site users because currently there have been many minor damages due to soil erosion caused by land degradation (Huang *et al.*, 2016). Therefore, planting plants in mountainous areas with steep slopes will provide stability to the slopes that can withstand soil movement if erosion occurs (Grima *et al.*, 2020).

Objects that have the highest value are the location of rice fields, peanut plantations, and farms. The three object locations are located in areas suitable for agro-tourism planning. The location of the object has the condition of agricultural tourism attractions and the accessibility to the location is fairly easy and is located around the main road. The object in the agro-tourism planning area that has the lowest value is the cashew plantation. Various agricultural activities are very minimal and there are only cashew plantations associated with residential areas, so it is very difficult to enjoy the natural scenery of the cashew plantations. Meanwhile, the accessibility

to the location is very easy and the road conditions are smooth and paved.

Most of the objects from plantations, agriculture to livestock that have agro-tourism potential in Soppeng Regency have been equipped with various natural scenery and supporting accessibility, but in terms of the availability of tourism resources, there is still a need for improvement and performance from various parties for the convenience of visitors who travel. If these four factors have been met, the objects in the agro-tourism planning area will be formed and become one of the recommended tourist sites.

Determination of agrotourism areas is not only based on the slope. But also in terms of soil type. The results of the identification of the area's suitability found that the soil types scattered in Soppeng Regency are quite good for use as an agrotourism area because this area has good fertility and humidity levels, especially in lowland areas. The relationship between soil type and agrotourism is closely related, where soil type is the main factor of soil fertility whose function is vital for plant growth, but highland areas will usually affect soil fertility due to different agricultural management practices, regardless of soil type (Tran *et al.*, 2021).

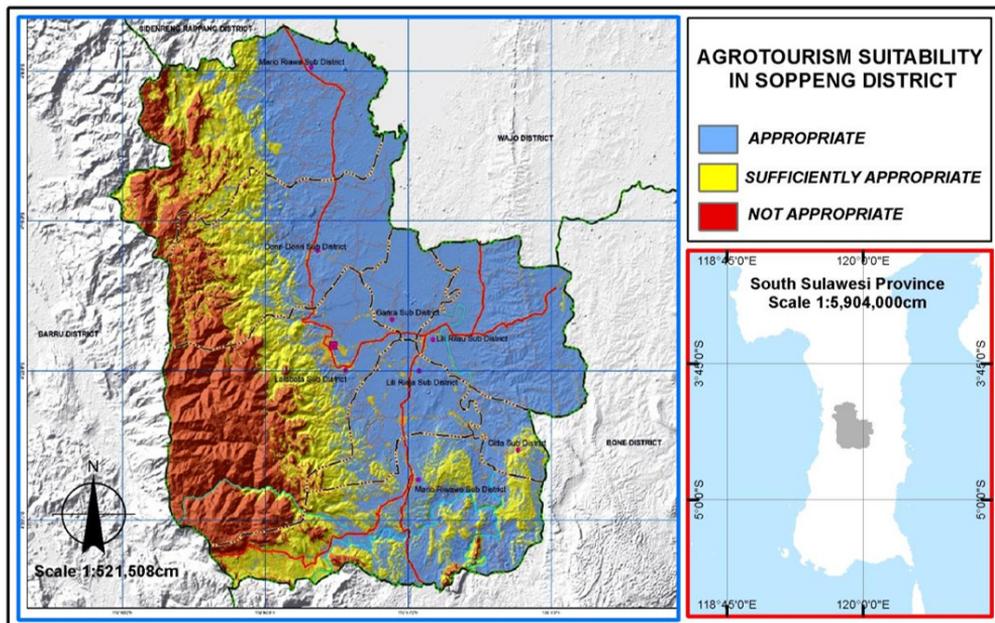


Figure 5. Agro-tourism land suitability map in Soppeng district



Figure 6. Some objects in Soppeng that can be developed into agrotourism

The results of Landsat 8 image analysis in 2019 Soppeng Regency has agro-tourism potential seen from land use. In general, it consists of forests, mixed gardens, fields, plantations, settlements, rice fields, shrubs, and bodies of water. The potential of this land is very likely to become an agrotourism attraction even though it has not been fully utilized optimally. Therefore, it is necessary to assess the suitability of appropriate land use and implement policies by the government and involve every stakeholder in order to be able to reach the right decision-making for the sustainability of agricultural tourism (Lazoglou & Angelides, 2020).

Although land use has a great opportunity as a determinant aspect of agrotourism, if its management is not regulated in such a way, it will not get maximum results. For this reason, this research can be used as a reference so that land use in Soppeng Regency can be more focused so that land use management can be cultivated and carried out optimally in order to preserve the environment, of course with the cooperation of the community and the government as the core of environmental management (Musavengane, 2019).

In addition to slopes, soil types, and land use, hydrological factors also influence soil and plant moisture as the basic things that support human life and development (Zhou & Wang, 2019). These factors will certainly greatly affect the productivity level of the agro-tourism area because the location of Soppeng Regency is also

located along the watershed so that it has the potential to irrigate the soil and crops around it (Soppeng Regency Government, 2017).

Land suitability for agro-tourism planning in Soppeng Regency resulted in 5 suitability classifications. A very suitable area stretches from the north which borders Sidenreng Rappang Regency, towards the northeast which borders Wajo Regency to the east which borders Bone Regency. Meanwhile, the appropriate area is located in the mid-administrative area of Soppeng Regency and a small part of the suitability area borders Wajo Regency and Bone Regency. While the area is quite suitable, it is also in the middle of the administration of Soppeng Regency and is bordered by Bone Regency in the south. On the other hand, the unsuitable area for agro-tourism stretches from the northwest of Soppeng Regency which borders Sidenreng Rappang Regency to parts of Barru Regency and Bone Regency, while the area that is not very suitable for agrotourism is found in a fairly steep mountainous area in the southwest of Soppeng Regency, which also borders Barru Regency.

In general, Soppeng Regency has the potential for agro-tourism development based on the analysis results using the Overlay technique that combines each of the parameters used, namely soil type, land use, etc, and slope. Furthermore, a land suitability map was made for agrotourism areas in Soppeng Regency.

The overlay results produce a composite map and divide the area into three land suitability areas, namely suitable, moderately suitable, and inappropriate areas. So that in essence Soppeng Regency is suitable for agro-tourism development.

The results of the analysis can be used as an agrotourism development plan in accordance with the current conditions and development of the village. Rural tourism can contribute to the development of agro-tourism that is tailored to the objectives of sustainable regional development and contributes to cultural, economic, and social development (Kastenholz *et al.*, 2018).

Theoretically, the development of agrotourism certainly requires tourist attractions, both natural and artificial. For the development of agrotourism in Soppeng Regency, tourist attraction aspects already exist, consisting of agricultural land, natural scenery accompanied by biodiversity. The diversity of flora and fauna has the economic potential to be marketed as a promising agro-tourism attraction (Navarro-Martínez *et al.*, 2020). However, these tourism potentials require maintenance that pays attention to sustainable and culturally valuable ecosystems (Chen, 2020).

Efforts to develop agrotourism in Soppeng Regency take several policies which will later be used as a guide in implementing agrotourism. The designation of agrotourism areas has been determined which is located in Mariolau Village and Gattareng Village in Marioriwawo District (Soppeng Regency Government, 2012). Based on the physical analysis of the land in this study, the location is in reasonably good criteria because it needs several conditions in developing agrotourism areas because it is located in a varied topography. But these limiting factors can be addressed by planting conservation plants that can prevent landslides and managing agricultural land that pays attention to environmental aspects. This limiting factor also requires cooperation from various parties so that in the future, there will be no overlapping interests that can damage the development of agrotourism areas in Soppeng Regency.

4. Conclusion

Soppeng Regency, South Sulawesi province, Indonesia has a natural beauty in the form of a mountainous area and many agricultural crop commodities, which are quite abundant, making this area have agrotourism potentials that are feasible to be developed. Based on the results of data analysis using the overlay technique, it shows that suitable criteria for agrotourism areas dominate Soppeng Regency in general. However, in identifying the suitability of agro-tourism in this research, it is still not perfect due to the limitations of the data analysis used. Therefore, for similar research in the future, it will be able to identify the suitability of agrotourism viewed from various factors (physical, biophysical, social, and economic) and, most importantly, reach the stage of planning the agrotourism landscape.

Acknowledgement

This research is fully funded by State University of Makassar with contract number: SP DIPA-023.17.2.677523/2021.

References

- Canteiro M, Córdova-Tapia F, Brazeiro A. Tourism impact assessment: A tool to evaluate the environmental impacts of touristic activities in Natural Protected Areas. *Tourism Management Perspectives*. 2018 Oct; 28: 220–7
- Chen H. Complementing conventional environmental impact assessments of tourism with ecosystem service valuation: A case study of the Wulingyuan Scenic Area, China. *Ecosystem Services*. 2020 Jun; 43:101100
- Ciolac R, Isac E, Tonea E, Hurmuzache T, Sirbu C, Martin S. Agrotourism – Traditional knowledge and rural biotechnology. *J Biotechnol*. 2015 Aug; 208: S62
- Creswell JW, Creswell JD. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 5th ed. SAGE Publications, Inc; 2017.

- Díez-Gutiérrez M, Babri S. Explanatory variables underlying the route choice decisions of tourists: The case of Geiranger Fjord in Norway. *Transportation Research Part A: Policy and Practice*. 2020 Nov;141: 398–409.
- Dokumen Rencana Program Investasi Jangka Menengah (RPIJM) Kabupaten Soppeng tahun 2017 [Soppeng Regency Medium Term Investment Program Plan (RPIJM) Document 2017].
- Gautam V. Examining environmental friendly behaviors of tourists towards sustainable development. *J Environ Manage*. 2020 Dec 15; 276: 111292
- Grima N, Edwards D, Edwards F, Petley D, Fisher B. Landslides in the Andes: Forests can provide cost-effective landslide regulation services. *Sci Total Environ*. 2020 Nov 25; 745: 141128
- Gunarto A. Penataan Lingkungan Demfarm Kakao Berbasis Masyarakat Dan Agrowisata Berkelanjutan Di Kabupaten Soppeng Sulawesi Selatan. *Jurtekling*. 2017 Apr 6; 18(1): 9
- Hardjowigeno, S. Evaluasi Kesesuaian Lahan dan Perancangan Tataguna Lahan [Land Suitability Evaluation and Land Use Design]. Gadjah Mada University Press, Yogyakarta, Indonesia, 2007.
- Huang W, Ho HC, Peng Y, Li L. Qualitative risk assessment of soil erosion for karst landforms in Chahe town, Southwest China: A hazard index approach. *CATENA*. 2016 Sep;144:184–93
- Kaswanto. Land suitability for agrotourism through agriculture, tourism, beautification and amenity (ATBA) method. *Procedia Environmental Sciences*. 2015; 24: 35–8
- Khanal S, Shrestha M. Agro-tourism: Prospects, importance, destinations and challenges in Nepal. *Arch Agric Environ Sci*. 2019 Dec 10; 4(4): 464–71
- Lazoglou M, Angelides DC. Development of a spatial decision support system for land-use suitability assessment: The case of complex tourism accommodation in Greece. *Research in Globalization*. 2020 Dec; 2:100022
- Liang ARD, Nie YY, Chen DJ, Chen P-J. Case studies on co-branding and farm tourism: Best match between farm image and experience activities. *Journal of Hospitality and Tourism Management*. 2020 Mar; 42:107–18
- Surat Keputusan Menteri Pertanian Nomor : 837/KPTS/UM/11/1980 Tentang Kriteria dan Tata Cara Penetapan Hutan Lindung tahun 1980 [Decree of the Minister of Agriculture Number: 837/KPTS/UM/11/1980 concerning Criteria and Procedures for Determining Protected Forests 1980].
- Muhammad A, Darmawan M. Pengembangan Potensi Agroekowisata Di Kawasan Bulu Dua Kabupaten Soppeng. *Gjfr*. 2019 Oct 30; 2(2):105
- Musavengane R. Using the systemic-resilience thinking approach to enhance participatory collaborative management of natural resources in tribal communities: Toward inclusive land reform-led outdoor tourism. *Journal of Outdoor Recreation and Tourism*. 2019 Mar; 25: 45–56
- Navarro-Martínez ZM, Crespo CM, Hernández-Fernández L, Ferro-Azcona H, González-Díaz SP, McLaughlin RJ. Using SWOT analysis to support biodiversity and sustainable tourism in Caguanes National Park, Cuba. *Ocean Coast Manag*. 2020 Aug;193:105188
- Peraturan Daerah Kabupaten Soppeng Nomor 8 tahun 2012 tentang Rencana Tata Ruang Wilayah tahun 2012-2032 [Soppeng Regency Regional Regulation Number 8 of 2012 concerning Regional Spatial Planning for 2012-2032].
- Peraturan daerah kabupaten Soppeng nomor 2 tahun 2019 tentang desa wisata [Soppeng regency regulation number 2 of 2019 concerning tourist villages].
- Petroman C, Mirea A, Lozici A, Constantin EC, Marin D, Merce I. The rural educational tourism at the farm. *Procedia Economics and Finance*. 2016; 39: 88–93.
- Situmorang R, Trilaksono T, Japutra A. Friend or Foe? The complex relationship between indigenous people and policymakers regarding rural tourism in Indonesia. *Journal of Hospitality and Tourism Management*. 2019 Jun; 39: 20–9

- Tran QT, Araki KS, Kubo M. An investigation of upland soil fertility from different soil types. *Annals of Agricultural Sciences*. 2021 Dec; 66(2): 101–8.
- Xiang C, Xiao qin J, Yin L. Study on the rural ecotourism resource evaluation system. *Environmental Technology & Innovation*. 2020 Nov; 20:101131
- Zhou X-Y, Wang X. Cd contamination status and cost-benefits analysis in agriculture soils of Yangtze River basin. *Environ Pollut*. 2019 Nov; 254(Pt A):112962