

# BUKTI KORESPONSENSI REVIEW ARTIKEL THE CO QUALITY LEVEL OF GREEN OPEN SPACE

(CASE STUDY OF JAGAKARSA DISTRICT, SOUNTH JAKARTA)

## 1. SUBMISSION TANGGAL 19 JUNI 2022

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Judul Artikel : CO Quality Level of Green Open Space (Case Study of Jagakarsa District, South Jakarta)

reviewers : Paulus Basuki Kuwat Santoso, Tatan Sukwika, Linda Noviana

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## CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

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**Abstract:** *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Green plants as one of the elements of Green Open Space have the ability to reduce carbon and some air pollutants. Therefore, in this study an analysis of the relationship between Green Open Space in reducing carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The results is proven that there is a very strong relationship between Green Open Space and CO with a correlation value of -0.865. Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels.*

**Abstrak:** *Kecamatan Jagakarsa di Jakarta Selatan merupakan daerah yang potensial dalam pengembangan Ruang Terbuka Hijau (RTH). Ruang Terbuka Hijau berfungsi secara tidak langsung untuk memperbaiki tingkat kesehatan masyarakat. Salah satu kecamatan di Jakarta Selatan dan sekaligus menjadi objek penelitian ini adalah Kecamatan Jagakarsa. Hal tersebut disebabkan karena adanya dinamika perubahan lahan Ruang Terbuka Hijau (RTH) dan pergeseran pembangunan pemukiman di Kecamatan Jagakarsa. Tumbuhan hijau sebagai salah satu unsur Ruang Terbuka Hijau (RTH) memiliki kemampuan untuk mereduksi karbon dan beberapa zat pencemar udara. Oleh karena itu, pada penelitian ini dilakukan analisa tentang hubungan antara Ruang Terbuka Hijau (RTH) dalam mereduksi karbon. Penentuan hubungan luas Ruang Terbuka Hijau (RTH) dengan CO dilakukan dengan menggunakan metode analisis korelasi. Berdasarkan hasil penelitian yang dilakukan, terbukti bahwa ada keterkaitan yang sangat kuat antara Ruang Terbuka Hijau (RTH) dengan CO yaitu dengan nilai korelasi - 0,865. Dimana setiap penurunan luas eksisting Ruang Terbuka Hijau (RTH) sangat berpengaruh terhadap kadar CO.*

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**INTRODUCTION**

South Jakarta is one of city that has rapid development but South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest and Setu Babakan Jagakarsa. South Jakarta has potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict which is located in the administrative city of South Jakarta, is the object of this research.

Air pollution has impact on public health and effects air quality in region. Air pollution is the presence of one or more physical, chemical, or biological substances in the atmosphere in amounts that can

harm human, animal and plant health. Air pollution can be caused by natural sources as well as human activity.

Indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (Indeks Standar Pencemar Udara (ISPU)). According to PP No 41 of 1999 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10 µm (PM), Sulfur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO), oxidants in the form of Ozone (O<sub>3</sub>), and Nitrogen Dioxide (NO<sub>2</sub>).

The acceleration of development in urban areas has an impact on changes in the environment and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or houses is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plant and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behaviour, estrangement of relations between individuals as community actors are forms of social and cultural shift in society.

## METHODE

The type of this research is descriptive quantitative, using secondary data that was obtained from Ministry of Environment and Forest, Park Administration Sub Department, South Jakarta. The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with SPSS to get the correlation between CO and land used.

Table 1. Air pollutant standard index

<b>ISPU (Index)</b>	<b>Level Air Pollution</b>	<b>Healthy Impact</b>
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to human or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality that can be detrimental to health in a number of exposed segments of the population
300-500	Hazardous	Hazardous air quality which in general can seriously harm the health of the population e.g eye irritation, cough and sore throat

According to Government Regulation of Republic of Indonesia No 41 of 1999 concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in the following equation:

$$I = \frac{Ia - Ib}{Xa - Xb} (Xx - Xb) + Ib$$

Dimana :

- I = calculated ISPU
- Ia = upper limit ISPU
- Ib = lower limit ISPU
- Xa = upper limit ambient
- Xb = lower limit ambient
- Xx = real ambient level measurement results

Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be testes is the correlation between green open space and air quality. The independent variable (X) is green open space and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1 with the strength of the correlation relationship can be seen in Table 2.

**Table 2.** Relationship strength correlation coefficient

<b>Correlation Coefficient</b>	<b>Relationship Strength</b>
<b>0,00 - 0,19</b>	Very weak correlation
<b>0,2 - 0,39</b>	Weak correlation
<b>0,4- 0,59</b>	Moderate
<b>0,6 - 0,79</b>	Strong correlation
<b>0,8 - 1</b>	Very strong correlation

(Source:[https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation\\_tbl1\\_322638699](https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation_tbl1_322638699))



**Picture 1.** The location of Jagakarsa

## THE RESULTS AND DISCUSSION

**Table 3.** Number of vehicle in Jagakarsa

Location	Year	Vehicle
Jagakarsa	2015	99.420
	2016	98.795
	2017	99.355
	2018	98.670
	2019	98.890

The number of vehicles in the district of Jagakarsa fluctuates. It can be seen from the following table the number of vehicles in Jagakarsa area.



**Picture 2.** Vehicles in Jagakarsa

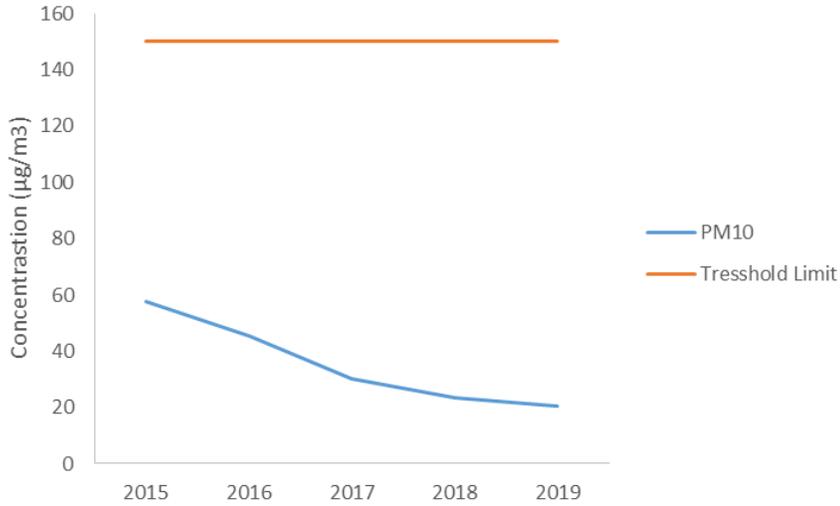
Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is  $228,878 \mu\text{g}/\text{m}^3$  - $244,72 \mu\text{g}/\text{m}^3$  at Tomang flyover (Ripana, 2003).

**PM<sub>10</sub> concentration**

Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer and even death (Lestari, 2019). Threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. Threshold limit value for PM<sub>10</sub> is  $150 \mu\text{g}/\text{m}^3$ . In the following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015-2019 period.

**Table 4.** PM<sub>10</sub> Measurements Results

2015	2016	2017	2018	2019
57,73 $\mu\text{g}/\text{m}^3$	45,45 $\mu\text{g}/\text{m}^3$	30,30 $\mu\text{g}/\text{m}^3$	23,58 $\mu\text{g}/\text{m}^3$	20,56 $\mu\text{g}/\text{m}^3$



**Picture 3.** Concentration of PM<sub>10</sub>

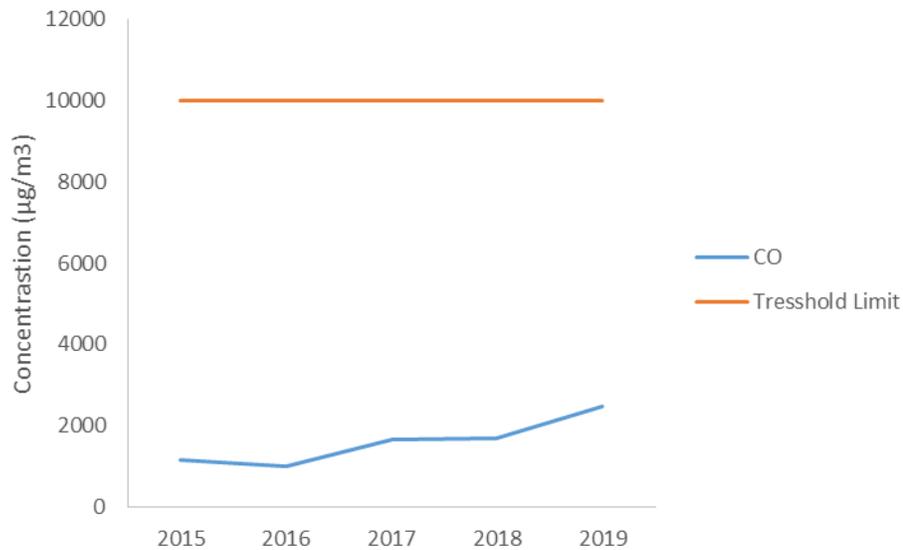
The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017).

**Table 5** Measurements Results of CO

2015	2016	2017	2018	2019
1170 µg/m <sup>3</sup>	1020 µg/m <sup>3</sup>	1670 µg/m <sup>3</sup>	1680 µg/m <sup>3</sup>	2490 µg/m <sup>3</sup>



**Picture 4.** Concentration of CO

CO concentration for 2015-2019 periode fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m3).

### Relationship Between The Number of Vehicles and CO Levels

The large number of vehicles results in air pollution produced by the remaining waste of vehicle fuel (Sugiyanto et al, 2011). High air pollutin can increase environmental temperature and climate change (Soedomo, 2011). One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle.

**Table 6. SPSS Results**

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.207 <sup>a</sup>	.043	-.276	383.95883

a. Predictors: (Constant), CO

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19796.851	1	19796.851	.134	.738 <sup>b</sup>
	Residual	442273.149	3	147424.383		
	Total	462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	99222.343	562.640		176.351	.000
	CO	-.122	.334	-.207	-.366	.738

a. Dependent Variable: Kendaraan

However, the variable number of vehicles with CO levels has a weak correlation (0,207). The absence of close correlation is most likely due to various types and quality of passing vehicles. New vehicles generally have a good internal combustion engine, so CO level released are small. Lack of data can also be an inaccuracy for data processing.

**Table 7. Correlation from SPSS Results**  
**Correlations**

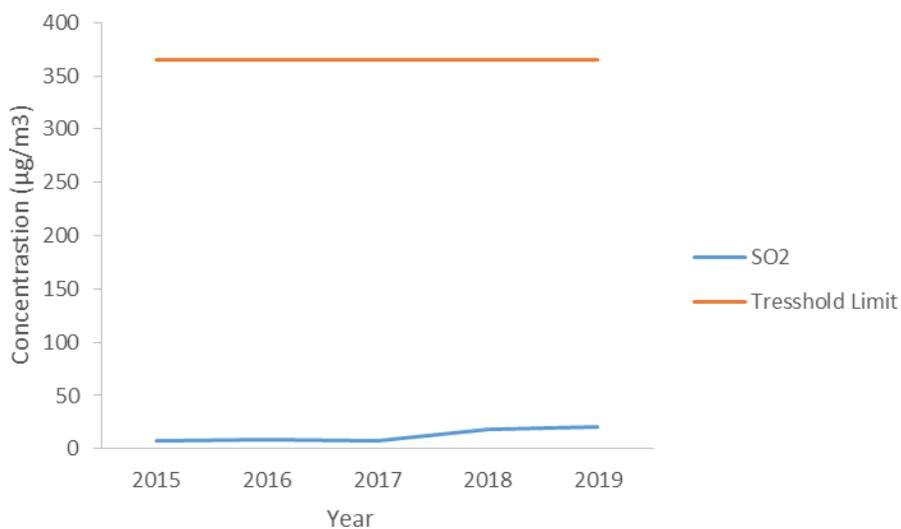
		Kendaraan	CO
Kendaraan	Pearson Correlation	1	-.207
	Sig. (2-tailed)		.738
	N	5	5
CO	Pearson Correlation	-.207	1
	Sig. (2-tailed)	.738	
	N	5	5

**SO<sub>2</sub> (Sulfur Dioxide)**

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gases (SO<sub>x</sub>). This gas is very easily dissolved in water, has an odor but colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015-2019 period.

**Table 8. SO<sub>2</sub> Measurements Results**

2015	2016	2017	2018	2019
7,28 µg/m <sup>3</sup>	8,62 µg/m <sup>3</sup>	8,09 µg/m <sup>3</sup>	18,47 µg/m <sup>3</sup>	20,11 µg/m <sup>3</sup>



### Picture 5 Concentration of SO<sub>2</sub>

Concentration of SO<sub>2</sub> increased every year, it can be seen from table and graph above. But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m<sup>3</sup>.

### O<sub>3</sub> (Ozon)

Table 9. O<sub>3</sub> Measurements Results

2015	2016	2017	2018	2019
64,78 µg/m <sup>3</sup>	72,31 µg/m <sup>3</sup>	56,34 µg/m <sup>3</sup>	56,31 µg/m <sup>3</sup>	70,72 µg/m <sup>3</sup>

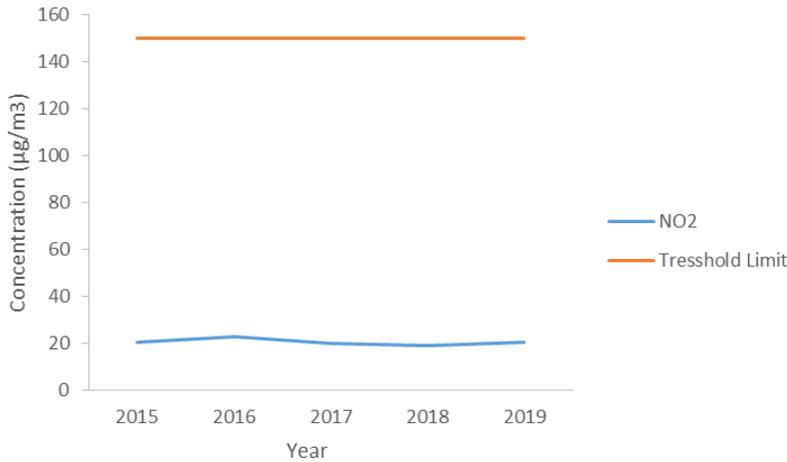


### Picture 6 Concentration of O<sub>3</sub>

The results of measurement of O<sub>3</sub> concentration are quite high, but this value is still below threshold value by PP 41 1999 (235 µg/m<sup>3</sup>).

### NO<sub>2</sub> (Nitrogen Dioxide)

Threshold value for NO<sub>2</sub> is 150µg/m<sup>3</sup>. In the following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015-2019 perio



**Picture 7** Concentration of NO<sub>2</sub>

The results of measurement of NO<sub>2</sub> concentration fluctuated, it can be seen from the table and graph above. However, this value is still safe because it is below threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

**Calculation of ISPU Value of Each Pollutant Parameter**

**Table 10.** ISPU Value of Each Pollutant Parameter

Year	PM <sub>10</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	CO (µg/m <sup>3</sup> )	O <sub>3</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

Each pollutant parameter also has an ISPU value which can be categorized as follows:

**Table 11.** ISPU Value Category of each pollutant parameter

Year	PM <sub>10</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	CO (µg/m <sup>3</sup> )	O <sub>3</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good

2019	Good	Good	Good	Good	Good
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Almost all parameters, ISPU in good condition except PM10 in 2015 at moderate condition

**Green Open Space in Jagakarsa District**

Green Open Space serves indirectly to improve the level of public health. The following is data Green Open Space for 2015-2019.

**Table 12.** Green open space area

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26 Tahun 2007
2015	372.82	746 Ha
2016	336,32	746 Ha
2017	305.62	746 Ha
2018	277,71	746 Ha
2019	258,49	746 Ha

The decreased in the existing area of green open space in 2015-2019 approximately 30%, the decrease could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities

**The Relationship between Areas of Green Open Space and CO Concentration**

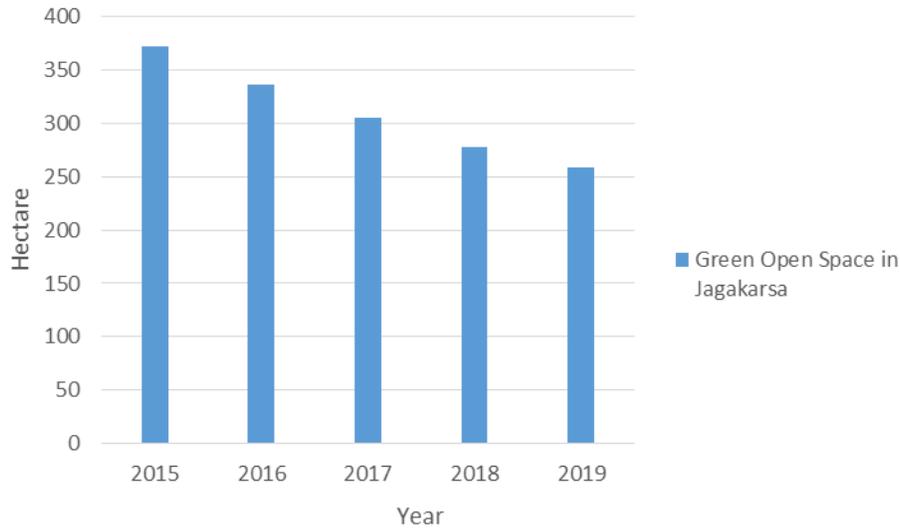
**Table 13.** Correlation between Green open space area and CO Concentration

		Correlations	
		Area	CO
Luasan	Pearson Correlation	1	-.865
	Sig. (2-tailed) N		.058
CO	Pearson Correlation	.5	5
	Sig. (2-tailed) N	-.865	1
		.058	
		5	5

The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower CO concentration.

Decreased area of Green Open Space also affects the quality of CO in the air. As can be seen in the graphic above, there is an increased in CO concentration every year along with the decreased of existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 Of

2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, which is for Jagakarsa District area approximately 746 hectares.



**Picture 8.** Green open space in Jagakarsa

## CONCLUSION

- Almost all parameters, ISPU in good condition except  $PM_{10}$  in 2015 at moderate condition.
- All air pollutant ( $pm_{10}$ , CO, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>) parameters still meet the quality standards based on PP 41 of 1999 from 2015-2019.
- The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area.
- Based on the results of the research, the existing area of green open space that is available is still far from UU No 26 of 20027 which is 30% of total area.

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Pre-Review Discussions				
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We have reached a decision regarding your submission to Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management), "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)".

Our decision is to: Decline Submission

This decision does not reflect the quality of your manuscript. However, to increase the quality of manuscript publishing, we ask all of the authors to prepare several document prior to submission. There are some documents you need to prepare:

1. Author Agreement Declaration
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## AUTHORS AGREEMENT DECLARATION

To:

Editorial Board of Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (JPSSL)

Herewith we submit a manuscript,

Title : CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

Corresponding author name : Purnomosutji Dyah Prinajati

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Jatiasih, Kota Bekasi-Jabar

to be published in Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (JPSSL). We declare that the content of this manuscript or a major portion thereof has not been published, that it is not being submitted for publication elsewhere, and it will not be submitted to any media during the review process, unless we have officially withdrawn the manuscript from Jurnal Manajemen Hutan Tropika on a letter containing relevant reasons signed by all of authors.

We agree to follow the entire process of manuscript selection in accord to Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (JPSSL) procedures, including revising the manuscripts by following the Editor and Reviewers comments in a specified time. We understand and agree that if does not follow the rules will be disqualified for publishing manuscript in Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (JPSSL) for 2 consecutive years since the letter issued.

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

We declare that all listed names are entitled to become an author and all have agreed the final form of submitted manuscripts.

We agree to release to the Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (JPSSL) the copyright of the manuscript.

Thank you for your attention and collaboration.

Date, June 21<sup>st</sup> 2022

A handwritten signature in blue ink, appearing to be 'Purnomosutji Dyah Prinajati'.

(Purnomosutji Dyah Prinajati)

A handwritten signature in blue ink, appearing to be 'Ratih Pratiwi'.

(Ratih Pratiwi)

## ETHICS AND ANTI PLAGIARISM STATEMENT

On behalf of the Authors of the manuscript entitled:

**CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)**

Authors:

1. Purnomosutji Dyah Prinajati
2. Ratih Pratiwi

I hereby declared that:

- a) This manuscript is original (free from fabrication, falsification, plagiarism, duplication, fragmentation/salami and copyright violation of data/contents).
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Jakarta, June 21<sup>st</sup> 2022



(Purnomosutji Dyah Prinajati)

## **DISCLOSURE STATEMENT AND INFORMED CONSENT**

### **Manuscript:**

CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

### **Conflict of Interest:**

Purnomosutji Dyah Prinajati declares that all authors have no conflict of interest. The funding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

### **Human rights statements and informed consent:**

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1964 and its later amendments. Informed consent was obtained from all respondents for being included in this study.

Jakarta, June 21<sup>st</sup> 2022



Purnomosutji Dyah Prinajati

Tanggal 26.06.2022



Dr. Yudi Setiawan, SP., M.E... 14:19



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Thank you for submitting the manuscript, "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)" to Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management). With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Manuscript URL: <https://journal.ipb.ac.id/index.php/jpsl/authorDashboard/submission/41694>

Username: purnomosutji\_dyah\_prinajati

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Please note that the editor will not proceed with your submission to a further stage unless you have already filled out the form.

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Dr. Yudi Setiawan, SP., [M.Env.Sc](#)

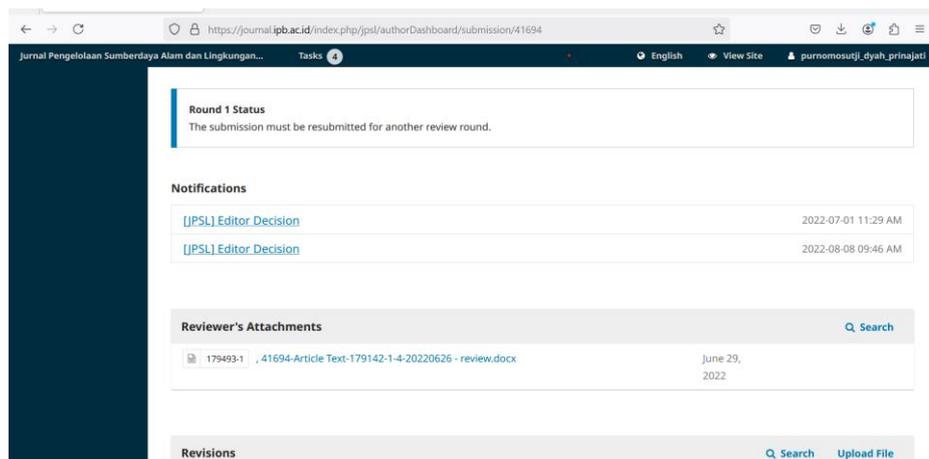
**Dr. Yudi Setiawan, [M.Env.Sc](#)**

Editor-in-Chief

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## BUKTI REVIEW

### The correlation of CO concentration and green open space (case study of Jagakarsa District, South Jakarta)



The screenshot shows the author dashboard for the submission 41694. The 'Round 1 Status' section indicates that the submission must be resubmitted for another review round. The 'Notifications' section lists two messages from the JPSL Editor Decision, dated 2022-07-01 11:29 AM and 2022-08-08 09:46 AM. The 'Reviewer's Attachments' section shows a file named '179493-1\_41694-Article Text-179142-1-4-20220626 - review.docx' uploaded on June 29, 2022. The 'Revisions' section is currently empty.

REVIEW 29 JUNI 2022



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**CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)**

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**Keywords:**Green Open Space, CO,  
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**Abstract:** *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Green plants as one of the elements of Green Open Space have the ability to reduce carbon and some air pollutants. Therefore, in this study an analysis of the relationship between Green Open Space in reducing carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The results is proven that there is a very strong relationship between Green Open Space and CO with a correlation value of -0.865. Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels.*

**Abstrak:** *Kecamatan Jagakarsa di Jakarta Selatan merupakan daerah yang potensial dalam pengembangan Ruang Terbuka Hijau (RTH). Ruang Terbuka Hijau berfungsi secara tidak langsung untuk memperbaiki tingkat kesehatan masyarakat. Salah satu kecamatan di Jakarta Selatan dan sekaligus menjadi objek penelitian ini adalah Kecamatan Jagakarsa. Hal tersebut disebabkan karena adanya dinamika perubahan lahan Ruang Terbuka Hijau (RTH) dan pergeseran pembangunan pemukiman di Kecamatan Jagakarsa. Tumbuhan hijau sebagai salah satu unsur Ruang Terbuka Hijau (RTH) memiliki kemampuan untuk mereduksi karbon dan beberapa zat pencemar udara. Oleh karena itu, pada penelitian ini dilakukan analisa tentang hubungan antara Ruang Terbuka Hijau (RTH) dalam mereduksi karbon. Penentuan hubungan luas Ruang Terbuka Hijau (RTH) dengan CO dilakukan dengan menggunakan metode analisis korelasi. Berdasarkan hasil penelitian yang dilakukan, terbukti bahwa ada keterkaitan yang sangat kuat antara Ruang Terbuka Hijau (RTH) dengan CO yaitu dengan nilai korelasi - 0,865. Dimana setiap penurunan luas eksisting Ruang Terbuka Hijau (RTH) sangat berpengaruh terhadap kadar CO.*

**INTRODUCTION**

South Jakarta is one of city that has rapid development but South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest and Setu Babakan Jagakarsa. South Jakarta has potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict which is located in the administrative city of South Jakarta, is the object of this research.

Air pollution has impact on public health and effects air quality in region. Air pollution is the presence of one or more physical, chemical, or biological substances in the atmosphere in amounts that can harm human, animal and plant health. Air pollution can be cause by natural sources as well as human activity.

Indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (Indeks Standar Pencemar Udara (ISPU)). According to PP No 41 of 1999 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10 µm (PM), Sulfur Dioxide (SO2), Carbon Monoxide (CO), oxidants in the form of Ozone (O), and Nitrogen Dioxide (NO).

The acceleration of development in urban areas has an impact on changes in the environment and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or house is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plant and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behaviour, estrangement of relations between individuals as community actors are form of social and cultural shift in society.

**METHODE**

The type of this research is descriptive quantitative, using secondary data that was obtained from Ministry of Environment and Forest, Park Administration Sub Department. South Jakarta. The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with spss to get the correlation between CO and land used.

Table 1. Air pollutant standar index

ISPU (Index)	Level Air Pollution	Healthy Impact
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to human or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality that can be detrimental to helath in a

**Commented [B11]:** In the background, state why this research is important to study. Provide scientific reviews related to the main problems in this study which are supported by references from previous studies that have been published both from domestic and foreign journals.  
The review in the introduction can be from a methodological or scientific perspective on the level of CO Quality which is correlated with the area of green open space. So it can be seen that this study has a share of knowledge about the environment.  
Also state that this research is interesting because it has not been done by many previous researchers and of course it is supported by references from previous studies that have not revealed the problems in this study. Write down the problems in this study which ends with a statement of the general objectives and specific objectives of this study.

**Commented [B12]:** Describe in the methodology the steps to achieve the goals followed by analytical tools justified by supporting theory. Also provide references to similar methodologies from previous researchers. Also disclose the advantages of the methodology used to complete the objectives of this study.

**Commented [B13]:** Apa index ini juga berlaku di Indonesia?

300-500



number of exposed segments of the population

Hazardous air quality which in general can seriously harm the health of the population e.g eye irritation, cough and sore throat

According to Government Regulation of Republic of Indonesia No 41 of 1999 concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in the following equation:

$$I = \frac{Ia - Ib}{Xa - Xb} (Xx - Xb) + Ib$$

Dimana :

- I = calculated ISPU
- Ia = upper limit ISPU
- Ib = lower limit ISPU
- Xa = upper limit ambient
- Xb = lower limit ambient
- Xx = real ambient level measurement results

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Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be testes is the correlation between green open space and air quality. The independent variable (X) is green open space and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1 with the strength of the correlation relationship can be seen in Table 2.

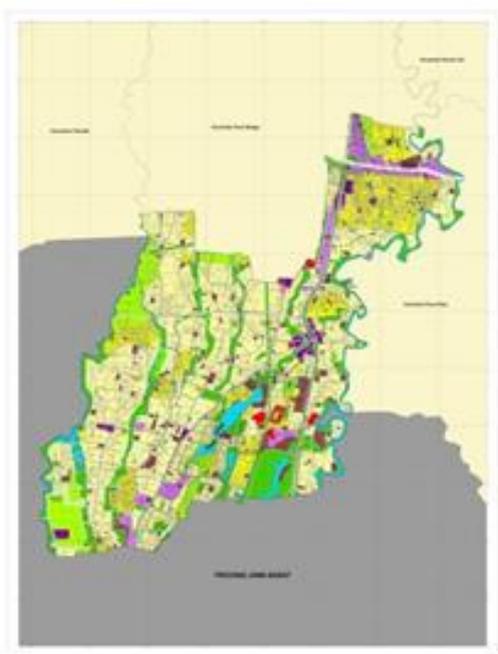
Table 2. Relationship strength correlation coefficient

Correlation Coefficient	Relationship Strength
0,00 - 0,19	Very weak correlation
0,2 - 0,39	Weak correlation
0,4 - 0,59	Moderate
0,6 - 0,79	Strong correlation

Commented [B15]: what is the basis of this criterion

<b>0,8 - 1</b>	Very strong correlation
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(Source: [https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation\\_tbl1\\_322638699](https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation_tbl1_322638699))



**Picture 1.** The location of Jagakarsa

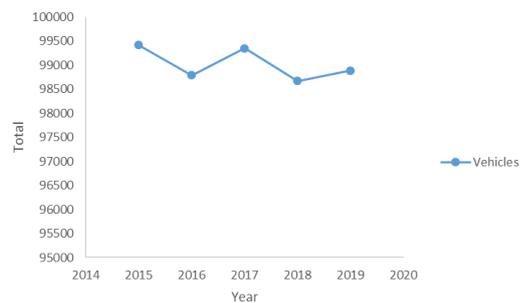
**THE RESULTS AND DISCUSSION**

**Table 3.** Number of vehicle in Jagakarsa

Location	Year	Vehicle
Jagakarsa	2015	99.420
	2016	98.795
	2017	99.355
	2018	98.670
	2019	98.890

**Commented [B16]:** Results and discussion, provide a scientific review of the data obtained. Elaborate with supporting theory and the advantages and novelties obtained in this study. Also reveal what are the advantages of the results of this study compared to the results of previous studies.

The number of vehicles in the district of Jagakarsa fluctuates. It can be seen from the following table the number of vehicles in Jagakarsa area. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is  $228,878 \mu\text{g}/\text{m}^3$  -  $244,72 \mu\text{g}/\text{m}^3$  at Tomang flyover (Ripahan, 2003).



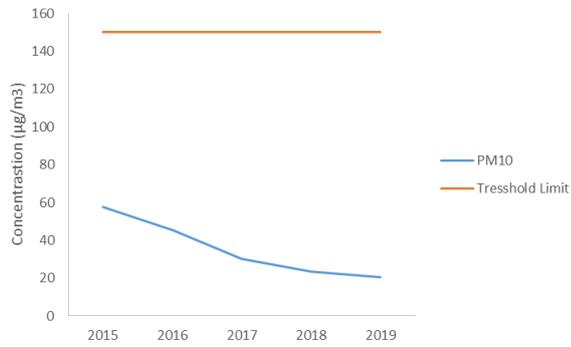
**Picture 2.** Vehicles in Jagakarsa

#### **PM<sub>10</sub> concentration**

Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer and even death (Lestari, 2019). Threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. Threshold limit value for PM<sub>10</sub> is  $150 \mu\text{g}/\text{m}^3$ . In the following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015-2019 period.

**Table 4.** PM<sub>10</sub> Measurements Results

2015	2016	2017	2018	2019
57,73	45,45	30,30	23,58	20,56



**Picture 3.** Concentration of PM<sub>10</sub>

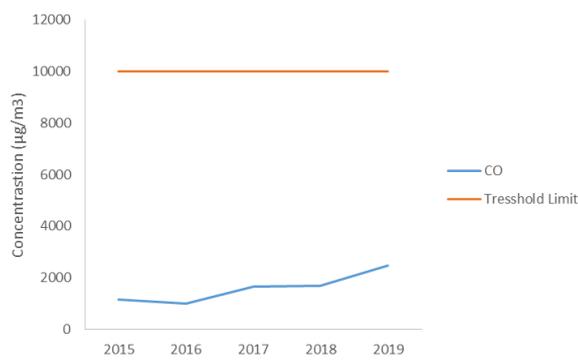
The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017).

**Table 5** Measurements Results of CO

2015	2016	2017	2018	2019
1170	1020	1670	1680	2490
3	3	3	3	3



**Picture 4.** Concentration of CO

CO concentration for 2015-2019 periode fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m<sup>3</sup>).

### Relationship Between The Number of Vehicles and CO Levels

The large number of vehicles results in air pollution produced by the remaining waste of vehicle fuel (Sugiyanto et al, 2011). High air pollutin can increase environmental temperature and climate change (Soedomo, 2011). One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle.

**Table 6.** SPSS Results

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the
1	.276 <sup>a</sup>	.040	.276	222.05883

a. Predictors: (Constant), CO

**ANOVA<sup>a</sup>**

Model <sup>b</sup>	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	42700.854	1	42700.854	4.24	.039 <sup>b</sup>
Residual	442273.149	3	147424.383		
Total	462070.000	4			

a. Dependent Variable: Kendaraan  
b. Predictors: (Constant), CO

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	22222.222	522.640		42.524	.000
CO	-.122	.334	-.207	-.366	.738

a. Dependent Variable: Kendaraan

However, the variable number of vehicles with CO levels has a weak correlation (0,207). The absence of close correlation is most likely due to various types and quality of passing vehicles. New vehicles generally have a good internal combustion engine, so CO level released are small. Lack of data can also be an inaccuracy for data processing.

**Table 7.** Correlation from SPSS Results

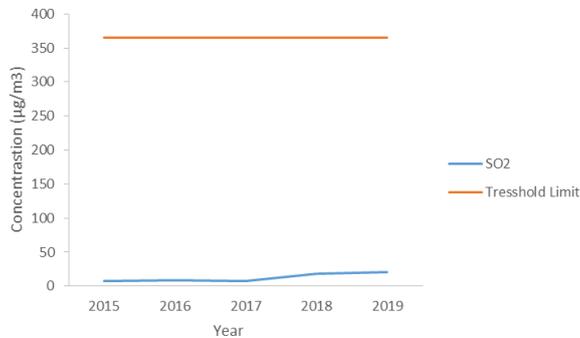
		Correlations	
Kendaraan	Pearson Correlation	.207	.738
	Sig. (2-tailed)	.5	.5
	N		
	Pearson Correlation	.738	.5

### SO<sub>2</sub> (Sulfur Dioxide)

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gases (SO<sub>x</sub>). This gas is very easily dissolved in water, has an odor but colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015-2019 period.

**Table 8.** SO<sub>2</sub> Measurements Results

2015	2016	2017	2018	2019
7,28 µg/m <sup>3</sup>	8,62 µg/m <sup>3</sup>	8,09 µg/m <sup>3</sup>	18,47 µg/m <sup>3</sup>	20,11 µg/m <sup>3</sup>

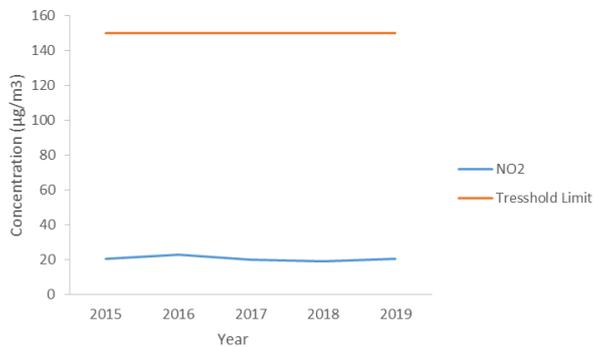


**Picture 5** Concentration of SO<sub>2</sub>

Concentration of SO<sub>2</sub> increased every year, it can be seen from table and graph above. But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m<sup>3</sup>.

**NO<sub>2</sub> (Nitrogen Dioxide)**

Threshold value for NO<sub>2</sub> is 150µg/m<sup>3</sup>. In the following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015-2019 period



**Picture 6** Concentration of NO<sub>2</sub>

The results of measurement of NO<sub>2</sub> concentration fluctuated, it can be seen from the table and graph above. However, this value is still safe because it is below threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

### Calculation of ISPU Value of Each Pollutant Parameter

**Table 9.** ISPU Value of Each Pollutant Parameter

Year	PM <sub>10</sub> (µg/m)	SO <sub>2</sub> (µg/)	CO (µg/)	O <sub>3</sub> (µg)	NO <sub>2</sub> (µg/)
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

Each pollutant parameter also has an ISPU value which can be categorized as follows:

**Table 10.** ISPU Value Category of each pollutant parameter

Year	PM <sub>10</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m)	CO	O <sub>3</sub> (µg/m)	NO <sub>2</sub> (µg/m <sup>3</sup> )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good
2019	Good	Good	Good	Good	Good

Almost all parameters, ISPU in good condition except PM<sub>10</sub> in 2015 at moderate condition

### Green Open Space in Jagakarsa District

Green Open Space serves indirectly to improve the level of public health. The following is data Green Open Space for 2015-2019.

**Table 11.** Green open space area

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26 Tahun 2007
2015	372.82	746 Ha
2016	336,32	746 Ha
2017	305.62	746 Ha
2018	277,71	746 Ha
2019	258,49	746 Ha

The decreased in the existing area of green open space in 2015-2019 approximately 30%, the decrease could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities

**The Relationship between Areas of Green Open Space and CO Concentration**

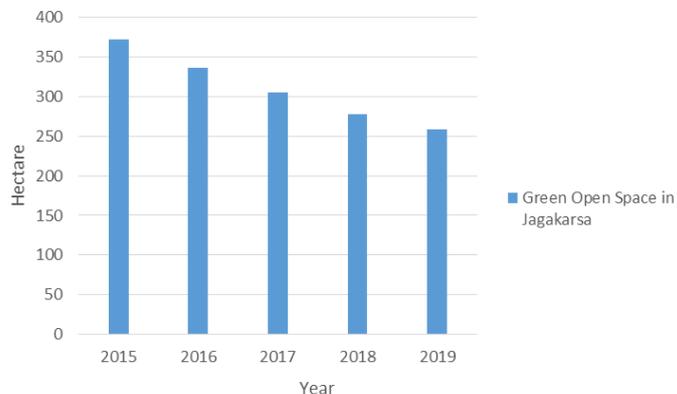
**Table 12.** Correlation between Green open space area and CO Concentration

		Area	CO
Luasan	• Pearson Correlation	1	-.865
	• Sig. (2-tailed)	5	.058
	• N	5	1
	• Pearson Correlation	-.865	.058
	• Sig. (2-tailed)	.058	5

The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower CO concentration.

Decreased area of Green Open Space also affects the quality of CO in the air. As can be seen in the graphic above, there is an increased in CO concentration every year along with the decreased of existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, which is for Jagakarsa District area approximately 746 hectares.

Green open space in Yogyakarta urban area reached 1,469.45 Ha or 16.2% of the total area. The need for green open space lacked 13.8% of the total area. Good condition was found only in low-density settlement, while poor condition of green open space was located in high-density settlement (Brontowiyono, 2016)



Picture 7. Green open space in Jagakarsa

## CONCLUSION

- Almost all parameters, ISPU in good condition except PM<sub>10</sub> in 2015 at moderate condition.
- All air pollutant (pm<sub>10</sub>, CO, SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>) parameters still meet the quality standards based on PP 41 of 1999 from 2015-2019.
- The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area.
- Based on the results of the research, the existing area of green open space that is available is still far from UU No 26 of 20027 which is 30% of total area.

Commented [B17]: the conclusion does not answer the research objectives

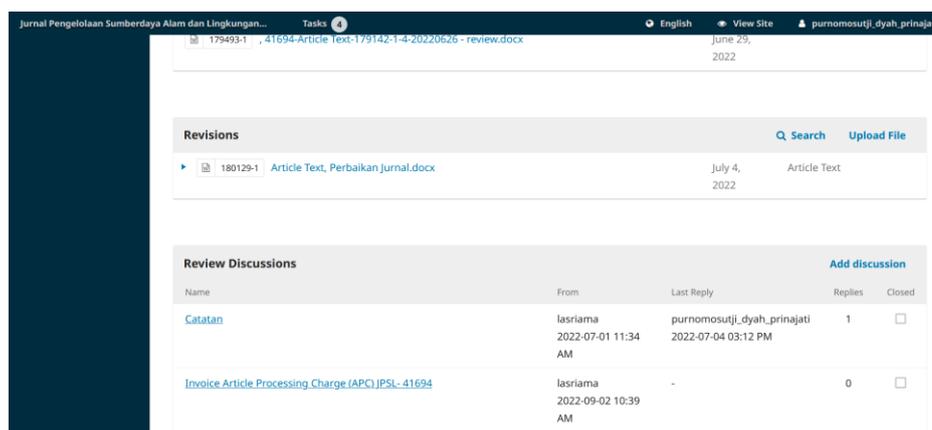
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## PERBAIKAN JURNAL

04 JULI 2022



The screenshot shows a web interface for managing journal submissions. At the top, there's a navigation bar with 'English', 'View Site', and a user profile 'purnomosutji\_dyah\_prinajati'. Below this, a 'Revisions' section is visible, containing a table with one entry: '180129-1 Article Text, Perbaikan Jurnal.docx' dated 'July 4, 2022'. Below the revisions is a 'Review Discussions' section with a table listing discussions from 'lasriama' and 'purnomosutji\_dyah\_prinajati'.

Revisions		Search	Upload File
180129-1	Article Text, Perbaikan Jurnal.docx	July 4, 2022	Article Text

Review Discussions		Add discussion			
Name	From	Last Reply	Replies	Closed	
Catatan	lasriama	2022-07-01 11:34 AM	purnomosutji_dyah_prinajati	1	<input type="checkbox"/>
Invoice Article Processing Charge (APC) JPSL-41694	lasriama	2022-09-02 10:39 AM	-	0	<input type="checkbox"/>



*Journal of Natural Resources and Environmental Management*

9(1): 100-103. <http://dx.doi.org/10.29244/jpsl.9.1.%15p>

E-ISSN: 2460-5824

<http://journal.ipb.ac.id/index.php/jpsl>

## The Correlation of CO Concentration and Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

Available Online: xx – xx - xxxx

### Article Info:

Received: xx – xx - xxxx

### Keywords:

in revised form: xx – xx - xxxx

Green Open Space, CO, Jagakarsa

Accepted: xx – xx - xxxx

**Abstract:** Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Therefore, in this study an analysis of the relationship between Green Open Space and carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The results is proven that there is a very strong relationship between Green Open Space and CO with a correlation value of  $-0.865$ . Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels. Total CO that can be absorbed by tree is  $21.371,01$  kg/ha in Jagakarsa.

## INTRODUCTION

South Jakarta is one of city that has rapid development but South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest and Setu Babakan Jagakarsa. South Jakarta has potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict which is located in the administrative city of South Jakarta, is the object of this research.

Air pollution has impact on public health and effects air quality in region. Air pollution is the presence of one or more physical, chemical, or biological substances in the atmosphere in amounts that can harm human, animal and plant health. Air pollution can be cause by natural sources as well as human activity.

According to Agista (2020), the worst quality of South Jakarta in 2018 with 81 days unhealthy, while the best air quality in 2014 with 20 days was not healthy.

Indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (Indeks Standar Pencemar Udara (ISPU)). According to PP No 41 of 1999 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10  $\mu\text{m}$  (PM), Sulfur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO), oxidants in the form of Ozone (O), and Nitrogen Dioxide (NO).

The acceleration of development in urban areas has an impact on changes in the environment and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or house is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plant and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behaviour, estrangement of relations between individuals as community actors are form of social and cultural shift in society.

According to Aly (2020) with the title The capability of green open space in absorbing carbon monoxide and carbon dioxide emissions in Balai Kota Makassar, for Zone II and Zone III, carbon dioxide and carbon monoxide emissions from motor vehicles are 100% absorbed by existing vegetation. While for Zone I carbon dioxide emissions from motor vehicles have not been able to be absorbed completely by existing vegetation and in Zone IV carbon dioxide and carbon monoxide emissions from motor vehicles have not been able to be absorbed by existing vegetation. This 100% absorption ability is based on emission data during measurement hours (daytime).

## METHODE

The type of this research is non experimental research which is included in descriptive quantitative, using secondary data that was obtained from Ministry of Environment and Forest, Park Administration Sub Department. South Jakarta. Data were obtained from the ambient air quality monitoring station.

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The review in the introduction can be from a methodological or scientific perspective on the level of CO Quality which is correlated with the area of green open space. So it can be seen that this study has a share of knowledge about the environment. Also state that this research is interesting because it has not been done by many previous researchers and of course it is supported by references from previous studies that have not revealed the problems in this study. Write down the problems in this study which ends with a statement of the general objectives and specific objectives of this study.

**Commented [B19]:** Describe in the methodology the steps to achieve the goals followed by analytical tools justified by supporting theory. Also provide references to similar methodologies from previous researchers. Also disclose the advantages of the methodology used to complete the objectives of this study.



Picture Air Quality Monitoring Station

The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with spss to get the correlation between CO and land used. The location of monitoring station is in Taman Pendidikan Dinas Pertamanan, Jagakarsa, the coordinate is - 6.356317,106.804713.

Table 1. Air pollutant standar index based on Minister of Environment and Forestry Regulation No P.14.MENLHK/SETJEN/KUM.1/7/2020

Commented [B110]: Apa index ini juga berlaku di Indonesia?

ISPU (Index)	Level Air Pollution	Healthy Impact
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to human or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality that can be detrimental to health in a number of exposed segments of the population
300-500	Hazardous	Hazardous air quality which in general can seriously harm the health of the population e.g eye irritation, cough and sore throat

According to Government Regulation of Republic of Indonesia No 41 of 1999 concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in the following equation:

$$I = \frac{I_a - I_b}{X_a - X_b} (X_x - X_b) + I_b$$

Where :

I = calculated ISPU

Ia = upper limit ISPU

Ib = lower limit ISPU

Xa = upper limit ambient

Xb = lower limit ambient

Xx = real ambient level measurement results

Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be tested is the correlation between green open space and air quality. The independent variable (X) is green open space and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1 with the strength of the correlation relationship can be seen in Table 2.

**Table 2.** Relationship strength correlation coefficient based on Pearson correlation

<b>Correlation Coefficient</b>	<b>Relationship Strength</b>
<b>0,00 - 0,19</b>	Very weak correlation
<b>0,2 - 0,39</b>	Weak correlation
<b>0,4 - 0,59</b>	Moderate
<b>0,6 - 0,79</b>	Strong correlation
<b>0,8 - 1</b>	Very strong correlation

(Source: [https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation\\_tbl1\\_322638699](https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation_tbl1_322638699))

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**Commented [B112]:** what is the basis of this criterion



**Picture 1.** The location of Jagakarsa

Then to calculate the absorption power of vegetation using this table:

Type of Vegetation Cover	CO2 Absorption Power of Vegetation		
	Kg/ha/hour	Kg/ha/day	Kg/ha/year
Tree	129.925	1559.1	569.07
Bush	12.556	150.68	55
Grassland	2.74	32.88	12
Rice field	2.74	32.99	12

(Prasetyo in Tinambunan, 2006)

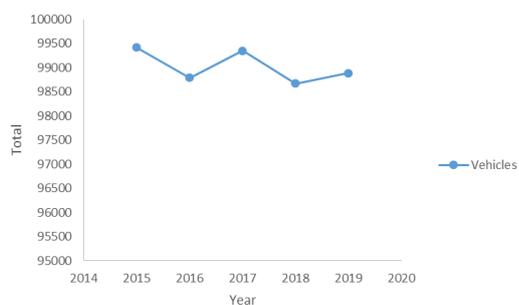
**THE RESULTS AND DISCUSSION**

**Table 3.** Number of vehicle in Jagakarsa

Location	Year	Vehicle
Jagakarsa	2015	99.420
	2016	98.795
	2017	99.355
	2018	98.670
	2019	98.890

**Commented [B113]:** Results and discussion, provide a scientific review of the data obtained. Elaborate with supporting theory and the advantages and novelties obtained in this study. Also reveal what are the advantages of the results of this study compared to the results of previous studies.

The number of vehicles in the district of Jagakarsa fluctuates. It can be seen from the following table the number of vehicles in Jagakarsa area. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is  $228,878 \mu\text{g}/\text{m}^3$  -  $244,72 \mu\text{g}/\text{m}^3$  at Tomang flyover (Ripana, 2003).



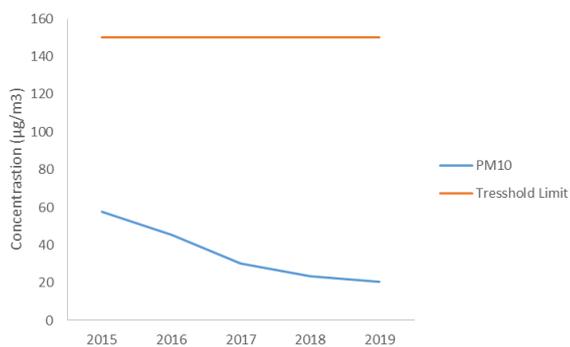
**Picture 2.** Vehicles in Jagakarsa

### PM<sub>10</sub> concentration

Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer and even death (Lestari, 2019). Threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. Threshold limit value for PM<sub>10</sub> is  $150 \mu\text{g}/\text{m}^3$ . In the following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015-2019 period.

**Table 4.** PM<sub>10</sub> Measurements Results

2015	2016	2017	2018	2019
57,73	45,45	30,30	23,58	20,56



**Picture 3.** Concentration of PM<sub>10</sub>

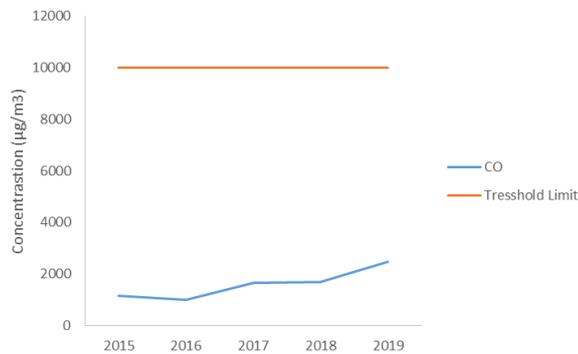
The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017).

**Table 5** Measurements Results of CO

2015	2016	2017	2018	2019
1170	1020	1670	1680	2490



**Picture 4.** Concentration of CO

CO concentration for 2015-2019 periode fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m<sup>3</sup>). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m<sup>3</sup> -244,72 µg/m<sup>3</sup> at Tomang flyover (Ripanah, 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

### Relationship Between The Number of Vehicles and CO Levels

The large number of vehicles results in air pollution produced by the remaining waste of vehicle fuel (Sugiyanto et al, 2011). High air pollutin can increase environmental temperature and climate change (Soedomo, 2011). One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle.

**Table 6.** SPSS Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the
1	.207 <sup>a</sup>	.042	.207	222.85000

a. Predictors: (Constant), C

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10706.951	1	10706.951	1.24	.729 <sup>b</sup>
	Residual	442273.149	3	147424.383		
	Total	462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients <sup>a</sup>					
Model		Unstandardized Coefficients	Standardized	t	Sig.
1	(Constant)	20222.242	.562	176.251	.000
		-.122	-.334	-.207	.738

a. Dependent Variable: Kendaraan

However, the variable number of vehicles with CO levels has a weak correlation (0,207). The absence of close correlation is most likely due to various types and quality of passing vehicles. New vehicles generally have a good internal combustion engine, so CO level released are small. Lack of data can also be an inaccuracy for data processing.

**Table 7.** Correlation from SPSS Results

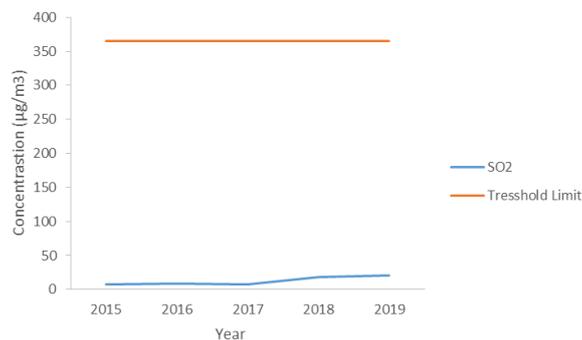
Correlations		
	Kendaraan	CO
Kendaraan	1	.207
		.738
	Sig. (2-tailed)	.5
	N	5
	Pearson Correlation	.738
		5

## SO<sub>2</sub> (Sulfur Dioxide)

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gases (SO<sub>x</sub>). This gas is very easily dissolved in water, has an odor but colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015-2019 period.

**Table 8.** SO<sub>2</sub> Measurements Results

2015	2016	2017	2018	2019
7,28	8,62	8,09	18,47	20,11

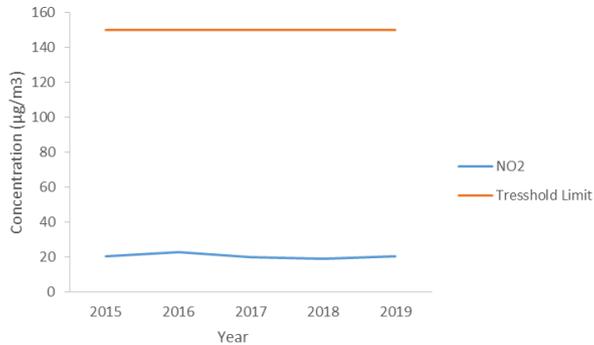


**Picture 5** Concentration of SO<sub>2</sub>

Concentration of SO<sub>2</sub> increased every year, it can be seen from table and graph above. But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m<sup>3</sup>.

## NO<sub>2</sub> (Nitrogen Dioxide)

Threshold value for NO<sub>2</sub> is 150µg/m<sup>3</sup>. In the following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015-2019 period



**Picture 6** Concentration of NO<sub>2</sub>

The results of measurement of NO<sub>2</sub> concentration fluctuated, it can be seen from the table and graph above. However, this value is still safe because it is below threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

**Calculation of ISPU Value of Each Pollutant Parameter**

**Table 9.** ISPU Value of Each Pollutant Parameter

Year	PM <sub>10</sub> (µg/m)	SO <sub>2</sub> (µg/)	CO (µg/)	O <sub>3</sub> (µg)	NO <sub>2</sub> (µg/)
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

Each pollutant parameter also has an ISPU value which can be categorized as follows:

**Table 10.** ISPU Value Category of each pollutant parameter

Year	PM10 (µg/m <sup>3</sup> )	SO2 (µg/m <sup>3</sup> )	CO	O3 (µg/m)	NO2 (µg/m <sup>3</sup> )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good
2019	Good	Good	Good	Good	Good

Almost all parameters, ISPU in good condition except PM10 in 2015 at moderate condition

### Green Open Space in Jagakarsa District

Green Open Space serves indirectly to improve the level of public health. The following is data Green Open Space for 2015-2019.

**Table 11.** Green open space area

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26 Year 2007	Difference between existing and regulation
2015	372.82	746 Ha	-50,02 %
2016	336,32	746 Ha	-54,91%
2017	305.62	746 Ha	-59,03%
2018	277,71	746 Ha	-62,77%
2019	258,49	746 Ha	-65,34%

The decreased in the existing area of green open space in 2015-2019 approximately 30,66%, the decreased could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities. The existing green open space still not meet regulation.

According to Prasetyo in Tinambunan (2006), the absorption CO<sub>2</sub> from tree is 129,92 kg/ha/hour. If all the green open space is assumed as tree, then total CO<sub>2</sub> can be absorbed by tree is 33.583,02 kg/hour and total CO that can be absorbed by tree is 21.371,01 kg/ha.

### The Relationship between Areas of Green Open Space and CO Concentration

**Table 12.** Correlation between Green open space area and CO Concentration

Correlations		
	Area	CO
▪ Pearson Correlation	1	-.865
▪ Sig. (2-tailed)	.058	.058
Luasan	5	5
▪ N	5	5
▪ Pearson Correlation	.058	.058

The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower CO concentration. Based on research from Aly (2020), green open space existing already can absorb 100% carbon dioxide emissions and carbon monoxide.

Decreased area of Green Open Space also affects the quality of CO in the air. As can be seen in the graphic above, there is an increased in CO concentration every year along with the decreased of existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, which is for Jagakarsa District area approximately 746 hectares.

Green open space in Yogyakarta urban area reached 1,469.45 Ha or 16.2% of the total area. The need for green open space lacked 13.8% of the total area. Good condition was found only in low-density settlement, while poor condition of green open space was located in high-density settlement (Brontowiyono, 2016)

## CONCLUSION

- The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area.
- Based on the results of the research, the existing area of green open space from 2015-2019 is decreased to 30,66%. The highest difference is in 2019 with -65,34 %.
- Total CO<sub>2</sub> can be absorbed by tree is 33.583,02 kg/hour. total CO that can be absorbed by tree is 21.371,01 kg/ha.

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Tinambunan, R. 2006. Analisis Kebutuhan Ruang Terbuka Hijau di Kota Pekanbaru. Bogor: Institut Pertanian Bogor.

The screenshot shows a web browser window with the URL <https://journal.ipb.ac.id/index.php/jpsl/authorDashboard/submission/41694>. The page title is "Invoice Article Processing Charge (APC) JPSL- 41694". Under the "Participants" section, the names "Lasriama Siahaan (lasriama)" and "Purnomosutji Dyah Prinajati (purnomosutji\_dyah\_prinajati)" are listed. The "Messages" section contains a message from "lasriama" dated "2022-09-02 10:39 AM". The message text reads: "Dear Author Here we charge the Article Processing Charge (APC) Journal of Natural Resources and Environmental Management (JPSL) Vol. 12 No. 4 in 2022 in the amount of Rp. 1,700,000 along with the attached invoice. Please include proof of payment (transfer-proof) (\*.pdf or \*.jpg) to the JPSL email (jpsl-ipb@aps.ipb.ac.id) by including the manuscript code in the email subject. \*NB: Only manuscripts that have paid the publication fee will be published by JPSL. Manuscripts that have paid the publication fee will be uploaded immediately for us to publish."

## REVIEWER'S ATTACHMENTS

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Round 1 Round 2

**Round 2 Status**  
Submission accepted.

**Notifications**

<a href="#">[JPSL] Editor Decision</a>	2022-07-01 11:29 AM
<a href="#">[JPSL] Editor Decision</a>	2022-08-08 09:46 AM

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182899-1	<a href="#">42246-Article Text-182744-1-4-20220725 Review.docx</a>	July 28, 2022
184025-1	<a href="#">JPSLreview 41694-Article Text-180190-1-4-20220704.docx</a>	August 7, 2022



**Lasriama Siahaan** 11:29  
kepada saya ▾



Purnomosutji Dyah Prinajati:

We have reached a decision regarding your submission to Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management), "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)".

Our decision is to: major revision

Reveal the superiority of the research results compared to the results of previous studies. Give a clear statement about the novelty obtained and what can be contributed to the development of science related to this research.

Lasriama Siahaan  
Phone 081318263084  
[uniesiahaan@gmail.com](mailto:uniesiahaan@gmail.com)

**Dr. Yudi Setiawan, M.Env.Sc**  
Editor-in-Chief



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# The Correlation of CO Concentration and Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

21.371,01 kg/ha in Jagakarsa.

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**Abstract:** *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Therefore, in this study an analysis of the relationship between Green Open Space and carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The results is proven that there is a very strong relationship between Green Open Space and CO with a correlation value of -0.865. Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels. Total CO that can be absorbed by tree is*

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12 tables too many. Tables no more than 5, as well as Fig. Please combine to be more effective.

On the other hand, the description in the discussion needs to be enriched by comparing the results of previous studies.

**Commented [A16]:** Finally, provide the policy implications.

**Commented [A15]:** It is necessary to briefly inform how the data was collected and measured.

## INTRODUCTION

South Jakarta is one of city that has rapid development but South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest and Setu Babakan Jagakarsa. South Jakarta has potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict which is located in the administrative city of South Jakarta, is the object of this research.

Air pollution has impact on public health and effects air quality in region. Air pollution is the presence of one or more physical, chemical, or biological substances in the atmosphere in amounts that can harm human, animal and plant health. Air pollution can be cause by natural sources as well as human activity.

According to Agista (2020), the worst quality of South Jakarta in 2018 with 81 days unhealthy, while the best air quality in 2014 with 20 days was not healthy.

Indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (Indeks Standar Pencemar Udara (ISPU)). According to PP No 41 of 1999 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10  $\mu\text{m}$  (PM), Sulfur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO), oxidants in the form of Ozone (O), and Nitrogen Dioxide (NO).

The acceleration of development in urban areas has an impact on changes in the environment and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or house is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plant and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behaviour, estrangement of relations between individuals as community actors are form of social and cultural shift in society.

According to Aly (2020) with the title The capability of green open space in absorbing carbon monoxide and carbon dioxide emissions in Balai Kota Makassar, for Zone II and Zone III, carbon dioxide and carbon monoxide emissions from motor vehicles are 100% absorbed by existing vegetation. While for Zone I carbon dioxide emissions from motor vehicles have not been able to be absorbed completely by existing vegetation and in Zone IV carbon dioxide and carbon monoxide emissions from motor vehicles have not been able to be absorbed by existing vegetation. This 100% absorption ability is based on emission data during measurement hours (daytime).

## METHODE

The type of this research is non experimental research which is included in descriptive quantitative, using secondary data that was obtained from Ministry of Environment and Forest, Park Administration Sub Department. South Jakarta. Data were obtained from the ambient air quality monitoring station.

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The review in the introduction can be from a methodological or scientific perspective on the level of CO Quality which is correlated with the area of green open space. So it can be seen that this study has a share of knowledge about the environment. Also state that this research is interesting because it has not been done by many previous researchers and of course it is supported by references from previous studies that have not revealed the problems in this study. Write down the problems in this study which ends with a statement of the general objectives and specific objectives of this study.

**Commented [A18]:** Write down your reasons in the article, why you don't use the Minister of Environment and Forestry Regulation No. 15 of 2020 as a reference for measuring the ISPU parameters.

In this 2020 regulation, the latest ISPU (Air Pollutant Standard Index) parameters are PM10, PM2.5, SO<sub>2</sub>, CO, O<sub>3</sub>, HC, and NO<sub>2</sub>.

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The biggest contribution of air pollution in Jagakarsa comes from transportation (in %), industry, community activities (in %);

Availability of carrying capacity of green open space (RTH) in Jagakarsa (Ha);

Average ISPU max per month for CO in Jagakarsa.

**Commented [B120]:** Describe in the methodology the steps to achieve the goals followed by analytical tools justified by supporting theory. Also provide references to similar methodologies from previous researchers. Also disclose the advantages of the methodology used to complete the objectives of this study.



Picture Air Quality Monitoring Station

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The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with spss to get the correlation between CO and land used. The location of monitoring station is in Taman Pendidikan Dinas Pertamanan, Jagakarsa, the coordinate is - 6.356317,106.804713.

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Table 1. Air pollutant standar index based on Minister of Environment and Forestry Regulation No P.14.MENLHK/SETJEN/KUM.1/7/2020

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ISPU (Index)	Level Air Pollution	Healthy Impact
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to human or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality that can be detrimental to helath in a number of exposed segments of the population
300-500	Hazardous	Hazardous air quality which in general can seriously harm the health of the population e.g eye irritation, cough and sore throat

According to Government Regulation of Republic of Indonesia No 41 of 1999 concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in the following equation:

$$I = \frac{Ia - Ib}{Xa - Xb} (Xx - Xb) + Ib$$

Where :

- I = calculated ISPU
- Ia = upper limit ISPU
- Ib = lower limit ISPU
- Xa = upper limit ambient
- Xb = lower limit ambient
- Xx = real ambient level measurement results

Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be testes is the correlation between green open space and air quality. The independent variable (X) is green open space and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1 with the strength of the correlation relationship can be seen in Table 2.

**Table 2.** Relationship strength correlation coefficient based on Pearson correlation

Correlation Coefficient	Relationship Strength
0,00 - 0,19	Very weak correlation
0,2 - 0,39	Weak correlation
0,4 - 0,59	Moderate
0,6 - 0,79	Strong correlation
0,8 - 1	Very strong correlation

(Source: [https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation\\_tbl1\\_322638699](https://www.researchgate.net/figure/Guidance-of-correlation-coefficient-interpretation_tbl1_322638699))

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**Commented [A28]:** The citation source must state the author and year (Name, 20xx). Please check the original source on RG



**Picture 1.** The location of Jagakarsa

Then to calculate the absorption power of vegetation using this table:

Type of Vegetation Cover	CO2 Absorption Power of Vegetation		
	Kg/ha/hour	Kg/ha/day	Kg/ha/year
Tree	129.925	1559.1	569.07
Bush	12.556	150.68	55
Grassland	2.74	32.88	12
Rice field	2.74	32.99	12

(Prasetyo in Tinambunan, 2006)

**THE RESULTS AND DISCUSSION**

**Table 3.** Number of vehicle in Jagakarsa

Location	Year	Vehicle
Jagakarsa	2015	99.420
	2016	98.795

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**Commented [B133]:** Results and discussion, provide a scientific review of the data obtained. Elaborate with supporting theory and the advantages and novelties obtained in this study. Also reveal what are the advantages of the results of this study compared to the results of previous studies.

**Commented [A34]:** In "Green City Resolution 30 Percent RTH" By Nirwono Yoga dan Iwan (2011)

Green open space in Jagakarsa is dominated by water absorption zones rather than land cover zones. What kind of policy control is most suitable to be implemented?

Please state in the discussion section.

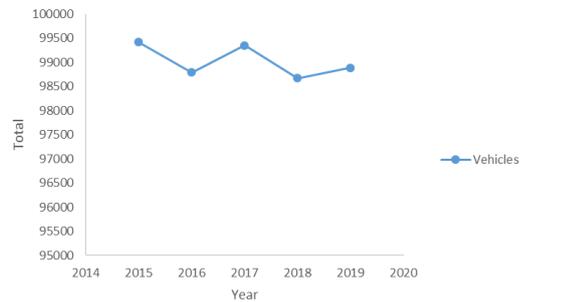
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	2017	99.355
	2018	98.670
	2019	98.890

The number of vehicles in the district of Jagakarsa fluctuates. It can be seen from the following table the number of vehicles in Jagakarsa area. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878  $\mu\text{g}/\text{m}^3$  -244,72  $\mu\text{g}/\text{m}^3$  at Tomang flyover (Ripana, 2003).

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Picture 2. Vehicles in Jagakarsa

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### PM<sub>10</sub> concentration

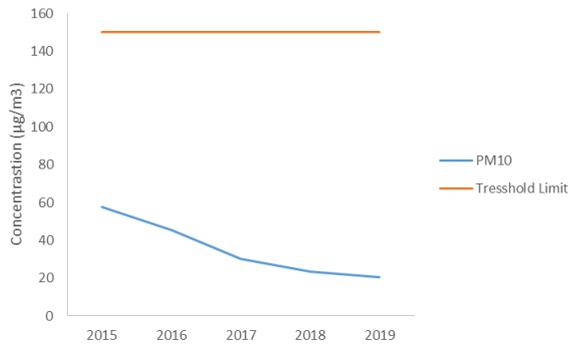
Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer and even death (Lestari, 2019). Threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. Threshold limit value for PM<sub>10</sub> is 150  $\mu\text{g}/\text{m}^3$ . In the following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015-2019 period.

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Table 4. PM<sub>10</sub> Measurements Results

2015	2016	2017	2018	2019
57,73	45,45	30,30	23,58	20,56

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**Picture 3.** Concentration of PM<sub>10</sub>

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The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

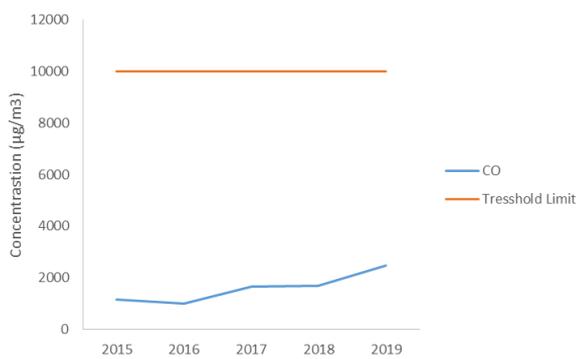
### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017).

**Table 5** Measurements Results of CO

2015	2016	2017	2018	2019
1170	1020	1670	1680	2490
3	3	3	3	3

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**Picture 4.** Concentration of CO

CO concentration for 2015-2019 periode fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because it is below the threshold value that has been set in PP No.41/1999 (10.000  $\mu\text{g}/\text{m}^3$ ). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878  $\mu\text{g}/\text{m}^3$  -244,72  $\mu\text{g}/\text{m}^3$  at Tomang flyover (Ripana, 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

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### Relationship Between The Number of Vehicles and CO Levels

The large number of vehicles results in air pollution produced by the remaining waste of vehicle fuel (Sugiyanto et al, 2011). High air pollutin can increase environmental temperature and climate change (Soedomo, 2011). One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle.

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Table 6. SPSS Results

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**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.276 <sup>a</sup>	.076	.276	222.65882

a. Predictors: (Constant), CO

**ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	42700.854	1	42700.854	1.24	.729 <sup>b</sup>
	Residual	442273.149	3	147424.383		
1	Residual	462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
1	(Constant)			
	176.354		176.354	.000
1	-.122	-.334	-.207	.738

a. Dependent Variable: Kendaraan

However, the variable number of vehicles with CO levels has a weak correlation (0,207). The absence of close correlation is most likely due to various types and quality of passing vehicles. New vehicles

generally have a good internal combustion engine, so CO level released are small. Lack of data can also be an inaccuracy for data processing.

**Table 7.** Correlation from SPSS Results

Correlations			
Kendaraan	Pearson Correlation	1	.738
	Sig. (2-tailed)	.5	.5
	N	.738	
	Pearson Correlation	.738	
		.5	.5

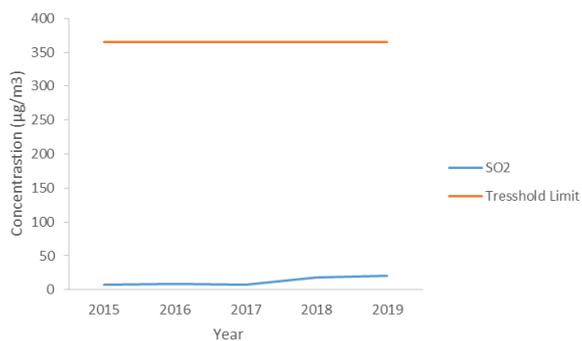
**SO<sub>2</sub> (Sulfur Dioxide)**

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gases (SO<sub>x</sub>). This gas is very easily dissolved in water, has an odor but colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015-2019 period.

**Table 8.** SO<sub>2</sub> Measurements Results

2015	2016	2017	2018	2019
7,28 µg/m <sup>3</sup>	8,62 µg/m <sup>3</sup>	8,09 µg/m <sup>3</sup>	18,47 µg/m <sup>3</sup>	20,11 µg/m <sup>3</sup>

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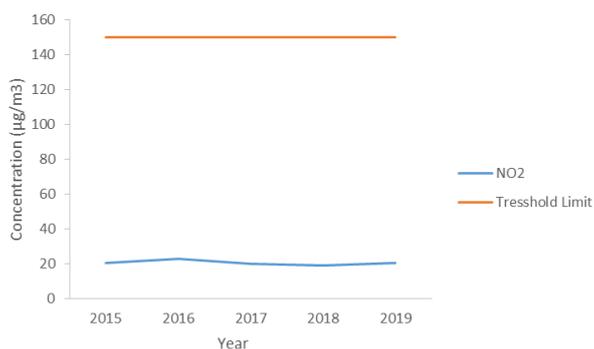
**Picture 5** Concentration of SO<sub>2</sub>

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Concentration of SO<sub>2</sub> increased every year, it can be seen from table and graph above. But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m<sup>3</sup>.

### NO<sub>2</sub> (Nitrogen Dioxide)

Threshold value for NO<sub>2</sub> is 150µg/m<sup>3</sup>. In the following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015-2019 period



**Picture 6** Concentration of NO<sub>2</sub>

The results of measurement of NO<sub>2</sub> concentration fluctuated, it can be seen from the table and graph above. However, this value is still safe because it is below threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

### Calculation of ISPU Value of Each Pollutant Parameter

**Table 9.** ISPU Value of Each Pollutant Parameter

Year	PM <sub>10</sub> (µg/m)	SO <sub>2</sub> (µg/)	CO (µg/)	O <sub>3</sub> (µg)	NO <sub>2</sub> (µg/)
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

Each pollutant parameter also has an ISPU value which can be categorized as follows:

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**Table 10.** ISPU Value Category of each pollutant parameter

Year	PM10 ( $\mu\text{g}/\text{m}^3$ )	SO2 ( $\mu\text{g}/\text{m}$ )	CO	O3 ( $\mu\text{g}/\text{m}$ )	NO2 ( $\mu\text{g}/\text{m}^3$ )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good
2019	Good	Good	Good	Good	Good

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Almost all parameters, ISPU in good condition except PM10 in 2015 at moderate condition

### Green Open Space in Jagakarsa District

Green Open Space serves indirectly to improve the level of public health. The following is data Green Open Space for 2015-2019.

**Table 11.** Green open space area

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26 Year 2007	Difference between existing and regulation
2015	372.82	746 Ha	-50,02 %
2016	336,32	746 Ha	-54,91%
2017	305.62	746 Ha	-59,03%
2018	277,71	746 Ha	-62,77%
2019	258,49	746 Ha	-65,34%

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The decreased in the existing area of green open space in 2015-2019 approximately 30,66%, the decreased could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities. The existing green open space still not meet regulation.

According to Prasetyo in Tinambunan (2006), the absorption CO2 from tree is 129,92 kg/ha/hour. If all the green open space is assumed as tree, then total CO2 can be absorbed by tree is 33.583,02 kg/hour and total CO that can be absorbed by tree is 21.371,01 kg/ha.

### The Relationship between Areas of Green Open Space and CO Concentration

**Table 12.** Correlation between Green open space area and CO Concentration

**Correlations**

	Area	CO
• Pearson Correlation	1	-.865
•		.058
•		
•		

Luasan	Sig. (2-tailed)	5	5
	N	.065	1
	Pearson Correlation	.058	5

The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower CO concentration. Based on research from Aly (2020), green open space existing already can absorb 100% carbon dioxide emissions and carbon monoxide.

Decreased area of Green Open Space also affects the quality of CO in the air. As can be seen in the graphic above, there is an increased in CO concentration every year along with the decreased of existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, which is for Jagakarsa District area approximately 746 hectares.

Green open space in Yogyakarta urban area reached 1,469.45 Ha or 16.2% of the total area. The need for green open space lacked 13.8% of the total area. Good condition was found only in low-density settlement, while poor condition of green open space was located in high-density settlement (Brontowiyono, 2016

## CONCLUSION

- The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area.
- Based on the results of the research, the existing area of green open space from 2015-2019 is decreased to 30,66%. The highest difference is in 2019 with -65,34 %.
- Total CO<sub>2</sub> can be absorbed by tree is 33.583,02 kg/hour. total CO that can be absorbed by tree is 21.371,01 kg/ha.

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**Commented [A52]:** Conclusions are written in paragraphs, not bullet points.

Conclusions should be described qualitatively and not repeat sentences from the results and discussion.

**Commented [A53]:** Conclusions must answer the research objectives.

The purpose of this study is to analyze the relationship between Green Open Space and carbon.

What are the managerial implications of these findings?. Please explain briefly and clearly.

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The enrichment of the cited references is still lacking.

The minimum total of 15 references.

References sourced from journals are at least 80%.

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## REVISIONS 02 SEPTEMBER 2022

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Revisions		Search	Upload File
186953-1	Article Text, C:\JPSLReview 41694-Article Text-180190-1-4-20220704 rev 3.docx	September 2, 2022	Article Text

Review Discussions		Add discussion		
Name	From	Last Reply	Replies	Closed
<a href="#">Catatan</a>	lasriama 2022-07-01 11:34 AM	purnomosutji_dyah_prinajati 2022-07-04 03:12 PM	1	<input type="checkbox"/>
<a href="#">Invoice Article Processing Charge (APC) JPSL- 41694</a>	lasriama 2022-09-02 10:39 AM	-	0	<input type="checkbox"/>



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# The Correlation of CO Concentration and Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

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12 tables too many. Tables no more than 5, as well as Fig. Please combine to be more effective.

On the other hand, the description in the discussion needs to be enriched by comparing the results of previous studies.

Green Open Space, CO,  
Jagakarsa

*minimum proportion of green open space in a city is 30% of city area, but in Jagakarsa it is decreased to 10,33 %.*

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**Abstract:** *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Therefore, in this study an analysis of the relationship between Green Open Space and carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with SPSS to get the correlation between CO and land used. The results is proven that there is a very strong relationship between Green Open Space and CO with a correlation value of -0.865. Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels. Based on Law No. 26 of 2007 concerning spatial planning, the*

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## INTRODUCTION

South Jakarta is one of city that has rapid development. The increased of population followed by the increased of vehicles has an impact increasing of air pollution. Data of Environmental Agency states that in 2015, CO concentration in Bundaran HI Jakarta was 572.760  $\mu\text{g}/\text{Nm}^3$  and in 2016 was 798.690  $\mu\text{g}/\text{Nm}^3$  (Kusumaningtiar, 2020). It means, CO Concentration has increased. According to Agista (2020), the worst quality of South Jakarta in 2018 with 81 days unhealthy, while the best air quality in 2014 with 20 days was not healthy.

Plants can reduce CO concentration. Kusminingrum (2008) states that *Elaeocarpus sphaericus* can reduce CO as 81.53% *Iriansis* 88.61%, *Philodendron* 92.22%. Ivanastuti (2015) states that there is the decreased of CO concentration at location with vertical gardens as much as 94.1-100%.

According to Rachmawati (2016), the green open space area in Jagakarsa is 3.363.285,4  $\text{m}^2$  consisting of artificial lakes (campus and forest), mixed gardens, green land, green open space and campus infrastructure facilities (sport fields, parks). South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest and Setu Babakan Jagakarsa. South Jakarta has potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict which is located in the administrative city of South Jakarta, is the object of this research.

Indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (Indeks Standar Pencemar Udara (ISPU)). According to Minister of Environment and Forestry Regulation No. 14 of 2020 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10  $\mu\text{m}$  ( $\text{PM}_{10}$ ), particulates measuring less than 2.5  $\mu\text{m}$  ( $\text{PM}_{2.5}$ ), Sulfur Dioxide ( $\text{SO}_2$ ), Carbon Monoxide (CO), oxidants in the form of Ozone ( $\text{O}_3$ ), and Nitrogen Dioxide ( $\text{NO}_2$ ) and Hydrocarbon (HC).

The acceleration of development in urban areas has an impact on changes in the environment and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or house is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plant and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behaviour, estrangement of relations between individuals as community actors are form of social and cultural shift in society.

Motor vehicles have become the primary source of pollution in DKI Jakarta. In particular, the contribution of motor vehicles to the air pollution of DKI Jakarta is approximately 32–41%, from coal combustion 14%, construction activities 13%, open burning biomass and other fuel 11% (Vital Strategies, 2020)

According to Aly (2020) with the title The capability of green open space in absorbing carbon monoxide and carbon dioxide emissions in Balai Kota Makassar, for Zone II and Zone III, carbon dioxide and carbon monoxide emissions from motor vehicles are 100% absorbed by existing vegetation. While for Zone I carbon dioxide emissions from motor vehicles have not been able to be absorbed completely by existing vegetation and in Zone IV carbon dioxide and carbon monoxide emissions from motor vehicles have not been able to be absorbed by existing vegetation. This 100% absorption ability is based on emission data during measurement hours (daytime).

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The review in the introduction can be from a methodological or scientific perspective on the level of CO Quality which is correlated with the area of green open space. So it can be seen that this study has a share of knowledge about the environment. Also state that this research is interesting because it has not been done by many previous researchers and of course it is supported by references from previous studies that have not revealed the problems in this study. Write down the problems in this study which ends with a statement of the general objectives and specific objectives of this study.

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In this 2020 regulation, the latest ISPU (Air Pollutant Standard Index) parameters are  $\text{PM}_{10}$ ,  $\text{PM}_{2.5}$ ,  $\text{SO}_2$ , CO,  $\text{O}_3$ , HC, and  $\text{NO}_2$ .

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The biggest contribution of air pollution in Jagakarsa comes from transportation (in %), industry, community activities (in %);

Availability of carrying capacity of green open space (RTH) in Jagakarsa (Ha);

Average ISPU max per month for CO in Jagakarsa.

**METHODE**

The type of this research is non experimental research which is included in descriptive quantitative, using secondary data that was obtained from Ministry of Environment and Forest, Park Administration Sub Department.South Jakarta. Data were obtained from the ambient air quality monitoring station.



Figure 1 Air Quality Monitoring Station

The data used in this study is secondary data in the form of air quality data for 5 years in South Jakarta Area. Data processed with spss to get the correlation between CO and land used. The location of monitoring station is in Taman Pendidikan Dinas Pertamanan, Jagakarsa, the coordinate is - 6° 21' 22.74" LS, 106° 48' 16.96" BT.

Table 1. Air pollutant standar index based on Minister of Environment and Forestry Regulation No P.14.MENLHK/SETJEN/KUM.1/7/2020

ISPU (Index)	Level Air Pollution	Healthy Impact
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to human or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality that can be detrimental to helath in a number of exposed segments of the population
300-500	Hazardous	Hazardous air quality which in general can seriously harm the health of the population e.g eye irritation, cough and sore throat

According to Minister of Environment and Forestry Regulation No. 14 of 2020 concerning Air Pollution Control, concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in the following equation:

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In this 2020 regulation, the latest ISPU (Air Pollutant Standard Index) parameters are PM10, PM2.5, SO2, CO, O3, HC, and NO2.

$$I = \frac{Ia - Ib}{Xa - Xb} (Xx - Xb) + Ib$$

Where:

- I = calculated ISPU
- Ia = upper limit ISPU
- Ib = lower limit ISPU
- Xa = upper limit ambient
- Xb = lower limit ambient
- Xx = real ambient level measurement results

Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be tested is the correlation between green open space and air quality. The independent variable (X) is green open space and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1 with the strength of the correlation relationship can be seen in Table 2.

Table 2. Relationship strength correlation coefficient based on Pearson correlation (Schober et al, 2018)

0,00 - 0,19	Very weak correlation
0,2 - 0,39	Weak correlation
0,4 - 0,59	Moderate
0,6 - 0,79	Strong correlation
0,8 - 1	Very strong correlation

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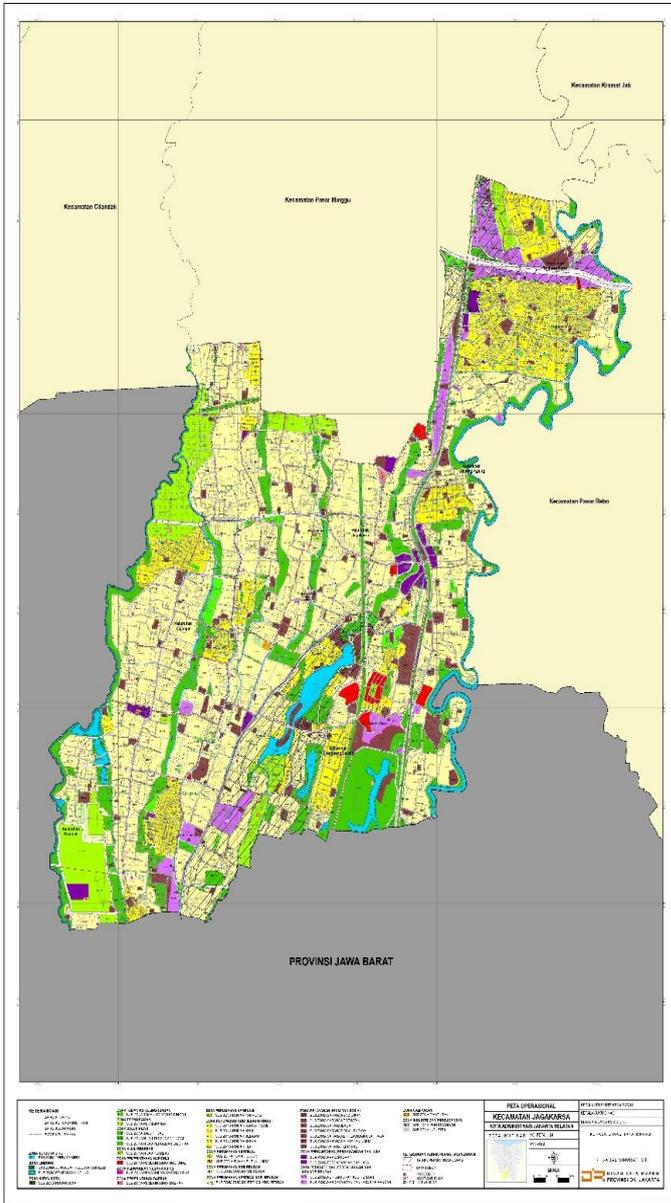


Figure 2. The location of Jagakarsa

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Then to calculate the absorption power of vegetation using this table;

Table 3. CO2 Absorption Power of Vegetation

Type of Vegetation Cover	CO2 Absorption Power of Vegetation		
	Kg/ha/hour	Kg/ha/day	Kg/ha/year
Tree	129.925	1559.1	569.07
Bush	12.556	150.68	55
Grassland	2.74	32.88	12
Rice field	2.74	32.99	12

(Prasetyo in Tinambunan, 2006)

### THE RESULTS AND DISCUSSION

The number of vehicles in the district of Jagakarsa fluctuates. It varied from 98.670-99.420 unit. It can be seen from the following table the number of vehicles in Jagakarsa area. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878  $\mu\text{g}/\text{m}^3$  -244,72  $\mu\text{g}/\text{m}^3$  at Tomang flyover (Ripanah et al, 2003).

Motor vehicles have become the primary source of pollution in DKI Jakarta. In particular, the contribution of motor vehicles to the air pollution of DKI Jakarta is approximately 32–41%, from coal combustion 14%, construction activities 13%, open burning biomass and other fuel 11% (Vital Strategies, 2020)

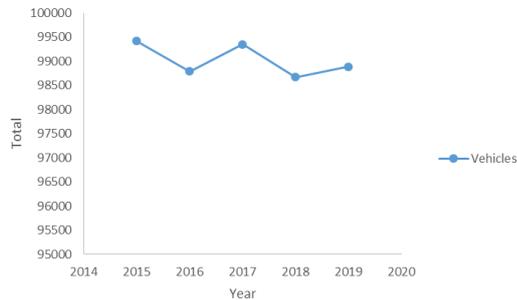


Figure 3. Vehicles in Jagakarsa

### PM<sub>10</sub> concentration

Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer and even death (Lestari et al, 2019). Threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. Threshold limit value for PM<sub>10</sub> is 150  $\mu\text{g}/\text{m}^3$ . In the following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015-2019 period. It was varied from 20,56-57,73  $\mu\text{g}/\text{m}^3$

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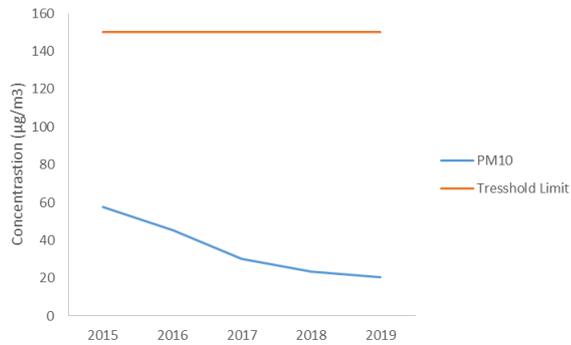


Figure 4. Concentration of PM<sub>10</sub>

The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

#### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017). It was varied 1020-2490 µg/m<sup>3</sup>.

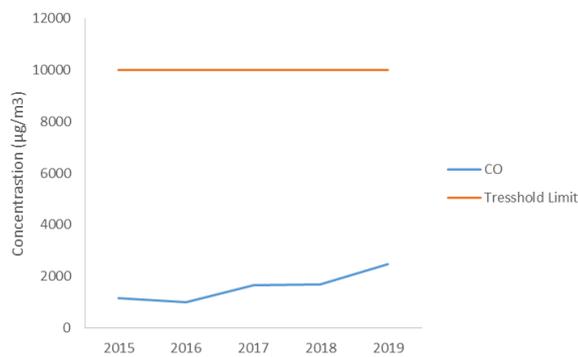


Figure 5. Concentration of CO

CO concentration for 2015-2019 periode fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m<sup>3</sup>). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m<sup>3</sup> -244,72 µg/m<sup>3</sup> at Tomang flyover (Ripana et al, 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

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### Relationship Between The Number of Vehicles and CO Levels

One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle.

However, the variable number of vehicles with CO levels has a weak correlation (0,207). The absence of close correlation is most likely due to various types and quality of passing vehicles. New vehicles generally have a good internal combustion engine, so CO level released are small. Lack of data can also be an inaccuracy for data processing.

Table 4. Correlation from SPSS Results

Correlations			
		Kendaraan	CO
	Pearson Correlation	1	.276
			.738
Kendaraan	Sig. (2-tailed)	5	5
	N	.738	
	Pearson Correlation	5	5

### SO<sub>2</sub> (Sulfur Dioxide)

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gases (SO<sub>x</sub>). This gas is very easily dissolved in water, has an odor but colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015-2019 period. It was varied from 7,28-20,11 µg/m<sup>3</sup>. The highest concentration was in 2019.

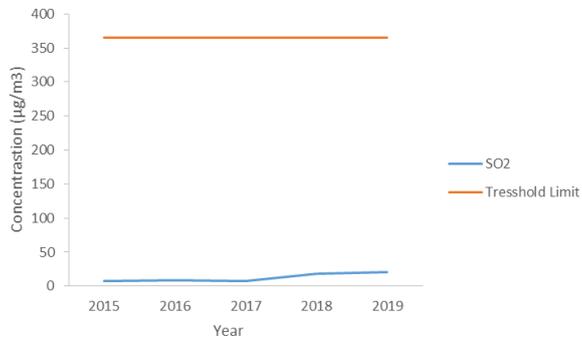


Figure 6. Concentration of SO<sub>2</sub>

Concentration of SO<sub>2</sub> increased every year, it can be seen from table and graph above. But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µg/m<sup>3</sup>.

**NO<sub>2</sub> (Nitrogen Dioxide)**

Threshold value for NO<sub>2</sub> is 150µg/m<sup>3</sup>. In the following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015-2019 period

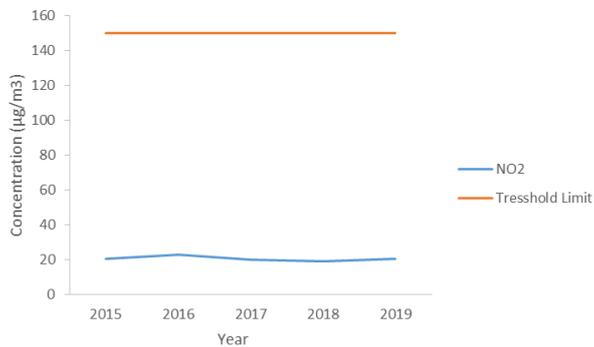


Figure 7. Concentration of NO<sub>2</sub>

The results of measurement of NO<sub>2</sub> concentration fluctuated, it can be seen from the table and graph above. However, this value is still safe because it is below threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

### Calculation of ISPU Value of Each Pollutant Parameter

Table 5. ISPU Value of Each Pollutant Parameter

Year	PM <sub>10</sub>	SO <sub>2</sub>	CO	O <sub>3</sub>	NO <sub>2</sub>
	(µg/m <sup>3</sup> )	(µg/	(µg/	(µg	(µg/
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

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Each pollutant parameter also has an ISPU value which can be categorized as follows:

Table 6. ISPU Value Category of each pollutant parameter

Year	PM <sub>10</sub> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	CO	O <sub>3</sub> (µg/m	NO <sub>2</sub> (µg/m <sup>3</sup> )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good
2019	Good	Good	Good	Good	Good

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Almost all parameters, ISPU in good condition except PM<sub>10</sub> in 2015 at moderate condition.

### Green Open Space in Jagakarsa District

Green Open Space serves indirectly to improve the level of public health. The following is data Green Open Space for 2015-2019.

Table 7. Green open space area

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26 Year 2007	Difference between existing and regulation
2015	372.82	746 Ha	-50,02%
2016	336,32	746 Ha	-54,91%
2017	305.62	746 Ha	-59,03%
2018	277,71	746 Ha	-62,77%
2019	258,49	746 Ha	-65,34%

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The decreased in the existing area of green open space in 2015-2019 approximately 30,66%, the decreased could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities. The existing green open space still not meet regulation.

According to Prasetyo in Tinambunan (2006), the absorption CO<sub>2</sub> from tree is 129,92 kg/ha/hour. If all the green open space is assumed as tree, then total CO<sub>2</sub> can be absorbed by tree is 33.583,02 kg/hour and total CO that can be absorbed by tree is 21.371,01 kg/ha.

### The Relationship between Areas of Green Open Space and CO Concentration

The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower CO concentration. Based on research from Aly (2020), green open space existing already can absorb 100% carbon dioxide emissions and carbon monoxide.

Decreased area of Green Open Space also affects the quality of CO in the air. There is an increased in CO concentration every year along with the decreased of existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, which is for Jagakarsa District area approximately 746 hectares.

Green open space in Yogyakarta urban area reached 1,469.45 Ha or 16.2% of the total area. The need for green open space lacked 13.8% of the total area. Good condition was found only in low-density settlement, while poor condition of green open space was located in high-density settlement (Brontowiyono, 2016)

### CONCLUSION

Every decreased in the existing area of Green Open Space (RTH) greatly affects CO levels. Based on Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of city area, but in Jagakarsa it is decreased to 10,33 %. The result of correlation between Green Open Space area and CO levels has value -0.865 which means it has a very strong correlation between CO levels in Jagakarsa District area. Based on the results of the research, the existing area of green open space from 2015-2019 is decreased to 30,66%. The highest difference is in 2019 with -65,34 %. Total CO<sub>2</sub> can be absorbed by tree is 33.583,02 kg/hour and total CO that can be absorbed by tree is 21.371,01 kg/ha.

To improve air quality, it can be done to control vehicle exhaust, reduce coal combustion, enforce ban open burning and control construction.

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**Commented [A78]:** Conclusions are written in paragraphs, not bullet points.

Conclusions should be described qualitatively and not repeat sentences from the results and discussion.

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The purpose of this study is to analyze the relationship between Green Open Space and carbon.

What are the managerial implications of these findings?. Please explain briefly and clearly.

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The minimum total of 15 references.

References sourced from journals are at least 80%.

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## **The Correlation of CO Concentration and Green Open Space (Case Study Of Jagakarsa District, South Jakarta)**

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*of air quality data for five years in South Jakarta Area. Data were processed with SPSS to get the correlation between CO and land used. The results have proven that there is a very strong relationship between Green Open Space and CO with a correlation value of -0.865. Where every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels. Based on Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of the city area, but in Jagakarsa, it is decreased to 10,33 %.*

**Keywords:**

Green Open Space, CO,  
Jagakarsa

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**Abstract:** *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Therefore, in this study, an analysis of the relationship between Green Open Space and carbon was carried out. Determination of the relationship between the area of Green Open Space and CO was carried out using the correlation analysis method. The data used in this study is secondary data in the form*

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## INTRODUCTION

South Jakarta is one of the cities that has rapid development. The increase in population followed by the increase of vehicles has an impact increasing of air pollution. Data from the Environmental Agency states that in 2015, CO concentration in Bundaran HI Jakarta was 572.760  $\mu\text{g}/\text{Nm}^3$  and in 2016 was 798.690  $\mu\text{g}/\text{Nm}^3$  (Kusumaningtiar 2020). It means CO Concentration has increased. According to Agista (2020), the worst quality of South Jakarta in 2018, with 81 days, was unhealthy, while the best air quality in 2014, with 20 days, was not healthy.

Plants can reduce CO concentration. Kusminingrum (2008) states that *Elaeocarpus sphaericus* can reduce CO at 81.53% *Iriansis* 88.61%, *Philodendron* 92.22%. Ivanastuti (2015) states that there is a decrease in CO concentration at the location with vertical gardens of as much as 94.1-100%.

According to Rachmawati (2016), the green open space area in Jagakarsa is 3.363.285,4 m<sup>2</sup> consisting of artificial lakes (campus and forest), mixed gardens, green land, green open space, and campus infrastructure facilities (sports fields, parks). South Jakarta has Green Open Space such as Ragunan fostered forest, UI campus forest, and Setu Babakan Jagakarsa. South Jakarta has the potential development of Green Open Space. According to Regional Regulation Number 1 2014, Jakarta District has an area of approximately 2,486.73 hectares. Jagakarsa Subdistrict, which is located in the administrative city of South Jakarta is the object of this research.

The indicator that can be used to determine the level of air quality is Air Pollutant Standard Index (*Indeks Standar Pencemar Udara* (ISPU)). According to Minister of Environment and Forestry Regulation No. 14 of 2020 concerning Air Pollution Control, ISPU is a measure value that does not have units to describe ambient air quality conditions at a certain location and time. The parameters used to calculate ISPU are particulates measuring less than 10  $\mu\text{m}$  (PM<sub>10</sub>), particulates measuring less than 2.5  $\mu\text{m}$  (PM<sub>2.5</sub>), Sulfur Dioxide (SO<sub>2</sub>), Carbon Monoxide (CO), oxidants in the form of Ozone (O<sub>3</sub>), and Nitrogen Dioxide (NO<sub>2</sub>) and Hydrocarbon (HC).

The acceleration of development in urban areas impacts environmental changes and urban spatial planning. The change in the function of Green Open Spaces into trading facilities or houses is a form of land shortage due to an increase in population.

Green Open Space is part of the open spaces of an urban area filled with plants and vegetation to support the direct or indirect benefits. The shift in the function of green open spaces to housing and settlement is a phenomenon that occurs in urban areas. Changes in the function of green open spaces have an impact on social, cultural, and environmental changes in the community. Changes in behavior, and estrangement of relations between individuals as community actors are a form of a social and cultural shift in society. Motor vehicles have become the primary source of pollution in DKI Jakarta. In particular, the contribution of motor vehicles to the air pollution of DKI Jakarta is approximately 32–41%, from coal combustion 14%, construction activities 13%, open burning biomass and other fuel 11% (Vital Strategies, 2020).

According to Aly (2020), with the title, The capability of green open space in absorbing carbon monoxide and carbon dioxide emissions in Balai Kota Makassar, for Zone II and Zone III, carbon dioxide and

carbon monoxide emissions from motor vehicles are 100% absorbed by existing vegetation. While for Zone I, carbon dioxide emissions from motor vehicles have not been able to be absorbed completely by existing vegetation, and in Zone IV carbon dioxide and carbon monoxide emissions from motor vehicles have not been able to be absorbed by existing vegetation. This 100% absorption ability is based on emission data during measurement hours (daytime).

**DATA AND METHOD**

The type of this research is a non-experimental research which is included in descriptive quantitative, using secondary data that was obtained from the Ministry of Environment and Forest, Park Administration Sub Department, South Jakarta. Data were obtained from the ambient air quality monitoring station. The data used in this study is secondary data in the form of air quality data for 5 years in the South Jakarta Area. Data were processed with SPSS to get the correlation between CO and land used. The location of monitoring station is located in Taman Pendidikan Dinas Pertamanan, Jagakarsa (- 6° 21' 22.74" S, 106° 48' 16.96" E).



Figure 1 Air Quality Monitoring Station.

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Table 1. Air pollutant standard index based on the Minister of Environment and Forestry Regulation

No. P.14.MENLHK/SETJEN/KUM.1/7/2020 (<https://ditppu.menlhk.go.id/>)

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ISPU (Index)	Level Air Pollution	Healthy Impact
0-50	Good	No Impact
51-100	Moderate	Do not affect human and animal health but affects sensitive plants
101-199	Unhealthy	Harmful to humans or animals that are sensitive or can cause damage to plants or aesthetic value
200-299	Very Unhealthy	Air quality can be detrimental to health in several exposed segments of the population

ISPU (Index)	Level Air Pollution	Healthy Impact
300-500	Hazardous	Hazardous air quality, which in general can seriously harm the health of the population, e.g., eye irritation, cough, and sore throat

According to Minister of Environment and Forestry Regulation No. 14 of 2020 concerning Air Pollution Control concerning air pollution control, the formula for Air Pollutant Standard Index can be seen in equation (1). Correlation analysis is used to determine whether the relationship between variables has a relationship or not. The relationship between variables to be tested is the correlation between green open space and air quality. The independent variable (X) is green open space, and the dependent variable (Y) is air quality. The correlation coefficient ranges from -1 to +1, with the strength of the correlation relationship can be seen in Table 2. Then to calculate the absorption power of vegetation using Table 3.

(1)

$$I = \frac{Ia - Ib}{Xa - Xb} (Xx - Xb) + Ib$$

Where :

I = calculated ISPU

Ia = upper limit ISPU

Ib = lower limit ISPU

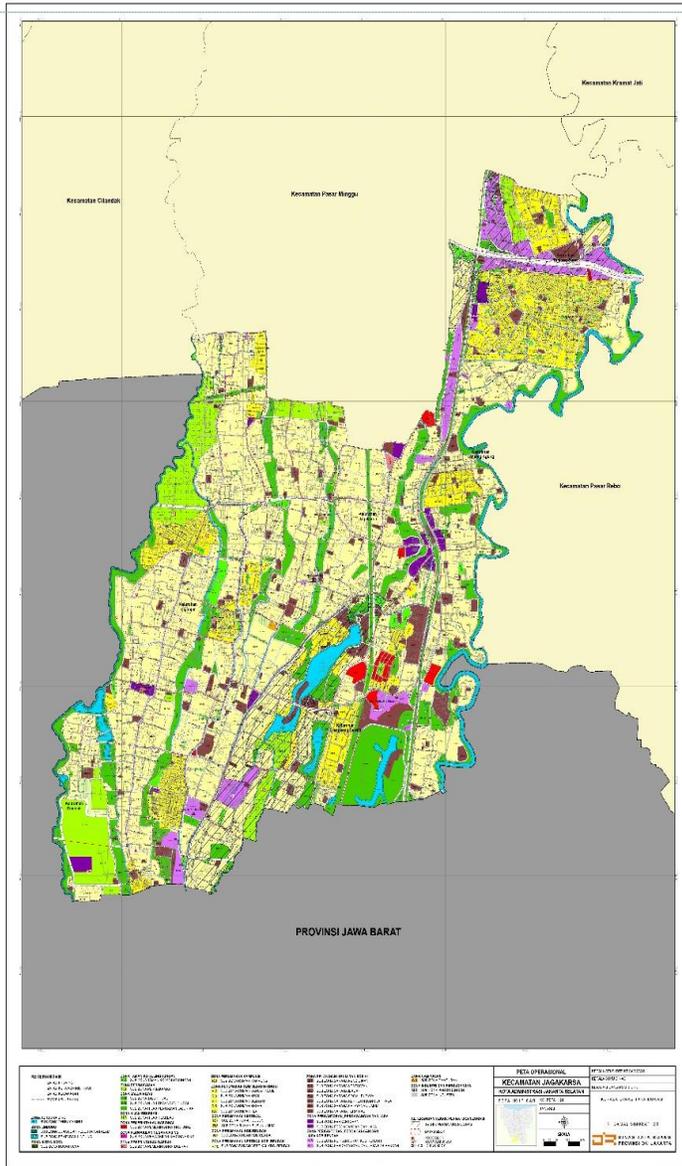
Xa = upper limit ambient

Xb = lower limit ambient

Xx = real ambient level measurement results

Table 2. Relationship strength correlation coefficient based on Pearson correlation (Schober et al. 2018)

Correlation Coefficient	Relationship Strength
0,00 - 0,19	Very weak correlation
0,2 - 0,39	Weak correlation
0,4 - 0,59	Moderate
0,6 - 0,79	Strong correlation
0,8 - 1	Very strong correlation



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Figure 2. The location of Jagakarsa  
 (<https://www.scribd.com/document/435609039/Peta-Zonasi-Kecamatan-Jagakarsa-2016>)

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Table 3. CO<sub>2</sub> Absorption Power of Vegetation (Prasetyo in Tinambunan, 2006).

Type of Vegetation Cover	CO <sub>2</sub> Absorption Power of Vegetation		
	Kg/ha/hour	Kg/ha/day	Kg/ha/year
Tree	129.925	1559.1	569.07
Bush	12.556	150.68	55
Grassland	2.74	32.88	12
Rice field	2.74	32.99	12

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### THE RESULTS AND DISCUSSION

The number of vehicles in the district of Jagakarsa fluctuates. It varied from 98.670 – 99.420 unit. It can be seen in the following table for the number of vehicles in the Jagakarsa area. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel, with CO average concentration is 228,878 µg/m<sup>3</sup> – 244,72 µg/m<sup>3</sup> at Tomang flyover (Ripana et al. 2003). Motor vehicles have become the primary source of pollution in DKI Jakarta. In particular, the contribution of motor vehicles to the air pollution of DKI Jakarta is approximately 32 – 41%, from coal combustion 14%, construction activities 13%, open burning biomass and other fuel 11% (Vital Strategies, 2020)

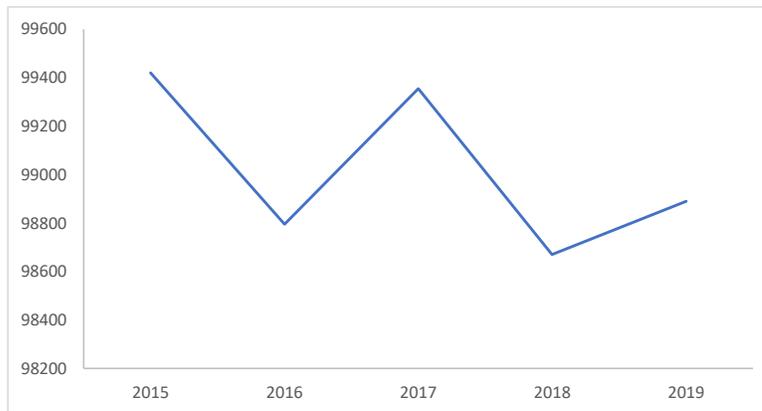


Figure 3. Vehicles in Jagakarsa.

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### PM<sub>10</sub> concentration

Particulates (PM<sub>10</sub>) are airborne particles smaller than 10 microns (micrometers). These particles can be inhaled and induce respiratory system disorders, such as breathlessness, lung cancer, and even death (Lestari et al. 2019). The threshold limit value is the air pollution concentration limit that is allowed to be in the ambient air. The threshold limit value for PM<sub>10</sub> is 150 µg/m<sup>3</sup>. The following tables and graphs are the results of PM<sub>10</sub> parameter measurements for 2015 – 2019 period. It varied from 20,56 – 57,73 µg/m<sup>3</sup>. The results of PM<sub>10</sub> parameter measurement are below the threshold value stated in PP No. 41 of 1999.

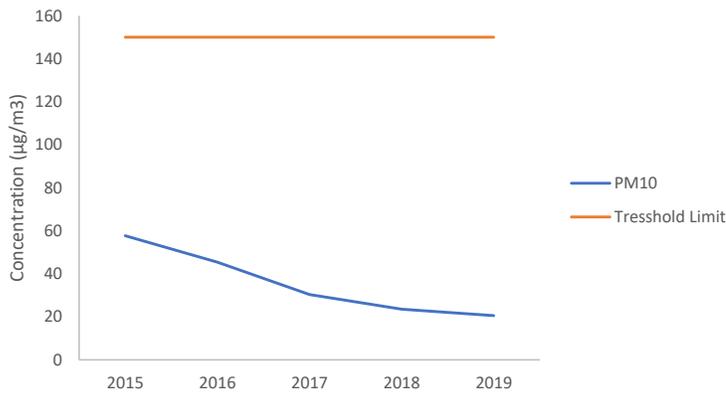


Figure 4. Concentration of PM<sub>10</sub>.

### CO Concentration

Carbon Monoxide (CO) is produced by the incomplete combustion of carbon-containing fuels and by combustion at high pressure and temperature that occurs in engines (Apriyanti, 2017). It was varied 1020 – 2490 µg/m<sup>3</sup>. CO concentration for 2015 – 2019 period fluctuated, it can be seen from the data in the table and graph above. However, this value is still safe because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m<sup>3</sup>). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel, with CO average concentration is 228,878 µg/m<sup>3</sup> – 244,72 µg/m<sup>3</sup> at Tomang flyover (Ripahan et al. 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

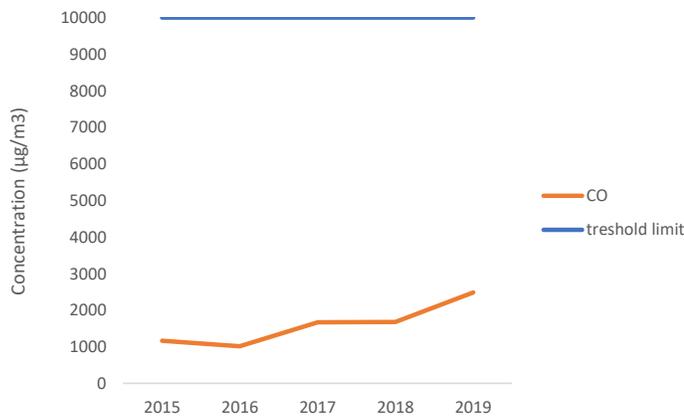


Figure 5. The concentration of CO.

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### Relationship Between The Number of Vehicles and CO Levels

One of the pollutants found in the combustion of motor vehicle fuel is carbon monoxide (CO). The results of the regression analysis and the correlation between the number of vehicles and CO levels found the r-value of 0.276, which means that 27.6% of the CO content variable is influenced by the number of vehicle. However, the variable number of vehicles with CO levels has a weak correlation (0.207). The absence of close correlation is most likely due to the various types and quality of passing vehicles. New vehicles generally have a good internal combustion engine, so CO levels released are small. Lack of data can also be an inaccuracy for data processing.

Table 4. Correlation from SPSS Results Correlations.

	Vehicles	CO
Pearson Correlation	1	.207
		.738
Vehicles Sig. (2-tailed) N	5	5
Pearson Correlation	.738	
CO Sig. (2-tailed)	5	5

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### SO<sub>2</sub> (Sulfur Dioxide)

Sulfur dioxide (SO<sub>2</sub>) is a species of sulfur oxide gas (SO<sub>x</sub>). This gas is very easily dissolved in water, and has an odor but is colorless. Like O<sub>3</sub>, secondary pollutants formed from SO<sub>2</sub>, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO<sub>2</sub> is 365 µg/m<sup>3</sup>. In the following tables and graphs are the results of measuring SO<sub>2</sub> parameters for 2015 – 2019 period. It varied from 7,28-20,11 µg/m<sup>3</sup>. The highest concentration was in 2019. Concentration of SO<sub>2</sub> increased every year, it can be seen from Figure 6 But the results of SO<sub>2</sub> measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m<sup>3</sup>.

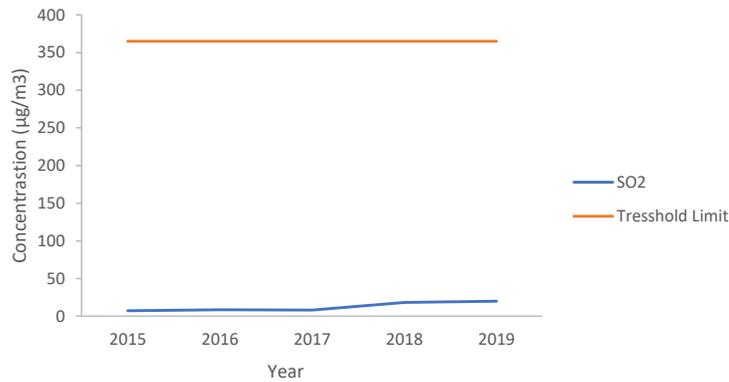


Figure 6. The concentration of SO<sub>2</sub>.

### NO<sub>2</sub> (Nitrogen Dioxide)

The threshold value for NO<sub>2</sub> is 150 µg/m<sup>3</sup>. The following tables and graphs are the results of NO<sub>2</sub> parameter measurements for 2015 – 2019 period. The results of the measurement of NO<sub>2</sub> concentration fluctuated. It can be seen from the table and graph above. However, this value is still safe because it is below the threshold value in PP No. 41 1999 (150 µg/m<sup>3</sup>).

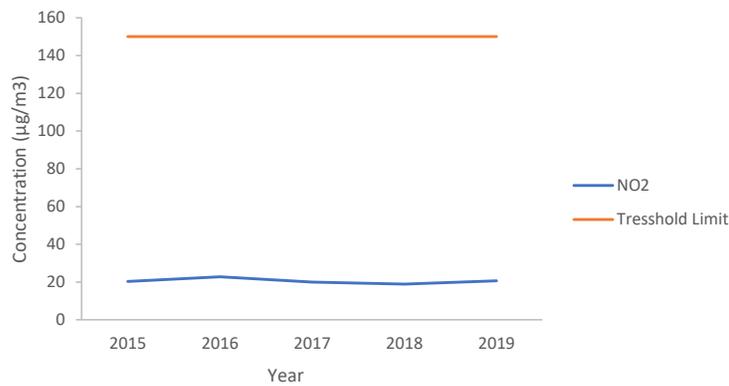


Figure 7. Concentration of NO<sub>2</sub>.

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### Calculation of ISPU Value of Each Pollutant Parameter

Each pollutant parameter also has an ISPU value which can be categorized as Table 5. Almost all parameters, ISPU in good condition except PM<sub>10</sub> in 2015 at moderate condition. The highest PM<sub>10</sub> concentration was measured in 2015, while the lowest PM<sub>10</sub> concentration was in 2019. Meanwhile, the highest concentration of SO<sub>2</sub> was in 2019 and the lowest concentration was in 2015. Concentration of O<sub>3</sub> is quite fluctuative.

Table 5. ISPU value of each pollutant parameter (Ministry of Environment and Forest, 2019).

Year	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

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Table 6. ISPU Value category of each pollutant parameter (Ministry of Environment and Forest, 2019)..

Year	PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	SO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )	CO ( $\mu\text{g}/\text{m}^3$ )	O <sub>3</sub> ( $\mu\text{g}/\text{m}^3$ )	NO <sub>2</sub> ( $\mu\text{g}/\text{m}^3$ )
2015	Moderate	Good	Good	Good	Good
2016	Good	Good	Good	Good	Good
2017	Good	Good	Good	Good	Good
2018	Good	Good	Good	Good	Good
2019	Good	Good	Good	Good	Good

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### Green Open Space in Jagakarsa District

Green Open Space serves indirectly to improve the level of public health. The decrease in the existing area of green open space in 2015 – 2019 was approximately 30,66%. The decrease could be due to the development of economic sectors causing the need for land resources to increase for the provision of supporting facilities. The existing green open space still does not meet regulations. According to Prasetyo in Tinambunan (2006), the absorption CO<sub>2</sub> from a tree is 129,92 kg/ha/hour. If all the green open space is assumed as a tree, then the total CO<sub>2</sub> that a tree can absorb is 33.583,02 kg/hour, and total CO that can be absorbed by a tree is 21.371,01 kg/ha.

Table 7. Green open space area.

Year	Green Open Space Existing Area (Ha)	Green Open Space Area According to UU No. 26/2007	Difference between existing and regulation
2015	372.82	746 Ha	-50,02 %
2016	336,32	746 Ha	-54,91%
2017	305.62	746 Ha	-59,03%
2018	277,71	746 Ha	-62,77%
2019	258,49	746 Ha	-65,34%

### The Relationship between Areas of Green Open Space and CO Concentration

The result of the correlation between Green Open Space area and CO levels has a value -0.865, which means it has a very strong correlation between CO levels in Jagakarsa District area. A negative value in the correlation value indicates an inverse relationship between Green Open Space and CO concentration. The greater the area of green open space, the lower the CO concentration. Based on research from Aly (2020), green open space existing already can absorb 100% of carbon dioxide emissions and carbon monoxide.

Decreased area of Green Open Space also affects the quality of CO in the air. There is an increase in CO concentration every year, along with the decrease in existing Green Open Space. The addition of green land and restriction on permits for commercial area development are also solutions to improve air quality in metropolitan cities. As stated in Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of the city area, which is for the Jagakarsa District area of approximately 746 hectares. Green open space in Yogyakarta's urban area reached 1,469.45 Ha, or 16.2% of the total area. The need for green open space lacked 13.8% of the total area. The good condition was found only in a low-density settlements, while the poor condition of green open space was located in high-density settlements (Brontowiyono, 2016).

### CONCLUSION

Every decrease in the existing area of Green Open Space (RTH) greatly affects CO levels. Based on Law No. 26 Of 2007 concerning spatial planning, the minimum proportion of green open space in a city is 30% of the city area, but in Jagakarsa, it is decreased to 10,33 %. The result of the correlation between the Green Open Space area and CO levels has a value -0.865, which means it has a very strong correlation between CO levels in Jagakarsa District area. Based on the results of the research, the existing area of green open space from 2015-2019 decreased to 30,66%. The highest difference is in 2019 with -65,34 %. The total CO<sub>2</sub> that can be absorbed by a tree is 33.583,02 kg/hour, and the total CO that can be absorbed by a tree is 21.371,01 kg/ha. To improve air quality, it can be done to control vehicle exhaust, reduce coal combustion, enforce ban open burning, and controlling construction.

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The screenshot shows a web browser window with the URL <https://journal.ipb.ac.id/index.php/jpsl/authorDashboard/submission/41694>. The page is titled "Participants" and lists two names: Lasriama Siahaan (lasriama) and Purnomosutji Dyah Prinajati (purnomosutji\_dyah\_prinajati). Below this is a "Messages" section with a table of messages. The message is from "lasriama" on "2022-09-02 01:14 PM". The message text reads: "Dear author, Here we convey the Decree on the manuscript with the number JPSL-41694. The editor will contact you again when the journal is published. Thank you for your cooperation and contribution to JPSL. Regards, Team JPSL". There are two attachments: "lasriama, KUITANSI\_JPSL- 41694.pdf" and "lasriama, SK JPSL-41694\_Purnomosutji.pdf".

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The screenshot shows the author dashboard for submission 41694. The 'Production' tab is active, displaying a table of production discussions. The table has columns for Name, From, Last Reply, Replies, and Closed. Two discussions are listed: 'Layout Review for 41694 Paper' and '[JPSL] Pre Publication Agreement'. Below the table is a 'Galley' section with a 'pdf' link.

Name	From	Last Reply	Replies	Closed
<a href="#">Layout Review for 41694 Paper</a>	viedya 2022-11-28 09:42 AM	purnomosutji_dyah_prinajati 2022-11-30 11:14 AM	3	<input checked="" type="checkbox"/>
<a href="#">[JPSL] Pre Publication Agreement</a>	viedya 2022-12-01 10:52 AM	-	0	<input type="checkbox"/>

Galley  
[pdf](#)

The email is titled '[JPSL] Pre Publication Agreement' and is marked as 'Eksternal' and 'Kotak Masuk'. It is from Vidya Nur Trissanti, sent at 10:52. The content of the email is as follows:

Dear Ms/Mrs. Purnomosutji Dyah Prinajati,

Your submission, "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta) (submission ID: 41694)", is now ready to be published. To be shortlisted on the publication list, please kindly confirm the Pre Publication Agreement by clicking this link:

[Pre Publication Agreement](#)

The confirmation is due: December 3rd, 2022.

Please note that we will assume that you agree to the Pre Publication Agreement and we will proceed with your submission to publication if you do not confirm the Pre Publication Agreement.

Please feel free to contact me if you have any questions or concerns about this.



### Participants

Dr Yudi Setiawan (yudi9999)

Vidya Nur Trissanti (viedya)

Purnomosutji Dyah Prinajati (purnomosutji\_dyah\_prinajati)

### Messages

Note	From
Dear Mrs./Ms. Purnomosutji Dyah Prinajati, Here we attach a manuscript that is ready for publication. However, there are some writings that need to be revised, especially in yellow highlight sentences. We give the opportunity to the author to be able to revise the manuscript regarding the layout review result in its entirety. If there any revision from author, please mark the sentence revised with a yellow highlight, and please submit the revised manuscript before November 30th, 2022. Thank you.	viedya 2022-11-28 09:42 AM

[viedya, 10, JPSL-41694.docx](#)

https://journal.ipb.ac.id/index.php/jpsl/authorDashboard/submission/41694

Vidya Nur Trissanti (viedya)  
Purnomosutji Dyah Prinajati (purnomosutji\_dyah\_prinajati)

### Messages

Note	From
<p>Dear Ms/Mrs. Purnomosutji Dyah Prinajati,</p> <p>Your submission, "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta) (submission ID: 41694)", is now ready to be published. To be shortlisted on the publication list, please kindly confirm the Pre Publication Agreement by clicking this link:</p> <p><a href="#">Pre Publication Agreement</a></p> <p>The confirmation is due: December 3rd, 2022.</p> <p>Please note that we will assume that you agree to the Pre Publication Agreement and we will proceed with your submission to publication if you do not confirm the Pre Publication Agreement.</p> <p>Please feel free to contact me if you have any questions or concerns about this.</p> <p>Vidya Nur Trissanti Environmental Research Center</p>	<p>viedya 2022-12-01 10:52 AM</p>

**PUBLIKASI JURNAL**

**15 NOVEMBER 2022**