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Development Strategy of Roro Kuning Waterfall Tourism Area in Nganjuk Regency Based on the Integration of Natural Potential and Local Culture

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ABSTRACT

Roro Kuning Waterfall, located in Bajulan Village, Loceret Subdistrict, Nganjuk Regency, is a nature-based tourism site containing both Wilis mountain landscape potential and the local cultural narrative of the Roro Kuning legend. Despite these combined strengths, visitor numbers remain low, reaching only 4,095 visitors during the third quarter of 2025, lagging 95.04% behind Jolotundo Tourism located in the same village. This study aims to formulate an area development strategy that integrates natural and cultural potential as a unified destination management framework. The method is descriptive-qualitative, involving field observation, interviews with the Nganjuk Tourism Office, policy document review, SWOT analysis, and carrying capacity analysis based on the 2021 Ministry of Tourism guidelines. Findings show that the area covers ±75,900 m² divided into three zones (gateway 23,800 m², core tourism 35,100 m², Selo Agung Park 17,000 m²) with an ideal capacity of 350 visitors per day. The development strategy is formulated through the "Confluence" approach, integrating water flow, landscape, and cultural activities through six strategic principles: flow integration, landscape adaptation, spatial sequence, activity convergence, cultural embedding, and ecological sustainability. This strategy is expected to improve destination competitiveness without sacrificing the ecological quality and cultural value of the area.

Keywords: *Area Development Strategy, Roro Kuning Waterfall, Nature-Culture Integration, Confluence Concept, Sustainable Ecotourism*

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INTRODUCTION

Tourism in Indonesia holds a strategic position as both a source of foreign exchange and a driver of regional economies. Law Number 10 of 2009 on Tourism affirms that tourism is a series of tourist activities supported by facilities and services provided by communities, businesses, and the government. At the regional level, tourism development is often used as a means of maximizing natural potential and elevating local cultural values so that they generate direct economic impact on local communities.

East Java Province is widely recognized for its diversity of nature-based tourism and culinary attractions. Nganjuk Regency contributes to this richness, particularly because of its position on the slopes of Mount Wilis with two main peaks: Mount Liman in Ngliman

Village and Mount Limas in Bajulan Village. This geographical character has produced various natural attractions, ranging from waterfalls and pine forests to camping grounds.

Data from Statistics Indonesia of Nganjuk Regency (BPS Nganjuk, 2025) recorded the peak of tourist visits in 2019 with a total of 355,609 visitors. This figure dropped sharply during 2020-2021 due to the Covid-19 pandemic, then rose again to 350,550 visitors in 2023. However, in 2024, visitor numbers fell significantly to 103,850. This decline is suspected to be influenced by massive infrastructure construction on several routes in East Java and floods that hit several tourism sites, including Roro Kuning Waterfall, which was damaged that same year.

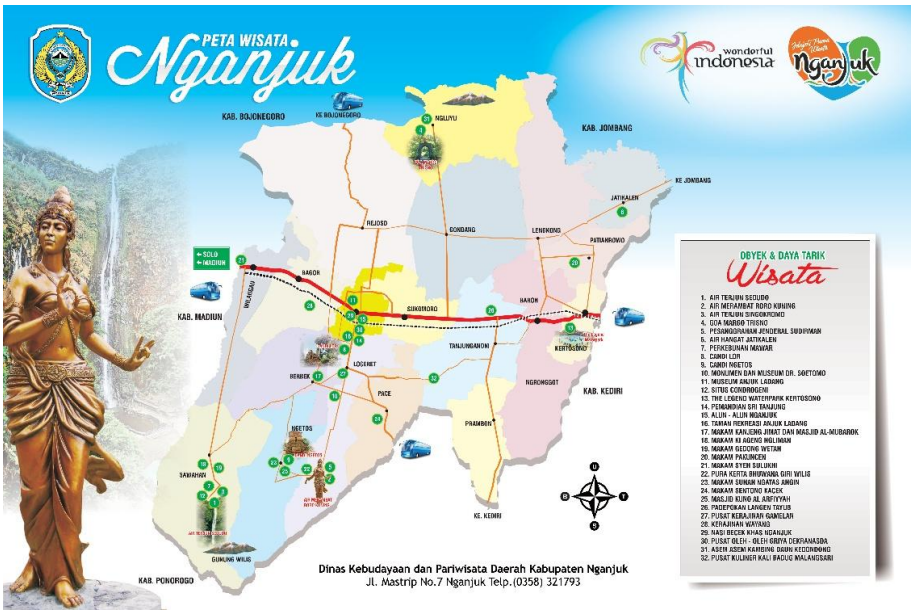

Figure 1. Map of tourism site distribution in Nganjuk Regency

Source: Nganjuk Regency Tourism and Culture Office

Based on CKAN Nganjuk data for the third quarter of 2025, the visitor distribution across four leading destinations reveals a wide gap. Jolotundo Tourism dominates at 82,484 visitors, followed by Sedudo Waterfall (17,540), Bukit Surga (9,333), and Roro Kuning Waterfall at only 4,095 visitors. The visitor gap between Roro Kuning and Jolotundo reaches 95.04%, even though both are located in the same village, Bajulan. Even compared with a similar waterfall attraction, Sedudo, Roro Kuning still lags by 76.65%. This condition places Roro Kuning as a destination whose natural potential does not match its visitor numbers.

Roro Kuning, locally known as Air Rambat Roro Kuning, is geographically located at an elevation of approximately 600 meters above sea level, with a waterfall height of around 10-15 meters (Auliayudi Adji Prakoso et al., 2024). The area combines rare values, namely a mountainous landscape with dense pine vegetation, a permanent river flow, and the Roro Kuning legend as an intangible cultural heritage. Maghfiroh (2023) positions the figure of Roro Kuning as a manifestation of Goddess Sekartaji, which gives the location a certain

sacred dimension for local communities. The main issue is that this natural and cultural potential has not been managed within a coherent development strategy.

Field observations reveal several problems that have become the root cause of low visitor numbers. Basic facilities such as parking, pedestrian paths, signage, and interpretation spaces do not meet the standards of Ministerial Regulation Number 3 of 2022 on Non-Marine Nature Tourism Areas. Area zoning is also unclear: sacred, recreational, and commercial areas still overlap. Aspects of security services, waste management, and cultural interpretation remain rudimentary. These issues indicate that the main challenge for Roro Kuning lies in the area management strategy, not merely in the availability of potential.

Figure 2. Mapping of existing problems in Roro Kuning area

Source: Author's field survey, 2025

Several previous studies have addressed tourism development in Nganjuk Regency. Irawan et al. (2025) highlighted the social impact of Sedudo Waterfall development on community job creation. Padmasana (2016) recorded the economic impact of Sedudo development during 1992-1997, which yielded relatively limited results. Laksana and Sembada (2018) found that Sedudo promotion still relied on word of mouth, resulting in no significant visitor surge. Regarding another nearby site in Bajulan, a study on Jolotundo Edupark demonstrated the success of a multi-activity tourism model combining glamping and education (Dan & Park, 2024). Specific studies on Roro Kuning development strategies that integrate natural and cultural dimensions remain scarce in the literature.

Departing from this gap, this study formulates two main questions. First, what are the characteristics of the potential and problems of Roro Kuning Waterfall Tourism Area that can serve as the basis for strategy formulation? Second, what area development

strategy is relevant for integrating natural and cultural potential into a sustainable management framework? The objective of this study is to formulate a development strategy for Roro Kuning based on site conditions, ecological potential, and local cultural value. The scope of discussion is limited to the level of development strategy, not to physical design outcomes or detailed design. The research contribution lies in providing a strategic framework that fills the literature gap while serving as a practical reference for regional tourism stakeholders.

METHOD

This research uses a descriptive-qualitative approach complemented by simple spatial analysis. This approach is chosen because the objective is not to test hypotheses but to comprehensively describe the area's condition, then formulate a development strategy relevant to the site's character. The study location is the Roro Kuning Waterfall Tourism Area in Bajulan Village, Loceret Subdistrict, Nganjuk Regency. The site is about 24 km from the Nganjuk town square and can be reached by motorcycle in approximately 45 minutes

The study subjects include the area site (physical condition, facilities, and environment), regional regulators (Nganjuk Regency Tourism Office), and relevant policy documents. Samples were purposively selected based on the relevance of information to the research questions. Secondary sources include BPS Nganjuk Regency in Figures 2025 and CKAN Nganjuk data for the third quarter of 2025.

Data collection was conducted using three techniques. First, field observation to document the site's physical condition, existing facilities, circulation paths, vegetation, hydrology, and visitor activities. Second, interviews with the staff of Nganjuk Regency Tourism Office to obtain the regulatory context and the direction of regional tourism development. Third, document study, including Law No. 10 of 2009 on Tourism, Nganjuk Regency Regulation No. 9 of 2021 on Spatial Planning 2021-2041, the Nganjuk Regency Medium-Term Development Plan 2025-2029, and Ministerial Regulation No. 3 of 2022.

Data analysis was carried out in three layers. The first layer is the analysis of context and policy to read the area's position within planning documents. The second layer is site analysis covering topography, climatology, vegetation, circulation, view, utilities, and surrounding settlement patterns. The third layer is SWOT analysis producing a strategy matrix of SO, WO, ST, and WT, which is then synthesized into a development strategy framework based on ecotourism and local wisdom as described by Akbari et al. (2025) and Waluya et al. (2022). The area's carrying capacity is calculated using the Technical Guidelines for Nature Tourism Carrying Capacity Analysis of the Ministry of Tourism (2021), namely 50-100 persons per hectare per day, and the tourism land suitability formula of Yulianda (2007).

FINDING AND DISCUSSION

RESEARCH RESULT

Area Character and Strategic Potential

Roro Kuning Waterfall is located within the slope morphology system of Mount Wilis at an elevation of 580-650 meters above sea level. Based on Digital Elevation Model 2024 analysis and field data, the area has a slope ranging from 15-45% forming a V-shaped valley that narrows toward the water source. This valley pattern creates a natural corridor that strategically directs visitor movement toward the waterfall as the main focal point. This geographical character serves as both an initial asset and a challenge: on one hand it produces a dramatic landscape experience, on the other it requires strict ecological management to prevent damage.

The highest rainfall is recorded in December at 474 mm. This high rainfall places the area at risk of hydrometeorological disasters, especially flooding, landslides, and erosion. Indriani et al. (2023) noted that the high humidity of the area is indicated by intensive moss growth around paths and forest zones, signifying a healthy ecosystem that deserves priority in the conservation strategy.

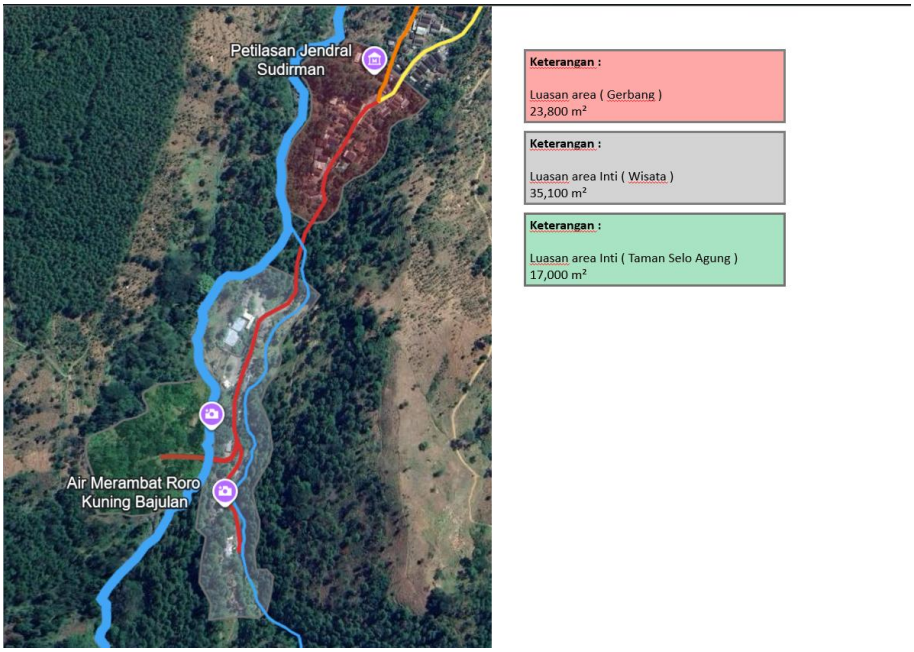

Figure 3. Zoning of Roro Kuning area and its dimensions

Source: Google Earth 2025 satellite image digitization, processed by author

Based on satellite image digitization, the area is divided into three zones with a total of ±75,900 m². The gateway zone covering 23,800 m² is dominated by active settlement, so development intervention is limited to the gateway and transition area redesign. The core tourism zone of 35,100 m² serves as the main management area, containing access to the waterfall, the main pedestrian path, and supporting facilities. The

Selo Agung Park zone of 17,000 m² functions as a complementary green open space that was previously used as a camping area and is now quiet because of competition from Jolotundo. This zoning becomes the first spatial framework that will serve as the basis for strategy formulation.

Visit Dynamics and Competitive Position

Roro Kuning's competitive position within the Nganjuk tourism map can be read through two data scales: the regency scale and the inter-site scale. Table 1 presents annual regency visitor trends, while Table 2 shows visits to four leading destinations in the third quarter of 2025.

Table 1: Number of tourists in Nganjuk Regency for the period 2019-2024

Year	Number of Tourists (persons)	Notes
2019	355,609	Peak visits before the pandemic
2020	184,739	Decline due to Covid-19 pandemic
2021	± 200,000	Still affected by restrictions
2022	± 280,000	Gradual recovery
2023	350,550	Approaching pre-pandemic level
2024	103,850	Decline due to floods and infrastructure works

Source: *BPS Nganjuk Regency, Nganjuk Regency in Figures 2025, Table 7.2, p. 225.*

Table 2: Visitor distribution across four tourism sites in Nganjuk Regency, Q3 2025

No.	Tourism Site	Location	Visitors
1	Jolotundo Tourism	Bajulan, Loceret	82,484
2	Sedudo Waterfall	Sawahan	17,540
3	Bukit Surga	Loceret	9,333
4	Roro Kuning Waterfall	Bajulan, Loceret	4,095

Source: *CKAN Nganjuk Q3 2025, processed by author.*

These two tables reveal two things at once. First, the regency tourism sector shows high volatility because of its vulnerability to environmental and infrastructure factors. Second, inter-destination competition is intense even within the same administrative area. Roro Kuning's position as the site with the lowest number of visitors among four leading destinations confirms that the landscape and cultural potential of the area has not been translated into a competitive selling value.

SWOT Analysis Result

The synthesis of site conditions, regulations, and comparison with similar sites is summarized in the SWOT analysis presented in Table 3. The assessment considers four dimensions: the natural and cultural potential owned, internal weaknesses of management

and facilities, opportunities from tourism trends, and threats that may arise from development.

Table 3: SWOT analysis result of Roro Kuning Waterfall Tourism Area

Aspect	Description
Strengths (S)	Waterfall and permanent river as core attraction; natural landscape with cool microclimate; cultural value of the Roro Kuning legend as identity; relatively undeveloped environment.
Weaknesses (W)	Unstructured area layout; limited and non-contextual tourism facilities; unorganized circulation paths; lack of cultural interpretation and environmental education.
Opportunities (O)	Nature and ecotourism trends; potential for education- and culture-based tourism development; support from the 2025-2029 Regional Medium-Term Development Plan for local-wisdom-based tourism; potential community involvement.
Threats (T)	Risk of environmental degradation from visitor pressure; erosion and vegetation damage; competition with similar destinations (especially Jolotundo and Sedudo); excessive commercialization.

Source: *Author's analysis, 2025.*

The intersection of the four aspects is processed in a strategy matrix summarized in Table 4. This matrix becomes a strategic map that translates the SWOT position into four directions of area development.

Table 4: SO, WO, ST, and WT strategy matrix for Roro Kuning Area

Combination	Strategy	Development Direction
SO (Strength-Opportunity)	Locally identified ecotourism development	Leveraging natural and cultural potential to build positioning as a distinctive nature-culture destination of Nganjuk; using the Roro Kuning legend as the main narrative.
WO (Weakness-Opportunity)	Re-zoning and education-based facility rearrangement	Using nature tourism trends to address internal weaknesses through clear zoning and education-based facilities.
ST (Strength-Threat)	Area conservation and active-zone limitation	Maintaining the natural character by establishing conservation zones that limit massive construction; protecting ecological advantages from the threat of degradation.
WT (Weakness-Threat)	Visitor flow control and diversification	Implementing structured paths to manage capacity; diversifying attractions to avoid dependence on a single activity point.

Source: *Author's synthesis, 2025.*

The "Confluence" Strategy Framework

Based on a reading of the site that places water, contour, and culture as the three dominant elements, a strategic framework named "Confluence" is formulated. The term literally means meeting, and is chosen because the character of Roro Kuning's site is essentially a space of meeting: water flow, valley landscape, and cultural activities meet at one convergence point, the waterfall. Confluence is not a physical design concept, but a management strategy framework that guides the direction of area development in an integrated manner. The framework is derived into six strategic principles (Table 5).

Table 5: Six strategic principles of the Confluence framework and their development directions

Strategic Principle	Problem Addressed	Development Strategy Direction
Flow integration	Water flow and visitor movement run separately and interfere with each other.	Making the water flow system the basis for arranging area circulation and zone organization.
Landscape adaptation	Development potentially damages natural contour and vegetation.	Directing development interventions to follow contours, minimize land-use change, and maintain vegetation cover.
Spatial sequence	Tourism experience is flat and lacks a narrative flow.	Constructing a phased tourism experience from transition area, active space, to the climax at the waterfall.
Activity convergence	Visitor activities are unorganized and scattered randomly.	Managing activity distribution at structured nodes so that pressure is not concentrated at one point.
Cultural embedding	Cultural value of the Roro Kuning legend is not managed as a main attraction.	Positioning the legend and local rituals as the narrative thread that binds all elements of the tourism experience.
Ecological sustainability	Potential environmental damage from tourism activities.	Implementing eco-friendly management policies, carrying capacity limits, and diversification of energy and waste management.

Source: *Author's synthesis based on site analysis and literature review, 2025.*

Area Carrying Capacity Management Strategy

One of the main components of the development strategy is the management of the area's carrying capacity. Referring to the Ministry of Tourism (2021) standard of 50-100 persons per hectare per day, with an effective tourism area of ±3.5 hectares, the ideal potential of Roro Kuning ranges between 175-350 visitors per day. Field observations show that the current actual capacity reaches only 40-50% of the ideal potential, equivalent to 140-175 persons per day, mainly due to limited parking, narrow pedestrian paths, and the absence of a zoning system. For the core area with a standard ratio of 1 person per 3-5 m^2

(Ministry of Environment and Forestry, 2021), the safe simultaneous capacity is estimated at 30-70 visitors.

These figures form the basis for setting the strategic target of gradually increasing capacity toward 350 visitors per day. The carrying capacity management strategy is pursued through several measures, including restricting the type of vehicles entering the area, implementing a zoning system that differentiates active recreation zones from conservation zones, managing peak visitor hours to avoid excessive pressure at a single point, and distributing attractions to several activity nodes so that visitor flow is not concentrated solely in the waterfall area.

DISCUSSION

The findings indicate that Roro Kuning's problems are structural at the management strategy layer, not in the natural or cultural potential itself. The implementation of the Confluence framework is interpreted as an answer to this gap because it positions integration as the basis of management, not merely as the addition of facilities. This approach aligns with the findings of Akbari et al. (2025) regarding the importance of sustainable tourism leadership in accelerating an inclusive ecosystem. Wirata (2025) also emphasized that local wisdom revitalization strategies are proven effective in maintaining the environmental sustainability of tourism in Indonesia's tropical regions.

The implementation of the Confluence framework at Roro Kuning carries three strategic implications. First, in terms of regional policy, the development direction aligns with Missions 06 and 07 of the Nganjuk Regency Medium-Term Development Plan 2025-2029, which place tourism sector development and the strengthening of local wisdom as priorities. The use of the Roro Kuning legend as a development narrative also supports Nganjuk Regency Regulation No. 7 of 2016 on the Preservation of Intangible Traditional Culture and Regent Regulation No. 3 of 2025 on the Preservation of Cultural Heritage.

Second, in terms of destination competition, this strategy offers differentiation that is difficult to imitate by Jolotundo or Sedudo. Jolotundo excels in the glamping concept and modern multi-activities, while Sedudo relies on its height and annual rituals. Roro Kuning, through the Confluence framework, can display its uniqueness as a destination that combines landscape authenticity, legend narrative, and reflective tourism experience. This differentiation aligns with the findings of Sugita et al. (2025) that integrated tourism based on culture and environment provides more enduring added value compared to single-attraction models.

Third, in terms of socioeconomics, the distributed activity-node model opens opportunities for local community involvement through culinary MSMEs, guide services, homestays, and agro-tourism on surrounding farmlands. This strategy is consistent with the community-based tourism model emphasized by Nadhirah and Adiputra (2024) as a more inclusive approach to tourism development. Diversifying community income sources becomes one direct contribution of area development to village development.

Several limitations of this study should be acknowledged. First, visitor data per site is only available for the third quarter of 2025, so the full seasonal trend has not been read.

Second, the carrying capacity calculation remains estimative and requires verification through actual surveys when the area is managed under the new model. Third, the sociological dimension, namely local community perception of the development concept, has not been measured quantitatively. These three limitations simultaneously become the agenda for further research, including empirical implementation testing, community perception measurement, and area branding-based marketing studies.

CONCLUSION

This study concludes three main points. First, the character of the Roro Kuning Waterfall Tourism Area has a linear-convergent valley shape covering ±75,900 m² with a slope of 15-45% and stable pine and community forest vegetation. The area possesses dual strengths: the landscape potential of Mount Wilis and the cultural heritage of the Roro Kuning legend. Existing conditions show very low visits, namely 4,095 visitors in Q3 2025, lagging 95.04% behind Jolotundo, which is located in the same village. The main issue is not the lack of natural or cultural assets but the absence of a coherent management strategy.

Second, the relevant development strategy is the Confluence framework, namely a management approach that integrates water flow, natural landscape, and cultural activities. The framework comprises six strategic principles: flow integration, landscape adaptation, spatial sequence, activity convergence, cultural embedding, and ecological sustainability. The division of the area into three zones (gateway 23,800 m², core tourism 35,100 m², Selo Agung Park 17,000 m²) becomes the management unit with an ideal capacity target of 350 visitors per day, to be achieved gradually.

Third, strategically, this framework supports Missions 06 and 07 of the Nganjuk Regency Medium-Term Development Plan 2025-2029, provides differentiation against competing destinations, and opens opportunities for local community involvement through MSMEs, guide services, and agro-tourism. Suggestions for further research include empirical examination of carrying capacity after implementation, measurement of community perception, and area branding-based marketing studies to strengthen Roro Kuning's positioning in the East Java tourism market.

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