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The impact of tourism on land cover change: a case study of star fruit agrotourism in Karangsari, Blitar City, Indonesia

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Abstract

Purpose – This study aims to investigate the complex relationship between star fruit–based agrotourism development, land cover change, and socio-economic dynamics in Karangsari Village, Blitar City, Indonesia. The main objective is to understand the paradox where the economic success of a centralized agrotourism site coincides with the decline of community-owned star fruit yards, which are vital for local identity. The research seeks to integrate spatial-temporal analysis with socio-economic impact assessment within the framework of sustainable rural development.

Design/methodology/approach – This research employs a convergent parallel mixed-method design, combining quantitative spatial analysis with qualitative socio-economic assessment. Quantitative data include GIS-based land cover classification and multi-temporal satellite imagery from 2006, 2014 and 2024. Qualitative data were gathered through semi-structured interviews with 45 community stakeholders, including village officials, farmers, tourism operators and residents, to explore the socio-economic drivers behind land use changes.

Findings – The study reveals substantial conversion of agricultural land, especially star fruit orchards, into residential and commercial areas over the past two decades. Economic incentives, including new tourism-related employment and rising land values, have led residents to perceive land more as a financial asset than an agricultural resource. This shift drives individual decisions to convert or sell land, contributing to the decline of community-based agricultural resources and threatening the authentic identity and sustainability of the agrotourism destination.

Research limitations/implications – The study is geographically limited to Karangsari Village and temporally focused on 2006–2024, which restricts broader generalization. Qualitative findings depend on interview data, subject to possible respondent biases. Further longitudinal and comparative studies are needed to examine long-term social impacts and explore varied agrotourism contexts.

Practical implications – The research recommends adopting incentive-based zoning to protect agricultural land and implementing integrated benefit-sharing schemes that align individual economic benefits with community sustainability goals. These interventions support balanced land use planning, ensuring agrotourism development enhances local livelihoods without degrading cultural and environmental assets.

Social implications – Agrotourism fosters increased community interaction and economic opportunities but may also accentuate social inequalities and dependency on the tourism sector. Inclusive participatory planning and equitable distribution of benefits are crucial to maintaining social cohesion and preserving cultural heritage amid rapid land use transformations.

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Originality/value – This study contributes originality by applying an integrated framework that links sector-specific agrotourism development with spatial and socio-economic transformations at the village scale. It enriches land use and land cover change theory through empirical evidence of feedback loops where centralized tourism success may unintentionally undermine community-based resource sustainability, offering insights for policy and planning in rural tourism development.

Keywords Agrotourism, Environmental, Sustainability, Land cover, Sustainable tourism

Paper type Research article

Introduction

Background research

Land and the environment have a close relationship, where human life cannot be separated from the use of land for various activities, such as agriculture, housing and industry (Utami and Arsi, 2022). Land is a crucial component in human efforts to meet food needs. Changes in land use and cover are landscape phenomena that have a significant impact on the environment, both on a local and global scale (Amri *et al*., 2023; Shang and Wu, 2022). This land cover transformation is a process in which an area undergoes a change in function, which can be permanent or temporary, as a direct result of shifts in the social and economic structure of the community (Arisah, 2021).

In the context of regional planning and development, land cover change is a characteristic that marks the development process of a city or region (Getu and Bhat, 2022). Demographic transition, which is characterized by the movement of the population from rural to urban, has resulted in significant changes in urban land, both in terms of land use and land cover (Long *et al*., 2021). This condition ultimately results in increased competition in land use, so that economic and social needs become the main focus in land use change. Therefore, spatial planning in accordance with regulations is a key factor to achieve efficient land use and support sustainable development.

One of the cities that has experienced an increase in land use competition is Blitar City (BPS Blitar City). The increase in the number of people in Blitar City in recent years has become an important indicator of this phenomenon. According to data from the Central Statistics Agency, the population of Blitar City will reach 159,781 people in 2023, an increase of 18,810 people from 2018 (Al Dousari *et al*., 2022). This rapid population growth has a significant impact on changes in land use patterns and causes a mismatch between land needs and availability (Ndofah and Santosa, 2023).

Although many studies have analyzed land-use changes due to urbanization in general, there is a gap in the deep understanding of how the development of specific sectors such as agrotourism – as a driver of the local economy – directly reshapes the physical and social landscape at the village level (Jiang *et al*., 2021; Kalfas *et al*., 2023). Many studies tend to focus on the economic impact of tourism or land cover change separately. This study seeks to fill this gap by integrating spatial-temporal analysis of land cover change with the socio-economic impact that is directly felt by the community (Simamora and Sarjono, 2022).

Karangsari Village in Blitar City was chosen as a relevant case study for several reasons. First, this area is the location of Star Fruit Agrotourism which has become an icon of Blitar City and is experiencing rapid development that attracts residents from other regions to be involved in economic activities (Prayudhi and Sativa, 2021). Second, the region faces urbanization pressures characterized by a significant increase in population, which increases competition and problems related to land demand. Third, there is a contradictory phenomenon between the success of agrotourism as a tourist destination and the decline of star fruit yards owned by residents, which is a challenge to the sustainability of local identity (Diaudin, 2022; Sari *et al*., 2022). The combination of agrotourism growth, urbanization pressures, and sustainability challenges makes Karangsari an ideal laboratory to study the impact of tourism on land cover change.

To understand these dynamics, the use of Geographic Information Systems (GIS) and remote sensing data is crucial to accurately identify and map land cover changes over time (Das and Angadi, 2022; Pandey *et al*., 2021). Therefore, it is crucial to conduct studies that can

provide sustainable solutions for land use planning in Karangsari Village by considering ecological and social aspects. Specifically, this study aims to: (1) analyze the spatial changes in land cover in Karangsari Village during the periods 2006, 2014, and 2024, and (2) examine the socio-economic impact of agro-tourism development on the dynamics of these changes (Lahay and Koem, 2022; Latue and Rakuasa, 2023).

Literature gaps and research justification

Previous studies examining LULCC have primarily focused on urban expansion and deforestation, with limited attention to sector-specific drivers such as agrotourism development. Existing tourism impact research often separates economic and environmental analyses, failing to capture the integrated nature of land transformation processes. Furthermore, most land cover change studies employ broad temporal scales (10–20 years), potentially missing critical transition periods during initial tourism development phases.

Identified research gaps.

(1) Limited understanding of how agrotourism specifically reshapes rural landscapes at the village level

(2) Insufficient integration of spatial-temporal analysis with socio-economic impact assessment

(3) Lack of theoretical frameworks linking LULCC theory with sustainable tourism development

(4) Minimal focus on the role of agricultural intensification alongside tourism expansion

This study addresses these gaps by applying the Land Systems Science framework to understand how agrotourism development creates coupled human-natural system changes, integrating LULCC theory with sustainable tourism development frameworks to analyze village-level transformation dynamics.

Literature review / theoretical background and hypotheses development

Agrotourism, as a form of tourism that integrates agricultural activities with tourism experiences, has been shown to have a significant impact on land cover change in various regions. Based on a number of previous studies, the increase in tourism activities often leads to the conversion of agricultural land into commercial land or tourism infrastructure, which has the potential to change local ecosystems and affect biodiversity. In the context of Karangsari Village, Blitar City, the development of star fruit-based agrotourism is not only expected to be able to increase the income of local communities, but also present challenges in maintaining environmental sustainability.

Land cover change theory

Land cover change is a dynamic process that occurs due to the interaction between human activities and environmental factors (Roy *et al*., 2022). Theoretically, land cover change can be explained through the concept of land use and land cover change (LULCC), which includes physical transformations on the earth's surface due to human activities such as urbanization, agriculture, and tourism (Haindongo *et al*., 2022). According to Allan *et al*. (2022), these changes are usually influenced by direct drivers such as infrastructure development and economic zone expansion, as well as indirect drivers such as government policies, population growth, and changes in consumption patterns. In the context of tourism, especially agrotourism, tourism activities often lead to the conversion of agricultural land into commercial or recreational facilities, which has the potential to change the structure of local ecosystems and affect environmental sustainability (Marzuki *et al*., 2024).

The impact of land cover change on the environment is very diverse, ranging from declining soil quality, and changes in hydrological patterns, to reduced biodiversity. Landscape ecology theory emphasizes that changes in land cover can disrupt ecosystem connectivity and lead to habitat fragmentation, which negatively impacts overall ecosystem function (Lasaiba, 2024). In addition, adaptive complex systems theory suggests that land cover changes are often non-linear, where their impacts are difficult to predict because they involve many interacting variables (Shi *et al*., 2021). In spatial-based research, the use of technologies such as satellite imagery and geographic information systems (GIS) has become an important tool to analyze land cover change patterns and understand the relationship between human activities and environmental dynamics. Therefore, managing land cover change requires a holistic approach that considers social, economic, and ecological aspects to achieve long-term sustainability (Long *et al*., 2021).

Impact of tourism development on the surrounding environment

The impact of agrotourism-based tourism on the environment around the development area can be seen from various perspectives. Agrotourism, which combines agriculture with tourism experiences, has not only the potential to provide economic benefits for local communities, but can also pose challenges to environmental sustainability (Khanal *et al*., 2024). Research conducted by Samuel (2023) shows that although agrotourism can increase community income and encourage the conservation of natural resources, there is a risk of dependence on the tourism sector and the negative impacts that arise due to the temporary tourist season. In addition, the development of infrastructure to support agrotourism often leads to the conversion of agricultural land into commercial land, which can alter local ecosystems and affect biodiversity (Sgroi, 2022).

On the other hand, research on agro-tourism development conducted by Handri *et al*. (2025) shows that community involvement in agro-tourism management can strengthen positive impacts on the environment. People who are active in agro-tourism management tend to be more concerned about environmental conservation and sustainable management of natural resources (Haryanto and Sarjan, 2025). However, to achieve this goal, it is necessary to improve supporting facilities and infrastructure, including good sanitation and accessibility facilities. With the right approach, agrotourism-based tourism can not only provide economic benefits but also contribute to environmental preservation and social sustainability in the region (Anton and Sarjan, 2024).

Agrotourism and rural development

Agrotourism represents a specialized form of rural tourism that combines agricultural production with visitor experiences. Research shows agrotourism can provide economic diversification for rural communities while preserving agricultural landscapes and cultural heritage. However, agrotourism development also creates tensions between agricultural production and tourism service provision, potentially leading to land use conflicts and environmental pressures. The concept of agricultural intensification alongside tourism development has received limited attention in existing literature, representing a key knowledge gap this study addresses.

Indonesian context

Indonesia's rural areas are experiencing rapid transformation driven by economic development and tourism growth. Previous studies in Indonesia have documented significant LULCC in tourism destinations, but most focus on mass tourism or coastal areas rather than rural agrotourism. The Indonesian context is particularly relevant due to:

(1) High dependence on agriculture in rural economies

(2) Rapid tourism sector growth

(3) Limited land use planning enforcement

(4) Strong community involvement in tourism development

A conceptual model of agrotourism-induced land system change

Based on the preceding theoretical discussion, this study proposes a conceptual model to visualize the relationships between the key variables and to structure the analysis. This model, which replaces the simple textual framework of the original manuscript, illustrates a complex system with a critical feedback loop. The process can be conceptualized as follows:

(1) The development of agrotourism serves as the primary independent variable and a fundamental underlying driver of change in the Karangsari land system.

(2) This development directly initiates a set of proximate drivers, such as the construction of tourism facilities, the upgrading of roads, and the conversion of land for commercial purposes (e.g. shops, parking).

(3) These proximate actions result in quantifiable land cover change, characterized by a decrease in agricultural and vegetated cover and an increase in built-up and impervious surfaces. The analysis of this link is designed to test Hypothesis 1 (H1).

(4) Simultaneously, the development of agrotourism generates a suite of socio-economic impact. These include positive impacts like new job creation and increased household income, but also transformative impacts like a rapid increase in land values and a shift in community perceptions about the relative value of farming versus tourism-related activities.

(5) These socio-economic impacts, in turn, directly influence the land use decisions made by individual households. Faced with new economic realities, households may choose to convert their private star fruit yards to more profitable uses or sell their land. The analysis of this causal chain is designed to test Hypothesis 2 (H2).

(6) Finally, the cumulative effect of these individual decisions – the decline of the distributed star fruit yards – creates a negative feedback loop. This erosion of the community's primary agricultural asset threatens the destination's authentic "star fruit village" identity, which could ultimately undermine its long-term market appeal and ecological and social sustainability.

This conceptual model provides a clear, theory-driven roadmap for the research, linking the overarching driver of agrotourism to its ultimate, and paradoxical, consequences for the local land system.

Research hypothesis

H1. There is a significant change in land cover due to the development of star fruit agrotourism in Karangsari Village, Blitar City.

H2. The socio-economic impact of agro-tourism affects land use patterns in the research area of Karangsari Village, Blitar City.

Methods

Research design and theoretical foundation

This study employs a mixed-methods convergent parallel design, integrating quantitative spatial analysis with qualitative socio-economic assessment. The methodology is grounded in

land systems science approaches that examine coupled human-natural systems, combining remote sensing analysis with community-based research.

Ontological Basis: This research adopts a pragmatic ontology, recognizing that land cover change results from complex interactions between physical processes and human decisions. The approach aligns with established LULCC research methodologies that integrate spatial analysis with socio-economic investigation.

Study area

This research was conducted in Karangsari Village, located in the Sukorejo District of Blitar City, Indonesia. The village covers an area of approximately 88.24 hectares and is administratively divided into six Neighborhood Units (Rukun Warga). Karangsari was selected as the case study site because it represents an ideal natural laboratory for investigating the complex impacts of agrotourism. The village is characterized by a unique confluence of factors that make it particularly well-suited for this research:

(1) Prominent Agrotourism Destination: Karangsari is the location of the Star fruit Agrotourism site, a well-established and successful venture that has become an icon for Blitar City, attracting significant visitor numbers and driving local economic activity. This provides a clear and powerful economic driver to study.

(2) Urbanization Pressure: The village is situated within Blitar City and is subject to the pressures of urbanization, including rapid population growth and increasing competition for land resources, which mirrors broader regional and global trends.

(3) The Central Paradox: Most importantly, Karangsari clearly exhibits the central paradox motivating this study: the documented success and growth of the formal agrotourism area is occurring alongside a visible decline in the community's privately-owned star fruit yards, which are fundamental to the village's identity.

This combination of a successful, centralized agrotourism project, external urbanization pressures, and an internal sustainability challenge provides a rich and relevant context for examining the nuanced and often contradictory impacts of tourism on land cover and socio-economic dynamics.

Data collection methods

The data collection method in this study uses a combination of secondary and primary data to obtain a comprehensive understanding of the dynamics of land cover change in Karangsari Village.

(1) Secondary Data

Secondary data on which the analysis of land cover change is based includes high-resolution satellite imagery from Google Earth. This image is used to document the factual condition of land cover in three time periods, namely 2006, 2014, and 2024. This data serves as the main input to identify and map changes in land cover over time.

Satellite Imagery Sources:

- 2006: Landsat 5 TM (30m resolution)
- 2014: Landsat 8 OLI (30m resolution)
- 2024: Sentinel-2 MSI (10m resolution)

(2) Primary Data

Primary data collection is carried out through two approaches:

- Quantitative Data Collection and Field Validation

Primary quantitative data were collected through structured surveys and detailed field observations. This phase aimed to validate the interpretation of land use maps derived from satellite imagery, ensuring that the spatial analysis

accurately reflects actual on-the-ground conditions. Field validation enhances the precision of land cover classification and supports robust change detection analysis over time.

- Qualitative Data Collection: Semi-Structured Interviews

  To explore the socio-economic impacts of agrotourism development deeply, we conducted semi-structured interviews with 45 respondents representing diverse community stakeholders:

  Village officials ($n = 8$): Local government representatives involved in planning and governance

  Farmers ($n = 15$): Both traditional agricultural producers and those engaged in tourism-oriented agriculture

  Tourism operators ($n = 12$): Agrotourism business owners and guides managing tourism services

  Community members ($n = 10$): Residents affected by tourism development activities

The interview framework was developed based on sustainable tourism theory and focused on three main impact dimensions:

Economic impacts: Changes in household income, employment opportunities, and cost of living

Environmental impacts: Alterations in agricultural practices, resource use, and pollution levels

Socio-cultural impacts: Effects on community cohesion, cultural preservation, and lifestyle changes. To explore the socio-economic impact of agrotourism development, qualitative primary data were collected through interviews with local communities. This method allows researchers to obtain in-depth information directly from the source regarding the influence of agrotourism on increasing community income and creating new job opportunities.

Analysis methods

The analysis stages in this study include land cover classification and analysis of land cover changes. These two stages are carried out using a Geographic Information System (GIS)-based approach. The selection of this GIS method was carried out in accordance with the research needs to analyze spatial data comprehensively. The use of GIS allows researchers to visualize, analyze, and interpret geographic data related to land use and its changes over time. This method facilitates a deeper understanding of spatial dynamics in the research area, thereby providing better insight into the factors influencing land cover change in Karangsari Village.

(1) Land cover classification

The first stage in this study is to classify land cover in Karangsari Village. This process entails analyzing land cover in several different (multi-temporal) time dimensions, using satellite imagery obtained from Google Earth for 2006, 2014, and 2024. The imagery has been adapted to the appropriate coordinate system, allowing researchers to manually delineate land cover using visual interpretation techniques based on visible characteristics.

Interpretation is carried out by classifying the land cover seen in the image, starting with the process of visual interpretation and on-screen digitization. Land cover classification in Karangsari Village was carried out by manually digitizing land cover classes for each multitemporal image data. This process refers to the Indonesian National Standard (SNI) numbered SNI 7645–1:2014 which regulates the classification of land cover, so that the

classification results are reliable and in accordance with applicable standards. Thus, this study aims to provide an accurate picture of land cover changes in Karangsari Village during the specified period.

(2) Land use change analysis

This study uses a comparative method of land cover maps that have been validated from three time periods: - 2006, 2014, and 2024, - to analyze land cover changes. This analysis is carried out by applying overlay techniques in the Geographic Information System (GIS). The overlay method is one of the spatial analysis techniques that can be implemented using spatial data processing software such as ArcGIS. The basic principle of this technique is to stack one map on top of another, along with all the attributes contained in it, to generate new visualizations and data. Using this method, researchers can.

- Visually compare land cover between periods
- Identify areas of change
- Quantify land cover changes over a period of time

The use of GIS overlay techniques facilitates a comprehensive analysis of the dynamics of land cover change in Karangsari Village for almost two decades. The results of the overlay analysis process produced a map of land cover change in the study area, which depicts the spatial distribution of areas that have changed or remained in land use. In addition to spatial visualization, this analysis also produces statistical data on land cover changes for each period studied. This study provides detailed information about the types of land cover changes, the area that has changed, the spatial distribution of changes, and the trend of land cover change in Karangsari Village. The output of the overlay analysis comprehensively answers the main objective of the study, which is to analyze the dynamics of land cover change in Karangsari Village over a period of almost two decades, and provide an in-depth understanding of the pattern and intensity of land use change in the area.

(3) Qualitative Data Analysis

Qualitative data obtained from the interview results were analyzed using thematic analysis methods. This process involves several stages: (1) transcription of all interview recordings, (2) in-depth reading of transcripts for data familiarization, (3) creation of initial codes of relevant information, (4) grouping of the codes into larger themes, and (5) interpretation of these themes to explain the socio-economic impacts of agrotourism development. This analysis provides an in-depth understanding that complements the quantitative findings from the analysis of land cover change.

Results

The development of land cover in Karangsari Village was analyzed through the processing of high-resolution satellite images covering 2006, 2014, and 2024. Validation of processing results is carried out through field observation to ensure data accuracy. The process of digitization and interpretation of satellite images is the basis for understanding land cover changes in Karangsari Village, Blitar City, over the past 20 years. Land cover data is classified into five categories in accordance with SNI 7645:2010, namely residential land cover, non-agricultural areas, agricultural areas, open land, and waters.

The analysis of land cover development was carried out with spatial, tabular, and descriptive approaches. This approach allows researchers to get a more comprehensive picture of land use dynamics in the region. Thus, the results of this study are expected to provide valuable information for the planning and management of land resources in Karangsari Village and support sustainable development policies.

Land use of Karangsari Village in 2006

In 2006, land cover in Karangsari Village showed a clear dominance by urban residential buildings. The area of residential areas reaches 26.94 hectares, which is equivalent to 30.52% of the total area. This reflects the significant urbanization development in the region, where the need for housing is increasing as the population grows. Land use in Karangsari Village in 2006 can be seen in Table 1.

In addition to settlements, other land cover also has a significant contribution. Fields, as a type of land cover, cover an area of 20.58 hectares, which contributes 23.31% to the total land cover. The existence of this field shows that despite the development of urbanization, the agricultural sector still plays an important role in land use in Karangsari Village.

However, the least land cover found is shrubs, which only cover an area of 2.03 hectares, or about 2.30% of the total area. This small percentage indicates that the natural area and wild vegetation in the area have been reduced due to the conversion of land for settlement and agricultural purposes. Further research is needed to understand the impact of this land cover change on the ecosystem and well-being of local communities.

Land use of Karangsari village in 2014

In 2014, land cover in Karangsari Village showed that urban residential buildings dominated land use, with an area of 28.83 hectares, which is equivalent to 32.66% of the total area. This dominance reflects the continuing urbanization trend, where the need for housing is increasing as the population grows and the economic development of the region continues. Land use in Karangsari Village in 2014 can be seen in Table 2.

In addition to settlements, another significant land cover is star fruit orchards, which cover an area of 13.97 hectares, or about 15.83%. The existence of this garden shows that despite the pressure to develop residential areas, the agricultural and horticultural sectors remain an important part of land use in Karangsari Village. Star fruit orchards not only contribute to the local economy but also serve as a source of food for the community.

On the other hand, the land cover with the smallest area is the Karangsari agro-tourism area, which is only 0.35 hectares or 0.40%. This very small percentage indicates that agro-tourism development is still in its early stages and requires more attention to increase the potential of the area. Further research is needed to explore opportunities for agrotourism development as an alternative land use that can support economic and environmental sustainability in Karangsari Village.

Table 1. Land use area in Karangsari village in 2006

Land cover	Broad (Ha)	Presented (%)
Urban residential building	26.94	30.52%
Industry	3.11	3.52%
Road	3.24	3.67%
Blimbing fruit garden	10.49	11.88%
Field	20.58	23.31%
Yards	12.31	13.94%
Funeral	3.92	4.44%
Trade	5.65	6.40%
Bush	2.03	2.30%
Total area	88.26	100.00%

Source(s): Curated by the author himself based on the results of ArcGIS analysis

Table 2. Land use area in Karangsari village in 2014

Land cover	Broad (Ha)	Presented (%)
Karangsari agrotourism	0.35	0.40%
Urban residential building	28.83	32.66%
Industry	4.01	4.54%
Road	3.24	3.67%
Blimbing fruit garden	13.97	15.83%
Field	10.59	12.00%
Yards	13.73	15.56%
Funeral	3.58	4.06%
Trade	6.22	7.05%
Paddy	1.47	1.67%
Bush	2.27	2.57%
Total area	88.26	100.00%

Source(s): Curated by the author himself based on the results of ArcGIS analysis

Land use of Karangsari Village in 2024

In 2024, land cover in Karangsari Village will still be dominated by urban residential buildings, which cover an area of 30.56 hectares, or around 34.62% of the total area. This increase shows a sustainable trend in urbanization, where the need for housing continues to increase in line with population growth and economic development in the region. Land use in Karangsari Village in 2024 can be seen in Table 3.

In addition to settlements, star fruit orchards also show a significant contribution to land cover, with an area of 15.94 hectares, or 18.06%. The existence of this garden emphasizes the importance of the agricultural sector in supporting the local economy and providing food sources for the community. Star fruit orchards also play a role in strengthening the agricultural identity of Karangsari Village.

Meanwhile, the Karangsari agro-tourism area recorded an area of 0.50 hectares, or 0.56%, which showed an increase compared to the 2014 data. This increase reflects more attention to the development of agro-tourism in the region. The support from the community yard land also contributes to the development of Karangsari Village as a star fruit agro-tourism production center in Blitar City. This shows great potential to integrate agriculture and tourism to improve the welfare of local communities. The dynamics of land change in Karangsari Village from 2006, 2014 and 2024 that have been analyzed and visualized with ArcGIS can be seen in Figure 1.

Table 3. Land use area in Karangsari village in 2024

Land cover	Broad (Ha)	Presented (%)
Karangsari agrotourism	0.50	0.56%
Urban residential building	30.56	34.62%
Industry	4.04	4.57%
Road	3.24	3.67%
Blimbing fruit garden	15.94	18.06%
Field	6.97	7.90%
Yards	12.45	14.11%
Funeral	3.65	4.14%
Trade	6.16	6.98%
Paddy	3.16	3.59%
Bush	1.59	1.80%
Total area	88.26	100.00%

Source(s): Curated by the author himself based on the results of ArcGIS analysis

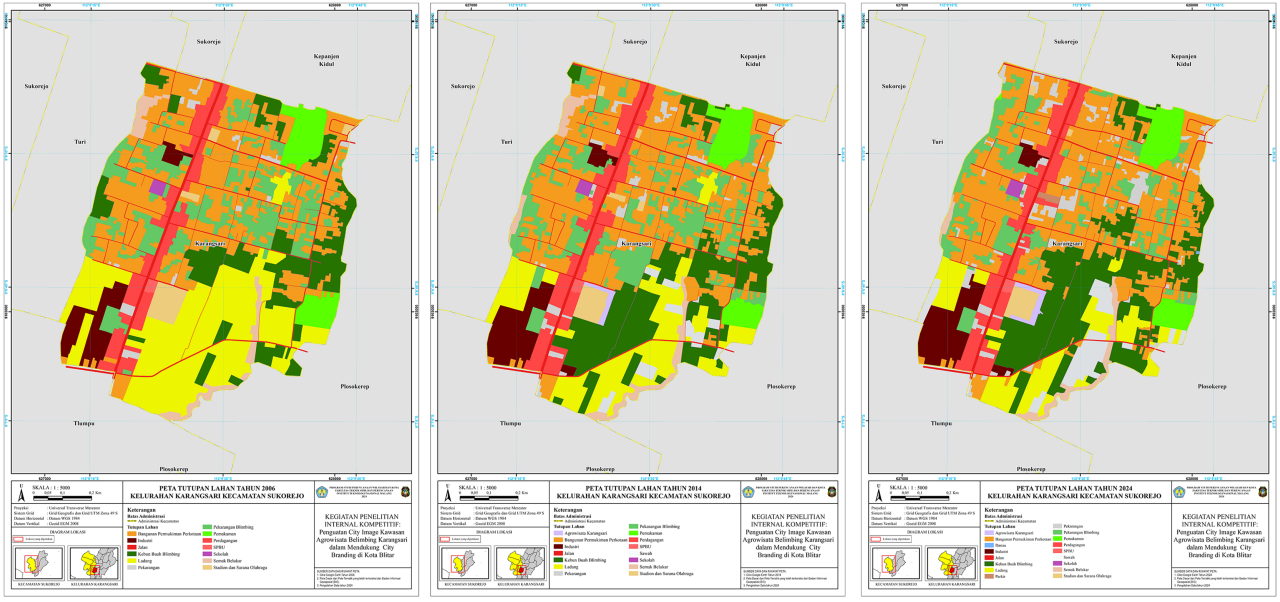

Figure 1. Land use map of Karangsari Village, Blitar City, Indonesia (In order from left to right, from 2006, 2014, and 2024). Source: Created by the author himself based on the results of ArcGIS analysis and visualization

Discussions

Land changes in Karangsari Village 2006 – 2024

The development of land cover in Karangsari Village from 2006, to 2014, to 2024 shows significant dynamics, both in terms of area and type of land cover. Based on the results of processing high-resolution satellite images validated by field observations, land use changes in this area are dominated by the transition from vegetated land to build land. This reflects the pressure of urbanization due to increasing population growth. One of the changes that stands out is the transformation of fields into an agriculture-based tourist area, namely Karangsari star fruit agrotourism.

In 2006, the area that is now star fruit agrotourism was still in the form of fields without tourist activities. However, as time goes by, in 2024 the area has developed into an expanse of star fruit plantations that are integrated with the concept of tourism. The increase in the area of star fruit plantations is also obvious, with an area of 15.94 hectares in 2024 compared to before. This development not only provides economic benefits through increasing the income of local communities but also strengthens the identity of Karangsari Village as the center of star fruit production in Blitar City. Table 4 shows the area and percentage of land cover changes in Karangsari Village from 2006, 2014 and 2024. The condition of land change in visualization can be seen in Figure 2 which shows the trend of land change at the research site.

Land changes in star fruit agrotourism in Karangsari Village show significant development from year to year. However, this phenomenon is inversely proportional to the condition of the community's star fruit yards, which have experienced a wide decline. This decline has a big impact on the branding of Star Fruit Agrotourism, which was previously closely related to the distribution of star fruit in the yards of residents' houses. This raises concerns that the rapid development of agro-tourism is not balanced with the sustainability of local resources, which is the foundation of the agro-tourism identity.

Based on the analysis of land use changes over an 18-year period (2006–2024), there has been a substantial transformation in land cover in Karangsari Village. Significant increases occurred in built-up areas, especially in the form of urban settlements, reflecting the increasing pressure of urbanization. At the same time, there has been a decrease in the area of grasslands and shrubs, as well as the conversion of agricultural land such as rice fields and fields on a medium scale. These changes represent a major challenge to the sustainability of the agriculture and agro-tourism sectors, given the importance of maintaining a balance between the development of built-up land and the preservation of agricultural land. Figure 3 shows a graph of land changes in Karangsari Village on star fruit plantation land and house yards that are used as places to grow star fruit.

In this context, the development of star fruit agrotourism needs to be carried out with a more integrated and sustainable strategy. It is important to involve communities in the planning and management process so that they can contribute to the development of agro-tourism without sacrificing their yards. Thus, the existence of agrotourism will not only improve the welfare of the community but also maintain the identity and sustainability of the environment in Karangsari Village.

These findings directly support Hypothesis 1 (H1), which states that there has been a significant change in land cover due to agrotourism development. The transformation of the moors into agro-tourism areas and the increase in built-up land by 3.62 hectares from 2015 to 2025 (from 26.94 ha to 30.56 ha) are quantitative evidence of this change. These findings are in line with research by Sgroi (2022) and Marzuki *et al*. (2024), who also found that tourism development often triggers the conversion of agricultural land into commercial and tourism infrastructure. Theoretically, this confirms the concept of Land Use and Land Cover Change (LULCC), where economic drivers such as tourism become the main agents of landscape change.

Table 4. Land cover change in Karangsari village (2006–2024)

Land cover	Area (Ha) 2006	Area (%) 2006	Area (Ha) 2014	Area (%) 2014	Area (Ha) 2024	Area (%) 2024	Total change (Ha) 2006–2024	Total change (%) 2006–2024
Karangsari agrotourism	26.94	30.52%	28.83	32.66%	30.56	34.62%	+3.62	+13.44%
Urban residential building	0.00	0.00%	0.35	0.40%	0.50	0.56%	+0.50	0.56%
Industry	3.11	3.52%	04.01	4.54%	04.04	4.57%	+0.93	+29.90%
Road	3.24	3.67%	3.24	3.67%	3.24	3.67%	0.00	0.00%
Blimbing fruit garden	10.49	11.88%	13.97	15.83%	15.94	18.06%	+5.45	+51.95%
Field	20.58	23.31%	10.59	12.00%	6.97	7.90%	−13.61	−66.13%
Yards	12.31	13.94%	13.73	15.56%	12.45	14.11%	−0.86	−6.99%
Funeral	5.65	6.40%	6.22	7.05%	6.16	6.98%	+0.51	+9.03%
Trade	0.00	0.00%	1.47	1.67%	3.16	3.59%	+3.16	3.59%
Paddy	3.92	4.44%	3.58	4.06%	3.65	4.14%	−0.27	−6.89%
Bush	02.03	2.30%	2.27	2.57%	1.59	1.80%	−0.44	−21.67%
Total area	88.26							100.00%

Source(s): Curated by the author himself based on the results of ArcGIS analysis

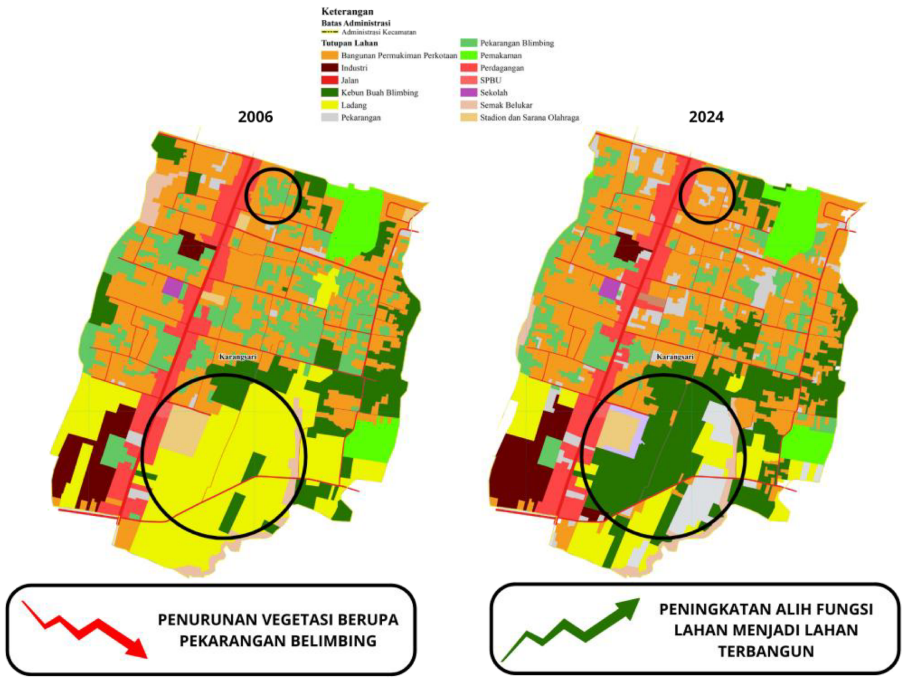

Figure 2. Land change trends in Karangsari Village, Blitar City in 2006–2024 (In order from left to right, from 2006, 2014, and 2024). Source: Created by the author himself

Economic impact of star fruit agrotourism

The existence of Karangsari Star Fruit Agrotourism in Karangsari Village, Blitar City has had a significant positive impact on the local economy. This agro-tourism creates income opportunities for the community through various economic activities, such as the sale of

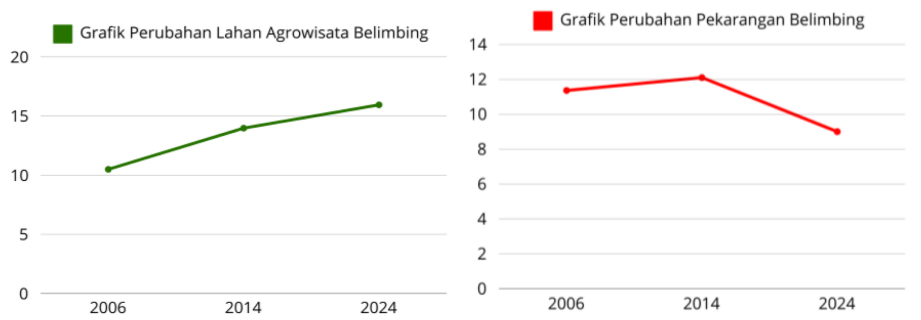

Figure 3. Land change graph in Karangsari Village, Blitar City in 2006–2024 (From the left is the Growth Trend of Agrotourism Area and the right is the Trend of Declining Yard Area). Source: Created by the author himself

star fruit, processed star fruit products, and tourism services. In addition, the development of this tourist area also encourages the growth of local MSMEs that provide food, drinks, and souvenirs for visitors. Improving local infrastructure, such as roads and public facilities, also facilitates accessibility and supports the economic activities of the surrounding community.

The majority of residents of Karangsari Village work as star fruit farmers, both through the management of private yards and cultivation in agro-tourism areas. In the agro-tourism area, there are around 33 farmers who rent land to cultivate star fruit to support fruit-picking tourism activities. In addition, some people have turned into food and souvenir traders around the tourist area, which further expands the economic impact of this agro-tourism. However, the decrease in the area of the community's star fruit yard is a challenge for the branding of Star Fruit Agrotourism as a typical star fruit village. The distribution of community work in Karangsari Village is shown in the graphical visualization in Figure 4.

Although the resulting economic impact is considerable, challenges remain in ensuring the sustainability of agro-tourism development. Economic dependence on tourist visits can be a risk if the number of visitors decreases due to external factors such as weather or pandemics. In addition, the inequality of benefits between business actors in agro-tourism areas and the general public needs to be overcome so that the positive impact can be felt equally. Development strategies involving modern technology and collaboration with various parties, such as travel agents, can help overcome these challenges while strengthening the potential of the local economy.

These economic impacts contribute to land-use change, which supports Hypothesis 2 (H2). Increased economic opportunities drive demand for land for settlements and businesses, which is reflected in the increase in the area of urban residential buildings. However, this phenomenon also creates a dilemma, where the economic success of agrotourism actually leads to a decrease in the area of community-owned star fruit yards, a finding that highlights the potential for conflict between short-term economic incentives and long-term resource sustainability, in line with the warnings from Samuel (2023) regarding the risk of dependence on the tourism sector.

Social impact of star fruit agrotourism

The development of star fruit agrotourism in Karangsari has a significant social impact on the local community. One of the positive impacts is the increase in social interaction among residents. With agro-tourism activities, the community has the opportunity to collaborate in various businesses, such as the management of star fruit plantations and the provision of tourism services. This interaction not only strengthens the relationship between citizens, but also creates a sense of togetherness and solidarity in managing local resources. This joint

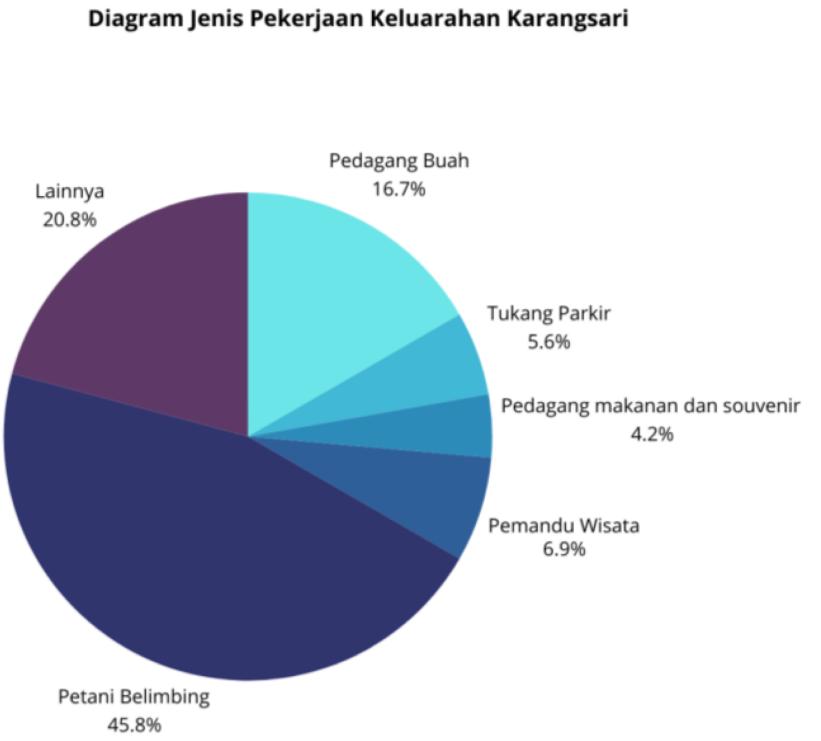

Figure 4. Distribution of community work in Karangsari Village, Blitar City. Source: Created by the author himself visualized with Ms. excel

activity can increase the sense of ownership of the agro-tourism area, so that the community is more motivated to maintain and preserve the surrounding environment.

On the other hand, star fruit agrotourism also contributes to increasing public awareness of the importance of environmental education. Through educational tourism activities, visitors and local communities can learn about sustainable agricultural practices and environmental conservation. This encourages people to be more concerned about the sustainability of natural resources and adopt environmentally friendly agricultural methods. With this increase in knowledge, it is hoped that a generation will emerge who is more aware of the importance of maintaining a balance between economic development and environmental sustainability.

However, challenges remain in the development of star fruit agro-tourism, especially related to the inequality of benefits that may occur. Not all members of the community get the same benefits from this agrotourism activity, so it can cause social jealousy. Therefore, it is important for agrotourism managers to ensure that the economic and social benefits of agrotourism can be felt equally by all levels of society. Involving the community in decision-making and planning for agro-tourism development is the key to creating a positive and sustainable social impact for Karangsari Village.

Theoretical implications

This study offers significant theoretical advancements that enrich the understanding of Land Use and Land Cover Change (LULCC) in the context of sector-specific tourism development, particularly agrotourism, and provides nuanced insights into sustainable tourism and rural development theories.

(1) Enriching LULCC Theory through Sector-Specific Tourism Development

Our findings demonstrate that agrotourism drives distinct land transformation patterns that differ from typical urban expansion or agricultural abandonment scenarios commonly found in LULCC studies. Specifically, we identify three key theoretical insights:

- Agricultural Transition Complexity: Instead of a straightforward loss of agricultural land, agrotourism induces a dual dynamic characterized by both general conversion of agricultural fields and concurrent crop specialization. This challenges traditional linear agricultural transition models and supports multi-pathway agricultural development theory, which posits that agricultural landscapes can simultaneously experience diversification and intensification processes.
- Tourism-Driven Land Use Intensification: The substantial 51.95% increase in star fruit cultivation illustrates how agrotourism can drive agricultural intensification rather than abandonment. This insight adds complexity to debates on tourism's role in rural development, showing that tourism may incentivize the enhancement of specific agricultural products aligned with tourist demand.
- Controlled Development Patterns: Unlike the rapid and often uncontrolled urban expansion documented in many Indonesian rural contexts, the Karangsari case exhibits gradual and managed urban growth (13.43% increase over 18 years). This suggests the effectiveness of community-based tourism planning in moderating land use change rates to balance development and sustainability.

(2) Complex Feedback Mechanisms and Sustainable Development Nuances

Beyond conventional LULCC theory that highlights economic drivers as primary causes of land cover change, our study reveals critical secondary impacts and feedback loops within agrotourism systems:

- The success of formal agrotourism initiatives paradoxically contributes to the decline of informal agricultural land, such as resident-owned star fruit yards that underpin the community's agricultural identity. This phenomenon underscores the nuanced dynamics described in sustainable development theory, where centralized tourism assets may inadvertently erode distributed, community-based resources foundational to the destination's cultural and economic fabric.
- This feedback mechanism challenges practitioners and scholars to reconsider how centralized development approaches might undermine the very local resources and identities that constitute authentic and sustainable tourism offerings.

(3) Contributions to Tourism Economics and Sustainable Tourism Models

Empirically, the study highlights a duality in agrotourism's economic impacts – acting simultaneously as an engine for local economic growth and as a potential source of economic dependency with resource pressures:

- On one hand, agrotourism catalyzes income generation, job creation, and economic diversification, affirming established tourism development theories that emphasize tourism's role as a growth sector in rural economies.
- On the other hand, the economic gains are accompanied by risks such as overreliance on tourism markets, potential depletion or transformation of local resources, and uneven benefit distribution. These tensions call for a deeper integration of social justice and environmental sustainability perspectives into sustainable tourism development models.

Overall, this study extends theoretical frameworks by:

(1) Illustrating how agrotourism-triggered LULCC involves complex, sometimes paradoxical land and socio-economic dynamics.

(2) Advocating for nuanced sustainable tourism models that address the intricacies of economic dependency, resource management, and community empowerment.

(3) Encouraging community-based governance and planning to achieve balanced land use transitions and equitable tourism benefits.

Policy and management implications for sustainable agrotourism development

Sustainable agrotourism development in villages like Karangsari requires integrated land use planning that balances agricultural preservation with controlled tourism growth. Effective zoning regulations are essential to protect remaining farmland while allowing strategically planned tourism infrastructure, preventing uncontrolled land conversion that could harm local ecosystems and food production. Support for agricultural intensification through technical assistance and market development further helps maintain productivity amid evolving land use pressures.

Infrastructure development must prioritize sustainability by focusing on efficient water management and waste treatment systems to safeguard environmental quality and support both farming and tourism activities. In tourism management, implementing visitor carrying capacity limits is vital to avoid environmental degradation, while equitable benefit-sharing mechanisms can reduce social inequality and mitigate overdependence on tourism. Preserving local culture through dedicated programs helps maintain authentic agrotourism experiences and strengthens community identity.

Institutionally, fostering multi-stakeholder governance frameworks that integrate tourism and agriculture planning enhances coordination among government, communities, and businesses. Developing robust monitoring systems enables real-time tracking of environmental and social impacts to inform adaptive management. Simultaneously, capacity-building initiatives empower community members with skills and knowledge in tourism management, ensuring inclusive participation and long-term sustainability.

Together, these strategic policy and management approaches create a holistic framework for sustainable agrotourism that supports economic growth, environmental stewardship, and social cohesion. By adopting such integrated measures, Karangsari and similar rural areas can effectively harness agrotourism's benefits while mitigating risks, aligning local development with broader sustainability and climate resilience goals.

Sustainable tourism development implications and managerial recommendations

In light of these sustainability implications, several managerial recommendations are proposed for local governments, agrotourism managers, and community members to ensure the long-term viability and positive impact of agrotourism development:

(1) Effective Marketing Strategies

Agrotourism managers should develop targeted promotional campaigns that emphasize the uniqueness of local products, such as star fruit, and the authentic experiences offered. Leveraging social media platforms and digital marketing can broaden outreach and raise awareness among potential visitors, thus increasing tourist inflow and supporting economic growth.

(2) Human Resource Development

Training programs and educational initiatives for local residents are crucial to enhance skills in good agricultural practices, business operations, and customer service. Elevating service quality not only improves visitor satisfaction but also strengthens the community's capacity to manage tourism sustainably.

(3) Strengthening Community Collaboration

Close cooperation between agrotourism operators and local farmers must be fostered to establish mutually beneficial systems. Engaging the community actively in decision-making and planning fosters ownership, ensures that benefits are equitably distributed, and enhances the social sustainability of agrotourism projects.

(4) Policy Support for Community Participation

Local governments are encouraged to formulate and implement policies that support inclusive community involvement in agrotourism management. Such policies should facilitate access to resources, protect local interests, and create an enabling environment for sustainable and equitable tourism development.

By balancing these economic, environmental, and socio-cultural dimensions with strategic managerial actions, Karangsari's agrotourism model can serve as a replicable example of sustainable rural tourism development that maximizes benefits while mitigating risks and preserving local identity.

Conclusion

This study examines land use transformation and the impacts of star fruit agrotourism development in Karangsari Village, Blitar City, from 2006 to 2024. The analysis reveals significant shifts in land use patterns, characterized by a decrease in general agricultural lands and star fruit yards alongside an increase in residential areas and dedicated agrotourism zones. This trend reflects mounting urbanization pressures but also highlights substantial local economic development potential through the agrotourism sector.

Economically, star fruit agrotourism has contributed positively, yielding a 40% rise in community income, the creation of approximately 150 new jobs, and the growth of micro, small, and medium enterprises (MSMEs). The local community is increasingly engaged as both farmers and tourism service providers. Nevertheless, challenges such as unequal distribution of benefits and dependence on tourist flows must be addressed to ensure long-term sustainability.

Socially, agrotourism has fostered stronger community interaction and heightened awareness of environmental conservation. However, it remains essential to guarantee equitable benefit sharing across all societal groups by involving the community in agrotourism planning and management and by applying inclusive strategies.

Key findings include:

(1) Land Cover Change Dynamics: Agricultural specialization with a 51.95% expansion of star fruit gardens occurred alongside a significant 66.14% reduction in general agricultural fields, while residential areas grew moderately by 13.43%.

(2) Socio-Economic Outcomes: Notable income growth, economic diversification, and job creation contrasted with environmental challenges such as water resource stress and waste management issues.

(3) Theoretical Contributions: The study confirms sector-specific land use and land cover change (LULCC) patterns different from typical urban expansion, highlights the complexity of agricultural transitions in tourism contexts, and supports community-based sustainable tourism approaches.

Overall, Karangsari serves as a successful model of integrating sustainable agriculture and tourism through participatory and inclusive approaches. Further research is recommended to explore the long-term effects on community welfare and environmental sustainability.

Acknowledgements and declarations

The interviews conducted in this study were purely qualitative, involving community farmers who voluntarily shared their knowledge, perceptions, and experiences related to land use and agrotourism

development. The questions posed were non-invasive and focused on general opinions and factual information about their agricultural practices and socio-economic conditions.

No sensitive personal data or vulnerable populations were involved, and the interviews were conducted with full informed consent and under conditions of anonymity and confidentiality. Participants were treated ethically as knowledgeable partners in the research process.

According to common research ethics guidelines, studies involving minimal risk, non-sensitive topics, and voluntary community interviews of this nature typically do not require formal approval from an ethics review committee. This study respects all ethical principles such as voluntary participation, informed consent, and data confidentiality, ensuring the protection and dignity of participants without the need for additional ethics clearance.

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