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Analysis of the Availability and Utilization of Green Open Space (GOS) in Kahayan Hilir Subdistrict, Pulang Pisau Regency Using the DPSIR Approach

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ABSTRACT
This study aims to analyze the availability and utilization of Green Open Space (GOS) in Kahayan Hilir Subdistrict, Pulang Pisau Regency, utilizing the DPSIR (Driving Forces, Pressures, States, Impacts, Responses) approach and the Indonesian Green Blue Index (IHBI) model. This research addresses the growing demand for adequate GOS due to rapid urbanization and economic development. The study identifies the driving forces behind GOS changes, pressures arising from land conversion and population growth, the current state of GOS, and the public's perception of GOS utilization. Data collection involved interviews with stakeholders, systematic field observations, and a comprehensive analysis of regional planning documents. The results indicate that the availability of GOS in Kahayan Hilir is still below government standards, resulting in environmental issues such as declining air quality, biodiversity loss, and increased urban heat island effects. Public perception indicates an awareness of the importance of GOS for health and recreation, although accessibility and facilities remain limited. This study recommends increasing both the quantity and quality of GOS through stricter policies, community participation, and public-private partnerships to support environmental quality and the well-being of residents in Kahayan Hilir Subdistrict.

Keywords: Green Open Space, DPSIR, urban sustainability, environmental policy, public perception

1. Introduction

The rapid growth of economic and urban development in Indonesia often overlooks environmental sustainability, particularly in the provision of Green Open Space (GOS). In urban areas, GOS serve as essential components for ecological balance, aesthetic enhancement, and as public areas fostering social interactions that contribute to community well-being. GOS functions to reduce air pollution, moderate microclimates, and provide habitats for urban biodiversity. However, increasing demand for land for housing, commercial use, and infrastructure has significantly reduced GOS areas.

Kahayan Hilir Subdistrict, as the capital of Pulang Pisau Regency in Central Kalimantan Province, exemplifies this issue. As a supporting city for the provincial capital, Palangkaraya, Kahayan Hilir faces

intense development pressures, particularly as a residential center for urban populations and an industrial hub. The conversion of open spaces into built-up areas has directly reduced the available GOS, making it increasingly challenging to meet the minimum standard of 30% of the total urban area as mandated by national policy. Based on the Pulang Pisau Regency Spatial Plan (RTRW) for 2019-2039, the government has allocated 20% of GOS for public use and 10% for private GOS. However, the actual implementation falls significantly short of these targets.

This study aims to analyze the availability and utilization of GOS in Kahayan Hilir using the DPSIR framework (Driving Forces, Pressures, States, Impacts, Responses). The DPSIR approach enables the identification of driving factors, pressures on GOS, current conditions, environmental and social impacts, and responses from the government and community regarding GOS reduction issues. Additionally, the Indonesian Green Blue Index (IHBI) model is used to assess the urban ecosystem balance concerning the availability of green and blue spaces, which are essential for urban ecosystem sustainability.

By understanding public perceptions and governmental responses related to GOS utilization and management, this study is expected to provide recommendations for enhancing urban environmental sustainability in Kahayan Hilir. The findings of this study also have the potential to contribute to more sustainable and responsive policy planning for open space needs and could serve as a model for other urban areas facing similar challenges.

2. Literature Review

Research on Green Open Space (GOS) has demonstrated its essential role in supporting urban environmental sustainability, maintaining air quality, and providing public spaces for social and recreational activities. Several studies provide foundational insights and methodological frameworks relevant to this research, both in terms of methodology and relevant findings that confirm the importance of GOS in urban spatial planning.

Wulandari and Suryadi (2019) evaluated the utilization of GOS in Semarang City as an adaptation measure to climate change. They found that the distribution and quality of GOS in Semarang were uneven, and the availability of shading vegetation was limited, thereby reducing the effectiveness of GOS in mitigating urban temperature increases. This study highlights the importance of well-managed GOS to minimize the impacts of climate change, particularly through improvements in GOS quality and distribution.

Nuraini and Setiawan (2020) applied the DPSIR (Driving Forces, Pressures, States, Impacts, Responses) framework to analyze the availability and utilization of GOS in Bandung City. Their findings indicate that population growth and urbanization exert considerable pressure on the existence of GOS, with green spaces being converted for residential and commercial purposes, leading to a significant reduction in GOS areas. This study is relevant to the present research as it provides a methodological foundation by using the DPSIR framework to analyze urban spatial issues.

Research by Paraswatih et al. (2020) in Lembo Subdistrict, Makassar City, emphasized the limitations of GOS due to high population density. The findings showed that the reduction in GOS areas led to increased surface runoff and flood risks. This study suggests that GOS is crucial for water management and urban disaster prevention, aligning with the objectives of this research in understanding the function of GOS in highly urbanized areas.

Andiani and Harahap (2021) examined the effectiveness of GOS management in Surabaya City using the DPSIR approach. They found that rapid urbanization and the conversion of green spaces into commercial areas were the primary pressures hindering sustainable GOS management. This study also underscores the

importance of community participation in GOS management and the relevance of responsive policies to urban dynamics.

Finally, Kurniawan and Putri (2023) demonstrated how GOS in Yogyakarta contributes to enhancing the quality of life through physical health, mental well-being, and social cohesion. They highlighted the crucial role of GOS as the "lungs" of the city and as social spaces that enable community interaction, reinforcing the rationale for maintaining and increasing GOS in densely populated urban areas.

From this literature review, it is evident that previous studies have explored GOS from various perspectives, including climate adaptation, health, spatial distribution, and community involvement. However, most studies were conducted in major cities, and research using the DPSIR approach in rural or suburban areas like Kahayan Hilir Subdistrict remains limited. This study aims to fill that gap by applying the DPSIR framework to analyze the availability and utilization of GOS in Kahayan Hilir, as well as exploring local community perceptions related to GOS.

3. Research Methodology

This study employs a qualitative approach with a descriptive-analytical method to understand the availability and utilization of Green Open Space (GOS) in Kahayan Hilir Subdistrict, Pulang Pisau Regency. A qualitative approach was chosen because it allows for an in-depth exploration of the phenomenon being studied through a systematic and structured approach.

3.1 DPSIR Analytical Framework. The DPSIR (Driving Forces, Pressures, States, Impacts, Responses) framework is used as the primary analytical tool. This framework enables the identification of relationships between factors driving GOS changes (driving forces), pressures exerted (pressures), the current state of GOS (states), the impacts of these conditions (impacts), and the responses from the government and community (responses) in addressing GOS issues.

3.2 Use of the Indonesian Green Blue Index (IHBI) Additionally, this study applies the Indonesian Green Blue Index (IHBI) to assess urban ecosystem balance concerning the availability of green and blue spaces. IHBI provides a comprehensive evaluation of environmental sustainability, specifically in aspects of air quality, water management, and biodiversity, aligned with GOS conservation goals in urban areas.

3.3 Data Sources Primary data were collected through in-depth interviews with key informants, including officials from relevant agencies (Public Works and Housing Office, Environmental Agency), environmental activists, and community members who utilize GOS in Kahayan Hilir. Furthermore, field observations were conducted to directly observe the physical conditions and utilization of GOS. Secondary data included official documents, planning reports, and relevant regional regulations.

3.4 Informant Selection Technique The study employed purposive sampling and snowball sampling to select informants. Purposive sampling was used to ensure that informants had direct knowledge or involvement in GOS management. Respondents over the age of 40 were prioritized, as they were considered to have more experience and a deeper understanding of GOS changes and functions. Snowball sampling was subsequently employed to expand the informant network based on recommendations from initial informants, continuing until data saturation was achieved.

3.5 Data Collection Techniques Data were collected through three main techniques:

1. **Observation**: Non-participant observation was conducted, wherein the researcher observed the physical conditions of GOS without direct involvement in activities. This observation was carried out in several city parks in Kahayan Hilir to obtain visual data on the condition and utilization of GOS.

2. **Interviews**: Semi-structured interviews were used to gather in-depth information from selected informants. The interview guide covered key themes in DPSIR analysis, including community perceptions of GOS utilization and maintenance.
3. **Documentation Study**: Data from official documents such as regulations, spatial planning reports, and statistical data were used as supplementary sources to confirm the findings from observations and interviews.

3.6 Data Analysis Technique Data analysis in this study followed the Miles and Huberman model, which includes data reduction, data presentation, and verification. Data reduction was performed to simplify and focus on data relevant to the research objectives. Data presentation was conducted in narrative and tabular forms to facilitate understanding. Data verification was performed through triangulation to ensure the validity of the analysis results

4. Results

4.1 Availability and Utilization of GOS

This study analyzes the availability and utilization of Green Open Space (GOS) in Kahayan Hilir Subdistrict, Pulang Pisau Regency, based on the Regent's Decree and Ministerial Regulation ATR No. 11 of 2022. The research identified five main city parks functioning as GOS. However, the study findings indicate that GOS in Kahayan Hilir is constrained in both area and ecological functionality. The existing GOS is insufficient to address air quality issues, biodiversity habitats, and the urban heat island effect.

The study found that the availability of GOS in Kahayan Hilir Subdistrict remains below the minimum standard set by the government, which is 30% of the total urban area. Field data indicate that the existing GOS consists of main city parks such as Taman Sumbu Kurung, Taman Bawi Kuwu, Taman Kahanjak, Taman Bereng Barigas, and Taman Penyang Pangarasang. However, the limited area and facilities of these GOSs restrict their ecological functions. Using the Indonesian Green Blue Index (IHBI), it was determined that the distribution of GOS is uneven, and not all areas have optimal functionality in terms of microclimate mitigation and carbon absorption.

A table summarizing GOS calculations shows that areas such as Rimba Kota and City Parks play a major role in providing GOS, yet they do not fully meet the ecological needs of the region.

Table 1: Area and Condition of GOS in Kahayan Hilir Subdistrict

GOS Location	Area (Ha)	Main Function	Condition	Facilities
Taman Sumbu Kurung	5.2	Recreation and Greening	Moderate	Benches, jogging track
Taman Bawi Kuwu	3.8	Community Gathering Place	Poor	Lacks adequate facilities
Taman Kahanjak	4.5	Recreation	Poor	No facilities
Taman Bereng Barigas	6.0	Community Activities	Moderate	Benches
Taman Penyang Pangarasang	2.5	Greening	Poor	Lacks adequate facilities

Table 1 displays the area, condition, and facility availability of various city parks that serve as GOS in Kahayan Hilir Subdistrict. Most city parks are poorly maintained and lack adequate facilities, which hinders the role of GOS in supporting social activities and public health.

5. Discussion

5.1 Analysis Using the DPSIR Framework

This section presents the primary findings on GOS availability and utilization in Kahayan Hilir Subdistrict, analyzed through the DPSIR framework and the Indonesian Green Blue Index (IHBI) model. The analysis elaborates on each DPSIR element and explores how community perceptions contribute to the utilization and maintenance of GOS. The discussion also addresses the implications of these findings for policies and plans for GOS management.

Driving Forces

The driving forces in this study's context include demographic and socio-economic changes affecting the utilization and management of GOS in Kahayan Hilir Subdistrict. Rapid population growth is one of the main factors driving the conversion of green open spaces into residential and commercial areas. Urbanization in this area has increased the demand for infrastructure and basic services, placing considerable pressure on GOS availability.

Furthermore, political factors, especially campaign promises from regional election candidates, also influence the prioritization of GOS provision. Political promises focused on economic development, such as increasing housing or industrial zones, often overlook the need for GOS as an essential component of urban spatial planning. This indicates that economic and political factors play a significant role in determining spatial allocations, impacting the sustainability of the urban ecosystem in Kahayan Hilir.

Pressures

The pressure on GOS in Kahayan Hilir Subdistrict primarily arises from high land demand for economically profitable activities such as housing, shopping centers, and commercial areas. This has led to land conversion initially allocated for GOS to be repurposed for commercial use. This pressure also reflects the conflict between economic goals and ecological needs often faced by local governments in spatial planning.

Interviews with local officials revealed that regional development is frequently focused on economic expansion deemed more urgent and having a direct impact on increasing regional revenue. This focus results in GOS land allocation policies being deprioritized compared to commercial development. Additionally, limited awareness of the importance of GOS as an environmental buffer and biodiversity habitat leads developers and the community to give insufficient attention to the maintenance and conservation of GOS.

States

The current condition of GOS in Kahayan Hilir Subdistrict is far from meeting the government-mandated standard, which requires at least 30% of the urban area to be allocated as GOS. According to collected data, the availability of GOS in Kahayan Hilir only reaches a small fraction of this requirement, with main GOS locations such as Taman Sumbu Kurung, Taman Bawi Kuwu, Taman Kahanjak, and several others in poor condition.

The physical condition of the existing GOS is poorly maintained, and recreational facilities are highly limited. Field observations show that many parks lack supporting facilities such as benches, walking paths, and adequate lighting. This lack of amenities impacts the low frequency of public visits to GOS, reducing the functional value of GOS as a public space accessible to all.

Additionally, the imbalance between green and blue spaces exacerbates the urban heat island effect in Kahayan Hilir Subdistrict. This imbalance suggests that GOS management has not fully considered optimal ecological aspects, where natural elements such as trees and water bodies are underutilized for

environmental quality improvement.

Impacts

The shortage of GOS has significant impacts on environmental quality and public health in Kahayan Hilir Subdistrict. One major impact is the increase in surface temperature and the urban heat island effect, caused by the reduction of vegetation that serves as a natural cooling agent. Deterioration in air quality is also a pressing issue due to the lack of vegetation that can absorb air pollutants.

Another impact is the loss of habitats for various flora and fauna species typically found in green areas. This biodiversity loss can disrupt the balance of local ecosystems, potentially affecting overall environmental stability. Additionally, limited GOS reduces opportunities for residents to engage in physical and social activities outdoors, which ultimately negatively impacts public mental and physical health.

These findings align with previous studies by Fletcher et al. (2013), which demonstrated that GOS plays a critical role in reducing air pollution and enhancing the physical and mental health of urban residents. Inadequate open spaces can lead to stress, social isolation, and even a decline in the overall quality of life.

Responses

The responses from the government and the community regarding the issue of GOS shortages in Kahayan Hilir Subdistrict remain limited. The local government has made efforts to map the GOS needs and establish certain policies related to GOS provision, but the implementation of these policies remains weak. Often, existing policies are merely administrative and lack strong enforcement or incentives to encourage private sector investment in GOS development.

In interviews, several local officials stated that the budget allocated for the maintenance and expansion of GOS is still very limited. This indicates that budget priorities do not yet reflect the urgency of environmental issues and the quality of life for residents. Furthermore, public awareness about the importance of GOS is still low, resulting in suboptimal community participation in GOS maintenance.

The government needs to conduct campaigns and educate the public about the benefits of GOS and how they can play a role in preserving and protecting green areas around them. Raising public awareness is crucial to fostering an environmentally conscious culture that can strengthen GOS sustainability.

5.2 Policy Implications

The findings of this study have several important policy implications for GOS management in Kahayan Hilir Subdistrict. First, there is a need to strengthen regulations related to land allocation for GOS so that these policies are not just formalities but have enforceable legal power. The government should implement sanctions or incentives to encourage developers to participate in GOS conservation efforts.

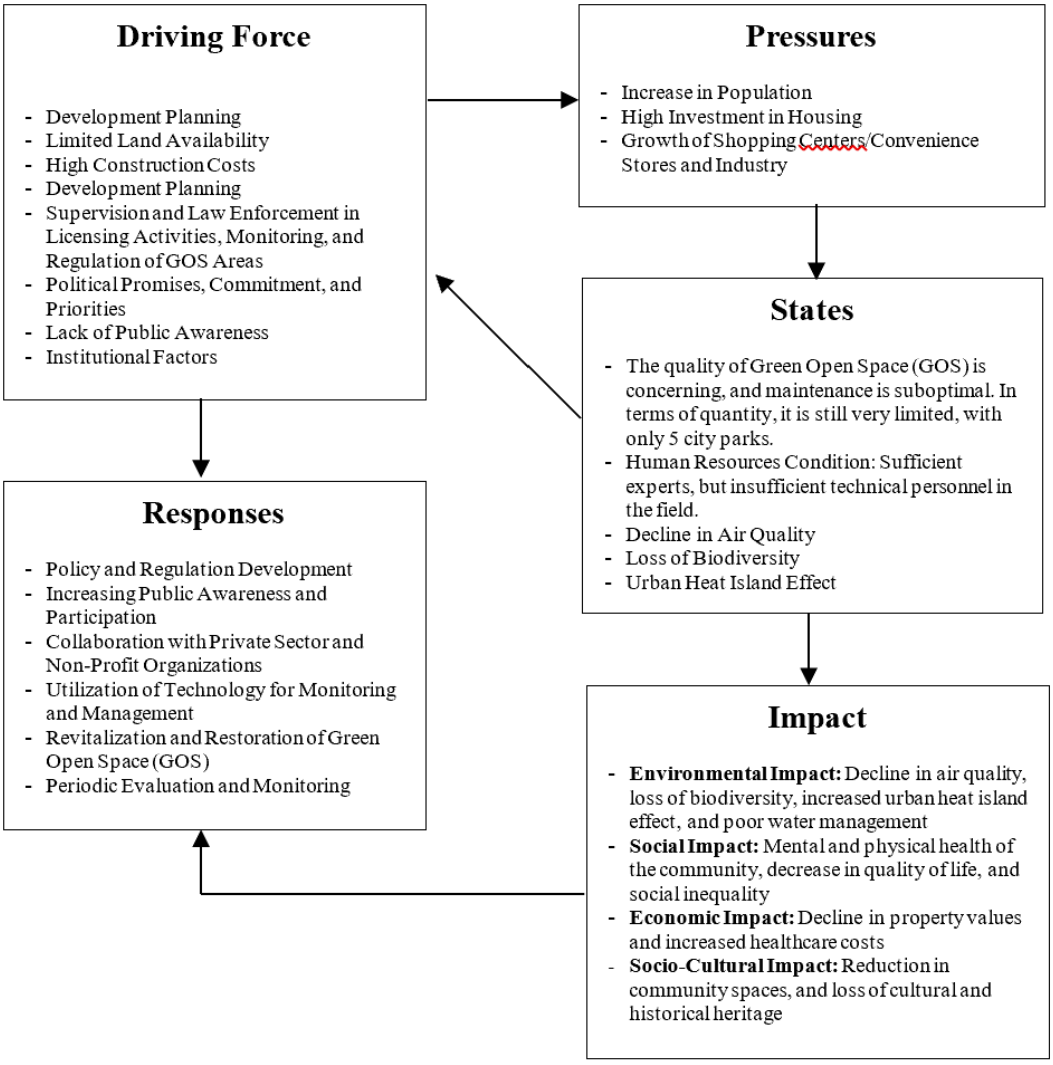
Second, collaboration between the public and private sectors is essential for GOS development. The private sector can be encouraged to invest in GOS maintenance through partnership schemes, where companies can contribute by developing facilities or implementing greening programs that improve GOS quality.

Third, involving the local community in GOS management can be an effective strategy to increase public engagement and a sense of ownership over their environment. Programs such as park adoption or community-led park management can provide opportunities for residents to participate directly in the maintenance and development of GOS in their area.

Fourth, it is essential for the government to integrate environmental indicators, such as the IHBI, into spatial planning processes. These indicators can aid in evaluating environmental performance and ensuring

that ecological balance is maintained even as economic growth and infrastructure development progress.

Figure 1: DPSIR Model for GOS in Kahayan Hilir



6. Conclusions and Recommendations

6.1 Conclusions

This study analyzed the availability and utilization of Green Open Space (GOS) in Kahayan Hilir Subdistrict, Pulang Pisau Regency, through the DPSIR (Driving Forces, Pressures, States, Impacts, Responses) framework. The results show that rapid urbanization and the prioritization of economic development have led to limited GOS availability in the area. Factors such as a lack of initial planning focused on sustainability, land constraints, as well as low political commitment and weak spatial planning oversight are the primary causes of limited GOS.

The impacts of GOS shortages include declining air quality, biodiversity loss, increased urban heat island effects, and water management issues that raise flood risks. In addition, GOS scarcity affects residents' quality of life, both in terms of physical and mental health, as well as social and economic aspects. Public awareness about the importance of GOS has improved, but limited facilities and accessibility reduce the benefits of GOS for the public

6.2 Recommendations

Based on the findings of this study, several strategic steps can be taken to improve the availability and quality of Green Open Space (GOS) in Kahayan Hilir Subdistrict. These steps include academic suggestions, practical recommendations for the government, and community participation.

From an academic perspective, further research is needed to explore specific strategies for more sustainable GOS provision, taking into account community involvement in GOS planning and maintenance. Future research should include a comprehensive analysis of GOS management, which can identify GOS classifications and develop community engagement strategies for GOS maintenance and conservation. This is essential for understanding environmental needs in greater depth and designing solutions tailored to local conditions.

At the policy level, the Pulang Pisau Regency government should strengthen regulations supporting GOS development and implement more specific spatial policies related to green land utilization. The government must allocate sufficient funding for GOS development and ensure stricter implementation of spatial policies, especially to prevent uncontrolled land conversion. Collaboration between the government and the private sector is also crucial to securing funding and resources for GOS development. In this regard, the government could encourage private sector involvement in providing facilities and maintaining GOS through corporate social responsibility (CSR) programs. Additionally, a strict system of penalties is needed for spatial violations to prevent unplanned green land conversion.

The community is expected to be more proactive in supporting GOS provision and conservation efforts. Community participation can be realized through involvement in greening programs and GOS maintenance initiatives initiated by the government or environmental organizations. Public awareness of the importance of preserving GOS as a public space beneficial to collective quality of life is vital. Community members can also engage in tree-planting initiatives in their residential areas, which not only increase vegetation cover but also foster social bonds and environmental stewardship within the neighborhood.

Implementing these recommendations could significantly improve GOS availability and quality in Kahayan Hilir. These steps are expected to support the enhancement of environmental quality, public health, and socio-economic welfare as a whole, while fostering more sustainable urban management amidst rapid urbanization and economic development.

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