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Time Series Evaluation of Land Use Suitability Using GIS: A Case Study of the Detailed Spatial Plan in Prambanan, Sleman Regency

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Article Info

Abstrak

Penggunaan lahan merupakan praktik pengelolaan yang dilakukan oleh manusia untuk mengoptimalkan hasil sumber daya alam untuk mendukung kegiatan multi sektor. Perubahan penggunaan lahan yang didorong oleh sektor pariwisata yang dimanfaatkan oleh masyarakat dapat menimbulkan dampak positif maupun negatif. Kecamatan Prambanan yang merupakan bagian dari Kabupaten Sleman ditetapkan sebagai kawasan wisata warisan budaya dan pertanian berkelanjutan. Tujuan penelitian untuk mengetahui perubahan penggunaan lahan dari waktu ke waktu dan kesesuaiannya dengan peraturan tata ruang yang berlaku. Penelitian ini menggunakan pendekatan metode campuran: analisis kuantitatif untuk menilai perubahan penggunaan lahan dari waktu ke waktu dan kesesuaiannya dengan Rencana Detail Tata Ruang (RDTR) dengan menggunakan data Penginderaan Jauh (Remote Sensing/RS) dan Sistem Informasi Geografis (SIG), serta analisis kualitatif untuk mengeksplorasi penyebab perubahan tersebut dan upaya untuk menyelaraskannya dengan peraturan tata ruang. Data yang digunakan meliputi citra konstelasi satelit Airbus, data pola spasial, dan dokumentasi lapangan. Hasil penelitian menunjukkan bahwa perubahan penggunaan lahan antara tahun 2022 dan 2024 bervariasi, dengan beberapa area menunjukkan peningkatan, penurunan, atau tidak berubah. Peningkatan terbesar terjadi pada permukiman, sedangkan penurunan terbesar terjadi pada pertanian. Kepatuhan terhadap peraturan zonasi Rencana Detail Tata Ruang selama periode ini menunjukkan bahwa 84% penggunaan lahan telah diizinkan, 1% memiliki izin terbatas, 5% memerlukan izin bersyarat, dan 10% tidak diizinkan. Faktor pendorong perubahan penggunaan lahan dan ketidakpatuhan terhadap Rencana Detail Tata Ruang disebabkan oleh kebutuhan manusia di berbagai sektor. Upaya yang telah dilakukan oleh pemerintah melalui peraturan tata ruang dan program petani berkelanjutan. Penerapan analisis spasial dalam melihat perubahan penggunaan lahan dari waktu ke waktu dan mengevaluasi kepatuhan terhadap peraturan tata ruang dapat menjadi acuan bagi daerah lain. Selain itu, hal ini juga dapat menjadi dasar bagi penelitian-penelitian selanjutnya mengenai dampak pariwisata terhadap keberlanjutan penggunaan lahan, yang dapat menjadi dasar perencanaan pembangunan.

Abstract

Land use represent a management practice carried out by humans to optimize the results of natural resources to support multi-sector activities. Land use changes driven by the tourism sector, which is leveraged by the community, can result in both positive and negative impacts. Prambanan District, which is part of Sleman Regency, is designated as an area for cultural heritage tourism and sustainable agriculture. Research objectives to determine changes in land use over time and compliance with applicable spatial regulations. This research employs a mixed-method approach: a quantitative analysis to assess land use changes over time and their compliance with the Detailed Spatial Plan (RDTR) using time series Remote Sensing (RS) data and Geographic Information System (GIS) , and a qualitative analysis to explore the causes of these changes and the efforts to align them with spatial regulations. The data includes Airbus satellite constellation imagery, spatial pattern data, and field documentation. The results indicate that land use changes between 2022 and 2024 have varied, with some areas showing increases, decreases, or remaining unchanged. The largest increase occurred in settlements, while the largest decrease in agriculture. Compliance with the Detailed Spatial Plan zoning regulations during this period reveals that 84% of land use was permitted, 1% had limited permission, 5% required conditional permission, and 10% was not permitted. The driver of land use changes and non-compliance with the Detailed Spatial Plan are due to human needs in various sectors. Efforts have been made by the government through spatial regulations and sustainable farmer programs. The implementation of spatial analysis in examining land use changes over time and evaluating compliance with spatial regulations can serve as a reference for other regions. Furthermore, it provides a foundation for future

studies on the impacts of tourism on land use sustainability, serving as a basis for development planning.

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INTRODUCTION

Land use represents human business management to optimize the utilization of natural resources and the environment, such as agricultural activities, industry, settlements, and others (Gebeyehu et al., 2023; Koroso, 2023). According to Loures (2019), human activities in land use are identical to land changes aimed at achieving sustainable development for community life while maintaining environmental preservation, culture, and natural assets. Current conditions show that land use can lead to both positive and negative utilization, so land use changes need to be planned, developed, and implemented considering not only the meaning of sustainability pillars but also the impact of sustainability itself (Xie et al., 2020).

Changes in land use by communities have positive impacts on development in economic and social aspects. The economic benefits of land use that align with regional characteristics can increase job opportunities, create mutualistic relationships between rural and urban areas across various sectors, and develop agricultural industries (Liu et al., 2018). Social benefits are also felt in providing community welfare and human development index (Nurliah & Tajuddin, 2021). Land use changes can also cause negative impacts. Land use that doesn't align with environmental conditions can potentially cause losses to built-up areas, namely floods and landslides, depleting groundwater, and household and industrial waste (Deliar et al., 2023; Rasool et al., 2021). According to Gao et al. (2020), changes in land function in the agricultural sector can threaten food security, decrease farming professions, and lead to egocentric development. These problems arise due to regulatory inconsistencies and strategies and implementation in spatial planning contexts that cause communities/ individuals to commit development violations (Nurhikmahwati et al., 2021).

This condition prompts stakeholders, especially the government, to create Spatial Plan (RTR) containing directives for land use control for development across all sectors and regions synergistically (Pambudi & Sitorus, 2021). Spatial planning is carried out by the government as an effort to regulate multi-sector activities in meeting land needs for rapidly growing populations (Simamora & Sarjono, 2022). The implementation of spatial regulations is also intended to prevent violations of land use and utilization as well as potential misuse of space above land (Nurhikmahwati et al., 2021; Simamora & Sarjono, 2022). Spatial planning is

prepared following the uniqueness of the region as a policy scope, one of which is tourism areas (Pambudi & Sitorus, 2021).

Tourism has become one of the world's largest economic sectors and plays an important role in multi-sector activities on a local scale in various countries (Soliku et al., 2021). The development of the tourism sector has a major influence on changes in land use that support service provision and tourist facilities and infrastructure (Subki, 2018). This occurs in Sleman Regency, where tourists increase annually due to natural charm and cultural heritage, so the local government makes maximum efforts for tourism sector development (Anggriani et al., 2022).

Development, including from the tourism sector, has caused changes in land conversion (Astuti & Lukito, 2020; Sarastika et al., 2023). According to (Astuti & Lukito, 2020), food security and safety areas in Sleman Regency experienced a land conversion of 5,733 ha during 2012-2018. Analysis of land cover data from 2017 compared to 2022 shows changes in land use area around tourist locations: (i) Prambanan Temple from 19.4 ha to 20 ha; (ii) Ijo Temple from 1 ha to 3.8 ha; (iii) Barong Temple from 1.5 ha to 3.8 ha; and (iv) Ratu Boko Palace from 8.6 ha to 10 ha. This condition requires spatial regulation to determine resource utilization optimization and ecocentric-based development (Saleh & Hanafi, 2015).

Prambanan District, which is part of Sleman Regency, is designated as a cultural heritage tourism area and sustainable agriculture area (Pemerintah Kabupaten Sleman, 2021). Prambanan District is identical to ancient temple relics. One of the largest temple remains is Prambanan Temple, an Indonesian cultural heritage site registered with the United Nations Educational, Scientific and Cultural Organization (UNESCO) (Parlindungan et al., 2021). Prambanan District is one of the most popular historical tourist areas in Yogyakarta Province, with 262,107 visitors annually (Almas et al., 2023). The reality has caused vulnerability to land use changes, and Prambanan District's position is not too far from urban areas (Wardoyo et al., 2020). According to Suryaningsih (2020), Prambanan Temple tourism has changed land use in Kalasan and Prambanan Villages, with many lodgings and restaurants being established. The 2023 Agricultural Census shows that Prambanan District has the highest number of farmers in Sleman Regency (Badan

Pusat Statistik, 2023a). The majority are smallholder farmers who only own agricultural land less than 0.5 ha. Land as the main resource for agricultural activities has a major influence, so land that is too small leads to small income and insufficient household needs (Buchori et al., 2020).

These various conditions make it attractive to study Prambanan District, which still maintains the existence of the agricultural sector. However, most of the population consists of smallholder farmers (Badan Pusat Statistik, 2023a), and despite the presence of cultural heritage-based tourism, there is significant built-up land development (Suryaningsih, 2020). This requires in-depth study through land use changes and evaluation of their suitability to the East Sleman Detailed Spatial Plan. Spatial analysis needs to be applied in identifying characteristics and extent of land use changes in time series according to regional uniqueness. This land use is further analyzed against zoning regulations within spatial pattern provisions to identify areas that are permitted (I), limited permitted (T), conditionally permitted (B), and not permitted (X). Evaluation of changes and non-suitability can be used by stakeholders as a basic reference in formulating rules and policies in spatial planning activities. These various issues raise three main discussion points. First, land use in time series is related to types and area. Second, the suitability of land use according to zoning regulations related to characteristics and area. Third, factors causing land use changes and non suitability with the Detailed Spatial Plan of East Sleman Area.

METHODS

Prambanan District is included in the East Sleman Detailed Spatial Plan for 2021-2040, with its area specifically designated for cultural heritage tourism and agriculture. Various community activities to gain benefits from tourism have increased the need for built-up land, such as residences, hotels, restaurants, and others. According to Lone & Mayer (2019), there is a major challenge in 2050 to produce 70% more food. Agriculture remains a primary sector contributing to the community in Prambanan District. The total agricultural land in Prambanan District is 3,584 ha, with most land being used for rice fields covering 1,505 ha or 41.99% of total agricultural land (Badan Pusat Statistik, 2023a). This is supported by research from Munir *et al.* (2023) showing that land suitability analysis in the context of soil science indicates Prambanan District is highly suitable or agricultural development. The largest

expenditure per capita month in Sleman Regency is spent on daily food (Badan Pusat Statistik, 2023a), so these various conditions require agricultural productivity to be increased
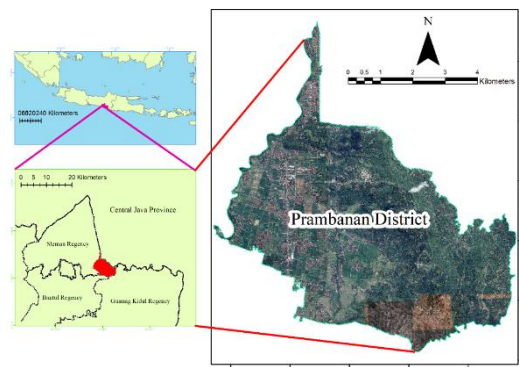

Figure 1. Research Location

The research uses a mixed method approach, with quantitative methods to understand land use aspects and spatial regulations in effect in Prambanan District. The spatial approach serves as the best solution in quantitative methods that can identify each type of land use across time series. The required secondary data includes Airbus satellite constellation imagery from 2022-2024, which can be downloaded through SAS Planet. The selection of Airbus satellite constellation imagery has very little to zero cloud cover, resulting in land use delineation having a low error rate. The use of satellite imagery in land use delineation activities needs to consider the spatial resolution of images according to the map scale in the Detailed Spatial Plan. Referring to Topan et al. (2009), the rule of thumb for map scale to spatial resolution in remote sensing context has the formula Rp (resolution in pixels) = 10^{-4} x map scale. The Airbus satellite constellation has a spatial resolution of 30 cm which can be used on 1:3,000 scale maps. The Detailed Spatial Plan spatial pattern map has a scale of 1:25,000, so Airbus constellation imagery can be used in land use classification activities in Prambanan District. The East Sleman Detailed Spatial Plan obtained through data requests to the Land and Spatial Planning Office of Sleman Regency.

Land use delineation uses ArcMap software. According to Wright et al. (1980), several aspects need to be assessed for determining land use classification: (i) the classification system can be applied to large areas; (ii) the classification system can be interpreted from land cover; and (iii) the classification system can be used with remote sensing data. This reference becomes the basis for determining land use classification using zone types from The East Sleman Detailed Spatial

Plan spatial pattern, land use types from thematic guide, and field observations according to regional characteristics in Prambanan District. The delineation results obtained eleven types of land use from this classification: (i) waters; (ii) green open space; (iii) non-green open space; (iv) settlements; (v) trade and services; (vi) road networks; (vii) public service facilities; (viii) industry; (ix) agriculture; (x) tourism; (xi) utilities, and (xii) railway networks.

The qualitative method uses a descriptive approach to understand government officials' perspectives regarding the causes of land use changes and their suitability with the East Sleman Detailed Spatial Plan. This research obtains primary data through land use delineation and notes from in-depth interviews with officials from the Land and Spatial Planning Office of Sleman Regency in the Land and Spatial Planning Supervision and Development Section.

The research flow diagram was created to determine land use changes and suitability to the East Sleman Detailed Spatial Plan as shown in Figure 2. Land use type determination is based on literature studies, applicable spatial regulations, and field observations. Spatial analysis is first performed on image photo processing to match actual coordinates. This is followed by delineation to obtain areas/locations for each type of land use in 2022, 2023, and 2024 through satellite image interpretation and field observations. Land use analysis begins in 2022 to align with the issuance of the East Sleman Detailed Spatial Plan, so suitability has been known since the regulation took effect. The next activity involves overlaying and merging land use data in time series to determine the extent and characteristics of land use types that remain constant and change from 2022, 2023, and 2024. Land use data in those years was combined with the East Sleman Detailed Spatial Plan data in creating suitability tables guided by zoning rules to determine locations that are permitted (I), limited permitted (T), conditionally permitted (B), and not permitted (X).

Permitted zones relate to land use activities where the spatial patterns have similar designated characteristics. Limited permitted zones relate to community activities that are restricted in aspects: (i) operational time in using and utilizing the land; (ii) maximum area that does not disturb the surrounding space; and (iii) limitations on land use benefits to ensure adequate service needs are met. Conditionally permitted zones relate to land use that must obtain permits with general or specific requirements. These requirements must be fulfilled as they will have significant impacts on the community and surrounding environment, necessitating documents such as Environmental

Impact Analysis (AMDAL), Environmental Management Efforts (UKL), Environmental Monitoring Efforts (UPL), Development Impact Fees, and others. Not permitted zones indicate community activities using and utilizing land that does not conform with the land's designated characteristics and cause negative impacts on the environment and surrounding community. The final activity is interviewing the Sleman Regency Land and Spatial Planning Office to determine causes of land use changes, non-suitability to the Detailed Spatial Plan patterns, and efforts made to ensure all land use complies with applicable spatial regulations.
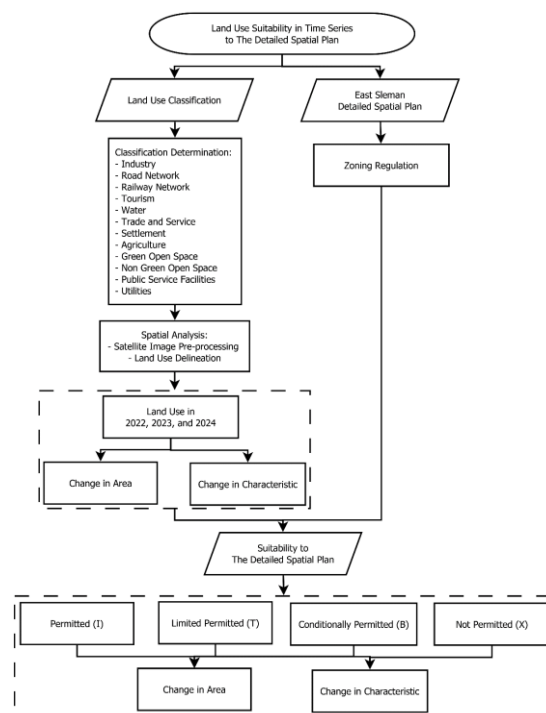

Figure 2. Research Flowchart

RESULTS AND DISCUSSION

1. Land Use In Time Series

Information contained in land use classification becomes an important component to understanding regional development growth that uses natural resources and its impact on the surrounding environment (Hashim et al., 2019). This statement aligns with this research's results to understand the rapid use and utilization of natural resources in Prambanan District, which unknowingly changes every year. Table 1 shows all types of land use in 2022, 2023, and 2024 from delineation results. Agriculture remains the largest land use as existing rice fields, gardens, and dry fields are still widely utilized by the

Table 1. Land Use Classification and Change in Time Series

Nu	Land Use	Area (ha)			Change	
		in 2022	in 2023	in 2024	In 2022-2023 (ha)	In 2023-2024 (ha)
1	Industry	21.287	21.340	21.340	+0.053	+0.250%
2	Road Networks	68.881	68.881	68.881	0.000	0.000%
3	Railway Networks	1.212	1.212	1.212	0.000	0.000%
4	Tourism	67.490	67.829	68.036	+0.339	+0.502%
5	Waters	24.338	24.338	24.338	0.000	0.000%
6	Trade And Services	19.027	19.074	19.197	+0.047	+0.247%
7	Settlements	1,104.223	1,110.902	1,114.413	+6.678	+0.605%
8	Agriculture	2,740.994	2,736.344	2,734.275	-4.650	-0.170%
9	Green Open Space	15,607	15.607	15.655	0.000	0.000%
10	Non-Green Open Space	61,181	58.258	56.301	-2.923	-4.777%
11	Public Service Facilities	15,735	16.120	16.224	+0.385	+2.448%
12	Utilities	1,278	1.348	1.348	+0.070	+5.466%

Source: Research Data Processing, 2024

community. The second largest is settlements because residents have long lived in Prambanan District for generations. Other land uses are below 100 ha because overall land use doesn't require extensive land space in its utilization. The smallest land use is railway networks in the form of railroad tracks, and utilities, namely wastewater treatment located in certain locations only. Overall land use didn't experience changes in area, except for settlements and agriculture which showed more noticeable increases and decreases than others.

The land use changes shown in Table 1 indicate the area size and percentage during the periods 2022-2023 and 2023-2024. Industry experienced an increase from 2022-2023, then remained stagnant/unchanged from 2023-2024. The road networks showed no changes at all from 2022-2024. Similarly, the railway networks area remained constant. Tourism and water bodies experienced no increase or decrease at all from 2022-2024. Trade and services experienced continuous increases from 2022-2024. Settlements showed the largest and most consistent increase compared to other land uses. This is inversely proportional to agriculture, which experienced the largest decrease compared to other land uses. Green open space remained stagnant in 2022-2023, then experienced an increase in 2023-2024. Non-green open space experienced continuous decreases. Public service facilities also experienced continuous increases. Utilities experienced an increase in 2022-2023,

then became stagnant in 2023-2024. The land use changes that have occurred each year need to be known in terms of area size over time to identify human exploitation in using natural resources. A study conducted by Senetra & Szarek-Iwaniuk (2020) found that changes occur due to policies made by stakeholders in a region that prioritize socioeconomic needs over environmental concerns. This needs to be studied in the Prambanan District, which has experienced increases, decreases, and stagnation in various land uses.

Land use changes occurring in Prambanan District are caused by three main factors: (i) growth in the tourism sector; (ii) development of the Yogyakarta Urban Agglomeration (APY); and (iii) increasing population growth each year. The tourism sector in Prambanan District has another unique characteristic of establishing culinary centers and recreational areas on agricultural land. Culinary centers and family recreation areas play a role in attracting tourists who want to reminisce about their childhood in a village atmosphere. Various large-scale events at provincial, national, and international levels become additional attractions in captivating tourists, such as Prambanan Jazz which is held in Prambanan District. The tourism concept created by the government in the East Sleman area, including Prambanan District, which was intended for cultural heritage-based tourism while maintaining the agricultural sector, has transformed into settlements and cultural heritage-based businesses. Initial development

for residential purposes has changed into business establishments that attract tourists. The added value of cultural heritage sites like Prambanan Temple attracts tourists for recreation at the site and its surroundings. Investors won't miss this opportunity to expand their businesses to meet tourist needs, such as hotels, villas, restaurants, and entertainment venues. Additionally, irrigation networks and rivers that were initially for agricultural land have been converted into restaurants with river view concepts.

Other problems arise for districts directly bordering the Yogyakarta Urban Agglomeration area, including Prambanan District. This cannot be prevented as the Yogyakarta Urban Agglomeration area, already full of non-agricultural activities, causes people to shift development towards its peripheries, which begin to enter the outskirts of East Sleman. This development has unconsciously begun to take over the Sustainable Food Agricultural Land (LP2B) that has been determined by applicable regulations (Ansari et al., 2020). Concerns that were initially focused on agricultural land within the Yogyakarta Urban Agglomeration area are now extending to the Sustainable Food Agricultural Land areas in Prambanan District. According to Munir et al. (2023), Prambanan District has good soil nutrient quality for agricultural activities, with many locations still having irrigation channels. Well-maintained soil and water resources can provide high agricultural productivity, making it regrettable if non-agricultural development occurs on land with such good resource quality.

Increasing population growth requires decent housing needs, which becomes urgent for the community. The population of Prambanan District was 44,832 people in 2003, it increased by 25% to 54,624 people in 2023 (Badan Pusat Statistik, 2023b). Business actors in the housing sector are driven to expand their business in Prambanan District. The increase in housing will be followed by community needs to support their lives through primary, secondary, and tertiary needs. Moreover, people's desires, which initially only needed one house, continue to grow. This desire continues to own shophouses, restaurants, boarding houses, and others. Limited space on built-up land causes entrepreneurs to start buying agricultural land, which becomes the only land available at low prices. This needs to be anticipated by government officials in Prambanan District to protect agricultural land and other types of land affected by community needs for built-up land.

2. Land Use Suitability In Time Series To The Detailed Spatial Plan

According to Syawal & Umar (2024), land use can change from its previous function to other functions that potentially cause inconsistencies with spatial planning guidelines in the area. The level of land use suitability with the Detailed Spatial Plan has regulations consisting of four zoning categories. Land use suitability in 2022 with the East Sleman Detailed Spatial Plan: permitted for 3,482.329 ha, limited permitted for 52.590 ha, conditionally permitted for 196.082 ha, and not permitted for 410.252 ha. Continuing with land use suitability in 2023: permitted for 3,477.798 ha, limited permitted for 52.700 ha, conditionally permitted for 196.030 ha, and not permitted for 414.725 ha. Last, land use suitability in 2024: permitted for 3,474.916 ha, limited permitted for 52.749 ha, conditionally permitted for 195.915 ha, and not permitted for 417.674 ha. Overall, permitted land use or those conforming to the Detailed Spatial Plan had the largest area, indicating that the community still utilizes the land according to its designated purpose.

The three largest areas of land use types concerning zoning regulations from 2022-2024 have remained consistent/unchanged. The permitted land use types (I) are agriculture in agricultural spatial patterns, settlements in residential spatial patterns, and agriculture in residential spatial patterns. The limited permitted land use types (T) are settlements in trade and service spatial patterns, settlements in tourism spatial patterns, and trade and services in residential spatial patterns. The conditionally permitted land use types (B) are agriculture in tourism spatial patterns, agriculture in river buffer zones, and tourism in cultural heritage spatial patterns. The not permitted land use types (X) are settlements in green open spaces, settlements in public service facility areas, and settlements in river buffer zones.

The land use is not suitability with the Detailed Spatial Plan spatial pattern in Prambanan District is caused by three main factors: (i) granting of land conversion permits; (ii) good infrastructure development; and (iii) increasing land transactions for built-up areas. The local government provides easy bureaucratic licensing to business actors in developing tourism, trade and services, industry, settlements, and others. Public policies made by the government, namely regulations, cannot yet be fully applied to society without exception for any interests. Misuse in licensing convenience lies in three
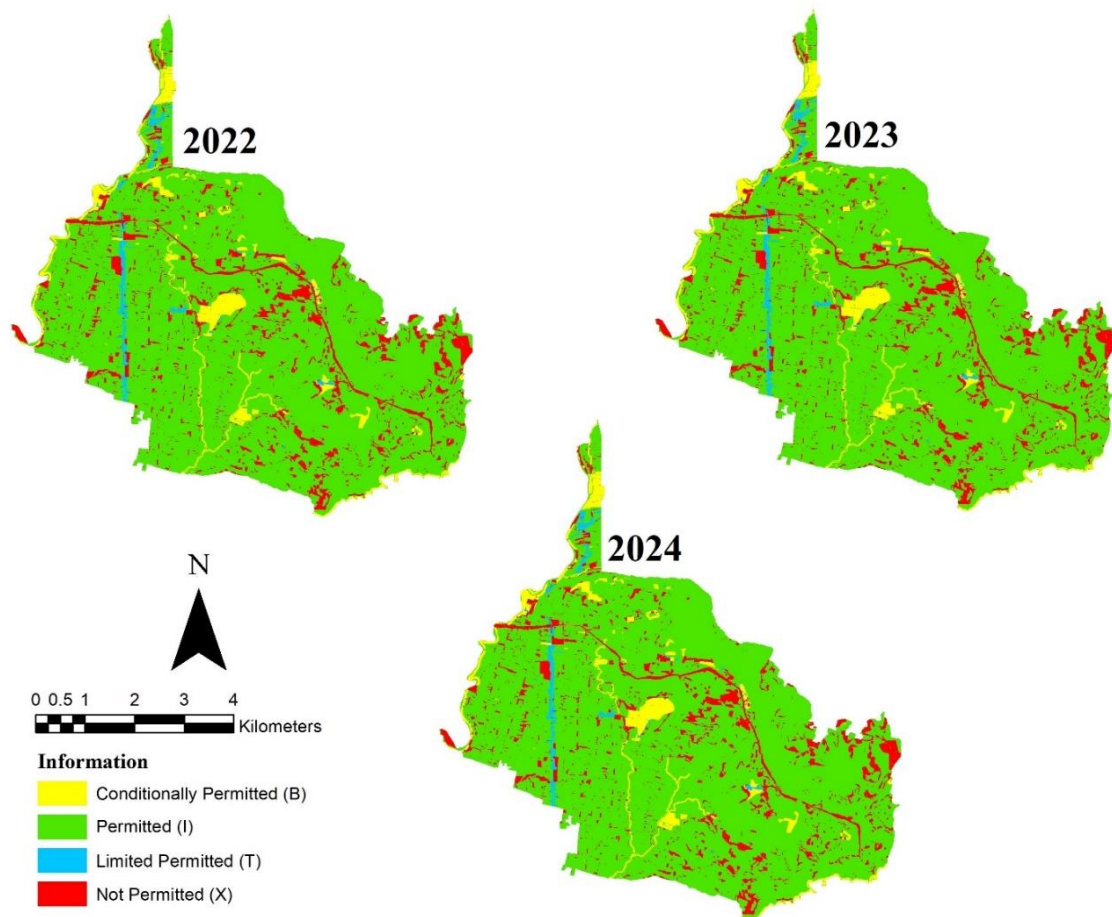
Figure 3. Time Series Evaluation of Land Use Suitability to the Detailed Spatial Plan

main problems: (i) coordination of different regulations between agencies; (ii) implementation of these regulations that can be followed by land-using communities; (iii) and sanctions for those who violate these regulations. The implementation of regulations in granting land conversion permits involves conflicts of interest by certain parties to facilitate permit issuance without following the applicable permit application process. Various interested parties with great power or business actors with large capital can sacrifice the land conversion licensing process. Violators submit large areas for development, but some areas fall within agricultural land zones.

Infrastructure development by stakeholders plays an important role in increasing multi-sector benefits for local government, business actors, and the community (Nawir et al., 2023). Road infrastructure built by government officials up to the village level in Prambanan District becomes a positive value for communities that can access remote areas, allowing new economic centers to grow. However, road network development can be

misused by the community, impacting agricultural land changes. The development of collector and local roads is utilized by the community to create settlements. People misuse these road functions to construct buildings for residence or business purposes under the pretext of agriculture-based and cultural heritage tourism. Even an adequate road infrastructure creates built-up land that initially numbered 1-10 houses, then develops into small-medium settlements, and finally becomes new residential areas.

The condition of land space already surrounded by built-up areas, high land values, and offers by investors become the main reasons for investors to engage in land transactions (Ahmed et al., 2022). According to Skog & Steinnes (2016), patterns of land conversion mostly occur on agricultural land that is adjacent to and surrounded by built-up land. Development of land plots and small housing on agricultural land is also carried out. The ease of obtaining capital loans is strongly felt by farmers who own agricultural land to be converted into built-up land. Studies conducted by Getzner & Kadi (2020) state that land transactions at high prices, even infrastructure development, and numerous investors become

attractions for farmers to create tourism-based built-up land on their agricultural land. Various actions have been and are still being taken to ensure that the community can follow the spatial pattern rules in the East Sleman Detailed Spatial Plan. Regional governments at the district, District, and village levels focus on two major activities: (i) integrated spatial regulation and spatial utilization licensing; and (ii) sustainable agriculture programs.

3.   Local Government Efforts to Ensure Community Compliance with the Detailed Spatial Plan of East Sleman Area

According to Wiraguna et al. (2019), agricultural land protection can be done through three approaches: regulation and rules, acquisition and management, and incentives and sanctions. Various protection measures have been and are still being carried out by the local government. First, integrated spatial regulation and space utilization permits. The local government will revise data related to spatial contexts through coordination between regional-level agencies so that all data can be used across agencies. According to Peerzado et al. (2019), making regulations and rules is not limited to discussing agricultural land protection but also includes regulations and rules for limiting urban expansion into rural areas. This has been implemented through the Space Utilization Activity Compatibility (KKPR) program that provides licensing for business activities and community interests. This requires the Online Single Submission Risk-Based Approach (OSS-RBA) which serves as a reference for business actors to start and run their businesses according to the risk level of the business. The OSS-RBA becomes the government's effort as an electronic system in business licensing that can facilitate and accelerate through an integrated one-stop service.

Second, sustainable agriculture programs are carried out by the government related to farmer empowerment and pro-agricultural infrastructure development. Various empowerment activities have been implemented from the district level to the site level, focused on farmers, women, and young people. Farmers receive empowerment through the Sleman Healthy Agricultural Area (SKPS) program. Stakeholders with expertise in agriculture provide training and guidance related to pest and disease management, use of the latest technology in monitoring and management, development of cultivatable land area, and implementation of sales distribution to consumers. Farmer empowerment becomes a main activity in

determining farmers' mindset toward financial management, technological innovation, productivity improvement, control of agricultural land conversion, and maintaining natural resource conservation (Nasikh et al., 2021). The local government has created the Women Farmers Group (KWT) program that empowers female farmers in urban farming activities. This farming system implementation is suitable for women who have limitations due to being housewives. Urban farming activities include rooftop gardens, verticulture, backyard gardens, and hydroponics. Additionally, the government also holds KWT festivals to introduce the existence of female farmers to the community.

The rapid advancement of the latest technology becomes a mandatory activity that can be collaborated with implementation in the agricultural sector. This activity begins with socialization to young generations to participate in the Millennial Farmers Network (JPM). This program is conducted for farmer regeneration which is currently dominated by elderly farmers and support towards becoming a world food barn by 2045. Young people who are identical with technology use can accelerate agricultural activities from seeding to sales stages. This support is provided through business improvement with People's Business Credit (KUR) access, the use of smart farming, and collaboration with various partners sought by the government. Technology use is also utilized for creating Web GIS mitigation and control of agricultural land conversion based on community participation. This program has been implemented by the Sleman Regency government attended by Combined Farmers Groups (Gapoktan) and youth organizations as community representatives who have more capabilities (Rineksi et al., 2024).

Third, appreciation to farmers and their families has also been carried out by the local government through various projects, namely providing scholarships to outstanding farmers' children, property tax exemption, ease in KUR capital, cross-sector certification activities, and provision of agricultural equipment for farmers whose land is included in the Sustainable Food Agricultural Land (LP2B) Area. According to Ayunita et al. (2021), village governments must be able to socialize these various programs until the community understands. This socialization contains three main understandings that need to be interpreted: production, life, and ecology. Communities are not merely given the understanding to protect agricultural land but are also given knowledge to manage and

produce agricultural land so that the results can improve their welfare (Song et al., 2023).

Fourth, studies conducted by Arowolo & Deng (2018)) state that road infrastructure development has a positive relationship with agricultural development. Pro-agricultural infrastructure has also been implemented through the construction and maintenance of road networks in agrarian areas, irrigation networks, bore wells, and electricity networks. Road networks construction and maintenance are expected to improve farmers' economies, larger agribusiness development, and maintain food security for the community. Irrigation networks are also built and maintained as the main basis for meeting water supply needs for crops. Irrigation network development is carried out through technical, semi-technical, and simple irrigation system development projects for rice fields. The Van der Wijck and Selokan Mataram irrigation networks are always maintained and guarded to keep their functions running. Retention basin construction is also carried out to maintain sufficient water supply during the dry season.

CONCLUSION

Various community activities to gain benefits from tourism have increased the need for built-up land, particularly in agricultural areas. This raises questions: (i) land use changes in time series; (ii) land use suitability with the Detailed Spatial Plan (RDTR); and (iii) factors causing changes and non suitability. Land use changes from 2022-2024 show continuous increases and decreases, as well as stagnation/stability. The changes are caused by the increased tourism sector originating from the cultural heritage, food culinary, and family recreation. Yogyakarta Urban Agglomeration development and increasing population make the need for settlements, services, and businesses increasingly expand in agricultural areas.

The local government ensures all land uses comply with the Detailed Spatial Plan spatial pattern through the Space Utilization Activity Compatibility (KKPR) program. This program is expected to encourage sustainable development that is ecocentric, environmental protection according to regional characteristics, and prevent potential conflicts between stakeholders. Sustainable agriculture programs are implemented by the local government through the Sleman Healthy Agricultural Area (SKPS) program for technology use in productivity improvement, Women Farmers Group (KWT) for empowering female farmers in urban farming

activities, and Millennial Farmers Network (JPM) which is expected to realize the World Food Barn by 2045.

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