

CHANGES IN LAND COVER IN TEMON DISTRICT IMPACT OF DEVELOPMENT OF YOGYAKARTA INTERNATIONAL AIRPORT

PERUBAHAN TUTUPAN LAHAN DI KECAMATAN TEMON DAMPAK PEMBANGUNAN YOGYAKARTA INTERNATIONAL AIRPORT

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ABSTRACT

In recent years, the Indonesian government has built several airports, including the Yogyakarta International Airport (YIA) in the Special Region of Yogyakarta (DIY). With the development of the airport, it will create a multiplier effect in which the growth of various facilities around it to support the needs of airport service users, which were previously very minimal or not even available around the airport area. This condition will certainly impact land cover and use in the surrounding area. This study aims to detect temporal changes in land cover in Temon District before development (2016), after it started operating (2019), and 2022 using several algorithms and indices such as Random Forest, Normalized Difference Built-up Index (NDBI), Normalized Difference Vegetation Index (NDVI), detection via google earth, and nighttime light (NTL). The results show a significant change in land cover, namely an increase in the built-up area while the other land cover classes decrease. Built-up area increased from 246.54 ha (6,72%) in 2016 to 617.83 ha (16,86%) in 2019, primarily due to the construction of airports. By 2022, the built-up area further expanded to 977.25 ha (26,67%), driven by the development of surrounding areas, including settlements, hotels, and other structures. In contrast, other land cover types have shown a decrease in area from 2016 to 2022. For example, vegetated agricultural areas reduced by 515.29 ha, bare land decreased by 111.43 ha, non-agricultural vegetation decreased by 48.81 ha, and water bodies reduced by 55.18 ha. Based on NTL, connectivity from Temon District to the surrounding areas has increased from 2016 to 2022.

Kata kunci : land cover, random forest, NDBI, NDVI, google earth, nighttime light

ABSTRAK

Dalam beberapa tahun belakangan ini, pemerintah Indonesia telah membangun sejumlah bandar udara dan salah satunya adalah Yogyakarta International Airport (YIA) di Daerah Istimewa Yogyakarta (DIY). Dengan adanya pembangunan bandara maka akan menimbulkan multiplier effect (efek pengganda), yakni terjadinya pertumbuhan berbagai fasilitas di sekitarnya sebagai penunjang kebutuhan pengguna jasa bandara yang sebelumnya sangat minim atau bahkan belum tersedia di sekitar wilayah bandara. Hal ini tentunya akan memberikan dampak pada tutupan dan penggunaan lahan pada wilayah sekitarnya. Penelitian ini bertujuan untuk mendeteksi adanya perubahan tutupan lahan secara temporal di Kecamatan Temon sebelum pembangunan (2016), saat mulai beroperasi (2019), hingga saat ini (2022) dengan menggunakan beberapa algoritma dan indeks seperti random forest, normalized difference built-up index (NDBI), normalized difference vegetation index (NDVI), deteksi melalui google earth, dan night time light (NTL). Hasilnya menunjukkan bahwa terdapat perubahan yang cukup

signifikan pada tutupan lahan, yakni meningkatnya luasan area terbangun sedangkan kelas tutupan lahan lainnya berkurang. Lahan terbangun meningkat dari 246,54 ha (6,72%) pada tahun 2016 menjadi 617,83 ha (16,86%) pada tahun 2019, terutama disebabkan oleh pembangunan bandara. Pada tahun 2022, area terbangun semakin meluas menjadi 977,25 ha (26,67%), didorong oleh pengembangan area sekitarnya, termasuk permukiman, hotel dan lainnya. Sebaliknya, tutupan lahan lainnya menunjukkan penurunan luas dari tahun 2016 hingga 2022. Diantaranya lahan pertanian berkurang 515,29 ha, lahan terbuka berkurang 111,43 ha, vegetasi nonpertanian berkurang 48,81 ha, dan badan air berkurang sebesar 55,18 ha. Berdasarkan NTL, konektivitas dari Kecamatan Temon ke sekitarnya mengalami peningkatan dari tahun 2016 hingga tahun 2022. Berdasarkan NTL, konektivitas dari Kecamatan Temon menuju wilayah sekitarnya semakin meningkat dari periode tahun 2016 hingga 2022.

Keywords : tutupan lahan, random forest, NDBI, NDVI, google earth, nighttime light

I. INTRODUCTION

Changes in agricultural land use to non-agriculture is a topic that has been discussed for a long time. The conversion of agricultural land to non-agricultural land on a massive scale can ultimately have a negative impact, mainly related to the provision of food for the community because it affects food production, the physical environment, and the welfare of the farming community (Iqbal et al., 2020). Along with the development dynamics marked by economic and demographic growth in Indonesia, in the 1980s, there was a massive land conversion from agriculture to non-agriculture in Java (Ashari, 2003). Based on land cover data issued by Kementerian Lingkungan Hidup dan Kehutanan (the Ministry of Environment and Forestry) in 2021, the area of paddy fields on Java Island in 2020 will be 3,565,000 ha or 26.77% of the land area on Java Island. This condition is different from the area of paddy fields in 2008, which amounted to 3,687,000 ha or 27.55% of the land area on Java Island (Kementerian Lingkungan Hidup dan Kehutanan, 2008). After comparing the data, it has been found that there has been a decrease in paddy fields in Java by 0.78%, equivalent to an area of 122,000 ha. Changes in the use of agriculture to non-agriculture are closely related to development. Development occurs due to dynamic human nature, developing according to time for the progress of his life while land resources are fixed (Sukri et al., 2022).

The development of a region is inseparable from the increase in infrastructure to meet the needs and facilitate human life. As a developing country, Indonesia is currently focusing on advancing national development in all aspects to improve people's welfare, one of which is infrastructure development (Siswoyo, 2020). One of the developments currently

being intensively carried out by the government is transportation infrastructure, which connects nodes between regions and supports human mobility. The Indonesian government in 2012 plans to build 45 new airports in 10 years (until 2022) to overcome overcapacity in the national aviation industry (Purbawa, 2021). One of the airports that have been built is Yogyakarta International Airport (YIA) which replaced Adisutjipto Airport because it could no longer accommodate the increasing number of air travelers to and from Yogyakarta. Location Determination Permit (IPL) was stipulated by the Governor of the Special Region of Yogyakarta with No.68/KEP/2015 dated 31 March 2015 concerning the Determination of Development Locations for the Development of a New Airport in the Special Region of Yogyakarta which stated that YIA's land acquisition would occupy a land area of 645,63 hectares located in Temon District (Nurcahyanto, 2019). In 2017, construction of the YIA officially began, and the airport was inaugurated on 28 August 2020 (Pamungkas, 2021).

Building a new infrastructure will undoubtedly have positive and negative impacts. On the one hand, the construction of an airport will create a multiplier effect whereby the growth of various facilities around it will support the needs of airport service users, which were previously very minimal or not even available around the airport area, such as lodging or hotels, restaurants, shops, houses of worship, offices, and others (Pratiwi, ES & Rahardjo N, 2018). In areas with airport developments, the local economy and social welfare increase, for example, in Lijiang (Yunnan), a famous tourist destination, but access to and from the place is quite tricky. After the airport was completed, the number of passengers increased exponentially, so the tourist city became more popular (Wu & Qi, 2021). On the

other hand, the impact that maybe negative is the increase in land conversion into the built-up area. One example is the West Java International Airport (BIJB) Kertajati. In the area around the airport, there has been a significant change in the land, namely the depreciation of agricultural land, even though agricultural land greatly influences food security and self-sufficiency programs (Rahmad, 2019). Another negative impact that may arise from the construction and operation of an airport is that it can cause serious environmental and health problems (Wu & Qi, 2021).

The most appropriate method that can be used to efficiently detect changes in land use or land cover (LULC) in a relatively short time and with results that can be accounted for their accuracy is to use remote sensing technology by utilizing various classification algorithms. The main steps of LULC classification using image data include determining the appropriate classification system, selecting training samples, image pre-processing, feature extraction, selecting the appropriate classification approach, post-classification processing, and assessing accuracy (Lu & Weng, 2007). The supervised classification approach is often used in classification, namely using machine learning which is now gradually replacing traditional classification algorithms due to the lack of effectiveness and accuracy (Jin et al., 2018). Supervised classification combines visual interpretation and machine learning (for example, Random Forest) (Li et al., 2022). Random Forest is one of the most popular machine learning algorithms because it can be used for classification and regression purposes. It can be used with categorical and continuous variables with a relatively high degree of accuracy (Woznicki et al., 2019). This classification technique requires training samples and analysis of various classes in the area of interest, automatic extraction of built-up areas from remote sensing data produces data with fast results, especially for large areas (Varshney & Rajesh, 2014). Even though it is objective, the use of GIS can also experience bias and errors, which can lead to misclassification, so a validation study is needed to provide a basis on which the level of accuracy used in research can be determined (Rhew et al., 2011).

A spectral index method was used to simplify the process of automatically mapping land cover. One index that is often used in general is the

Normalized Difference Vegetation Index (NDVI) (Zha et al., 2003). NDVI data provide an objective metric for healthy vegetation levels that can be applied to almost any area of the Earth's surface at different spatial scales (Rhew et al., 2011). However, at the urban scale, NDVI is limited in capturing high spatial heterogeneity; therefore, depending on the resolution, NDVI may override the variability and availability of urban green space (Gascon et al., 2016). By using NDVI, for the first time (Zha et al., 2003) developed an index of the built-up area called the Normalized Difference Built-up Index (NDBI) to calculate the built-up area automatically. However, using NDBI, it is not easy to distinguish residential areas from open areas because these objects have a watertight surface that reflects almost the same reflectance in the SWIR and NIR bands. Furthermore, NDBI cannot separate types of areas such as settlements, industrial areas, and commercial areas (Andriani et al., 2018).

Other land change pattern detection can use Google Earth and Nighttime Light (NTL) data. Google Earth data archived in the past can be used to identify changes in land use in certain areas (Wibowo et al., 2016). Night time light (NTL) from the Suomi National Polar-orbiting Partnership Visible Infrared Imaging Radiometer Suite (NPP-VIIRS) is currently widely used to determine urban expansion patterns and monitor built-up areas (Zheng et al., 2021). The launch of the Suomi-NPP VIIRS enables the continuity of satellite applications at night, calibrated quality at a higher spatial resolution by providing an improved data set than its predecessor, the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS)/DMSP-OLS (Cole et al., 2017). VIIRS DNB results improve electric light detection compared to DMSP OLS (Elvidge et al., 1999; Schueler et al., 2013).

Several previous studies have been carried out regarding the development of YIA and its impact on social, economic, and land change impacts on the surrounding area. (Purwakarta, 2021) argues that with the existence of YIA, there is a potential to create local economic progress under several requirements, namely, sufficient compensation has been made, compensation is mostly made for productive matters, the number of flights to DIY is very high, and government intervention in maximizing local resources. However, research conducted by

(Utami et al., 2021) shows that land acquisition on YIA land has an impact on job losses of 15.6% and 8.9% part-time work, 35.6% decrease in income, 7% decrease in ownership assets and 15.5% increase in the cost of living, and this result shows that land acquisition has a negative impact on the decline in the economic conditions of some of the affected communities (Sukri et al., 2022). In terms of the economic pattern for affected households, (Rijanta et al., 2019) identify four types of investments made to manage their financial resources namely; first, most of the affected households invest in buildings along the main road with various types of economic activity intending to meet the needs of passing road users; second, investing in businesses directly related to airport operations, such as purchasing buses for transportation services and others; third, investment in the form of purchasing land in the surrounding town or village; fourth, investment in the form of savings, stocks, bonds, and investments.

From previous studies, there are two perspectives regarding the study presence of YIA in Yogyakarta. One view states that the presence of YIA benefits affected households, while in another view, YIA causes adverse impacts on affected households and reduces agricultural land. This study aims to detect temporal changes in land cover around YIA from before construction in 2016 to 2022 using several methods, namely Random Forest, NDBI, NDVI, detection via Google Earth, and NTL.

II. MATERIAL AND METHODS

A. Study Area

Administratively, the location of Yogyakarta International Airport (YIA) is located in Jangkaran Village, Palihan Village, Sindutan Village, Kebon Rejo Village and Glagah Village (Temon District, Kulon Progo Regency, Yogyakarta Special Region (DIY)). This area is directly adjacent to the Indian Ocean to the south, the Bogowonto River to the west, and the Serang River to the east. This research will focus on land cover changes that occur in Temon District.

B. Data

The imagery used for land cover change monitoring and NDBI NDVI calculations is Sentinel-2 MSI which was launched in June 2015 (Sentinel-2A) and March

7, 2017 (Sentinel-2B) due to the availability of data since 2015, which covers the research timeframe (2016-2022). These two identical satellites can provide remote sensing imagery with 10 m and 20 m resolution, revisit the same area every five days and are often used to identify urban impervious surfaces (Xu et al., 2018). The image used for analysis in 2016 and 2019 is Sentinel-2 MSI: Multi-Spectral Instrument, Level-1C, with an average recording value in July. Meanwhile, the analysis for 2022 is Sentinel-2 MSI: Multi-Spectral Instrument, Level-2A, with an average recorded value in May. Both are Sentinel-2 Imagery with the lowest percentage of cloud cover in each period of the year. This image was obtained from the Google Earth Engine (GEE) platform, radiometric and geometric corrections have been made so that it can be directly used in processing using ArcGIS Pro. The training sample data is taken from Google Earth Images. Furthermore, the district boundaries are downloaded from the Geospatial Information Agency (BIG) portal (<http://tanahair.indonesia.go.id/portal-web>).

Tabel 1 Types of data used in research

No.	Data	Source
1	MSI imagery: Sentinel-2 Multi Spectral Instrument, Level-1C	European Copernicus (Google Engine(GEE)) Union/ESA/Earth
2	MSI imagery: Sentinel-2 Multi Spectral Instrument, Level-2A	European Copernicus (Google Engine(GEE)) Union/ESA/Earth
3	Citra VIIRS Stray Light Corrected Nighttime Day/Night Band Composites Version 1	Earth Observation Group, Payne Institute for Public Policy, Colorado School of Mines (Google Earth Engine (GEE))
4	Landsat image	Google Earth Pro
5	Administrative boundaries	Geospatial Information Agency (BIG) (http://tanahair.indonesia.go.id/portal-web)

Source: (Compilation by author)

C. Methods

Studying LULC changes using remote sensing through analysis of satellite imagery provides excellent results with easy and cost-effective tools since the imaging is freely available, covers a large geographical area and has an excellent temporal resolution (Fonji and Gregory, 2014; Alam et al., 2020; Lidzhegu & Kabanda, 2022).

The algorithm used in land cover classification is Random Forest (RF). The random forest method is a development of the Classification and Regression Tree (CART) method, namely by applying the bootstrap aggregating (bagging) and random feature selection methods (Breiman, 2001). The first tree level of randomization or bootstrap aggregating (bagging) is a randomization of a subset of two-thirds of the data used as a training sample and the remaining one-third of the data ("out-of-bag" observations) is used for validation (validation sample) (Woznicki et al., 2019). In a random forest, many trees are grown to form a forest. Then an analysis is performed on this collection of trees. Therefore, the accuracy results are better than its predecessor, CART. The training sample used in this study's land cover classification is 80 polygons consisting of built-up area (23), agricultural vegetation (23), non-agricultural vegetation (22), waters (6), and bare land (6). As for the validation sample, 20 polygons were used, namely: built-up area (5), agricultural vegetation (5), non-agricultural vegetation (5), waters (3) and bare land (2). It is done using a confusion matrix or an error matrix to determine the value of the accuracy of the data processing results. A number of 100 decision trees determined RF in this study after conducting experiments using 50, 100, 150, and 200 decision trees, and the maximum overall accuracy was obtained with a total of 100 trees. Classification results are said to be good if the level of accuracy obtained is $\geq 80\%$ or the error is $\leq 20\%$ (Anderson et al., 1976; Trinufi & Rahayu, 2020).

Composite image of monthly averaged emission using nighttime data from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) taken via Google Earth Engine (GEE) to obtain night

light at YIA and the surrounding area in 2016 (before the commencement of YIA development) and in 2022. The data uses the average value in one year using the band Average DNB radiance values 'avg_rad.' For 2022 the average value used is January-August 2022. Cloud cover is determined using the VIIRS Cloud Mask product (VCM).

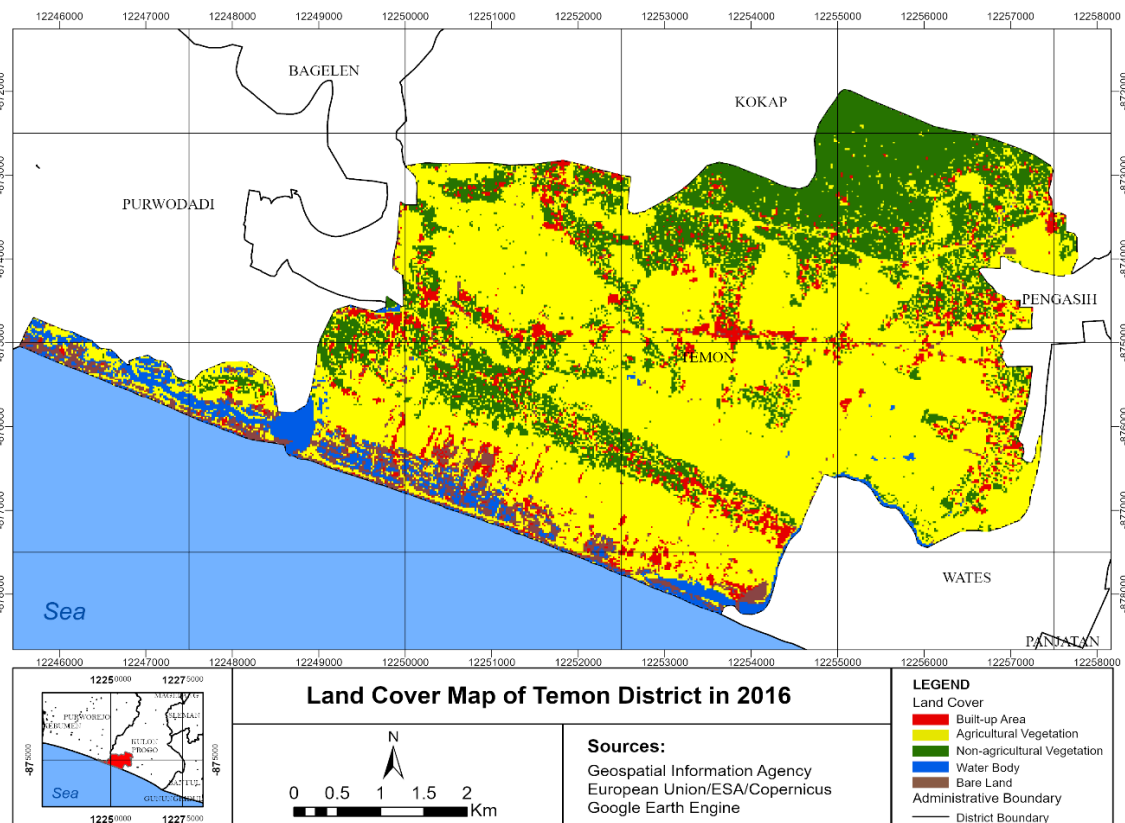
III. RESULTS

In 2016, 2019, and 2022, land cover maps contain spatial information for five land cover categories: vegetated (agricultural and non-agricultural vegetation), non-vegetated areas (bare land, settlements, and related non-agricultural land) and water bodies. Spatio-temporal changes in Temon District indicate that there has been an increase in built-up areas and connections to other areas due to the construction of YIA. These changes are presented and discussed extensively in the following sections.

A. Land Cover Change

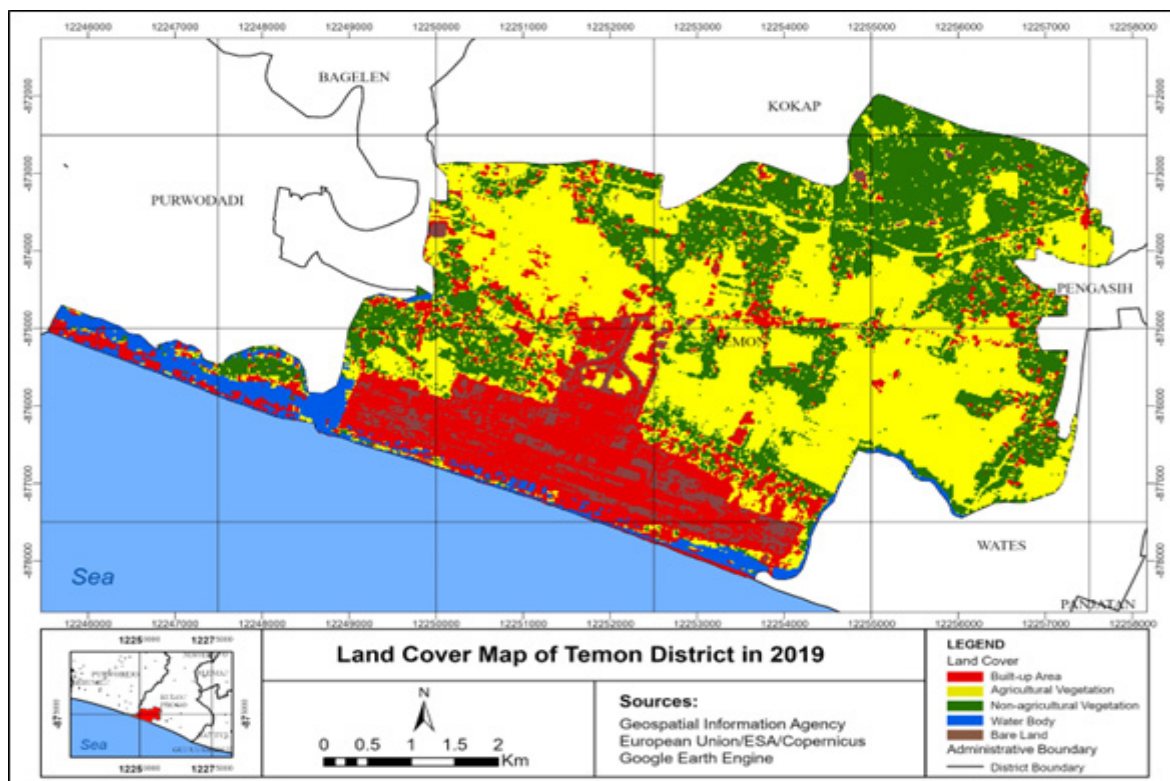
Land cover value was calculated using the Random Forest algorithm on the Google Earth Engine (GEE) platform, producing land cover with an Overall Accuracy (OA) value obtained for the 2016, 2019, and 2022 maps were 94.5%, 84.6%, and 96.7%, respectively. The lower OA observed in the 2018 map results can be attributed to a combination of factors, including frequent cloud cover and the harvest season. These factors introduce challenges in accurately distinguishing between vegetation and bare land pixels, leading to decreased clarity and legibility of the differences between these land cover categories. Overall, the most significant difference that can be observed in Figures 1, 2, and 3 is in the land cover of areas with agricultural vegetation (yellow color) and built-up area (red color).

$$r = \frac{N \sum xy - \sum x \sum y}{\sqrt{N \sum x^2 N \sum y^2 - (\sum y)^2}}$$



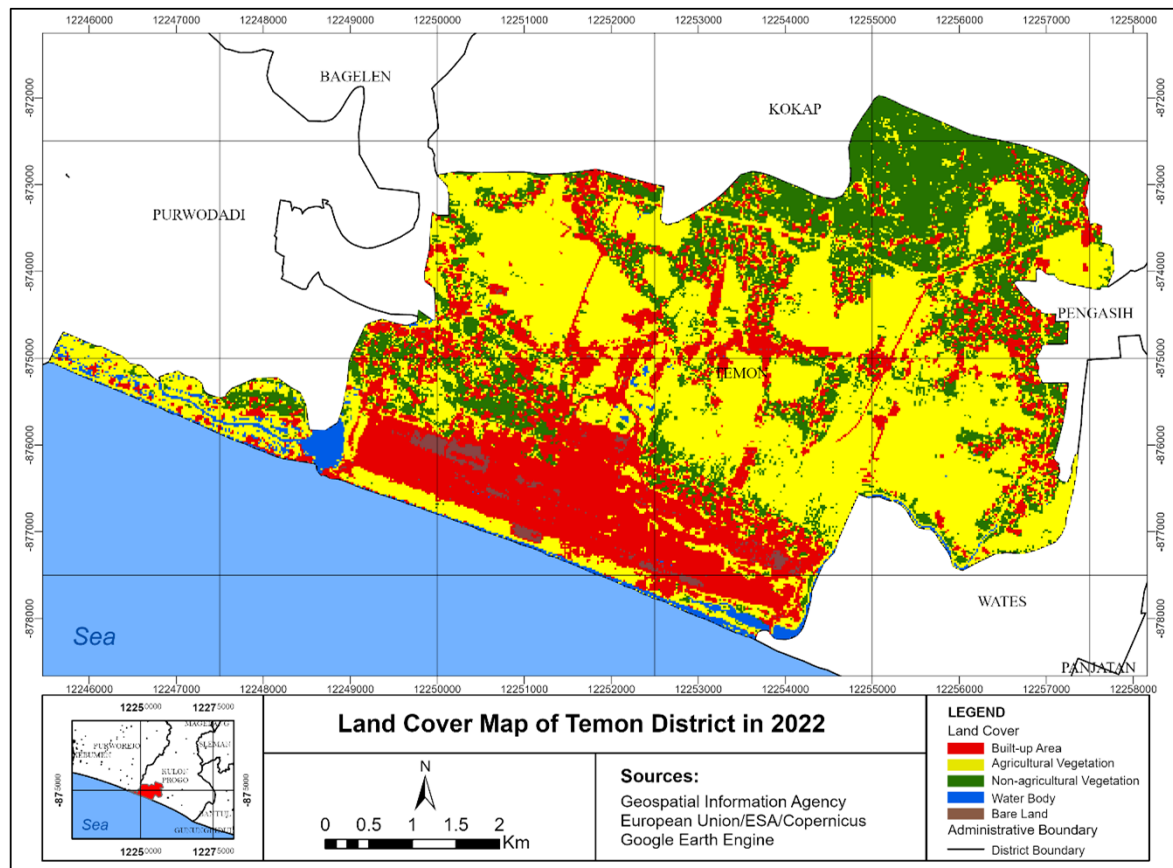
Gambar 1 Land Cover Map of Temon District in 2016

Source: Author's processing



Gambar 2 Land Cover Map of Temon District in 2019

Source: Author's processing



Gambar 3 Land Cover Map of Temon District in 2022

Source: (Author's processing)

Tabel 2 Land Cover Area of Temon District

No.	Class	Area (Hectares)			
		2016	2019	2022	Change (2016-2022)
1	Built-up Area	246,54	617,83	977,25	+730,71
2	Agricultural Vegetation	2.264,12	1.542,80	1.748,83	-515,29
3	Non Agricultural Vegetation	868,63	1.110,83	819,82	-48,81
4	Water Body	132,74	159,96	77,56	-55,18
5	Bare Land	152,65	233,26	41,22	-193,87
Total		3.664,68	3.664,68	3.664,68	

Source: (Author's processing, 2022)

The land cover area from 2016 to 2022 has undergone many changes, especially in built-up and vegetated areas (agriculture). According to the data presented in Table 2, the built-up area increased from 246.54 ha (6,72%) in 2016 to 617.83 ha (16,86%) in 2019, primarily due to the construction of airports. By 2022, the built-up area further expanded to 977.25 ha (26,67%), driven by the development of surrounding areas, including settlements, hotels, and other

structures. This is inversely proportional to other land cover which has experienced a reduction in the area from 2016 to 2022, such as vegetated agricultural areas (reduced 515,29 ha), bare land (decreased 193,87 ha), non-agricultural vegetation (reduced 48,81 ha), and water body (reduced 55,18 ha). Using the same method, namely the Classification and Regression Trees Algorithm (CART) machine learning, (Sholikah et al., 2021) studied changes in

land use in Kulonprogo for 2005, 2010, 2015, 2020 using Landsat 7 and 8 satellite imagery. Between 2005 and 2010, there was an increasing area in the paddy fields 69.49 hectares of agricultural land in the mountainous area of Kulon Progo Regency. However, in the subsequent periods of 2010-2015 and 2015-2020, there was a negative trend, with rates of -27.90 ha/year and -114.87 ha/year, respectively, indicating a significant reduction in agricultural land.

(Utami et al., 2023) also conducted a similar study in 2015 using Sentinel 2 images around YIA Airport, namely Temon District, part of Pengasih District, and Wates District because these locations are on the main route that connects the DIY province with Central Java. This study's findings indicate that before the construction of YIA Airport, most of the research area consisted of paddy fields with a percentage of up to 41%, while the built-up area reached 19%. However, in 2019 after the construction of YIA Airport was completed, there was a change in land use, with paddy fields decreasing to 37.9% and built-up area increasing to 25.6%. The use of Sentinel multitemporal imagery was also carried out by (Tantja et al., 2021) to study changes in land use caused by the construction of railway facilities and infrastructure in Tanete Rilau District, Barru Regency, South Sulawesi, in the 2015 and 2021 periods. The analysis revealed that paddy fields were one of the most dominant types of land use in constructing railroad lines, with a total area of 34.97 Ha (1.29%) and 2.80 Ha (0.1%) for building a warehouse. Meanwhile, the dry field area decreased by 12.40 Ha (0.60%). These studies align with the findings expressed by (Marlianawati et al., 2019), who emphasized that the land acquisition process for public development projects impacts community losses in terms of loss of agricultural land.

B. NDVI to Detect Vegetation

NDVI is the simplest way to identify an area's vegetation density level. The results of NDVI processing will show a value range of -1 to +1, where the closer to the value 1, the higher the vegetation density. Figure 3 shows the level of vegetation density in Temon District, with the green pixels representing vegetation areas, while the white pixels are non-vegetation areas. In 2016, the vegetation area in Temon District was still very high, whereas, in

2022, the vegetation density decreased as the built-up area increased. (Utami's et al., 2023) research in analyzing the impact of YIA uses NDVI to classify land use. However, variations in cropping patterns by farmers in Kulonprogo have resulted in differences in paddy field cover, including water bodies and bare land. This condition has an impact on the resulting vegetation index value. Therefore, a cross-check process is carried out by Utami et al., with a visual approach using nine key interpretation concepts to ensure the classification results have high-quality data. Likewise, in the results of this study, it can be seen in Figure 4 that water bodies and paddy fields that are currently harvesting cannot be distinguished (compare with Figure 3). Therefore NDVI, in this case, is only used to see vegetation density but not to classify land use.



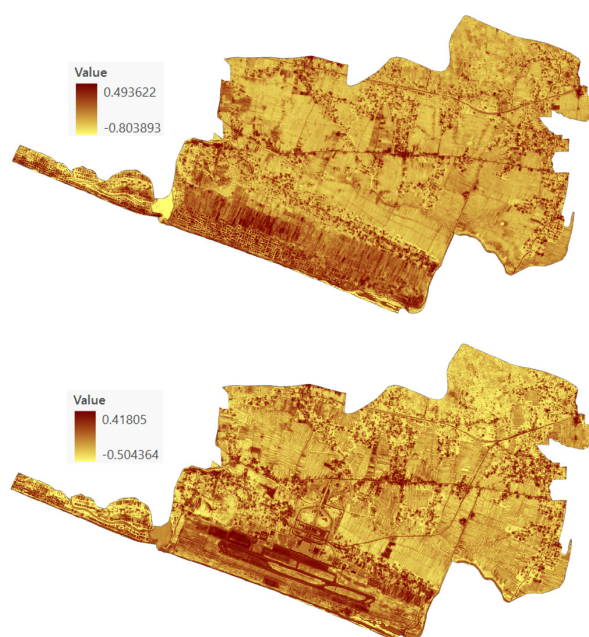
Gambar 4 NDVI of Temon District in 2016 (left) and 2022 (right)

Source: (Author's processing)

C. NDBI to Detect Buildings

The provisions for the range values for classification using the NDBI index are the same as those in NDVI, namely showing a range of values -1 to +1, where the closer to the value 1, the higher the building density level. Figure 5 shows that the yellow color is a pixel that has a non-built-up area index and the red color is a pixel that has a built-up area index. This approach has the disadvantage that it cannot

separate built-up areas from bare land (compare with Figure 3). Several deficiencies/errors occurred in the NDBI calculation, as found in 2016. Bare land and water body in the southern part were identified as built-up areas because the reflectance of SWIR and NIR were almost identical. However, overall the NDBI results are beneficial in identifying the growth of built-up areas, where there are more red pixels in the road area and near the airport area, which indicates that the growth of the built-up area is linear with the road. Similar research was conducted by (Ardi et al., 2023) using NDBI to analyze land cover and changes in population concentration in Kulon Progo Regency in the 2011-2021 period. In 2011, agricultural land was spread throughout Kulon Progo, with limited rice fields. By 2016, agricultural fields reduced while rice fields and plantations expanded. After the construction of the Yogyakarta international airport in 2021, settlements appeared along the main roads, primarily in Wates and its surroundings. The Menoreh strip saw no built-up development, but land openings emerged in the northern part of Kulon Progo.



Gambar 5 NDBI Temon District in 2016 (left) and 2022 (right)

Source: (Author's processing)

D. Detect Changes Using Google Earth

Google Earth provides high-resolution imagery data. This data can be used to identify changes in land use in certain areas and timeframes. The most significant change that can be analyzed from the image data in Temon District, precisely in the area around the airport, is the increase in the number of built-up areas, especially housing. Figures 6 and 7 in the red circle show that there are new housing in 2022, which was previously an agricultural area (rice fields) in 2016. The construction of an airport through land acquisition has led to the loss of livelihoods for the majority of farmers, necessitating the adaptation of farming communities to new environments (Marlianawati et al., 2019). This condition is inseparable from the increasing price of land around the airport and the increasing desire of the land owner to sell it. For those who are business savvy, YIA is a financial opportunity. Housing and food businesses are in high demand from project workers and residents. The need for clothing is also essential because the number of people around YIA is increasing. Some people open food businesses to meet the needs of airport workers and visitors (Susanto, 2020). In line with Ayuningtyas's research (2022) in Glagah Village, one of the villages in Temon District, it shows that the heads of families in Glagah Village have experienced a change in mindset, with the majority having an open and future-oriented view. They started investing and opening businesses to improve their social status, taking advantage of the YIA construction to encourage the growth of the village's Micro, Small, and Medium Enterprises (MSME) sector. The compensation received from land acquisition and the relocation of residential areas can bring additional advantages. Not only can it enable individuals to purchase a new place to live, but it also allows them to acquire new agricultural land and start their businesses (Marlianawati et al., 2019).



Gambar 6 Land use change detection in 2016 and 2022
(a)

Source: (Author's processing)



Gambar 7 Land use change detection in 2016 and 2022
(b)

Source: (Author's processing)

In addition to the increase in population settlements, the construction of homestays or lodging for travelers via the airport is one of the triggering factors for the increase in built-up areas around the airport. Figure 8 in the yellow box shows several homestays, boarding houses, inns, and hotels growing around the airport in 2022. (Satria et al., 2023) also conducted a similar study, employing

visual interpretation to examine the characteristics of roof shapes, boundaries, and object appearances using Pleiades imagery with a resolution of 0.5 meters, which had been corrected and mosaicked by BIG. The critical interpretation factors for identifying settlements, gardens, rice fields, and roads were shape, tone, color and size. From the results of his research, 882 buildings around the airport were increased in the 2015-2020 period in 4 villages: Glagah, Palihan, Sindutan, and Jangkaran. Significant growth occurred in the village of Jangkaran, where most of the buildings added were small, semi-permanent buildings used as workplaces for shrimp pond farmers. Meanwhile, in the villages of Glagah and Palihan, the primary growth resulted from the relocation of settlements affected by the YIA development.



Gambar 8 Lodging locations around the YIA area

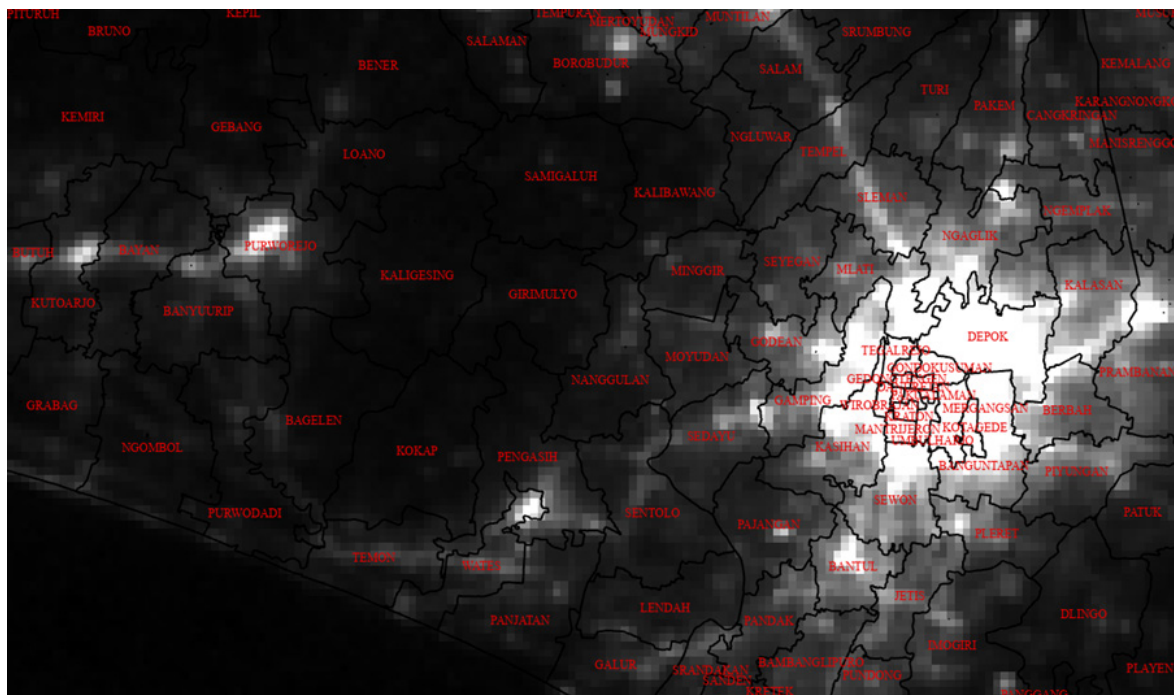
Source: (Author's processing)

E. Nighttime Light (NTL) to Detect Human Activity

Nighttime light is used as a proxy to see the intensity of development and human activity. Using nighttime light data as observations of building growth to study the impact on human activities is a low-cost and efficient method for investigating large areas in a non-contact and rapid manner. The analysis of night light data shows that after YIA (Figure 10), the night light in Temon District and the surrounding road nodes is brighter than in 2016 (Figure 9). The night light forms a brighter line from Temon District, which can be analyzed as an increase in building growth or human activity due to mobility from the airport to the surrounding areas such as Purworejo, Wates, Pengasih, to the city of Yogyakarta. Based on research conducted by Nurkholidah & Pratiwi, (2020) the unemployment rate in Purworejo Regency significantly decreased, particularly in areas directly

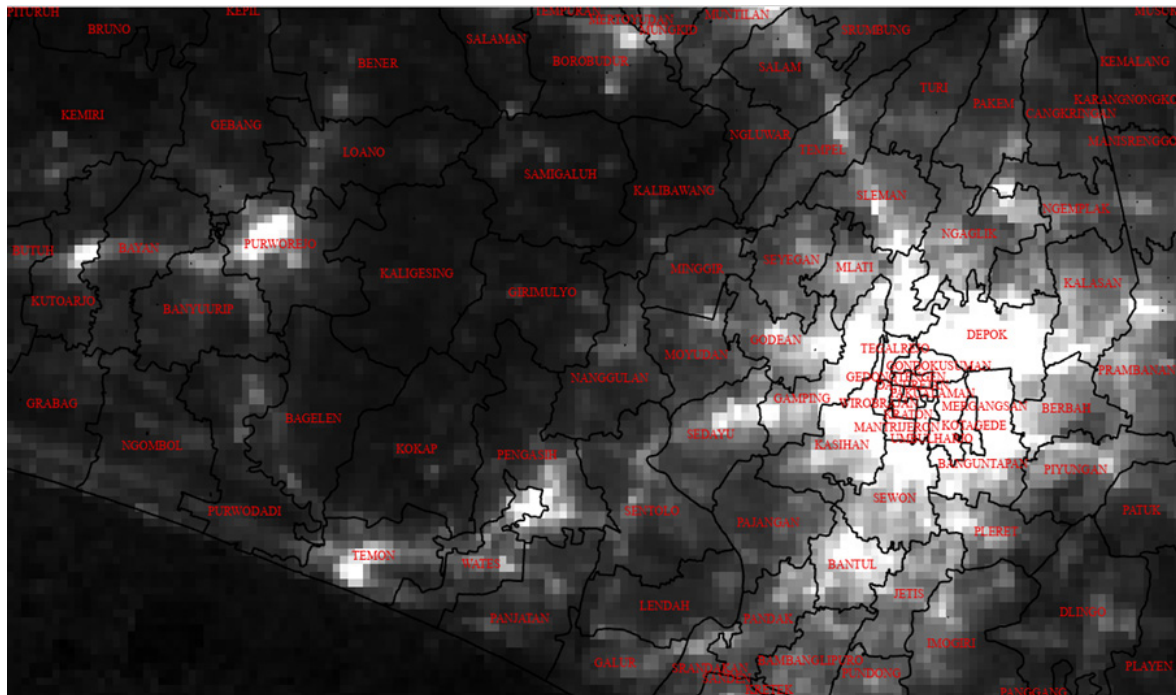
adjacent to the YIA airport premises. The local communities now have access to stable employment opportunities and a monthly income by participating in the airport construction process, whether as unskilled laborers, drivers, or by establishing businesses such as food stalls, boarding/rental services, LPG gas agencies, and more. Additionally, the tourism sector in Purworejo Regency has witnessed a surge in activity, as evident from the increased human activity from NTL (see Figure 9), contributing to the overall growth and development in Purworejo and its surrounding area.

According to research conducted by (Prasetyo & Trijetti, 2020), several national road sections support YIA Airport, such as the Toyan-Bts Kota Wates, Bts Kota Wates-Milir, and the Bts. Kab Kulonprogo-Yogyakarta shows a saturation level of $DS > 0.75$. This condition indicates increased traffic volume, resulting in low vehicle speeds and long queues, increasing vehicle travel time. The absence of road widening measures would lead to significant congestion and negatively affect the mobility between YIA and Jogja City and its surrounding regions.



Gambar 9 The night light of Yogyakarta and its surroundings in 2016
(Blue box: Temon District before YIA construction)

Source: (Author's processing)



Gambar 10 The night light of Yogyakarta and its surroundings in 2022
(Blue box: Temon District after YIA is operational)

Source: (Author's processing)

IV. CONCLUSION

This study uses the concept of land cover change to analyze the impact of the construction of a utility, namely YIA, on the intensity of human activity in Temon District and the surrounding area from 2016 (before the construction of YIA), after it started operating in 2019, to the present in 2022. Several algorithms and indices were adopted based on remote sensing imagery from these timeframes, such as Random Forest, NDVI, NDBI, night light data, and detection through Google Earth data. The entire method is advantageous as a temporal, spatial detection of land use for land cover and land use mapping. The results show a significant change in land cover, namely an increase in the built-up area while the other land cover decreases. Using the NDVI and NDBI indices, it was observed that Temon District had considerable vegetation coverage in 2016. However, in 2022, there was an apparent decrease in vegetation density, coinciding with an expansion of built-up areas. Based on the night light, Temon District connectivity to and from the surrounding area has increased from 2016 to 2022. The limitations of this study are primarily attributed to the reliance on secondary data without accompanying field investigations.

Consequently, there is a potential for increased error rates compared to studies incorporating on-site observations. Therefore, it is recommended that future research endeavors prioritize the inclusion of field checks to validate and enhance the reliability of the findings. The anticipated outcome of this research is to contribute significantly to the knowledge base, intending to guide future policymaking processes. It is hoped that the government will consider the results, ensuring that policy implementation incorporates not only the orientation and interests of the state but also prioritizes the diverse interests and needs of society as a whole.

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