



The Impact of Rice Field Land Conversion on the Availability of Green Open Space and Waste Management for Islamic-Based Sustainable Development in Kartasura District

Arizal Permana Aqila^{1*}, Faizal Aziz Latif Karim¹, Maya Aulia¹, Muhammad Atha Aufa¹, Munawaroh Al Azizah¹, Islani Maya Teana¹, Ika Feni Setiyaningrum¹

¹UIN Raden Mas Said Surakarta, Indonesia.

*Corresponding author's email: arizalpermanaqila@gmail.com

Abstract

This study aims to examine the impact of rice field land conversion on the availability of Green Open Space (GOS) and waste management systems in the suburban area of Kartasura District, using an Islamic value-based approach to support sustainable development. The method employed is a qualitative approach, utilizing field observations, structured interviews, visual documentation, and secondary data analysis based on spatial imagery and land-use maps for the period from 2020 to 2024. The results show that the conversion of rice fields to residential areas, industrial areas, and infrastructure has caused a drastic decrease in GOS area, ranging from 65% to 95% in four observation locations. This phenomenon indicates that the process of land conversion in the suburban area of Kartasura has not been accompanied by systematic environmental governance. From an Islamic perspective, environmental preservation is a form of responsibility of the caliph to the earth (khalifah fil-ardh), which emphasizes the principle of balance (mizān) and the prohibition of causing damage (fasād). Therefore, this study recommends the importance of integrating Islamic values in spatial planning and waste management systems, through strengthening the role of the community, local government supervision, and the application of circular economy principles to create a healthier, fairer, and more sustainable environment.

Keywords: Land conversion, Green Open Space, Waste management, Suburban areas.



Introduction

Changes in land use are a concrete manifestation of spatial dynamics due to population growth, economic development, and population growth. (Putri et al., 2022). In Indonesia, the phenomenon of land conversion, particularly from agricultural land to residential and industrial areas, is an important issue that has a direct impact on environmental sustainability and local food security (Dharyan et al., 2025; Rohmah et al., 2024). In suburban areas, these changes often occur more rapidly than in rural areas, due to their strategic position as buffers for urban activity. Winarso et al. (2015) The peri-urbanization phenomenon accelerates the process of land use change because the need for space in the city center is increasing and driving expansion into the surrounding areas.

The phenomenon of peri-urbanization, namely the process of changing space on the outskirts of the city, has become a characteristic of the development of areas around large cities in Indonesia. (Kurniati et al., 2022)Kartasura, as the gateway to Surakarta City, has undergone a significant transformation in the last 5 years. A study from Pradhana (2021) Shows that there have been significant changes in the land use structure in peri-urban areas, particularly marked by the conversion of agricultural land to residential and industrial areas. Land use change is a key indicator for measuring the dynamics of suburban areas. Without proper management, this can lead to environmental degradation, spatial conflicts, and decreased agricultural productivity.

Kartasura District in Sukoharjo Regency is an example of a suburban area that has experienced intensive land-use changes in the past five years. Strategically located within reach of Surakarta City, Kartasura is developing rapidly with the emergence of new housing, industrial areas, and boarding houses. Analysis of Google Earth imagery from 2020–2024 shows a significant decrease in green open space, shifting to built-up areas. According to research by Pramitasari and Sarwadi (2015), the main factors driving changes in land use in suburban areas include population growth, development of road infrastructure, increasing housing needs, and private sector investment in property development.

These changes in land use bring challenges to regional sustainability, particularly in relation to the availability of green open spaces, reduced local food production capacity, and increased risks of disasters such as flooding and traffic jams. (Ramadhan et al., 2016)Without integrated and sustainability-based spatial planning, the development of suburban areas can lead to environmental degradation and social inequality. (Adianti, 2020)Therefore, research related to the dynamics of land use change in the Kartasura area is highly urgent, not only to provide an empirical picture of the patterns and direction of land use change that have occurred, but also to produce recommendations for more sustainable spatial management policies.(Pradoto et al., 2024).

From an Islamic perspective, preserving the environment is part of the mandate of humans as caliphs on earth. (Klongrua et al., 2024)In the Qur'an, the holy book of Islam, Allah SWT emphasizes the importance of maintaining balance (*mīzān*) and prohibiting destruction (*fasād*)



on earth (QS. Ar-Rum: 41). Therefore, sustainable development emphasizes not only economic and technical aspects, but also moral and spiritual values in resource management. (Aqsa Tasgheer & Tehreem Fatima, 2022). Green Open Space (GOS) plays a vital role in maintaining ecological balance, improving environmental quality, and providing social space in suburban areas experiencing development pressure. The presence of GOS has been proven to reduce surface temperatures, improve the microclimate, enhance the aesthetics of the area, and provide a means for recreation and social interaction. (Faisal, 2022). In addition, green open space functions as a crucial water catchment area for flood disaster mitigation, as well as supporting biodiversity conservation in urban and suburban areas. (Fuady et al., 2025).

The conversion of agricultural land into residential areas, industry, and other infrastructure has become an increasingly intensive phenomenon in suburban and peri-urban areas. Changes in land use that have reduced the area of productive agricultural land represent a deviation from humanity's mandate as caliphs on earth. Agricultural land that should be used for the benefit of the people, such as meeting food needs, has been converted without consideration for sustainability and ecological justice. (Prayitno et al., 2021) This is contrary to the principles of *maslahah*, *tawazun* (balance), and the prohibition of *ifsad* (damage). As a result, the availability of local food sources has decreased, particularly staple crops such as rice, vegetables, and fruits previously produced on the land. This situation not only implies a decline in local food production capacity but can also worsen a region's long-term food security, given the continuing increase in population growth and increasing food demand. (Putri et al., 2024) Several studies also show that uncontrolled conversion of agricultural land has an impact on the decline in the sustainability of local food systems and has the potential to increase dependence on food supplies from other regions, which are economically and ecologically less efficient. (Somantri, 2022).

Poor waste management in suburban areas reflects humanity's negligence in fulfilling its mandate as caliphs on earth. The increasing volume of waste generated due to rapid land conversion and the growth of new settlements is a result of unsustainable lifestyles that do not align with the principles of balance and the prohibition of excess in Islamic teachings. (Derysmono & Kahfi, 2025). In contrast to core urban areas, which have a relatively well-organized waste management system, in suburban areas there are generally still limited supporting facilities and infrastructure, low community participation, and waste disposal practices that do not meet standards, such as open burning or indiscriminate dumping. (Amos, 2015) This condition is exacerbated by the lack of local government policy intervention in building community-based management systems and implementing circular economy principles at the local level. (Mafruhah et al., 2025) Therefore, institutional strengthening, public education, and the provision of adequate waste management facilities are needed to encourage the creation of a clean, healthy, and sustainable suburban environment.



From an Islamic perspective, land conversion in suburban areas that reduces the presence and quality of green open spaces (GOS) represents an imbalance in earth governance that contradicts humanity's role as caliphs (custodians of the earth). GOS is not only an aesthetic element of the city, but also a crucial part of maintaining the balance of the ecosystem created by Allah SWT. When GOS is sacrificed for the sake of unsustainable development, it is tantamount to failing to implement Islamic ecological values, resulting in *mafsadah* (damage) to the surrounding environment. (Ali & Agushi, 2024). In this context, this study aims to identify and analyze changes in the area of undeveloped land and the form of green open space as a result of land conversion in suburban areas, and to determine the waste management system implemented by the community in the environment and its effectiveness. First, changes in the area and shape of green open space as a result of land conversion in suburban areas. Remember that green open space not only functions as a microclimate cooler, but also as a vital social and ecological space. (Auwalin et al., 2024). Second, the waste management system implemented by the community in the area and its effectiveness in addressing the impact of increased waste volume due to increased housing. This problem is relevant considering that poor waste management systems are often the main contributor to environmental pollution, especially in urban transition areas. (Made et al., 2024) Third, this study also aims to determine the differences in green open space conditions and waste management systems in four different locations within a mountainous suburban area, to observe the diversity of local environmental responses and policies to development pressures.

Based on this formulation, this study has several main objectives. First, to identify changes in the shape and area of green open space as a result of land conversion, both visually through satellite imagery interpretation and through resident perceptions. Second, to examine the waste management systems in place at each location, including waste types, handling methods, and management implementers. And third, to compare environmental conditions, specifically green open space, and waste management systems in four locations with similar geographic characteristics but different management practices, to uncover patterns of local environmental adaptation to the pressures of urbanization. (Setiadi, 2015) The findings of this study are expected to provide input for local governments in developing more responsive, data-driven policies.

Methods

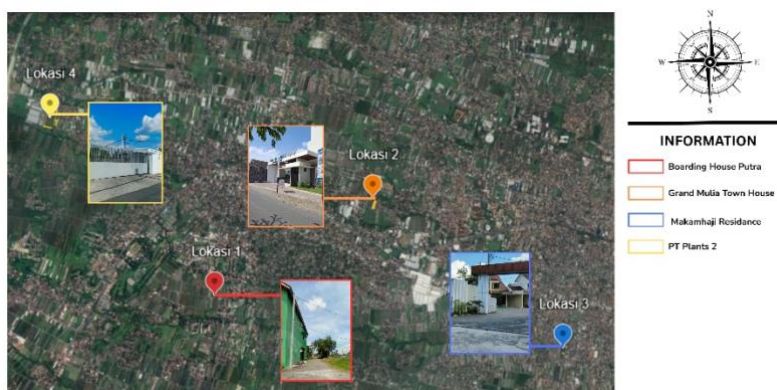
This research used a qualitative approach using field observation, interviews, and documentation techniques. The research location was divided into four points with different land conversion characteristics.

1. Scope of Research Location

This research is a qualitative study that aims to specifically explain a phenomenon related to changes in urban spatial structure during the peri-urbanization process in the Kartasura District. The approach used in this study is a deductive one, where theories are used as research variables to answer the problem. (Wibowo et al., 2024).

This research was conducted at four locations in the suburban area of Sukoharjo Regency. Specifically in Kartasura District, which experienced a change in land function from rice fields to residential and industrial areas, namely as follows:

- 1) Surya Putra Boarding House
- 2) Grand Mulia Town House
- 3) Makamhaji Residence
- 4) PT Kias Plant 2



Picture 1. Research location map
 Source: [Google Earth, 2025]

These four locations were selected because they represent different characteristics in terms of land conversion patterns, green open space availability, and waste management systems. This study aims to compare ecological, social, and environmental governance conditions across locations to obtain a comprehensive picture of the impact of land conversion on environmental quality in suburban areas. (Pramitasari & Sarwadi, 2015). This study uses time series data consisting of four location points and data years, namely 2020 and 2024. The use of data with two time points is used to understand the peri-urbanization process and changes in the shape of the spatial structure over 5 years (Pradoto et al., 2024).



2. Techniques and Data Collection

The data for this study consisted of primary and secondary data. Primary data were obtained from structured interviews and observations in the research area. In this study, we interviewed 20 respondents, including housing managers, residents of the housing complex and its surrounding areas, and employees at industrial sites. Questions covered residents' knowledge of the existence, type, extent, and utilization of green open space, as well as the existence of conservation programs. Regarding waste management, questions covered waste generation, waste management practices, and the resulting impacts. (Isbilly et al., 2025). The observation method we used was to observe the condition and type of green open space and the amount of waste generated. (Silalahi et al., 2023) Secondary data were collected from land use data and maps of the research area obtained from Google Earth and several relevant journals discussing land use changes in suburban areas.

Results and Discussion

1. Conditions of Land Conversion in Sub-Urban Areas in Kartasura District, Research Location

The Kartasura Suburban area shows changes in land function and a decrease in the area of green open space. Reflects the challenges in maintaining the mandate as a caliph on earth. Results observation shows that the rice field area has changed function into a residential area and an industry. Observations at four locations showed that rice fields had been converted into housing and industrial areas. The green open space at each location also took different forms: roadside greenery, residential gardens, and infiltration areas in industrial areas.

2. Land Use

Based on research analysis, there has been significant land-use change, particularly in the conversion of agricultural land to residential areas, commercial facilities, and industrial areas. This change has directly impacted the reduction in the area of Green Open Space (GOS), which previously played a role in balancing the ecosystem. Green open space is not only a physical element of the city, but also part of Allah's creation, which functions to maintain the balance of nature, becoming a water catchment area, as well as supporting environmental comfort and health. This reduction in ecological function is contrary to the principle of *maslahah 'ammah* (public welfare) and violates the prohibition of *ifsad* (damage) on the face of the earth (Mutakin & Waheeda, 2023). The following table presents the results of land-use change calculations, illustrating the dynamics of land conversion in the study area. This tabulation compares land conditions over two different periods, allowing quantitative identification of changes in built-up and unbuilt-up land areas, including green open space (GOS).

Table 1. Land use change

No	Location	Year 2020				Year 2024			
		Undeveloped land area	Percentage (%)	Built-up land area	Percentage (%)	Undeveloped land area	Percentage (%)	Built-up land area	Percentage (%)
1.	Surya Putra Boarding House	3.726 m ²	86,5%	582 m ²	13,5%	2.701 m ²	66,9%	1.337 m ²	33,1%
2.	Grand Mulia Town House	2.136 m ²	100%	0 m ²	0%	668 m ²	73,3%	1.468 m ²	26,7%
3.	Makamhaji Residence	2.752 m ²	33,9%	2.913 m ²	46,1%	2.153 m ²	42%	3.152 m ²	58%
4.	PT Kias Plant 2	31.109 m ²	100%	0 m ²	0%	14.196 m ²	45,7%	16.913 m ²	54,3%

Source: [Researcher, 2025]

OnLocationFirst is an area that was previously productive rice fields, located in Hamlet IV, Pucangan, Kartasura District, Sukoharjo Regency. The total area analyzed was 4,308 m², with the boundaries remaining the same throughout both observation periods.

Conditions at the beginning of 2020



Current conditions in 2024



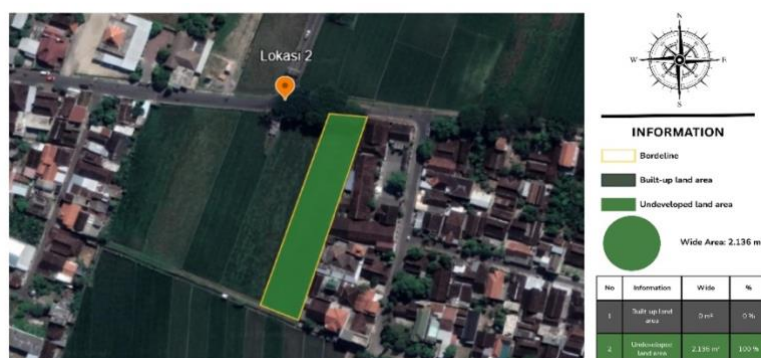
Picture 2. Map of built-up and unbuilt-up areas of the first location

Source: [Google Earth, 2025]

As shown in the two images above, the initial conditions in 2020 showed that the majority of the land was still open space or undeveloped land, dominated by vegetation and agricultural land. Development only covered a small area in the northern part of the site. However, in 2024, the built-up area increased by 755 m².

On location second is in Delegan Hamlet, Pabelan, Kartasura District, Sukoharjo Regency, with a total land area of 2,136 m². This location was previously active agricultural land (rice fields), but over time, it underwent a process of conversion into a built-up area.

Conditions at the beginning of 2020



Current conditions in 2024

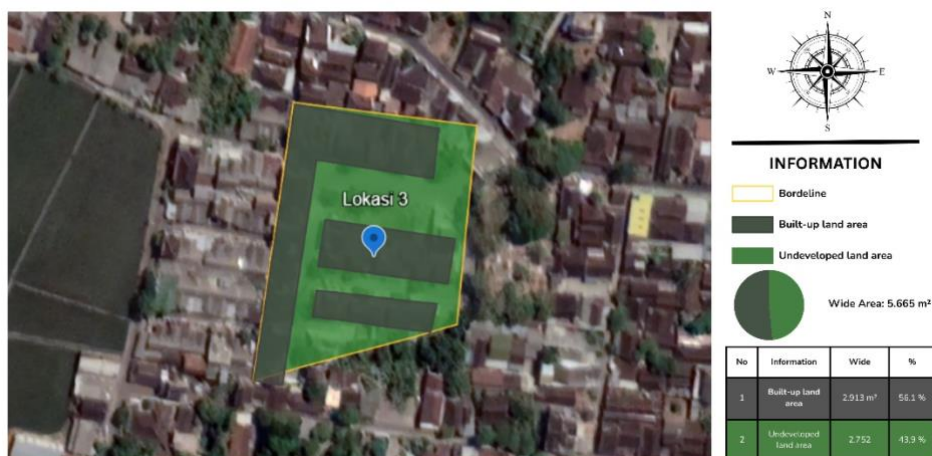


Picture 3. Map of built-up and unbuilt-up areas of the first location
 Source: [Google Earth, 2025]

As shown in the two images above, the entire area was initially open, undeveloped land, dominated by vegetation and used as rice paddies. The current condition of the site has changed, from rice paddies to housing with a built-up area of 1,468 m².

Onlocationthird is a residential area in the Makamhaji Residence area, Kartasura District, Sukoharjo Regency, with a total land area of 5,665 m². This area has changed its spatial structure along with physical development and the growth in the number of residences.

Conditions at the beginning of 2020



Current conditions in 2024

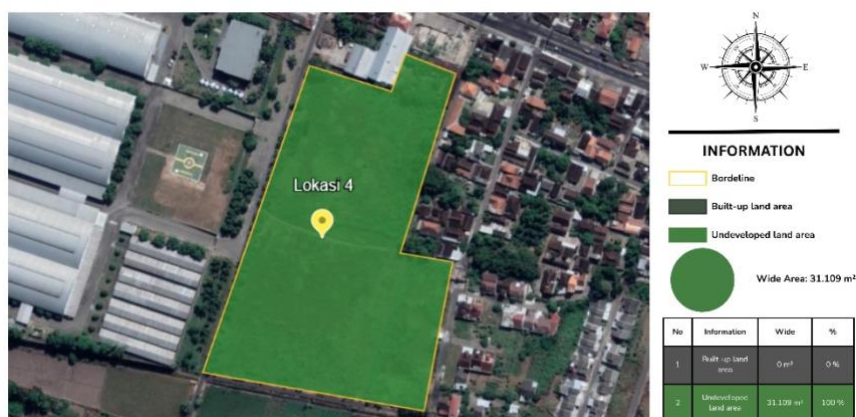


Picture 4. Map of built-up and unbuilt-up areas of the third location
 Source: [Google Earth, 2025]

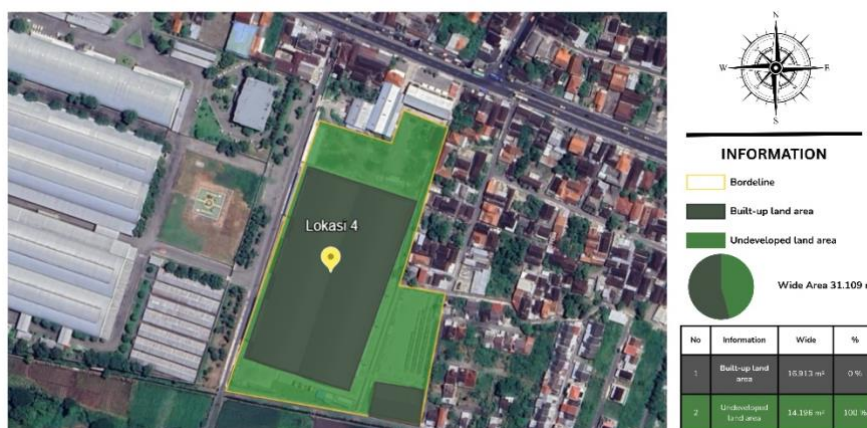
As shown in the two images above, initially, although the development was quite dense (more than 50%), there was still open space functioning as a park, yard, or undeveloped green area. However, over time, the built-up area increased by 3,152 m², compared to only 2,913 m² in 2020.

At the fourth location, an industrial area in Kartasura District, Sukoharjo Regency, with a total land area of 31,109 m². This area was previously a large open area, believed to be agricultural or vacant land, that later underwent large-scale development.

Conditions at the beginning of 2020



Current conditions in 2024



Picture 5. Map of built-up and unbuilt-up areas of the fourth location
 Source: [Google Earth, 2025]

As shown in the 2 images above from 2020, the location was an open space with an area of 31,109 m². In its initial condition, the entire area was undeveloped land, which was most likely an open field or bushes.

Based on the results of the analysis of land area at four research locations in the Suburban area of Kartasura District, Sukoharjo Regency, it is known that the average decrease in built-up land reached around 33.5% in the period 2020 to 2024. The first location, namely in the Putra Surya Boarding House area, shows a change in land function from an unbuilt area of 3,726 m² (86.5%) in 2020 to only 2,701 m² (66.9%) in 2024, with a decrease in green open space of 19.6%. At the second location, Grand Mulia Town House, the change in unbuilt land is more drastic, namely from the condition of the entire land (2,136 m²) still being 100% open space in 2020, to only 668 m² (73.3%) in 2024, resulting in a decrease in green open space of 26.7%. Meanwhile, at the third location, Makamhaji Residence, there was a slight increase in the percentage of undeveloped land from 43.9% to 48%; however, in total area, there was a decrease in green space of 599 m², which was likely caused by changes in the layout of open areas that were more private, such as residential yards. Meanwhile, at the fourth location, namely the PT Kias Plant 2 industrial area, there was a significant decrease, where the entire area was previously undeveloped land (31,109 m² or 100%) and in 2024, only 14,196 m² (45.7%) remained, resulting in a decrease in green space reaching 54.3%. Overall, this pattern of change indicates a fairly massive land conversion, especially the conversion of agricultural land and open space to



residential and industrial areas, with the remaining green space dominated by private gardens, narrow green belts, and open spaces that tend not to be ecologically integrated.

3. Existence and Utilization of Green Open Space

Visual documentation and interviews show that the existence of green open spaces is still recognized by the community, although they are tending to decrease in size and quality. However, the lack of active government and community involvement in conservation programs has resulted in suboptimal utilization of green open spaces. In some locations, green open space maintenance relies solely on community initiatives such as community service or youth organization activities, without systematic institutional support.

Table 2. Form of Green Open Space (GOS)

No	Location	Existing Forms of GOS	GOS Area	Utilization of GOS	Presentation	Conservation Program	General Condition Notes
1	Surya Putra Boarding House	Mini park, garden, community garden	1.500 m ²	Relax, play, exercise, aesthetics	27%	There isn't any	RTH still exists, but is managed independently by residents, not systematically.
2	Grand Mulia Town House	Mini parks, green paths, gardens, roadside trees	648 m ²	Recreation, children's play, sports, cool environment	23%	There is, but it is limited to citizen initiatives.	There is collective awareness, but it is not yet widespread.
3	Makamhaji Residence	Green belts, roadside trees, playgrounds, small gardens, tree fields	1.152 m ²	Sports, gymnastics, community gatherings, school children's activities, village greening	17%	Yes, some know (Sukoharjo DLH & community service)	Awareness is quite good, but not all residents are involved
4	PT Kias Plant 2	Company park, industrial area,	2.913 m ²	Noise reduction, aesthetics,	8%	Yes, internal company & government policy	High awareness, more orderly management of



No	Location	Existing Forms of GOS green belt	GOS Area	Utilization of GOS ecosystem balance.	Presentation	Conservation Program	General Condition Notes
							green space open

Source: [Researcher, 2025]

The existence and condition of green open space (GOH) at each location vary in terms of form, size, and management. At the first location, Putra Surya Boarding House, the available green open space consists of a mini park, a garden, and a community garden, covering a total area of approximately 1,500 m², or 27% of the area. Residents use this green open space for relaxation, play, light exercise, and to enhance the aesthetic value of the environment. However, green open space management still relies entirely on community initiatives without any systematic conservation programs or institutional support.

Meanwhile, at Grand Mulia Town House, the green open space (GTH) found includes a mini park, green belt, garden, and several roadside trees with a total area of 648 m², equivalent to 23% of the total area. Its uses include simple recreation, a children's playground, light exercise, and improving the area's coolness. Collective community awareness of preserving green open space is beginning to form, as evidenced by limited conservation activities initiated by residents, although involvement is not yet evenly distributed among all residents.

Furthermore, in the Makamhaji Residence area, the green space is more varied, including green paths along the road, shade trees, playgrounds, small gardens owned by residents, and open fields with trees. The total green space area reaches 1,152 m² or approximately 17% of the area. Residents utilize this green space for morning exercise, group exercise, community social activities, and village greening activities. The green space conservation program has been implemented with the support of the Sukoharjo Environmental Agency (DLH), although the level of community participation is still not optimal in all residential areas.

Unlike other locations, at PT Kias Plant 2, which is an industrial area, green space is focused on company gardens and green belts around the factory area. The total area of green space at this location reaches 2,913 m² or approximately 8% of the total land area. The main function of green space in this industrial area is to reduce noise from production activities, improve the aesthetics of the work environment, maintain the balance of the company's ecosystem, and support the comfort and health of workers. Green space management is carried out in an orderly manner by internal company parties, supported by government policies regarding green spaces in industrial areas. Awareness and concern for the sustainability of green space at this location are relatively high compared to other locations.



Case study on the conversion of rice fields into residential areas from research by Nugroho et al (2022). This study examines the conversion of agricultural land to residential areas in the peri-urban areas of East Java. It found that the economic value of residential land increased up to seven times compared to its value as agricultural land, thus accelerating agricultural land conversion in suburban areas.

4. Waste Management in Sub-Urban Areas

The implementation of environmentally friendly waste management facilitation and stimulation programs through community-based approaches still faces various challenges. One of the main obstacles is the limited availability of supporting facilities and infrastructure, such as sorting facilities, storage areas, and standardized waste vehicles. Although community groups have begun to form that initiate independent waste management, this development remains uneven. (Idrus et al., 2024) The scale of services achieved is also still limited, so their impact on overall waste reduction remains insignificant. This highlights the need for stronger policy interventions, including institutional support, public education, and strengthening circular economic systems at the local level.

Table 3. Waste processing

No	Location	Daily Waste Volume	Management System	Main Problem	Burning Practice	Additional information
1	Putra Surya Boarding House	2–3 bags	Independently owned by the boarding house owner, some were burned	Trash strewn about, smoke & smell	Still found	Low citizen participation, minimal infrastructure
2	Grand Mulia Town House	8–10 bags	Transported by official officers, orderly	Garbage scattered by animals, smelly	There isn't any	The system is quite good, but there are still wild disturbances
3	Makamhaji Residence	±12 bags	Transported by officers, there is a garbage bank	Scattered trash, wild disturbance	There isn't any	Awareness is quite high, collective management
4	PT Kias Plant 2	±15 bags	Transported by special company officers	No contamination found	There isn't any	An orderly industrial system, according to K3 standards

Source: [Researcher, 2025]



At the first location, the Putra Surya Boarding House area, the average daily waste volume reaches 2 to 3 bags per day, mostly from the activities of boarding house residents. Waste management at this location is still traditional and independent, with residents or boarding house owners collecting waste in bags and then disposing of it in a public area or even burning it in the surrounding area. This burning practice is still common because some residents do not participate in cleaning fees, thus encouraging burning as a cost-cutting measure. As a result, environmental pollution problems such as smoke, pungent odors, and scattered trash are still common. This condition is exacerbated by the lack of adequate waste management infrastructure and low community participation in efforts to maintain environmental cleanliness.

Meanwhile, at the second location, Grand Mulia Town House, the waste management system is relatively more orderly. The average volume of waste generated reaches 8 to 10 bags per day, and all waste is collected in plastic bags and then transported by authorized cleaning staff. No burning of waste was observed by residents in this area. However, environmental pollution still occurs, primarily due to scattered waste caused by disturbances by wild animals such as cats, as well as unpleasant odors from temporary waste accumulations. All sources at this location agreed that the involvement of authorized staff in waste management is crucial for maintaining cleanliness, preventing pollution, and avoiding substandard management practices.

At the third location, Makamhaji Residence, the daily waste volume is higher, estimated at around 12 bags per day, due to the population increase caused by housing development. The waste management system in this neighborhood is quite good, with residents collecting waste in front of their homes, which is then collected by environmental sanitation workers. Furthermore, the area also has a waste bank as part of a circular economy-based management effort. Despite this, pollution still occurs, particularly in the form of scattered waste caused by disturbances from wild animals, but some sources stated that they are not directly affected. Collective management and the presence of a waste bank indicate a better level of public awareness compared to boarding houses.

The fourth location, PT Kias Plant 2, has the most orderly waste management system of all the locations. The daily waste volume is estimated at 15 bags, but all waste is handled by the company's internal cleaning staff. Waste is collected in a designated area that meets industry standards, and there is no evidence of waste burning or environmental pollution, such as strong odors or scattered trash. This management is carried out as part of efforts to maintain cleanliness, enhance the aesthetics of the work environment, and meet occupational health and safety (K3) requirements in the industrial area.

5. Comparison Between Locations

Field studies conducted at four observation points in Kartasura District—the Putra Boarding House Complex, Grand Mulia Town House, Makam Haji Residence, and PT Kias Plant 2—revealed significant variations in the availability of green open space and waste management systems. This variation reflects the level of spatial planning, the socioeconomic structure of residents, and institutional involvement in environmental management.

At the first location, it is a residential area dominated by boarding houses. Based on visual documentation and interviews, it was discovered that green space is very limited. The only green spaces available are small gardens or poorly maintained artificial parks. There is no government intervention or community participation in maintaining green space. In terms of waste management, burning is still frequently practiced by both residents and boarding house owners. This is due to minimal participation in cleaning fees and the absence of a formal waste collection system. As a result, pollution occurs in the form of smoke and a pungent odor that disturbs nearby residents.



Picture 6. First research location
Source: [Researcher, 2025]

At the second location, as a residential area, Grand Mulia Town House demonstrates improved environmental quality. Green open space (GOS) is available in the form of mini-parks and green belts throughout the residential area. The green open space is used for recreation and social activities such as children's play. Furthermore, joint cleaning activities demonstrate the community's awareness of environmental protection. Waste management is carried out by authorized personnel using a scheduled collection system. No burning of waste was observed,



and the community participated in maintaining orderly waste disposal. This demonstrates that institutional structures and access to public services significantly influence the effectiveness of environmental management.



Picture 7. Second research location
Source: [Researcher, 2025]

At the third location, the kwarunghousing area, which still has remaining green open space in the form of community gardens, small fields, and roadside trees. The green open space is still used for various social activities such as gymnastics, children's activities, and youth organizations. However, there is no official government maintenance program, and green open space maintenance relies largely on community initiatives. In terms of waste management, most households have adopted a waste collection system provided by officers. However, pollution still occurs due to littering that isn't promptly collected or disturbance by wild animals. However, there are waste bank activities run by residents.



Picture 8. Third research location
Source: [Researcher, 2025]

At the fourth location, inPT Kias is the industrial estate that demonstrates the most orderly environmental management of the four locations. The company not only maintains but also increases the green space through the development of an industrial park. The green space in this area serves ecological and aesthetic purposes, such as reducing noise and improving air quality around the factory. Waste management is carried out internally by the company's dedicated cleaning staff. Waste is stored in a dedicated location and not incinerated. No significant environmental pollution was found, demonstrating the company's sound environmental management system.



Picture 9. Research location fourth
Source: [Researcher, 2025]



A comparison between the four locations reveals disparities in spatial and waste management, despite all being within the same administrative region. Informal and semi-formal areas tend to have poorly maintained green spaces and unorganized waste management systems, while formal and industrial areas demonstrate significantly better environmental performance. This confirms that governance and institutional capacity are key determinants of successful suburban environmental management (Hadijah & Sadali, 2020).

6. Impact on Suburban Environment

From the synthesis of all data collection techniques, including field observations, structured interviews, visual documentation, and secondary data collection, it can be concluded that changes in land use in the research area have had a significant impact on the ecological and social conditions of the Kartasura suburban area. One of the most obvious impacts is the degradation of the local ecosystem, characterized by a reduction in the presence and extent of Green Open Space (GOS). The loss of this GOS directly reduces the environmental carrying capacity in providing water absorption, air conditioning, and natural habitats. (Rusandi et al., 2021).

Furthermore, land conversion also increases environmental burdens, particularly in terms of domestic waste management. Waste volumes increase with residential growth, but management systems are inadequate. (Kusumastuti et al., 2018) This is exacerbated by the traditional practice of burning garbage, which is still carried out by some residents, causing a decline in air quality and environmental visuals, marked by the appearance of smoke, unpleasant odors, and a dirty environment.

Another impact is the disruption of the comfort and quality of life of residents, both in terms of noise due to development activities, reduced aesthetics of the area due to disproportionate spatial planning, and reduced social function of open spaces as places for community interaction and recreation. (Nursanty et al., 2018).

This situation indicates that the suburban area of Kartasura is under pressure from rapid spatial transformation, yet it is not yet fully managed by spatial planning policies or local environmental management systems. The imbalance between development needs and ecological sustainability is a critical issue that requires immediate address through a more participatory, targeted, and data-driven cross-sectoral approach. (Wibowo et al., 2015).



Conclusion

The research shows that converting rice fields into residential areas in the suburban region of Kartasura has significantly decreased the availability of green open space (GOS) and impacted the area's waste management system. This change in land use, which was once mainly productive agricultural land, not only threatens local food security because of less food production land but also causes a reduction in the size and quality of GOS.

Based on observations and analysis, the remaining green open space in the study area has generally experienced a drastic reduction in area, with an average reduction of 65% to 95% depending on the area's characteristics. The remaining green open space largely consists of miniature parks, narrow green lanes, residents' gardens, and shade trees along roadsides or in private areas. The lack of adequate public green space indicates a degradation in the ecological and social function of green open space in suburban areas.

Furthermore, land conversion leads to more waste production, especially in boarding houses and new housing developments that lack proper waste management systems. Environmentally harmful waste disposal methods, like open burning and random dumping, are still common, mainly in crowded areas where residents do not participate much in sanitation efforts. In contrast, wealthy residential and industrial zones have more organized waste management systems, although scattered waste continues to cause pollution in some places.

Thus, this study confirms that the conversion of rice fields in Kartasura has complex ecological, social, and environmental impacts. Therefore, stricter spatial planning policies, integrated green space conservation efforts, and improved community-based waste management systems are needed to create a sustainable suburban area.

References

- Adianti, S. Y. (2020). Perencanaan Tata Ruang sebagai Upaya Mewujudkan Pembangunan Kota Berkelanjutan (Studi Analisis Rencana Tata Ruang Wilayah Kota Mojokerto). *Jurnal Ilmiah Administrasi Publik*, 006(01), 108–117. <https://doi.org/10.21776/ub.jiap.2020.006.01.13>
- Ali, D. M., & Agushi, D. M. (2024). Eco-Islam: Integrating Islamic Ethics into Environmental Policy for Sustainable Living. *International Journal of Religion*, 5(9), 949–957. <https://doi.org/10.61707/gq0we205>
- Amos, S. (2015). Studi pengelolaan sampah berbasis komunitas pada kawasan permukiman perkotaan di Yogyakarta. *Jurnal Wilayah Dan Lingkungan*, 3(1), 27–38.
- Aqsa Tasgheer, & Tehreem Fatima. (2022). Sustainable Development and Natural Resource Management for Environmental Stability: An Islamic Approach. *International Research Journal on Islamic Studies (IRJIS)*, 4(1), 41–56. <https://doi.org/10.54262/irjis.04.01.e03>



- Auwalin, I., Rumayya, & Sukartini, N. I. M. (2024). Environmental Impacts of Green Open Space in Urban Indonesia: A Difference-in-Differences Analysis. *Asian Development Review*, 42(1), 89–116. <https://doi.org/10.1142/S0116110525500039>
- Derysmono, & Kahfi, A. (2025). Islamic Environmental Ethics and Waste-to-Energy Innovation : Insights from the Quran. *Quhas, Journal of Qur'an and Hadith Studies*, 14(1), 134–154. <https://doi.org/10.15408/quhas.v14i1.45155>
- Dharyan, Y., Agil R, M. A., Zoish, S., Fauzi, M., & Simamora, Y. (2025). *Analisis Hukum: Konversi Lahan Pertanian Dan Dampaknya Terhadap Ketahanan Pangan*. 10(7), 1–6.
- Faisal. (2022). Konsep dan Peran Ruang Terbuka Hijau dalam Pembanguna Perkotaan. *REFORM : Jurnal Pendidikan, Sosial, Dan Budaya*, 5(03), 32–40. <https://doi.org/10.70004/reform.v5i03.111>
- Fuady, M., Buraida, Kevin, M. A., Farrel, M. R., & Triaputri, A. (2025). Enhancing Urban Resilience: Opportunities and Challenges in Adapting to Natural Disasters in Indonesian Cities. *Sustainability (Switzerland)*, 17(4), 1–15. <https://doi.org/10.3390/su17041632>
- Idrus, A., Ningsih, B. H., Surhayani, E., Febrianti, I. A., Pinandar, L. S., Reza, M., Ali, I., Piaziuri, L., Saputri, N., Febrianti, R., & Wahyudi, S. (2024). *Formation of A Group of Waste Management Youth In Tanjung Luar Village*, 2(April), 64–69.
- Isbilly, I. El, Amarrohman, F. J., & Firdaus, H. S. (2025). Pemetaan Potensi Pengembangan Kawasan Permukiman Di Kecamatan Jepara Kabupaten Jepara Menggunakan Metode Sistem Informasi Geografis. *Jurnal Geodesi Undip*, 41–47.
- Juwita Silalahi, Ronald Hasibuan, & Immanuel D. B. Silitonga. (2023). Pengaruh Metode Pembelajaran Outdoor Learning Terhadap Keterampilan Menulis Laporan Observasi Siswa Kelas X Sma Negeri 5 Pematang Siantar. *Jurnal Review Pendidikan Dan Pengajaran*, 6(4), 1086–1100.
- Klongrua, S., Umari, K., & Muftahuddin. (2024). Maqasid al-Shariah and Environmental Sustainability: An Islamic Economic Perspective. *Journal Of Kita Kreatif*, 1, 12–19.
- Kurniati, S. A., Rahayu, P., & Istanabi, T. (2022). Peri-Urbanisasi Dan Dinamika Perkembangan Kawasan Perkotaan Sekunder (Studi Kasus: Bosukawonosraten). *Desa-Kota*, 4(2), 167. <https://doi.org/10.20961/desa-kota.v4i2.55247.167-180>
- Kusumastuti, A. C., Kolopaking, L. M., & Barus, B. (2018). Faktor yang Mempengaruhi Alih Fungsi Lahan Pertanian Pangan di Kabupaten Pandeglang. *Jurnal Sosiologi Pedesaa*, 6(2), 130–136.
- Made, N., Wina, A., Yahya, F., Ananda, F. H., & Ekarini, F. (2024). Bagaimana Masyarakat Urban Sampah : Pembelajaran. *Jurnal Program Studi Pendidikan Masyarakat*, 5(1), 431–447.
- Mafruhah, I., Istiqomah, N., & Ismoyowati, D. (2025). *Penerapan Ekonomi Hijau pada Pengelolaan Sampah Rumah Tangga (Organik) Berbasis Pemberdayaan Ekonomi*. 6(2), 1115–1128.



- Mutakin, A., & Waheeda. (2023). Fiqh Ekologi; Upaya Merawat Lingkungan Hidup Berbasis Konsep Maqashid Syariah. *Syariah: Journal of Fiqh Studies*, 1(2), 107–126. <https://doi.org/10.61570/syariah.v1i2.31>
- Nugroho, S., Yuliani, E., & Kautsary, J. (2022). Fenomena Urban Sprawl terhadap Faktor-faktor Perubahan Penggunaan Lahan di Pinggiran Kota. *Journal of Urban and Regional Planning*, 3(1), 1–8.
- Nursanty, E., Alie Syahbana, J., & Suprpti, A. (2018). Using City Branding as the Part of the Intersection Point of Modernization and Tradition. Case Study: Surakarta City (Solo), Indonesia. *SHS Web of Conferences*, 41, 04001. <https://doi.org/10.1051/shsconf/20184104001>
- Pradhana, S. L. (2021). Analisis Perubahan Penggunaan Lahan Kecamatan Kartasura Kabupaten Sukoharjo Tahun 2010 Dan 2020. 167(1), 1–5. <http://eprints.ums.ac.id/id/eprint/96515>
- Pradoto, W., Setiyono, B., Wahyono, H., & Joong Choi, M. (2024). Peri-urbanisation in Surakarta City and Economic Transformation in the Fast-Growing Region of Sukoharjo Regency. *Forum Geografi*, 38(2), 203–221. <https://doi.org/10.23917/forgeo.v38i2.5497>
- Pramitasari, D., & Sarwadi, A. (2015). A Study on Elderly's Going Out Activities and Environment Facilities. *Procedia Environmental Sciences*, 28(Sustain 2014), 315–323. <https://doi.org/10.1016/j.proenv.2015.07.040>
- Prayitno, G., Dinanti, D., Hidayana, I. I., & Nugraha, A. T. (2021). Place attachment and agricultural land conversion for sustainable agriculture in Indonesia. *Heliyon*, 7(7), e07546. <https://doi.org/10.1016/j.heliyon.2021.e07546>
- Putri, I. D., Martanto, R., & Junarto, R. (2024). Dampak Alih Fungsi Lahan Terhadap Ketahanan Pangan, Lingkungan, dan Keberlanjutan Pertanian di Kabupaten Sleman. *Widya Bhumi*, 4(1), 55.
- Putri, N. M., Taroreh, R. D. C., & Rengkung, M. M. (2022). Analisis Perubahan Penggunaan Lahan Pertanian Menjadi Lahan Terbangun Di Kecamatan Lolak Kabupaten Bolaang Mongondow. *Fraktal*, 7(2), 1–8.
- Ramadhan, R., Widiatmaka, W., & Sudadi, U. (2016). Perubahan Penggunaan Lahan Dan Pemanfaatan Ruang Pada Wilayah Rawan Longsor Di Kabupaten Banjarnegara, Jawa Tengah. *Journal of Natural Resources and Environmental Management*, 6(2), 159–167. <https://doi.org/10.19081/jpsl.2016.6.2.159>
- Rohmah, W., Ramadhani, M., & Amri, G. F. (2024). Ketahanan Pangan Kota Surakarta Sebagai Kota Urbanisasi di Jawa Tengah. *Jurnal Bengawan Solo Pusat Kajian Penelitian Dan Pengembangan Daerah Kota Surakarta*, 3(1), 37–44. <https://doi.org/10.58684/jbs.v3i1.46>
- Rusandi, A., Hakim, A., Wiryawan, B., Sarmintohadi, & Yulianto, I. (2021). Pengembangan Kawasan Konservasi Untuk Mendukung Pengelolaan Perikanan yang Berkelanjutan di Indonesia. *Marine Fisheries : Journal of Marine Fisheries Technology and Management*, 12(2), 137–147. <https://doi.org/10.29244/jmf.v12i2.37047>
-



- Setiadi, A. (2015). Studi Pengelolaan Sampah Berbasis Komunitas pada Kawasan Permukiman Perkotaan di Yogyakarta. *Jurnal Wilayah Dan Lingkungan*, 3(April), 27–38.
- Somantri, L. (2022). Pemetaan mobilitas penduduk di kawasan pinggiran Kota Bandung. *Majalah Geografi Indonesia*, 36(2), 95. <https://doi.org/10.22146/mgi.70636>
- Wibowo, A. B., Anggoro, S., & Yulianto, B. (2015). Status Keberlanjutan Dimensi Ekologi Dalam Pengembangan Kawasan Minapolitan Berkelanjutan Berbasis Perikanan Budidaya Air Tawar Di Kabupaten Magelang. *SAINTEK PERIKANAN : Indonesian Journal of Fisheries Science and Technology*, 10(2), 107–113. <https://doi.org/10.14710/IJFST.10.2.107-113>
- Wibowo, B. R. G., Rahayu, P., & Kusumastuti, K. (2024). Peri-urbanisasi dan Perubahan Struktur Ruang Perkotaan di Kawasan Solo Baru. *Desa-Kota*, 6(1), 26. <https://doi.org/10.20961/desa-kota.v6i1.76288.26-41>
- Winarso, H., Hudalah, D., & Firman, T. (2015). Peri-urban transformation in the Jakarta metropolitan area. *Habitat International*, 49, 221–229. <https://doi.org/10.1016/j.habitatint.2015.05.024>



Proceedings of SARIRA:
Said Annual Roundtable on Indonesia and Religious Affairs
Theme: Religion and Ecology for Sustainable Development
Sukoharjo, August 27th - 28th 2025
