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MORALITY BEFORE KNOWLEDGE

Pollution absorbtion of green open space: A comparative review between Singapore and Jakarta urban areas

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ABSTRACT

Background: Rapid urbanization has significantly increased industrial activity, transportation, and energy use in cities, increasing air pollution. In addition to having a detrimental effect on the ecosystem, air pollution raises the risk of heart disease, respiratory conditions, and early mortality. Green open space is seen as a natural way to lower air pollution because of the vegetation's capacity to absorb pollutants like PM2.5 and PM10. **Method:** This SLR analysis combines quantitative bibliometry and descriptive research methods. **Findings:** The study results show that GOS plays an important role in reducing air pollutant concentrations, improving air quality, and providing health benefits to the community. However, the effectiveness of GOS is influenced by factors such as vegetation type, green area area, and urban spatial planning. Limited land, lack of integration in urban planning, and low public awareness are major problems in GOS development. In addition, this study found the potential to optimize GOS through innovations such as vertical green spaces and green roofs. **Conclusion:** This study also found that GOS should be included in sustainable urban spatial planning policies to improve air quality, reduce pollution impacts on health, and create a healthier and more comfortable urban environment for people by optimizing the GOS. To ensure the GOS development can go smoothly and sustainably in the future, it is required to have scientifically based policy recommendations. **Novelty/Originality:** This study assesses GOS's capacity to absorb air pollution by contrasting case studies from Indonesia and Singapore.

KEYWORDS: green open space; air pollution; public health; urban planning; sustainability.

1. Introduction

Rapid urbanization has led to a massive increase in industrial activity, the number of motor vehicles and energy use in urban areas, which causes air pollution to rise (Trianah et al., 2024). In addition to causing pollution problems, urbanization also leads to a decrease in green open space (GOS), which is essential for maintaining urban ecosystems (Caesarina & Rahmani, 2019). Cities are becoming the source of economic, social, and cultural activities due to the increasing population. Air pollution is one of the negative effects of uncontrolled urban growth (Harahap, 2013). Urban air pollution can cause various health problems for residents, such as respiratory disorders, skin diseases, and increase risk of developing chronic diseases. Air pollution can also damage the environment and threaten the sustainability of ecosystems (Njonge, 2023).

In facing this problem, urban green open spaces (GOS) are important in solving and reducing air pollution (Mashur & Rusli, 2018). Green areas that have existed long and serve as nature pillars are often used for settlements, business establishments, and industrial facilities. This GOS project improves the city's ability to manage carbon emissions, regulate

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the microclimate, and provide habitat for plants and animals (Trianziani, 2020). According to some studies, areas with high vegetation levels have better architectural quality than less inhabited areas. For local ecosystems to remain healthy, green open places like parks, urban woods, and playgrounds are crucial (Effendy, 2009). This green open area has the potential to produce oxygen, which is required by humans and other living things, as well as reduce pollution. Furthermore, in the heart of a congested city, open green spaces may naturally cool the air by lowering its temperature. Green open spaces can help naturally chill the air, providing coolness and lowering the temperature. Furthermore, the natural cooling effect of green open spaces can provide comfort by lowering the air temperature. (Novyanti, 2016).

The conversion of green land into built-up areas, a lack of sustainable planning, and a lack of public awareness of the GOS's significance in maintaining air quality are just a few of the obstacles that continue to face the realisation and maintenance of the numerous policies that support the development of green spaces in urban areas. (Cahya et al., 2016). Therefore, in order to offer evidence-based suggestions for creating more sustainable urban spatial plans, research on how well green open spaces absorb air pollution is essential.

Increasing public access to green spaces and improving the vegetation cover in large cities are two strategies that are expected to have negative health effects as a result of climate change. Urban greening helps mitigate some of the negative health effects of climate change. For instance, trees can lessen human exposure to UV rays and high temperatures. By absorbing and trapping precursors and ozone pollutants, vegetation can reduce ozone levels and exert cooling effects through evapotranspiration and radiation reflection (Bowler et al., 2010). With photosynthesis, trees can absorb carbon dioxide (CO2) from the atmosphere. For carbon sequestration, trees function as a place for carbon stockpiling and deposition. Therefore, trees must be in green swathes in cities (Rinjani, 2016). Green vegetation serves as a natural filter for pollutants in the open environment; They capture and absorb it through the leaf stomata and settle on the plant surface. (Masrurah, et al., 2024). To live, plants need charcoal acid gas (CO2), which is absorbed from air, water, and nutrients absorbed from the soil (Rahma, 2012)

It is envisaged that cities would be able to better optimise the planning and administration of green open spaces to enhance the environment and general public health by comprehending the function and efficacy of these areas in absorbing air pollutants. Therefore, to preserve and expand green city open spaces, the community and the government must cooperate. To preserve the sustainability of the urban environment, conservation initiatives and tree planting must also be strengthened. It is intended that with adequate green space, all of its residents will be able to live in a comfortable and healthy urban environment. This study compares Singapore with Indonesia in order to explain how to maximise urban green spaces.

2. Methods

This study combines secondary data analysis with quantitative descriptive techniques and bibliometric analysis. Its focus is to determine how effective green open spaces are in reducing air pollution by conducting a comparative analysis between Singapore and Indonesia. This approach was chosen to comprehensively understand the connection between green open spaces and air pollution absorption. Bibliometric analysis was conducted using Scopus.com databases to identify research trends related to pesticide use and their impact on children. Search keywords include "urban AND green AND spaces AND in AND reducing AND air AND pollution", with restrictions on articles published between 2019 and 2025. The inclusion criteria applied include articles with publication status from "last", sources of type "journal", and within "English". The search results generated 4,236 documents stored in Indonesian: CSV format and imported into the VOS Viewer application for fuGOSer analysis (Fig. 1).

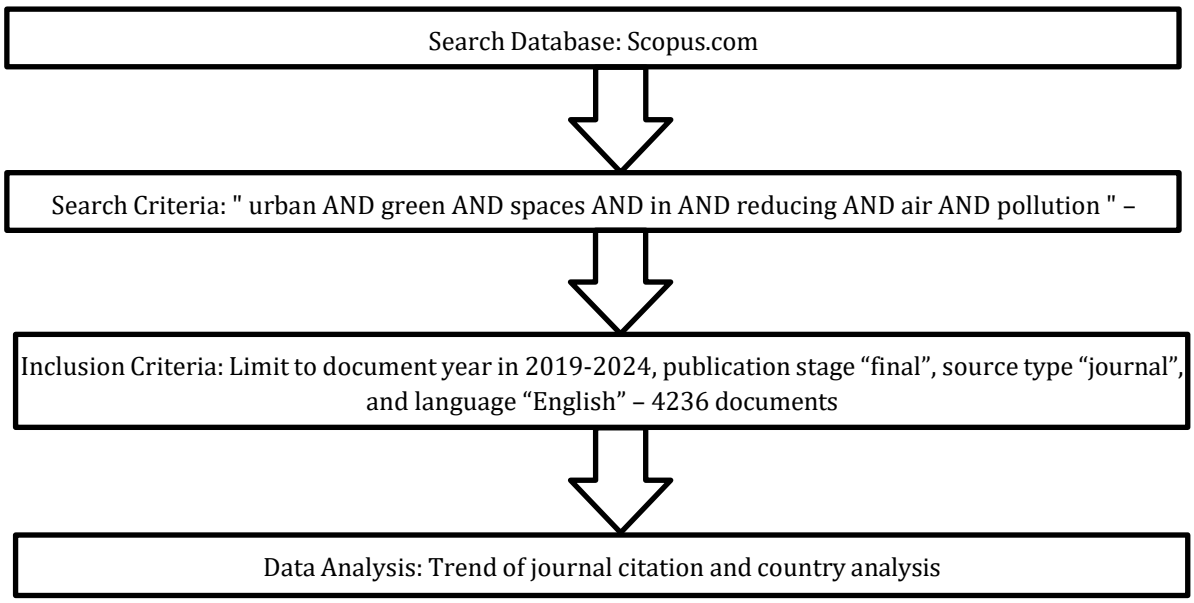

Fig. 1. Stages of bibliometric analysis

Quantitative descriptive analysis and bibliometric analysis were used to perform the data analysis. The VOSviewer software is used to conduct a comprehensive bibliometric analysis of journal citation trends related to the application of renewable energy. The analysis used data extracted from bibliographic database files, focusing on using data from Scopus, one of the world's leading academic databases. In conducting the country analysis, the researchers applied strict selection criteria. For this analysis, a minimum threshold of two publications per country was set so that only countries with significant research contributions were considered.

3. Results and Discussion

3.1 Global trends in green open space research

Bibliometric analysis using VOSviewer results in a network keywords visualization that illustrates the connection between research topics related to sustainable energy development and other agendas that follow it. The image shows several key interrelated groups, with "urban green spaces" and "reducing" and "pollutant" being the most prominent central nodes connected to a variety of other topics. This is pertinent to the results of numerous studies that show that urban areas and the mitigation of water pollutants are the main topics of investigation into the environmental effects of urban green space practices. As the most frequently occurring keyword (34 times) and essential to the network, "air pollution" reflects the primary topic of the series of research under analysis. The phrase "urban area" (17 times) is also significant. In addition to the subjects mentioned above, air pollution and urban green areas can also be related to other concerns. "Particulate matter," "atmospheric pollution," "urban green spaces," "people," "air quality," and "China" are among the subjects that come up. These subjects are highly pertinent for sub-discussion in studies that focus on "urban green spaces" as the primary focus. Research can also highlight how air quality in cities can affect human health directly or indirectly. This shows how important it is to maintain urban green spaces to act as air pollution absorbers and improve the air quality around them. Thus, in urban environmental study, it becomes crucial to pay attention to the relationship between air pollution and urban green spaces.

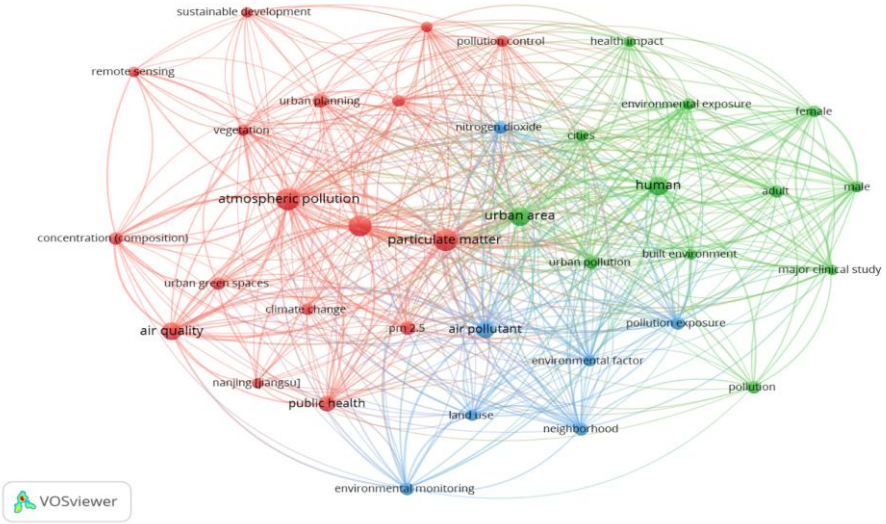

Fig. 2. Bibliography compilation by keyword

3.2 Trends and findings related to green open space

Overall, this visualization highlights the complexity and interconnectedness of various aspects. The substantial link between "urban areas," "particulate matter," and "human" suggests that the impacts of air pollution on urban residents have been extensively studied. The relationship between "air quality" and "climate change" and "urban green spaces" suggests that further research is needed to identify how green spaces might assist reduce air pollution. "Environmental exposure" , "pollution exposure" , and "health impact" . The concentration of critical nodes and connections between clusters shows that research in this area is multidisciplinary, combining perspectives from urban green spaces, environmental monitoring, sustainable development, public health, urban planning and environmental science. This bibliometric analysis using VOSviewer illustrates the connection between the topics that become the focus from 2021 to 2025. The color gradient from blue (2021) to yellow (2025) provides insight into the shift and development of research interest during the period. The key keywords "urban" and "green" and "in" and "reducing" and "air" and "air pollution" were colored bright green, indicating that these topics remained a significant and consistent focus throughout the study.

There has been an attention shift to urban areas and wider air pollution. At first, the elements that appear "atmospheric pollution", "particulate matter", "urban area", and "pollutant water", appear in light green, showing increased attention to these topics in recent years (around 2021-2022). This reflects a trend towards a more comprehensive "urban green spaces", "public health", "pollution exposure", "vegetation", and "health impact" that focuses on public health (2022-2023). Topics such as "sustainable development" and pm 2 "human" pollution control, climate change and urban planning appear in areas closer to yellow, showing that these are relatively new. That research is getting attention as we approach 2024–2025. This demonstrates an increasing understanding of the health benefits of urban green spaces. The fact that urban areas like "urban green spaces," pollution control, climate change, and PM 2.5 were found in green to yellow regions indicates that there has been a surge in research on these urban areas in recent years. "Urban green spaces," urban planning, pollution management, and sustainable development are all aspects that are associated with vulnerable communities. Also, the yellow indicator in the trends section indicates increased attention to this group in the latest research. Overall, this visualization illustrates the evolution of urban green spaces research from an initial focus on urban areas and air pollution to a more holistic approach that includes human health, urban planning, air quality and people.

The visualization results show the shift of research attention from the initial focus on air pollution in urban areas to a more holistic approach, including human health, urban planning, and sustainability. This is especially pertinent to the discussion of how well urban green open spaces (GOS) absorb air pollutants. This change is a result of increased knowledge of GOS as a factor that absorbs pollutants and also plays a significant role in raising urban communities' standard of living.

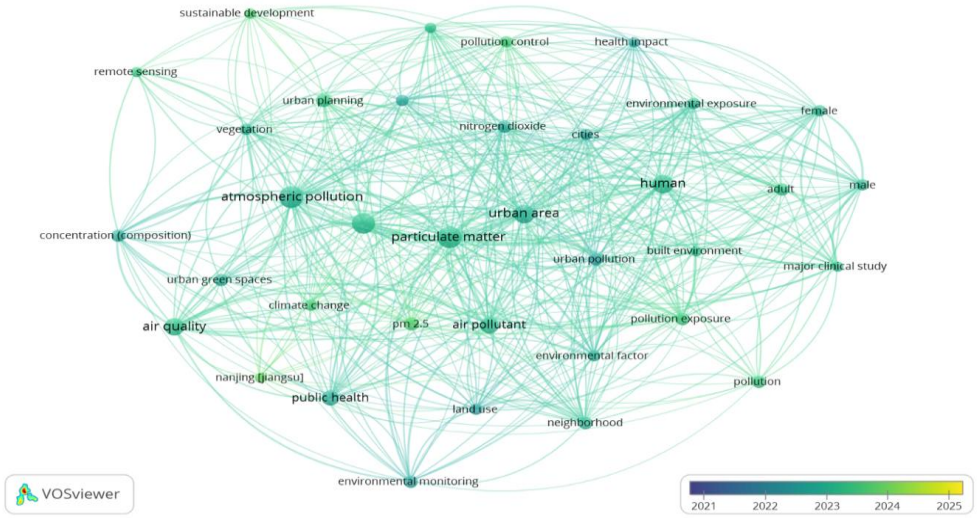

Fig. 3. Compilation of bibliographies based on research contributions

3.3 Overview of GOS in Jakarta (Indonesia)

The World Health Organisation (WHO) reports that, of Jakarta's total area of 664.01 km2, only around 5.2%, or 35,999/m^2, is currently covered by Green Open Space (GOS). The desired goal of at least 30% of the city's total area, as set forth in Law Number 26 Year 2007 regarding Spatial Planning, is far from this. The availability of GOS per capita is now much below that level due to Jakarta's dense population.

Fig. 4. Overview of the spread GOS in Jakarta

To reach the desired standard, Jakarta's Green Open Space (GOS) still has to deal with a number of challenging issues. According to Spatial Planning Law Number 26 of 2007, the GOS area must make up at least 30% of the city's total area. But according to the most recent data, Jakarta's GOS region only makes up around 5.2% of the city's overall size, which is 664.01 km², or 35,999 square meters. This number is still far from the ideal figure, both in total and in the context of per capita needs. According to the standards set by the WHO, each individual needs a minimum of 9 square meters of green space, ideally reaching 20–25 square meters. However, the per capita GOS in Jakarta currently only ranges from 2 to 3 square meters, which means it is very insufficient to provide a significant ecological impact, including air filtration and temperature drops. Limited land, lack of government budget, and low involvement of the private sector and the community are the main obstacles to GOS development in this city. In addition, the lack of strong technical guidelines and supporting institutions also makes GOS management unoptimal. As a result, the available green space is not optimal in carrying out its ecological functions, such as absorbing pollution, providing clean air, and providing thermal comfort for urban communities.

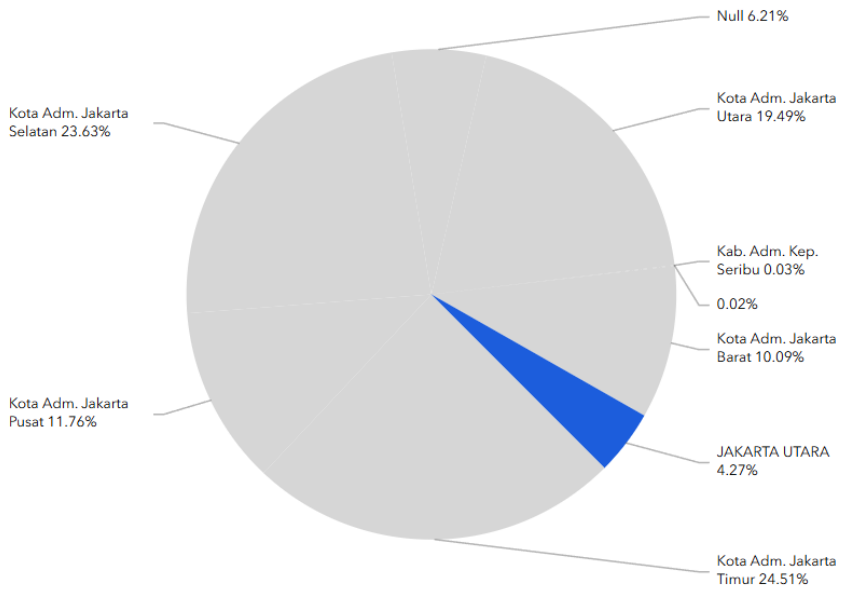

Fig. 5. Presentation of GOS area to total GOS area

3.4 Overview of GOS in Singapore

Prime Minister Lee Kuan Yew's 1963 "Trees Planting" campaign was the beginning of Singapore's greening plan, which aimed to make Singapore a clean and green city with the motto "clean green" to address inequality, create a city identity, and enhance national pride (Rowe & Hee, 2019). Singapore is one example of a country that has successfully integrated green open space in its regional planning and development. Since 1963, the Singapore government has launched the "Trees Planting" campaign under the leadership of Prime Minister Lee Kuan Yew as part of the city's vision for a clean and green city. This effort continues consistently through the preparation of a Masterplan that is integrated with the green-blue space policy. The planning results are clearly seen through the very high GOS area. In 1986, GOS in Singapore's proportion had reached 36% and increased to 47% in 2011. The per capita GOS in the country even reached 66 square meters, far exceeding the WHO minimum standard. Strong policies, stakeholder support, and active community participation achieved this success.

Singapore is also developing innovative GOS, such as vertical parks, rooftop gardens and green spaces integrated with urban infrastructure. The GOS ecological function is utilized to the maximum to reduce air pollution, control temperature through natural cooling effects, absorb rainwater and support biodiversity. Systematic and data-driven green space planning and implementation make Singapore a model of best practice in sustainable and adaptive GOS management to face more urbanization and climate change challenges. In addition, the urban greening program that involves community participation has also successfully raised awareness of the importance of environmental preservation. By continuously implementing innovation and cross-sector collaboration, Singapore strives to set an example for other countries in balancing urban development and environmental preservation.

3.5 GOS Comparison in Singapore and Indonesia

Green open spaces (GOS) in Indonesia and Singapore show many differences in area, quality, and ecological role. In Indonesia, big cities such as Jakarta and Surabaya recorded a relatively low GOS percentage, which is around 10-12% for Jakarta and around 20% for Surabaya. The per capita GOS has not reached the standard recommended by the WHO (9 m^2 per person), and Jakarta is only about 2–3m^2; Surabaya is close to that threshold. In contrast, Singapore recorded a percentage of GOS of 47% of its total area, with an average GOS per capita of around 66 m^2, far exceeding global standards. Singapore has successfully allocated a significant portion of its territory for parks and open spaces, allowing every citizen to enjoy extensive access to nature. On the other hand, major cities in Indonesia still need to enhance their efforts in developing green open spaces to support the well-being and health of their communities.

In contrast to Singapore, which has successfully distributed green open space throughout the city, including core business areas, Indonesia's distribution of green open space is typically uneven and still concentrated at specific locations. Regarding innovation, Indonesia is still dominated by conventional parks, such as urban parks and thematic parks, while Singapore has implemented modern GOS concepts, such as vertical gardens, rooftop gardens, and green open spaces integrated with urban infrastructure. The GOS ecological role in Singapore is also very strong, especially in controlling temperature, absorbing pollution, and supporting biodiversity, in contrast to Indonesia where the GOS ecological function has not been optimally utilized. Singapore can be an example of best practice in developing sustainable and integrated GOS. Singapore's experience shows that strong policy commitments, holistic spatial planning, and community support are key to creating green, healthy, and environmentally friendly cities. Indonesia has great potential to develop in the same direction, especially if the approach to GOS development is done in a comprehensive, sustainable, and data-driven.

By leveraging Singapore's experience as a guide, Indonesia can enhance the utilization of its green open spaces to create a healthier and more sustainable environment. Collaboration between the government, society, and the private sector is needed to achieve this goal. With the adoption of best practices in the development of green open spaces, Indonesia has the potential to become a successful example in creating green and environmentally friendly cities.

According to the proposed premise, optimising urban green open space presents issues for every nation. Land restrictions, the absence of green space integration in urban planning, air pollution, urban heat islands (UHI) that hinder the growth of vegetation, and a lack of public awareness are all factors that can have an impact (Pakaya et al., 2024; Naftalia & Amalia, 2025). This study's primary goal is to give policymakers useful information by highlighting the necessity of focused interventions and sustainable improvements, particularly in the area of sustainable energy development. The distribution of GOS between Indonesia and Singapore was reviewed using this study. The research results are expected to provide science-based recommendations for policymakers in designing and managing GOS that is more effective and sustainable. Thus, this research is expected to

improve urban air quality, reduce health risks due to air pollution, and create a healthier and more comfortable urban environment for the community. In addition, the study will also propose an innovative model of green open space distribution with a technology and science-based approach to support sustainable energy development and sustainable improvement in urban areas. Through this research, it is expected that there will be an increase in understanding of the importance of green open spaces as an integral part of urban infrastructure. Thus, this will assist decision-makers in formulating more sustainable and environmentally friendly policies. In addition, the implementation of this innovative green space distribution model can also serve as an example for other cities in their efforts to create a healthier and more sustainable urban environment. Collaboration between the government, society, and the private sector is cruciSSal in creating a hSSealthier and more sustainable environment. With the adoption of best practices in the development of green open spaces, Indonesia has great potential to become a successful example in creating green and environmentally friendly cities. With a comprehensive, sustainable, and data-driven approach, Indonesia can leverage Singapore's experience as a guide for better progress in the future.

The GOS area in large cities is quite tiny for three reasons, according to Cipta Karya Director General Danis Hidayat Sumadilaga. First, there isn't enough land for the local government to build GOS. Second, it is challenging to purchase land for open space conversion because of cost or non-strategic locations. Many local governments thus struggle to increase the GOS shares within their authority. (Wahdaniyat, 2019). However, this innovative project proves that with hard work and creativity, every city can provide solutions to increase the amount of green open space. By involving various parties and using an integrated approach, the development of green open spaces in major cities can become a successfully achieved priority. It is hoped that the steps taken by this city can inspire and serve as a model for other cities to be more concerned about the environment and public health.

Although GOS has great potential in reducing air pollution, visualizations also indicate challenges in its implementation. Converting green land into populated regions, which frequently occurs in rapidly expanding cities, is one of the primary challenges. The loss of green space has decreased the GOS's ability to absorb pollutants and raised the danger of air pollution exposure for populations, according to a study by Zhang et al. (2022). However, via innovative design and technology, there is a chance to maximise GOS. For instance, building green roofs and vertical gardens can be a solution in places with a high population density but little available land. In addition, increasing public awareness of the importance of GOS can also encourage active participation in maintaining and developing green open spaces.

Not only Indonesia, Singapore also faces many challenges in managing green open spaces (GOS) despite being known as a developed green city. Limited land is a major challenge due to the high demand for space for housing, infrastructure, and economic activities. Rapid urbanization also threatens the existence of existing GOSs, while the need for economic development often clashes with environmental conservation. In addition, the GOS quality is still a concern, as not all green open spaces function optimally ecologically or are accessible to the public. Other challenges include the importance of integration between green open spaces through ecological connectivity, adaptation to climate change, and the need for active community participation in maintaining and utilizing GOS sustainably.

According to research (Ridwan, 2022) in Balekambang Park, Banjarsari District, Surakarta City, based on the observation results of each block based on vegetation density, Block I is a block with a lower vegetation density than Block II. The temperature, humidity and wind speed were calculated as well. In Block I, the morning air temperature averages 23.6ºC, while during the afternoon, it increases to 36.78ºC, and in the evening, it decreases again to 29.15ºC. Meanwhile, the wind speed in Block I ranged from 3.9m/s in the morning and 3.9m/s in the afternoon and evening was 4m/s. Thermal comfort in Block I listed as the comfortable category in the morning, very uncomfortable during the afternoon, and partially comfortable in the evening. The air temperature in Block II is lower than in Block

I. The average morning air temperature is 22ºC, 27.4ºC during the afternoon, and 27ºC in the evening. The average wind speed was 1.9 m/s in the morning, afternoon, and evening, so Block II was considered thermally comfortable for all research times. Therefore, greater efforts are needed to integrate urban development with environmental preservation through integrated planning. The sustainable development of green open spaces/*Ruang Terbuka Hijau* (RTH) must also consider ecological and social aspects to provide maximum benefits to the community. In addition, there is a need to raise public awareness about the importance of maintaining green open spaces as valuable assets that can enhance the overall quality of life. Thus, the challenges in managing green open spaces in urban areas can be overcome through cooperation and involvement of all parties to create a healthy and sustainable environment.

A study by Kumar et al. (2020) shows that vegetation in GOS can absorb particulates (PM2.5 and PM10) through the processes of dry and moist deposition, as well as through the absorption of stomata in leaves. Furthermore, recent World Health Organisation research have linked exposure to air pollution, particularly particles, to an increased risk of heart disease, respiratory illnesses, and even premature death. As a result, GOS can reduce pollutant concentrations in the air, lowering disease risk. This is consistent with the visualization's findings, which show an increase in attention to themes such as "pollution exposure", "health impact", and "public health" between 2022 and 2023. FuGOSermore, GOS gives psychological and social benefits to urban areas. A study by Zhang et al. (2022) discovered that the presence of GOS can reduce stress and improve people's quality of life. Thus, GOS not only serves as a pollutant absorber but also as an essential element in creating a healthy and comfortable urban environment (Santosa & Koestoer, 2020). In addition, green spaces also play a role in absorbing carbon dioxide and producing oxygen, which is very important for maintaining ecosystem balance and reducing the greenhouse effect. By increasing green open spaces, cities can create a healthier and more comfortable environment for their residents. Therefore, the government and the community need to work together to develop and maintain green spaces in urban areas to reduce the negative impact of air pollution and improve the overall well-being of the community.

With efforts to optimize green open spaces/*Ruang Terbuka Hijau* (RTH) through technological and design innovations, it is expected to enhance the effectiveness of RTH in absorbing pollutants and reducing the risk of air pollution exposure for the community. Vertical green spaces and green roofs are potential solutions for densely populated areas with limited land, thus providing broader benefits for the environment and public health. Through increasing public awareness of the importance of green open spaces/*Ruang Terbuka Hijau* (RTH), it is hoped that active involvement in maintaining and developing green spaces can be created for a better environmental sustainability.

Therefore, in order to combat air pollution and preserve public health, creating green open spaces in metropolitan areas needs to be a major priority. This is due to the fact that green open spaces can lower the risk of diseases brought on by air pollution and enhance the quality of life for city dwellers. Factors such as vegetation type and density, green areas, atmospheric conditions, and urban spatial layout affect how well green open spaces absorb air pollution (Pakaya et al., 2024). In addition, green spaces also play a role in absorbing carbon dioxide and producing oxygen, which is very important for maintaining ecosystem balance and reducing the greenhouse effect. By increasing green open spaces, cities can create a healthier and more comfortable environment for their residents. Therefore, the government and the community need to work together to develop and maintain green spaces in urban areas to reduce the negative impact of air pollution and improve the overall well-being of the community.

According to Hendrawati (2016), vegetation plays an important role in increasing humidity, lowering temperature, and reducing solar radiation. While the design and location of green spaces affect how well they reduce the concentration of pollutants in the air, some plant species have a higher ability to absorb pollutants than others. Further studies need to be conducted to evaluate the effectiveness of various types of vegetation in absorbing air pollution and how the design of green open spaces can be optimized to reduce

pollutant concentrations. In addition, urban spatial planning policies also need to be considered to ensure that sufficient green areas are available and well-maintained, so they can provide maximum benefits in maintaining urban air quality. With a better understanding of the role of green open spaces in reducing air pollution, steps can be taken to improve air quality and public health in urban areas.

The emergence of topics such as "sustainable development", "urban planning", and "climate change" in the visualization shows that GOS is increasingly seen as an integral part of sustainable urban planning. Research by (Yücedağ & Çiçek, 2023) emphasized that the effectiveness of GOS in absorbing air pollution is greatly influenced by spatial design, vegetation type, and area of green area. For example, urban forests and parks with dense vegetation can absorb pollutants more than fragmented green areas (Setiowati et al., 2023).

The use of extensive and connected green open spaces/*Ruang Terbuka Hijau* (RTH) can be more effective in absorbing pollutants compared to fragmented green areas. In addition, research also shows that the proper use of green open spaces/*Ruang Terbuka Hijau* (RTH) can help reduce the effects of global warming and improve air quality in urban areas. This is becoming increasingly important given the continuous growth of urbanization, which poses new challenges in maintaining the environment. Therefore, the integration of green open spaces/*Ruang Terbuka Hijau* (RTH) in urban planning has become a necessity to create a healthier and more sustainable environment for future generations. Thus, the role of green open spaces/*Ruang Terbuka Hijau* (RTH) in maintaining the environmental balance of the city cannot be overlooked.

Furthermore, GOS helps to adapt to climate change and mitigate the effects of urban heat islands (UHI). According to Njonge (2023), GOS can naturally cool cities by lowering air temperatures via evapotranspiration. Given that cities around the world are experiencing an increase in temperatures and the frequency of heat waves due to climate change, this is even more pertinent. But there are also issues with incorporating GOS into urban planning, namely a lack of cooperation among stakeholders and a shortage of available land. Therefore, a holistic approach that involves the government, society, and the private sector is needed for the sustainable development of GOS.

The government needs to strengthen policies that support the implementation of green open spaces/*Ruang Terbuka Hijau* (RTH), such as requiring every new development to include green areas, allocating funds for the development of city parks, and involving the community in the planning process. Additionally, education about the benefits of green open spaces/*Ruang Terbuka Hijau* (RTH) needs to be improved so that the community better understands the importance of preserving green open spaces amid rapid urban development. It is hoped that the integration of green open spaces/*Ruang Terbuka Hijau* (RTH) in urban planning will become more effective and sustainable in creating a healthier and more comfortable urban environment for all its residents. It is also important to pay attention to the sustainability of RTH management so that existing green areas are well-maintained and preserved. In addition, it is also important to involve various parties such as the government, private sector, and the community in maintaining the sustainability of green open spaces so that the benefits can be felt by all parties. With the awareness and active participation of all parties, it is hoped that a healthy, comfortable, and sustainable urban environment can be created for future generations.

4. Conclusions

This research shows that green open spaces (GOS) are important in reducing air pollution, supporting public health, and creating a comfortable urban environment. Research trends show a shift in focus from simply air pollution to a more holistic approach covering health, urban planning, and sustainability. The comparison between Indonesia and Singapore emphasizes the importance of policies, spatial planning, and community participation in GOS management. For this reason, an integrated and innovative strategy and support from stakeholders are needed to optimize GOS as a vital element in developing a healthy and sustainable city. The importance of managing green open spaces/*Ruang*

Terbuka Hijau (RTH) in urban areas has increasingly been recognized as an integral part of sustainable development. Indonesia and Singapore serve as examples of countries that have successfully implemented policies and planning that support the effective management of green open spaces/*Ruang Terbuka Hijau* (RTH). Through integrated strategies and active community participation, green open spaces/*Ruang Terbuka Hijau* (RTH) can become an effective means to improve public health and create a comfortable and sustainable urban environment.

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T.R.P., & R.H.K., contributed to the literature search, interpretation, writing, and proofreading of the manuscript. T.R.P., & R.H.K., have read and agreed to the published version of the manuscript.

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