BUKTI KORESPONSENSI REVIEW ARTIKEL

THE CORRELATION OF CO CONCENTRATION AND GREEN OPEN SPACE (CASE STUDY OF JAGAKARSA DISTRICT, SOUNTH JAKARTA)

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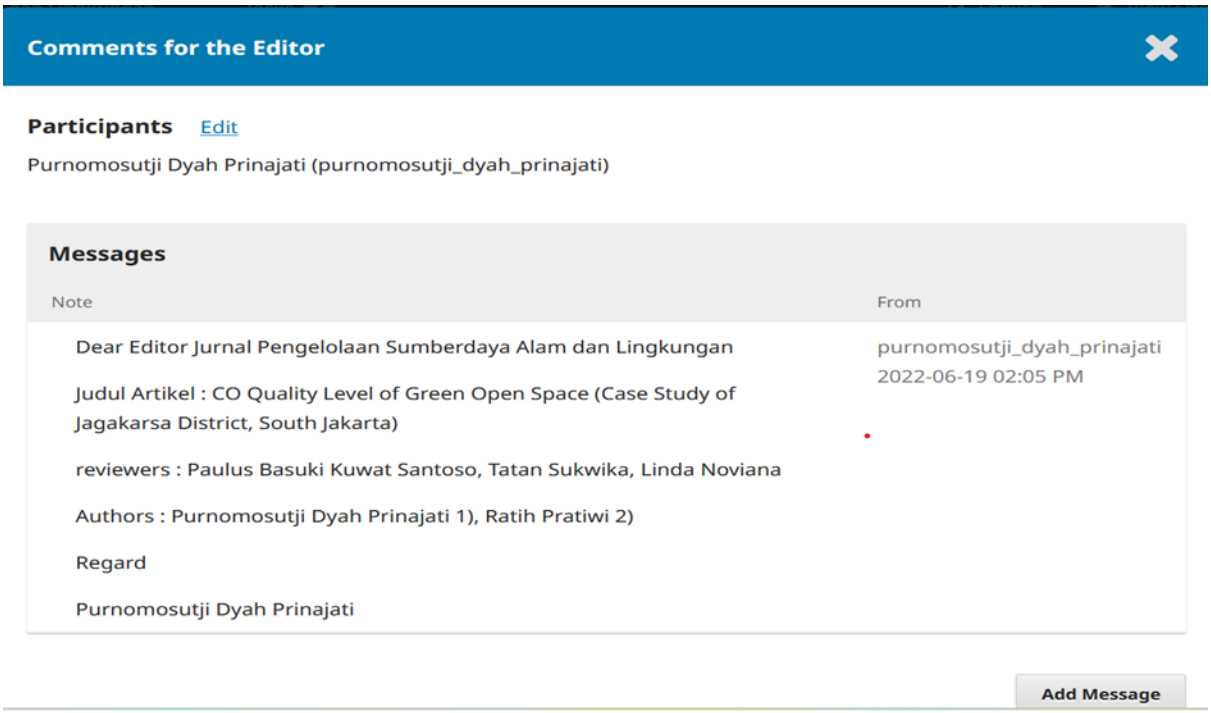

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CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

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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.*

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 particultates 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 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

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)

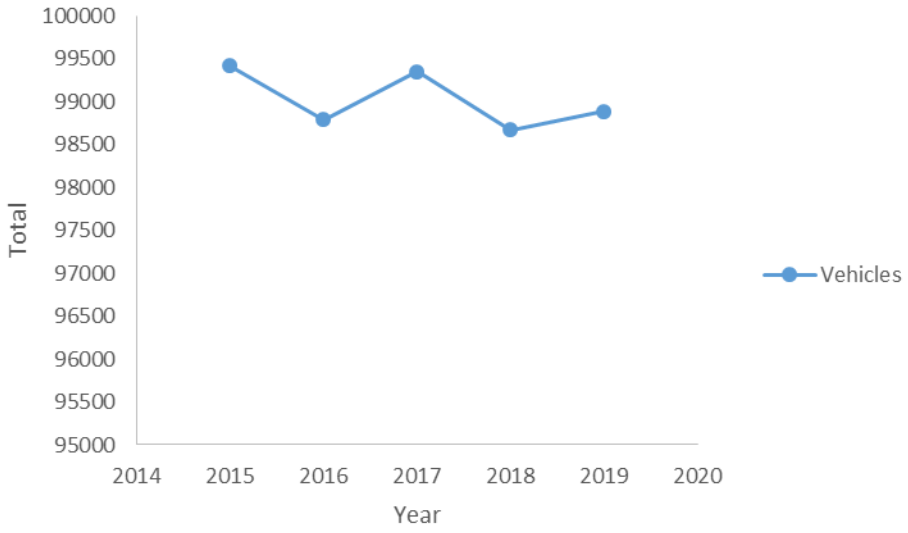
Picture 1. The location of Jagakarsa

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

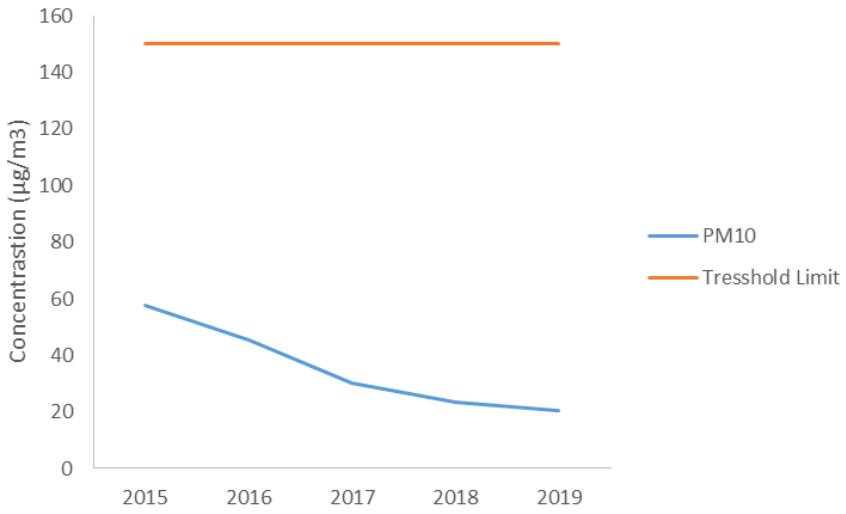
Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah, 2003).

PM_{10} concentration

Particulates (PM_{10}) 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_{10} is 150 µg/m^3. In the following tables and graphs are the results of PM_{10} parameter measurements for 2015-2019 period.

Table 4. PM_{10} Measurements Results

2015	2016	2017	2018	2019
57,73 µg/m^3	45,45 µg/m^3	30,30 µg/m^3	23,58 µg/m^3	20,56 µg/m^3



Picture 3. Concentration of PM_{10}

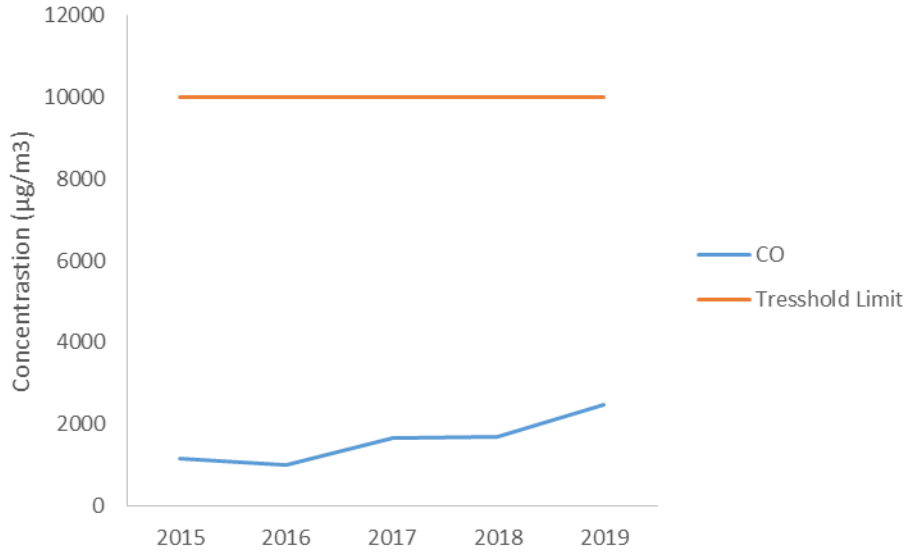
The results of PM_{10} parameter measurement are below the threshold value stated in PP No. 41 of 1999.

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 $\mu g/m^3$	1020 $\mu g/m^3$	1670 $\mu g/m^3$	1680 $\mu g/m^3$	2490 $\mu g/m^3$



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 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 betwwen 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[a]	.043	-.276	383.95883

a. Predictors: (Constant), CO

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19796.851	1	19796.851	.134	.738[b]
	Residual	442273.149	3	147424.383		
	Total	462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients[a]

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

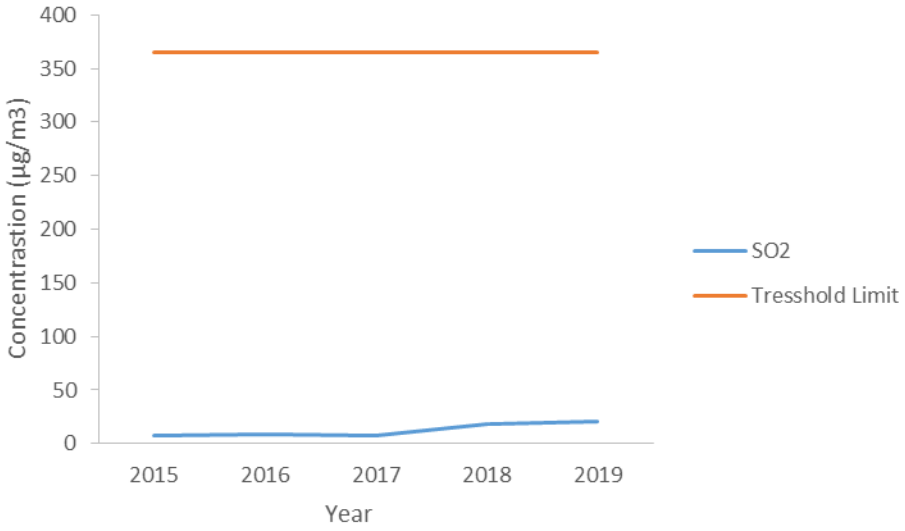
		Kendaraan	CO
Kendaraan	Pearson Correlation	1	-.207
	Sig. (2-tailed)		.738
	N	5	5
CO	Pearson Correlation	-.207	1
	Sig. (2-tailed)	.738	
	N	5	5

SO2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gases (SO_X). This gas is very easily dissolved in water, has an odor but colorless. Like O3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015-2019 period.

Table 8. SO_2 Measurements Results

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



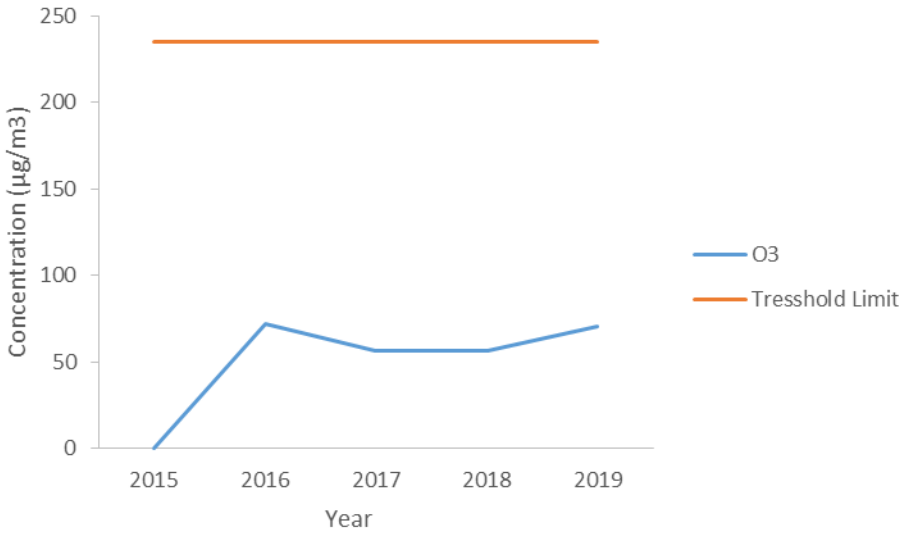
Picture 5 Concentration of SO2

Concentration of SO2 increased every year, it can be seen from table and graph above. But the results of SO2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

O_3 (Ozon)

Table 9. O_3 Measurements Results

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

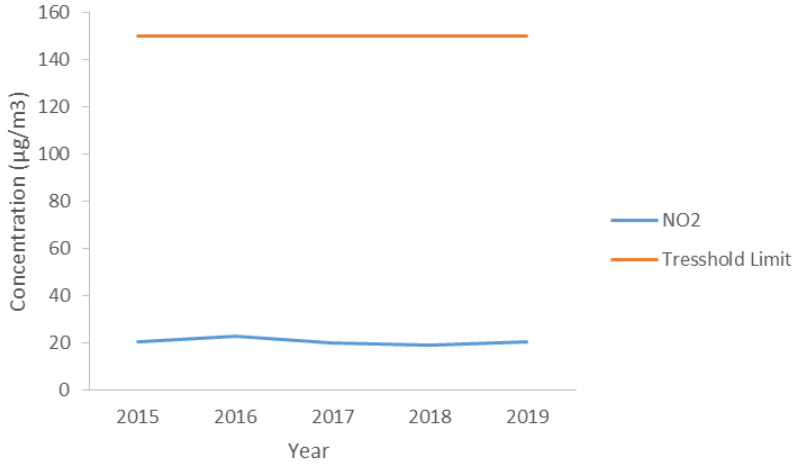


Picture 6 Concentration of O_3

The results of measurement of O3 concentration are quite high, but this value is still below threshold value by PP 41 1999 (235 µg/m3).

NO2 (Nitrogen Dioxide)

Treshold value for NO2 is 150µg/m3. In the following tables and graphs are the results of NO2 parameter measurements for 2015-2019 perio



Picture 7 Concentration of NO_2

The results of measurement of NO_2 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/m3).

Calculation of ISPU Value of Each Pollutant Parameter

Table 10. ISPU Value of Each Pollutant Parameter

Year	PM_{10} (µg/m^3)	SO_2 (µg/m^3)	CO (µg/m^3)	O_3 (µg/m^3)	NO_2 (µg/m^3)
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	PM10 (µg/m^3)	SO2 (µg/m	CO (µg/m^3	O3 (µg/m	NO2 (µg/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**

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 decerase 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

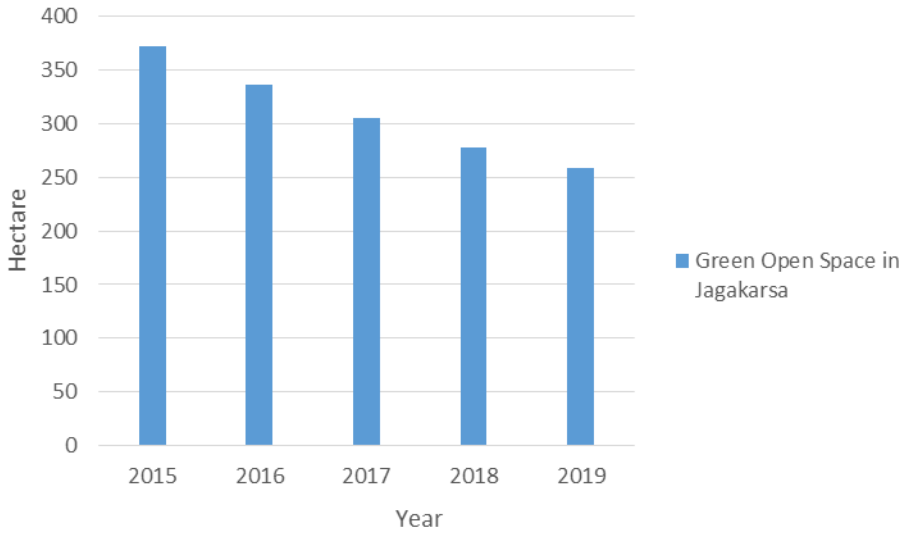
Correlations

		Area	CO
Luasan	Pearson Correlation	1	-.865
	Sig. (2-tailed)		.058
	N	5	5
CO	Pearson Correlation	-.865	1
	Sig. (2-tailed)	.058	
	N	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 concentrastion. 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 concenytration 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 ciries. As stated in Law No. 26 0f

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 (pm10, CO, SO2, NO2, O3) 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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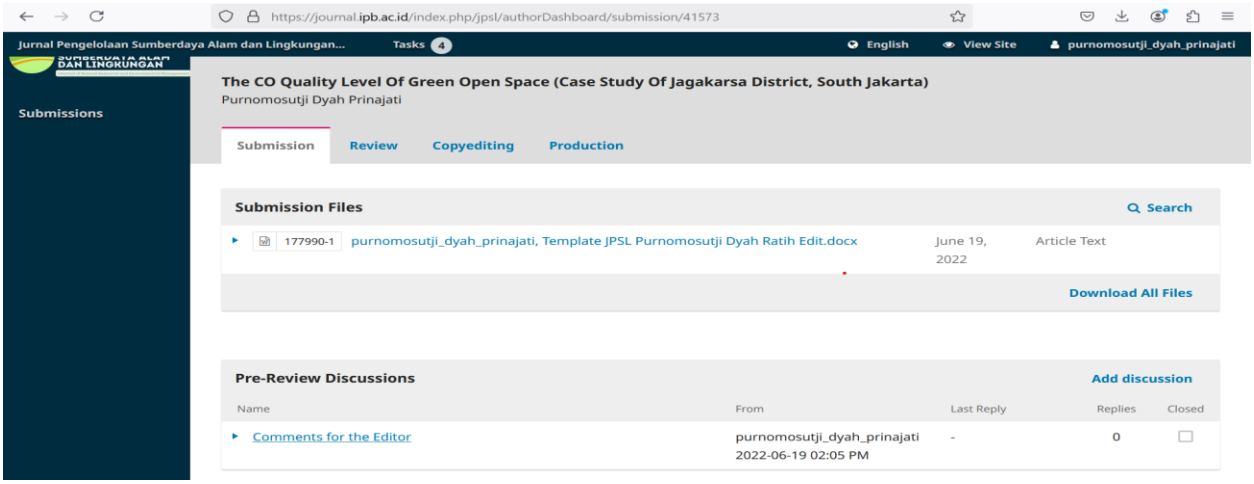

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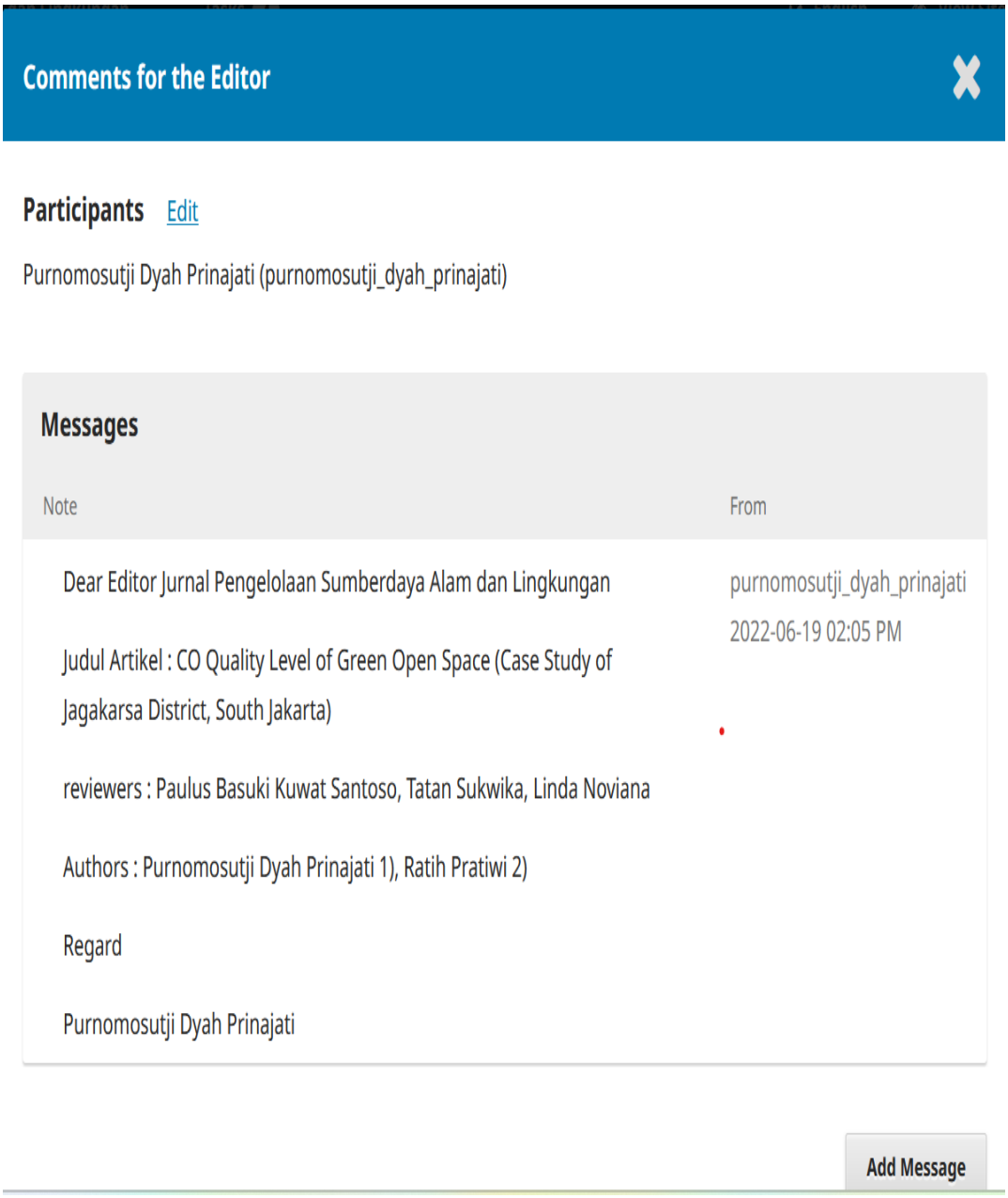

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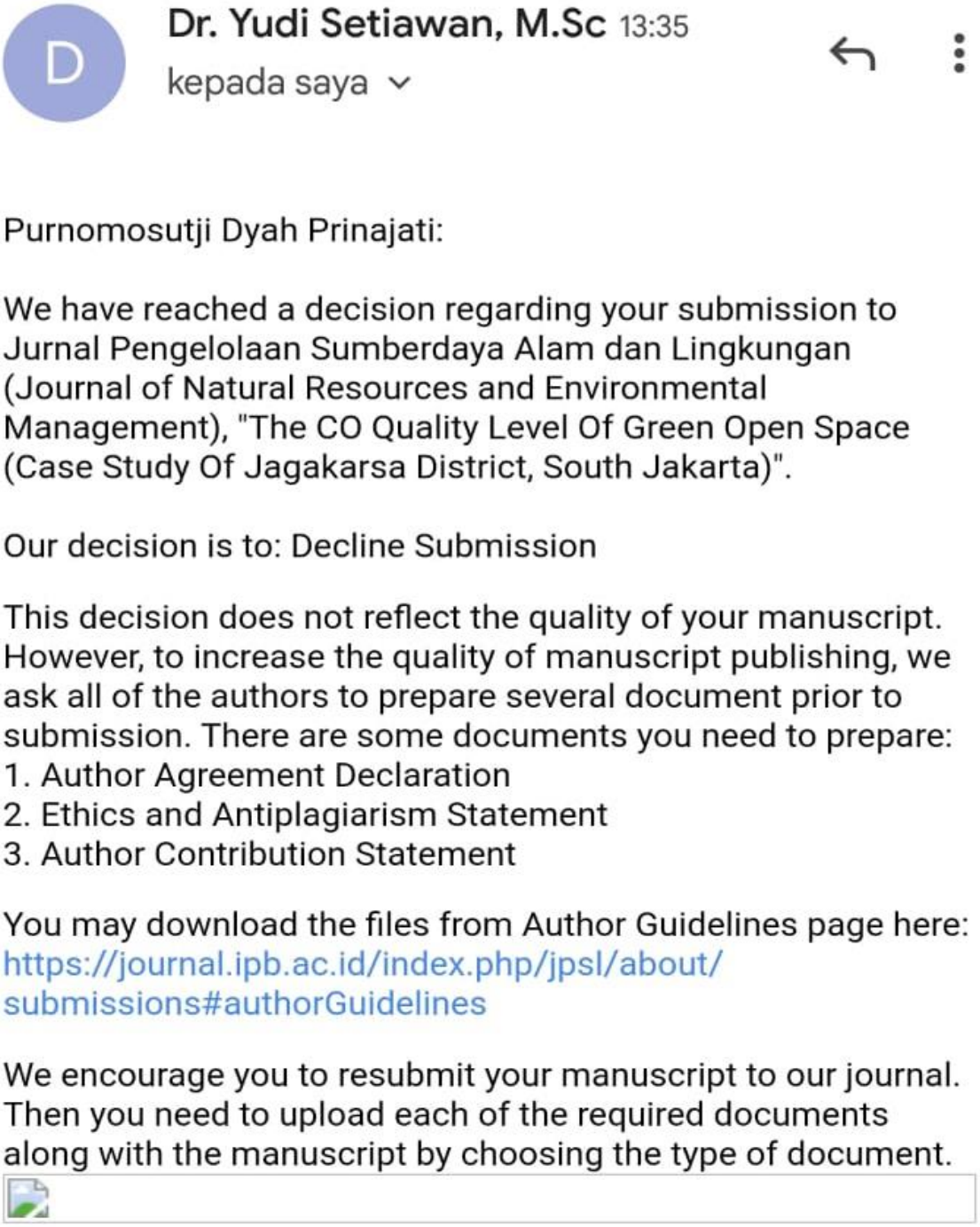

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CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

Authors:

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DISCLOSURE STATEMENT AND INFORMED CONSENT

Manuscript:

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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.

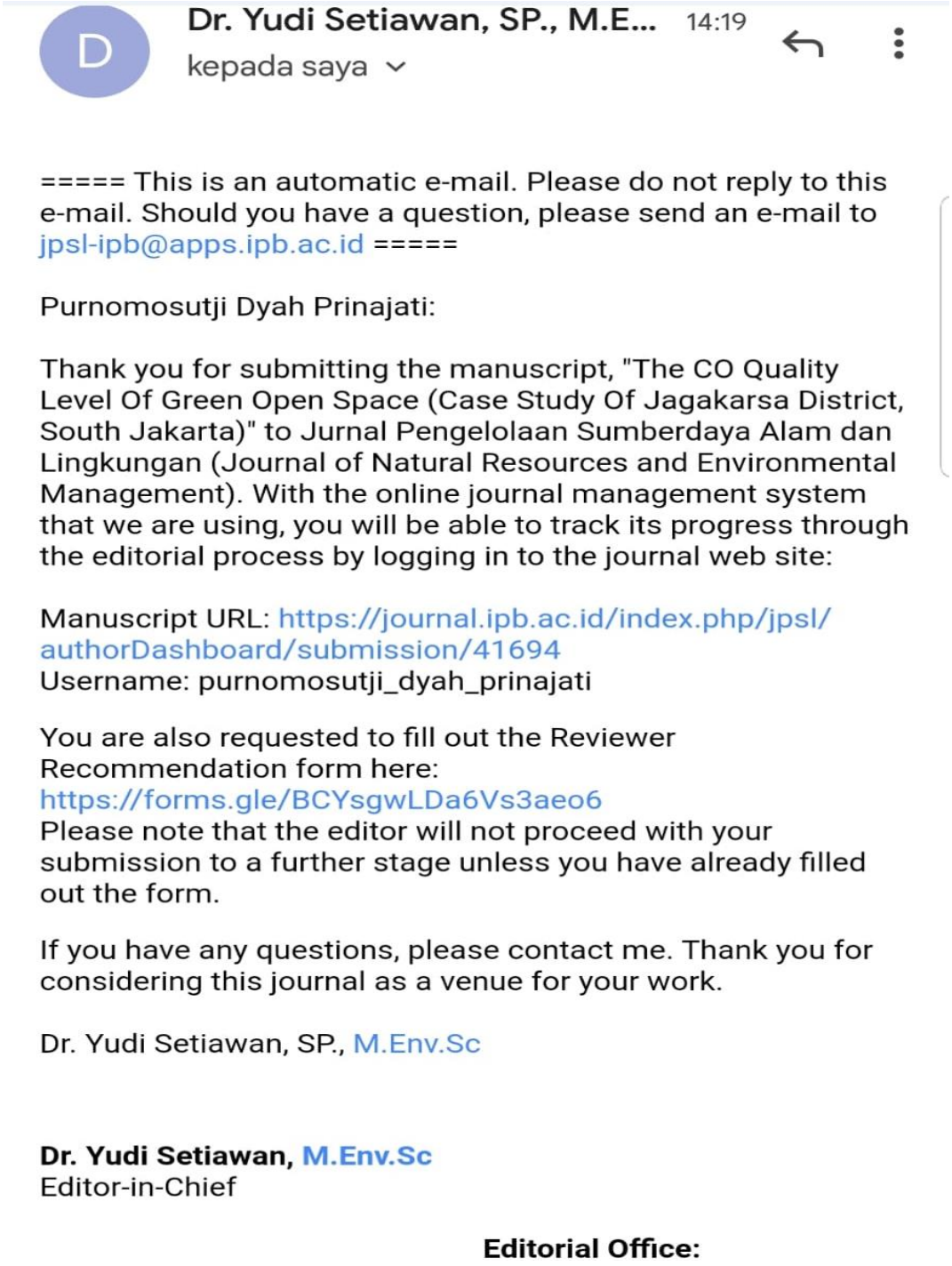
Human rights statements and informed consent:

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 21st 2022

Purnomosutji Dyah Prinajati

Tanggal 26.06.2022



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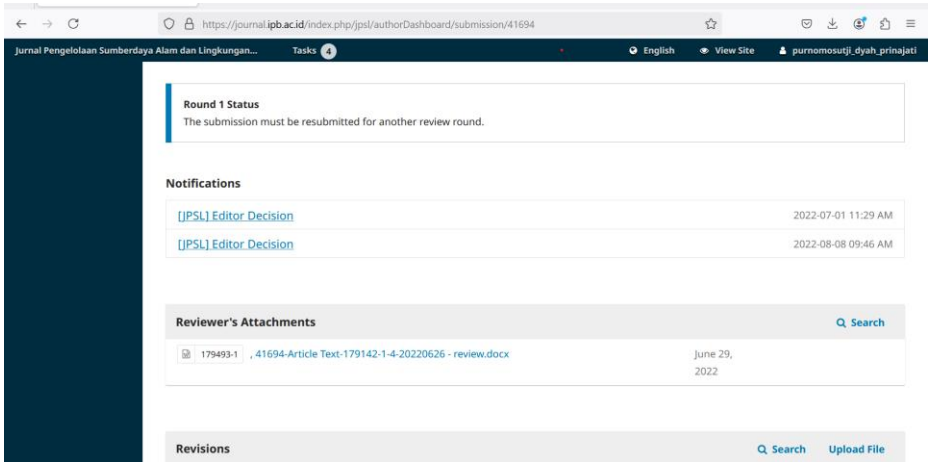

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Abstract: *Green Open Space serves indirectly to improve the level of public health. One of the sub-districts in South Jakarta is Jagakarsa is a potential area in the development of Green Open Space. Green plants as one of the elements of Green Open 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 particultates 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.

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.

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.

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.

Table 1. Air pollutant standar index

Commented [B13]: 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 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:

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

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

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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)

Picture 1. The location of Jagakarsa

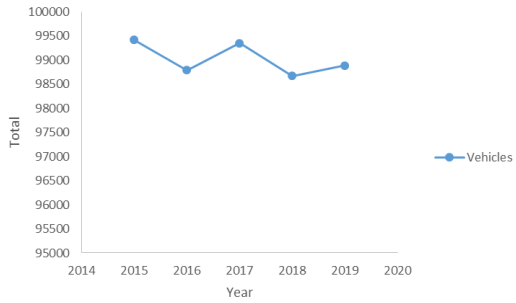
THE RESULTS AND DISCUSSION

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.

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. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah, 2003).



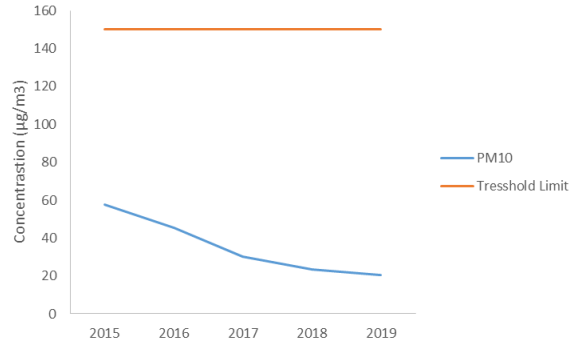
Picture 2. Vehicles in Jagakarsa

PM_{10} concentration

Particulates (PM_{10}) 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_{10} is 150 µg/m^3. In the following tables and graphs are the results of PM_{10} parameter measurements for 2015-2019 period.

Table 4. PM_{10} Measurements Results

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



Picture 3. Concentration of PM_{10}

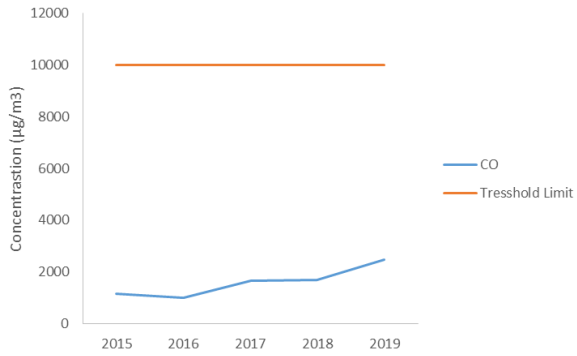
The results of PM_{10} parameter measurement are below the threshold value stated in PP No. 41 of 1999.

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 , 3	1020 , 3	1670 , 3	1680 , 3	2490 , 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 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 betwwen 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[a]	.043	-.276	282.05982

a. Predictors: (Constant), CO

ANOVA[a]

Model						
1	Regression	19796.851	1	19796.851	.134	.739[b]
		442273.149	3	147424.383		
	Residual	462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	99232.242	562.640		176.351	.000
		-.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

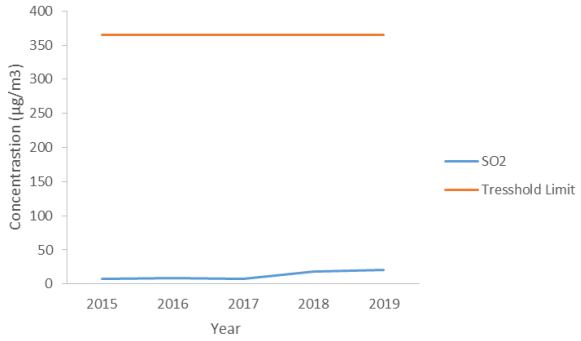
Kendaraan	Pearson Correlation	1	.207
	Sig. (2-tailed)		.738
	N	5	5
	Pearson Correlation	.738	
		5	5

SO2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gases (SO_X). This gas is very easily dissolved in water, has an odor but colorless. Like O3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015-2019 period.

Table 8. SO_2 Measurements Results

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

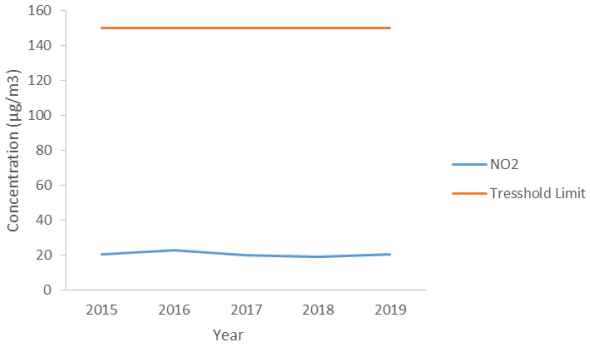


Picture 5 Concentration of SO2

Concentration of SO2 increased every year, it can be seen from table and graph above. But the results of SO2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

NO2 (Nitrogen Dioxide)

Treshold value for NO2 is 150µg/m3. In the following tables and graphs are the results of NO2 parameter measurements for 2015-2019 period



Picture 6 Concentration of NO_2

The results of measurement of NO_2 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/m3).

Calculation of ISPU Value of Each Pollutant Parameter

Table 9. ISPU Value of Each Pollutant Parameter

Year	PM_{10} (µg/m	SO_2 (µg/	CO (µg/	O_3 (µg	NO_2 (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 ($\mu g/m^3$)	SO2 (µg/m	CO	O3 (µg/m	NO2 ($\mu g/m^3$)
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

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 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 decerase 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

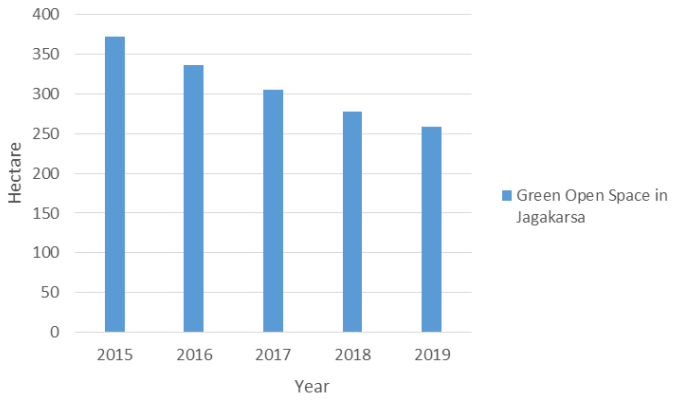
Correlations

		Area	CO
Luasan	Pearson Correlation	1	-.865
	Sig. (2-tailed)		.058
	N	5	5
	Pearson Correlation	-.865	1
	Sig. (2-tailed)	.058	
	N	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 concentrastion. 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 concenytration 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 ciries. As stated in Law No. 26 0f 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_{10} in 2015 at moderate condition.
- All air pollutant (pm10, CO, SO2, NO2, O3) 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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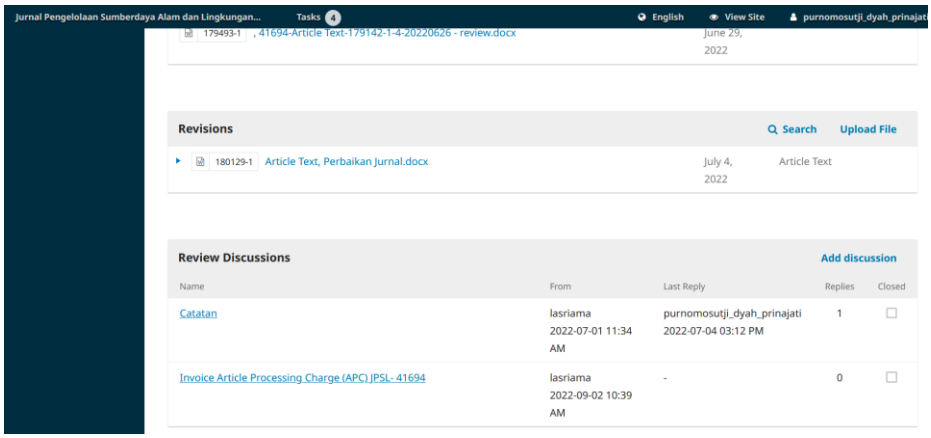

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Keywords:

Green Open Space, CO, Jagakarsa

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 particultates 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.

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).

Commented [B18]: 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.

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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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

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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)

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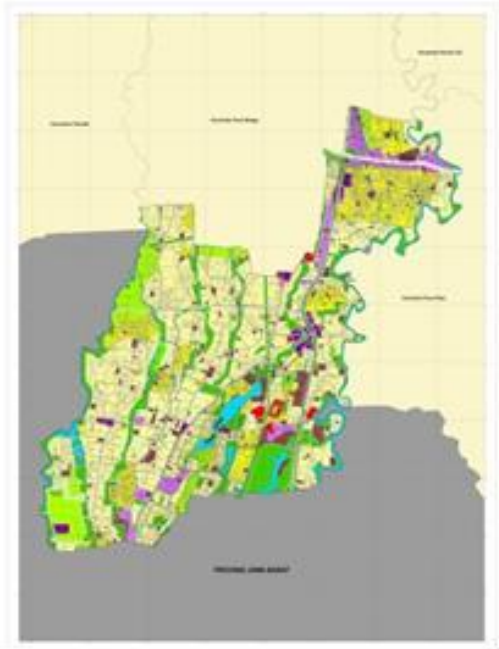


Picture 1. The location of Jagakarsa

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)

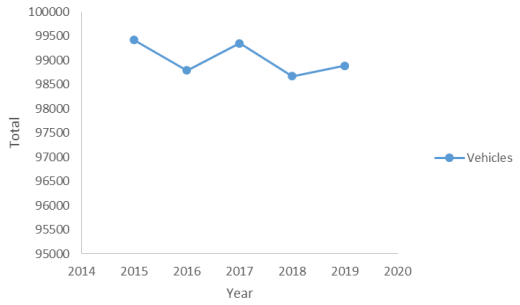
THE RESULTS AND DISCUSSION

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.

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. Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah, 2003).



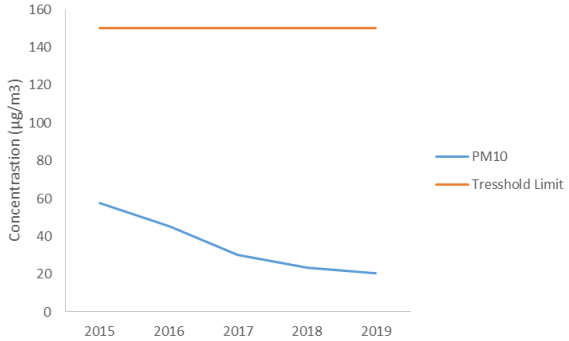
Picture 2. Vehicles in Jagakarsa

PM_{10} concentration

Particulates (PM_{10}) 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_{10} is 150 µg/m^3. In the following tables and graphs are the results of PM_{10} parameter measurements for 2015-2019 period.

Table 4. PM_{10} Measurements Results

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



Picture 3. Concentration of PM_{10}

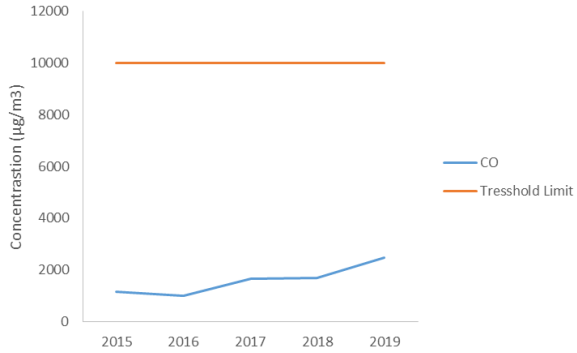
The results of PM_{10} parameter measurement are below the threshold value stated in PP No. 41 of 1999.

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 , 3	1020 , 3	1670 , 3	1680 , 3	2490 , 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 because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m3). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 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 betwwen 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[a]	.043	-.276	292.05892

a. Predictors: (Constant), C

ANOVA[a]

Model						
1	Regression	19706.851	1	19706.851	.124	.738[b]
	Residual	442273.149	3	147424.383		
		462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	99232.242	562.640		176.351	.000
		-.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

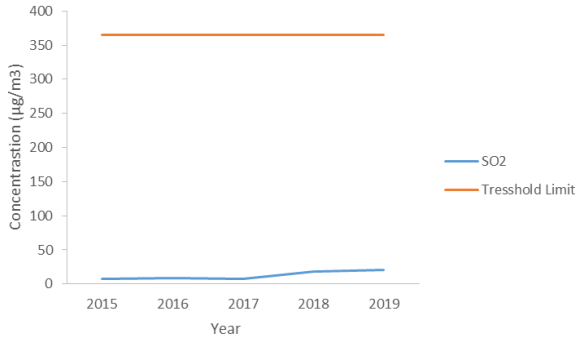
		Kendaraan	CO
Kendaraan	Pearson Correlation	1	.207
	Sig. (2-tailed)		.738
	N	5	5
CO	Pearson Correlation	.207	1
	Sig. (2-tailed)	.738	
	N	5	5

SO2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gases (SO_X). This gas is very easily dissolved in water, has an odor but colorless. Like O3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015-2019 period.

Table 8. SO_2 Measurements Results

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

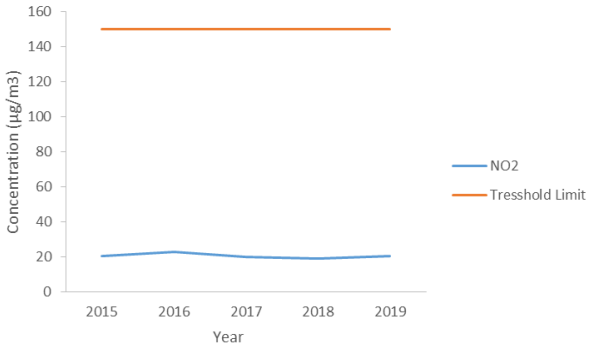


Picture 5 Concentration of SO2

Concentration of SO2 increased every year, it can be seen from table and graph above. But the results of SO2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

NO2 (Nitrogen Dioxide)

Treshold value for NO2 is 150µg/m3. In the following tables and graphs are the results of NO2 parameter measurements for 2015-2019 period



Picture 6 Concentration of NO_2

The results of measurement of NO_2 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/m3).

Calculation of ISPU Value of Each Pollutant Parameter

Table 9. ISPU Value of Each Pollutant Parameter

Year	PM_{10} (µg/m	SO_2 (µg/	CO (µg/	O_3 (µg	NO_2 (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^3)	SO2 (µg/m^3	CO	O3 (µg/m	NO2 (µg/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

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 decerased 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
Luasan	Pearson Correlation	1	-.865
	Sig. (2-tailed)		.058
	N	5	5
	Pearson Correlation	-.865	1
	Sig. (2-tailed)	.058	
	N	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. 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 ciries. As stated in Law No. 26 0f 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 CO2 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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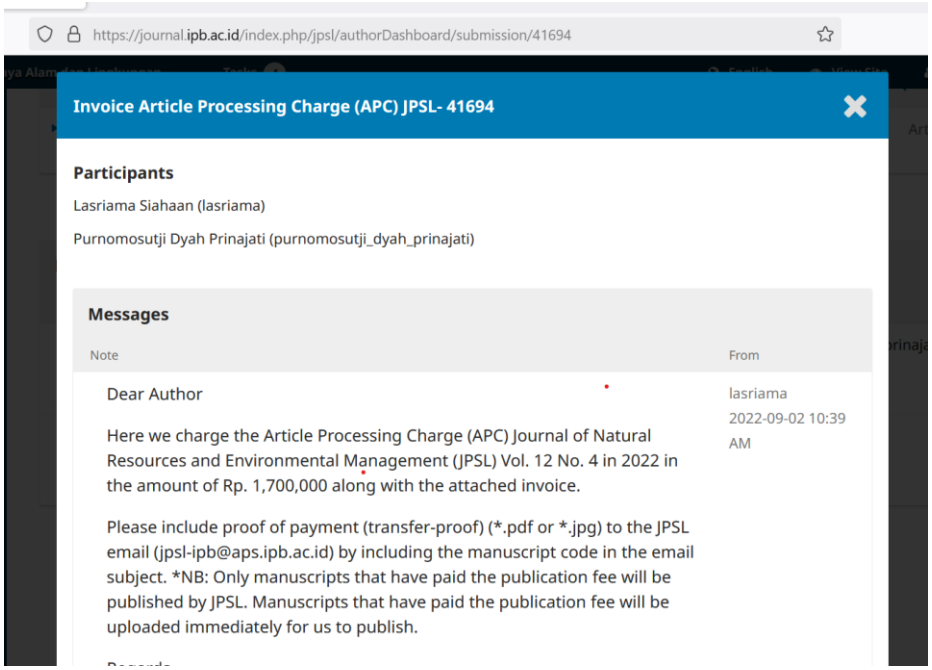

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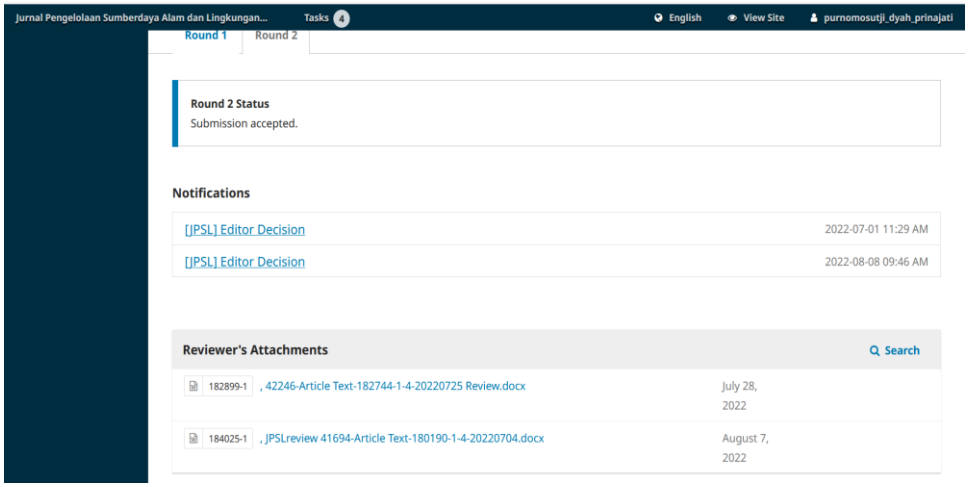

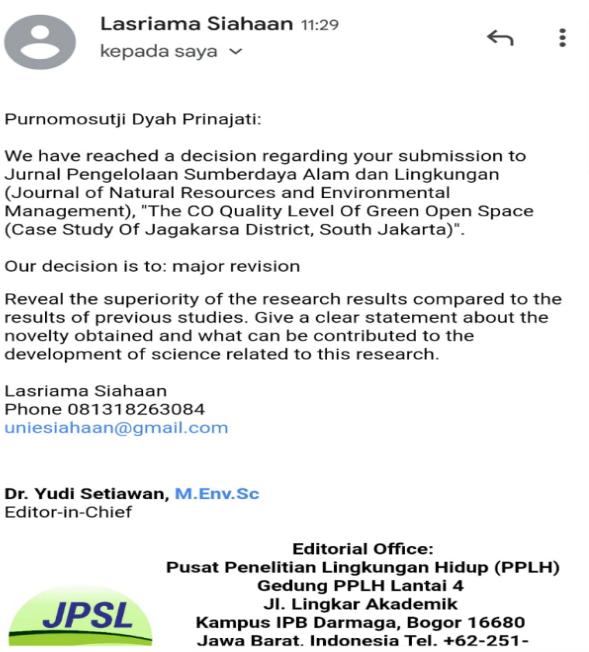

Lasriama Siahaan 11:29
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Purnomosutji Dyah Prinajati:

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
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Editor-in-Chief

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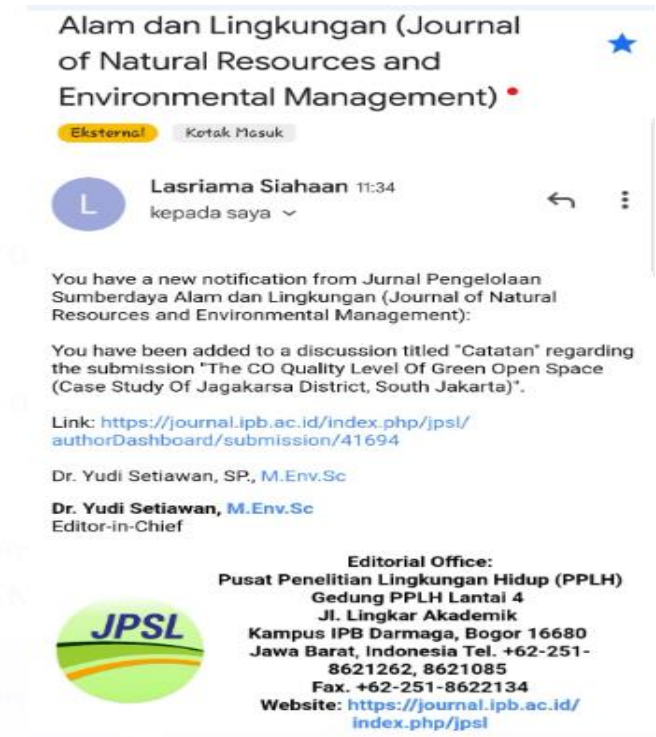

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You have a new notification from Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan (Journal of Natural Resources and Environmental Management):

You have been added to a discussion titled "Catatan" regarding the submission "The CO Quality Level Of Green Open Space (Case Study Of Jagakarsa District, South Jakarta)".

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

Dr. Yudi Setiawan, SP., M.Env.Sc

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

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Commented [A14]: The author please focus on the topic. In the title only CO is listed, but the results also discuss PM10, SO, NO.

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.

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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.

Commented [B117]: 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 [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, SO2, CO, O3, HC, and NO2.

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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.

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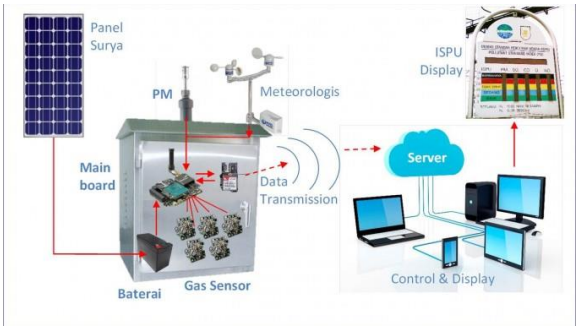

Picture Air Quality Monitoring Station

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

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

Commented [A21]: There is no number in the Figure

Commented [A22]: Geographical coordinates should be expressed in degrees (°), minutes ('), and seconds (“), S, E.

Commented [B123]: Apa index ini juga berlaku di Indonesia?

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)

Commented [B124]: In bahasa ? English?

Commented [B125]: what is the basis of this criterion

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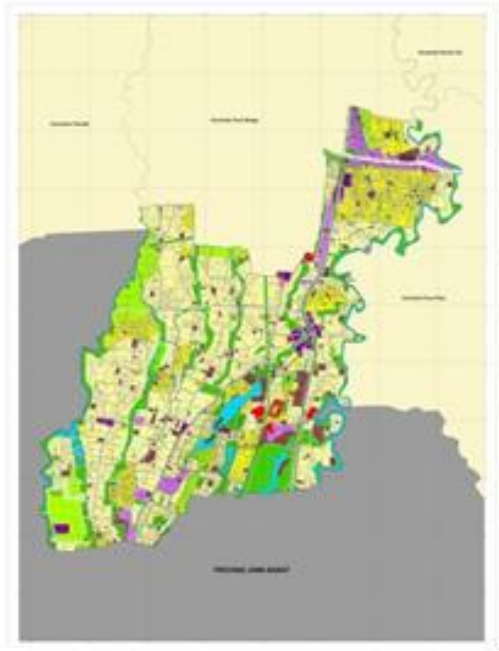

~~Picture~~ 1. The location of Jagakarsa

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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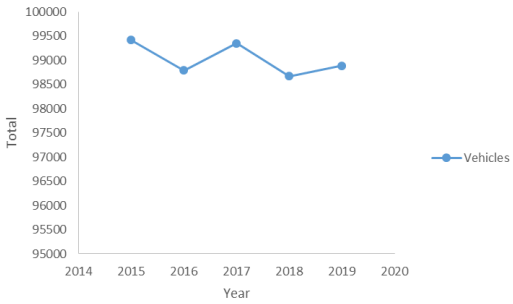
	2017	99.355
	2018	98.670
	2019	98.890

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 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah, 2003).

Commented [A36]: Ripanah et al ?



~~Picture~~ 2. Vehicles in Jagakarsa

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PM_{10} concentration

Particulates (PM_{10}) 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_{10} is 150 µg/m^3. In the following tables and graphs are the results of PM_{10} parameter measurements for 2015-2019 period.

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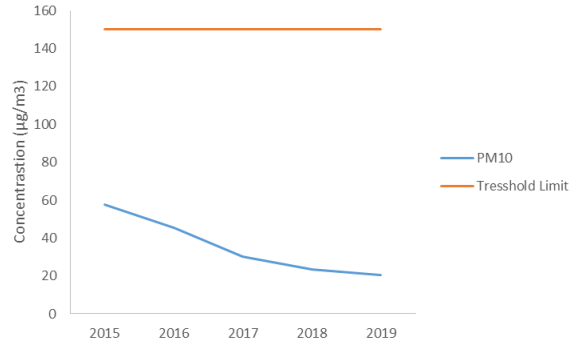
Table 4. PM_{10} Measurements Results

Commented [A39]: The table does not use vertical lines. you can remove or delete it.

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



~~Picture~~ **3.** Concentration of PM_{10}

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The results of PM_{10} parameter measurement are below the threshold value stated in PP No. 41 of 1999.

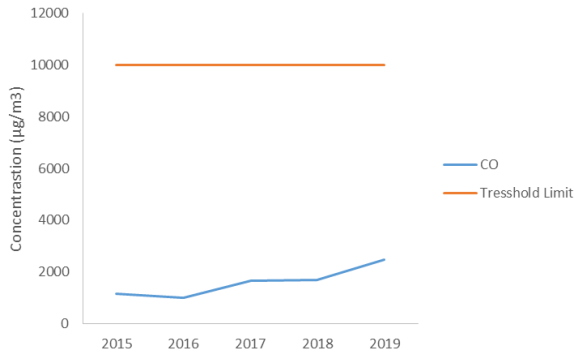
CO Concentration

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

Commented [A41]: The table does not use vertical lines. you can remove or delete it.

2015	2016	2017	2018	2019
1170 , 3	1020 , 3	1670 , 3	1680 , 3	2490 , 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 because it is below the threshold value that has been set in PP No.41/1999 (10.000 µg/m3). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah, 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

Commented [A42]: Et al ?

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 betwwen 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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Commented [A44]: the author who cited this is not available in the reference

Table 6. SPSS Results

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Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the
1	.207[a]	.043	-.276	292.05892

a. Predictors: (Constant), CO

ANOVA[a]

Model						
1	Regression	19706.851	1	19706.851	.134	.738[b]
	Residual	442273.149	3	147424.383		
		462070.000	4			

a. Dependent Variable: Kendaraan

b. Predictors: (Constant), CO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	99232.242	562.640		176.351	.000
		-.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

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

SO2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gases (SO_x). This gas is very easily dissolved in water, has an odor but colorless. Like O3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015-2019 period.

Table 8. SO_2 Measurements Results

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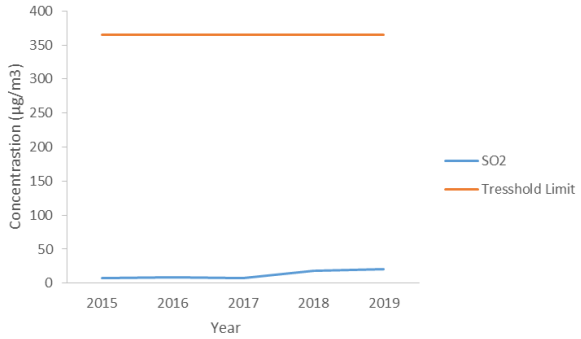
2015	2016	2017	2018	2019
7,28 µg/m³	8,62 µg/m³	8,09 µg/m³	18,47 µg/m³	20,11 µg/m³



~~**Picture**~~ **5** Concentration of SO2

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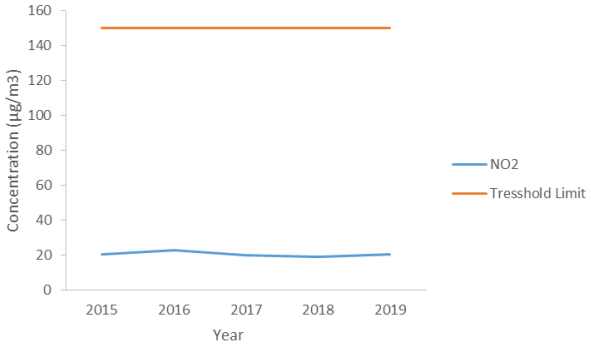
Concentration of SO2 increased every year, it can be seen from table and graph above. But the results of SO2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

NO2 (Nitrogen Dioxide)

Treshold value for NO2 is 150µg/m3. In the following tables and graphs are the results of NO2 parameter measurements for 2015-2019 period



~~Picture~~ 6 Concentration of NO_2

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The results of measurement of NO_2 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/m3).

Calculation of ISPU Value of Each Pollutant Parameter

Table 9. ISPU Value of Each Pollutant Parameter

Commented [A49]: The table does not use vertical lines. you can remove or delete it.

Year	PM_{10} (µg/m	SO_2 (µg/	CO (µg/	O_3 (µg	NO_2 (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/m3)	SO2 (µg/m	CO	O3 (µg/m	NO2 (µg/m3)
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 conditio

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 decerased 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
Area	Pearson Correlation	1	-.865
			.058

Luasan	Sig. (2-tailed)	5	5
	N	.058	
	Pearson Correlation	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. 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 ciries. As stated in Law No. 26 0f 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 CO2 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%.

Harahap, Y.Y. 2013. Perbandingan Kadar Monoksida (CO) dan Nitrogen Dioksida (NO2) di Udara Ambien Berdasarkan Keberadaan Pohon Angsana (*Pterocarpus indicus*) di Beberapa Jalan Raya di Kota Medan Tahun 2012. Skripsi FKM USU.

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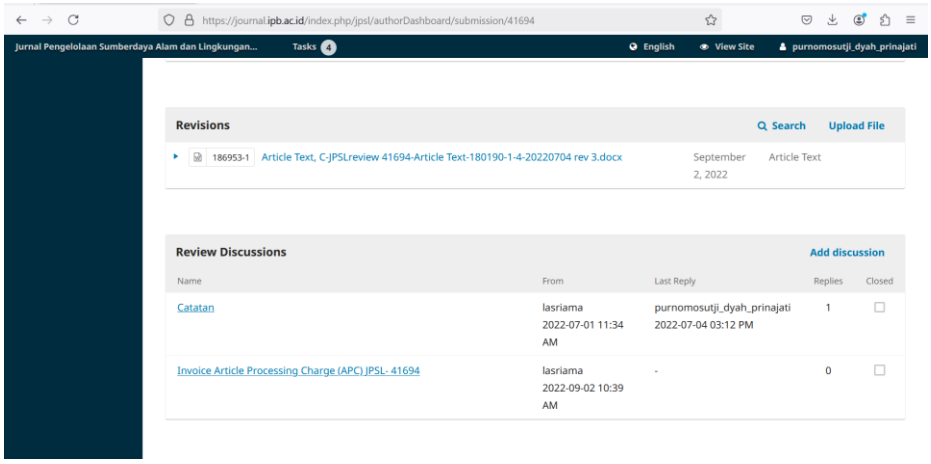

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http://journal.ipb.ac.id/index.php/jpsl

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.

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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 0f 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 %.*

Commented [A57]: It is necessary to briefly inform how the data was collected and measured.

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 µg/Nm^3 and in 2016 was 798.690 µg/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 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 particultates measuring less than 10 µm (PM_{10}), particultates measuring less than 2.5 µm ($PM_{2.5}$), Sulfur Dioxide (SO2), Carbon Monoxide (CO), oxidants in the form of Ozone (O_3), and Nitrogen Dioxide (NO_2) and Hidrocarbon (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).

Commented [B158]: 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 [A59]: 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, SO2, CO, O3, HC, and NO2.

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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.

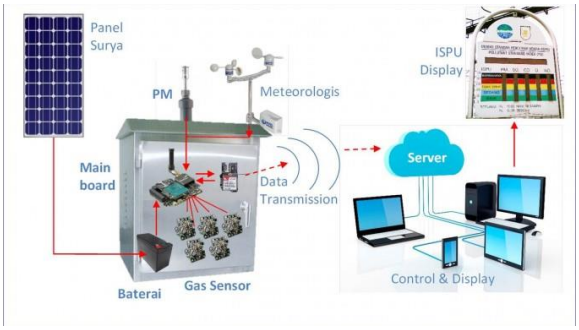

Figure 1 Air Quality Monitoring Station

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 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 (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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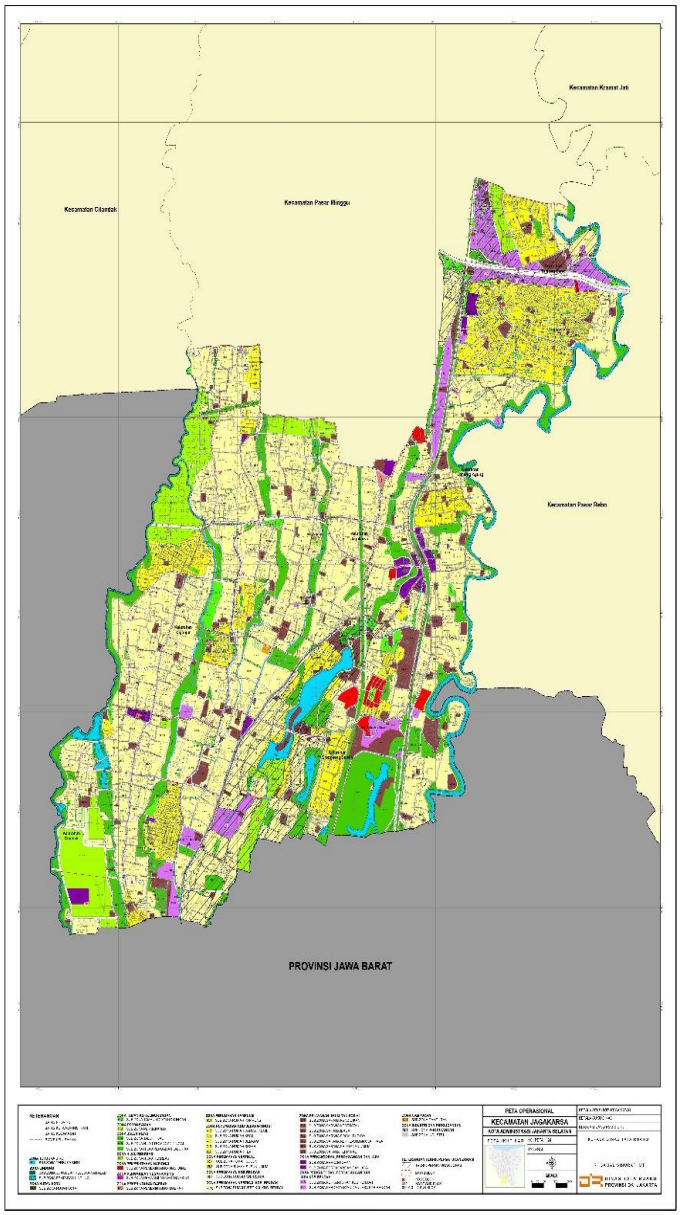

Figure 2. The location of Jagakarsa

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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 µg/m^3 -244,72 µg/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)

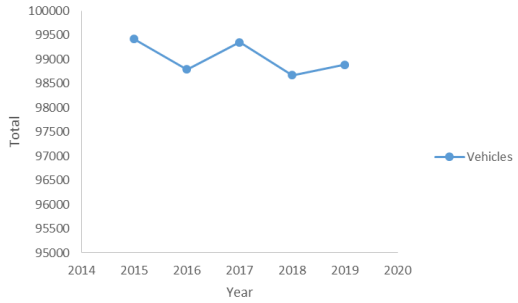

Figure 3. Vehicles in Jagakarsa

PM$_{10}$ concentration

Particulates (PM$_{10}$) 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$_{10}$ is 150 µg/m^3. In the following tables and graphs are the results of PM$_{10}$ parameter measurements for 2015-2019 period. It was varied from 20,56-57,73 µg/m^3

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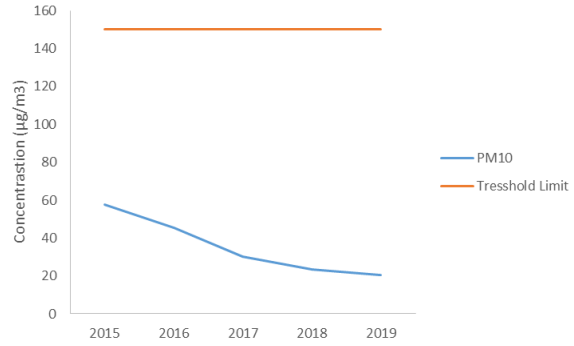

Figure 4. Concentration of PM_{10}

The results of PM_{10} 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^3.

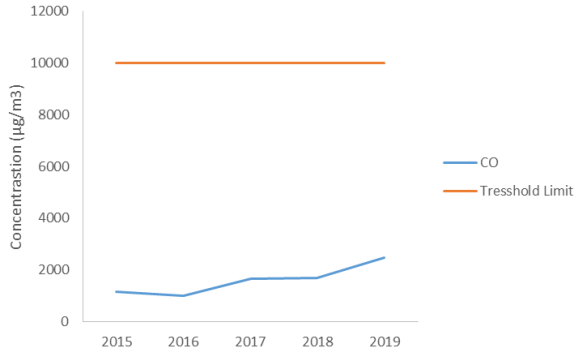

Figure 5. Concentration of CO

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/m3). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel with CO average concentration is 228,878 µg/m^3 -244,72 µg/m^3 at Tomang flyover (Ripanah 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
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_2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gases (SO_X). This gas is very easily dissolved in water, has an odor but colorless. Like O_3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015-2019 period. It was varied from 7,28-20,11 µg/m^3. The highest concentration was in 2019.

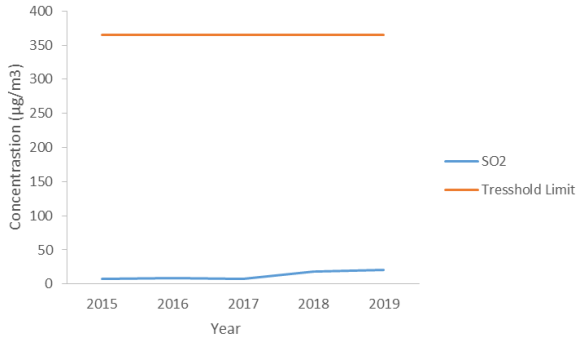

Figure 6. Concentration of SO2

Concentration of SO2 increased every year, it can be seen from table and graph above. But the results of SO2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

NO2 (Nitrogen Dioxide)

Treshold value for NO2 is 150µg/m3. In the following tables and graphs are the results of NO2 parameter measurements for 2015-2019 period

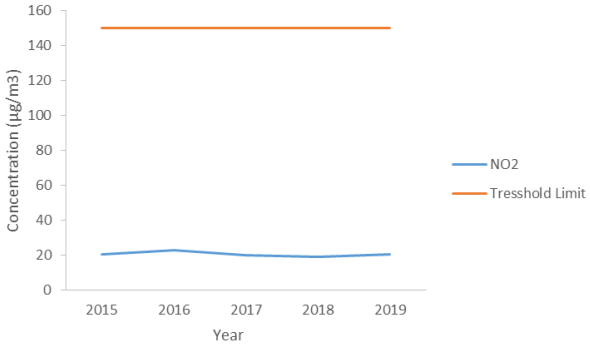

Figure 7. Concentration of NO_2

The results of measurement of NO_2 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/m3).

Calculation of ISPU Value of Each Pollutant Parameter

Table 5. ISPU Value of Each Pollutant Parameter

Year	PM_{10} (µg/m	SO_2 (µg/	CO (µg/	O_3 (µg	NO_2 (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 6.ISPU Value Category of each pollutant parameter

Year	PM10 ($\mu g/m^3$)	SO2 ($\mu g/m^3$	CO	O3 (µg/m	NO2 ($\mu g/m^3$)
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

Almost all parameters, ISPU in good condition except PM_{10} 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 decerased 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

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 ciries. As stated in Law No. 26 0f 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 0f 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 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.

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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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.

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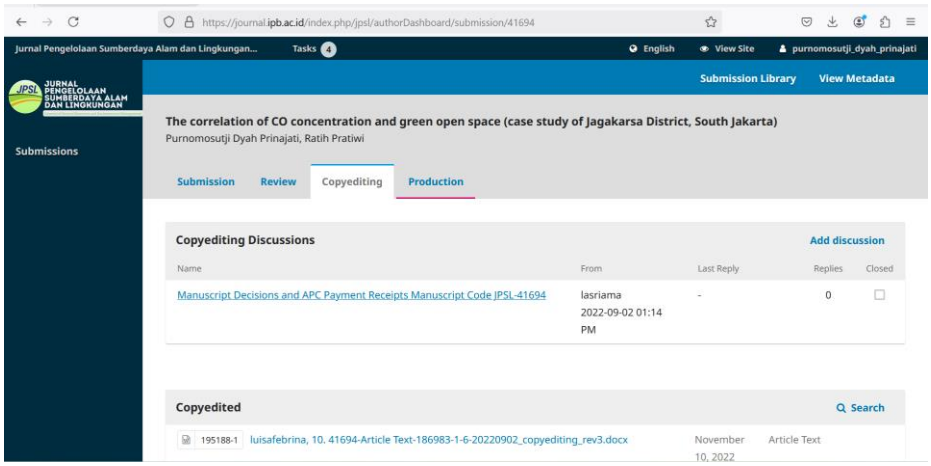

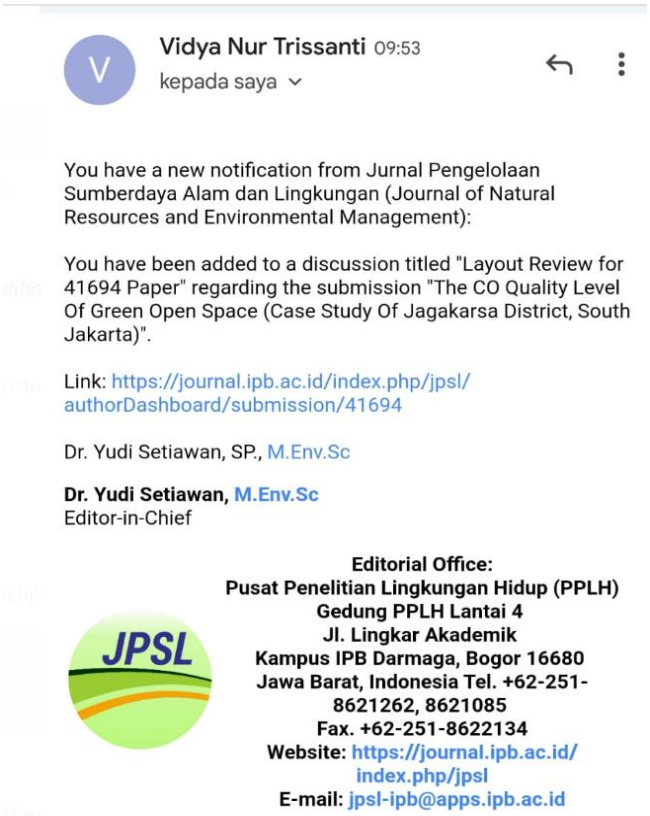

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The Correlation of CO Concentration and Green Open Space (Case Study Of Jagakarsa District, South Jakarta)

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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. 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 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 0f 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 %.*

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 µg/Nm^3 and in 2016 was 798.690 µg/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^2 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 µm (PM_{10}), particulates measuring less than 2.5 µm ($PM_{2.5}$), Sulfur Dioxide (SO2), Carbon Monoxide (CO), oxidants in the form of Ozone (O_3), and Nitrogen Dioxide (NO_2) 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.

(https://lingkungan.itats.ac.id/mekanisme-kerja-stasiun-pemantau-kualitas-udara/)

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/)

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

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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 Controlconcerning 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

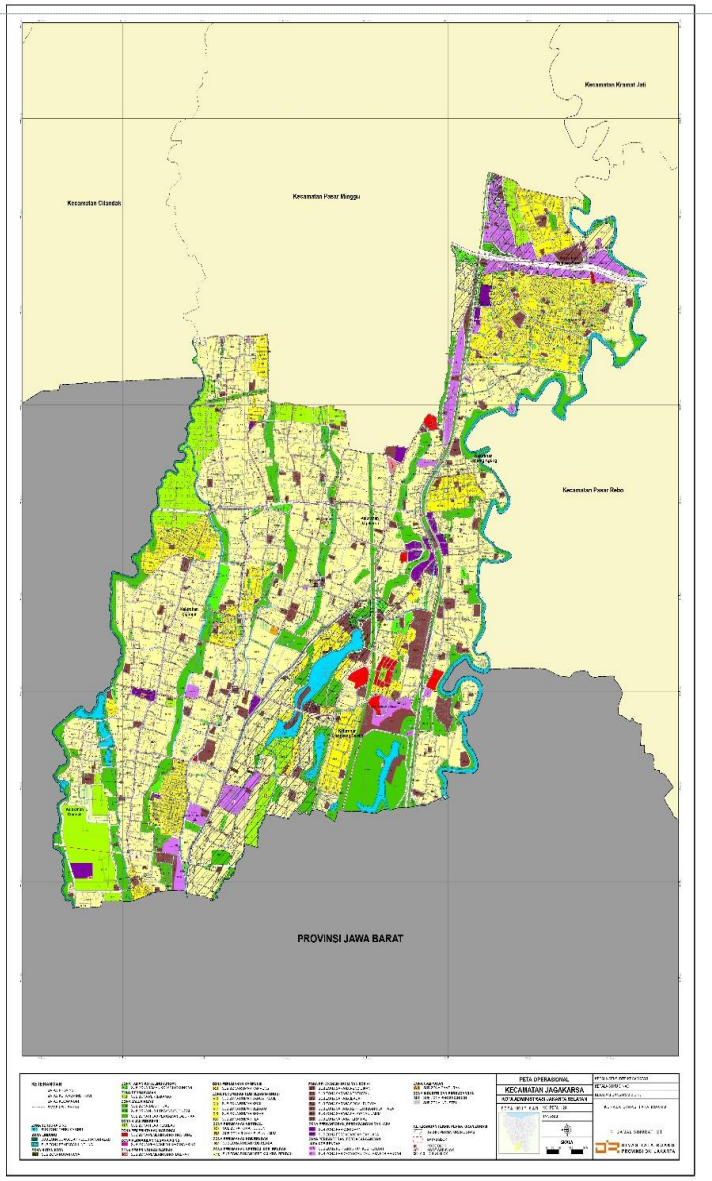

Figure 2. The location of Jagakarsa
(https://www.scribd.com/document/435609039/Peta-Zonasi-Kecamatan-Jagakarsa-2016)

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Table 3. CO_2 Absorption Power of Vegetation (Prasetyo in Tinambunan, 2006).

Type of Vegetation Cover	CO_2 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^3 – 244,72 µg/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)

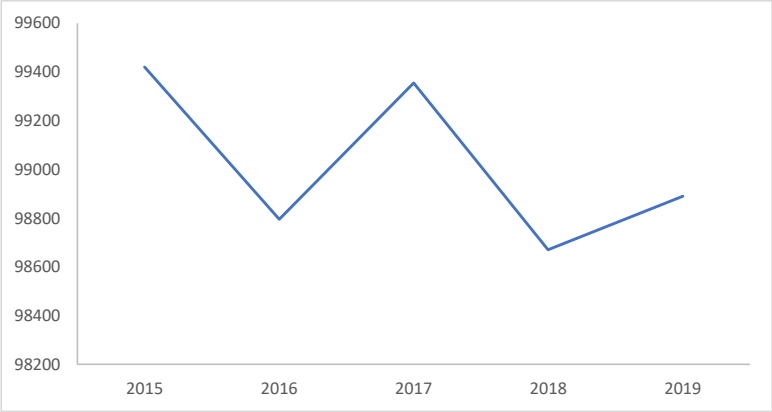

Figure 3. Vehicles in Jagakarsa.

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PM_{10} concentration

Particulates (PM_{10}) 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_{10} is 150 µg/m^3. The following tables and graphs are the results of PM_{10} parameter measurements for 2015 – 2019 period. It varied from 20,56 – 57,73 µg/m^3. The results of PM_{10} parameter measurement are below the threshold value stated in PP No. 41 of 1999.

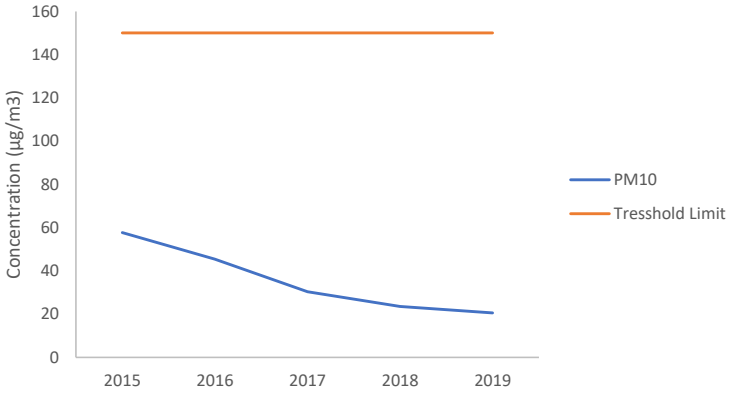

Figure 4. Concentration of PM_{10}.

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^3. 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_3). Most of CO is produced by transportation, especially from vehicles that use gasoline as fuel, with CO average concentration is 228,878 µg/m^3 – 244,72 µg/m^3 at Tomang flyover (Ripanah et al. 2003). The CO concentration in Jagakarsa is greater than CO concentration in Tomang flyover.

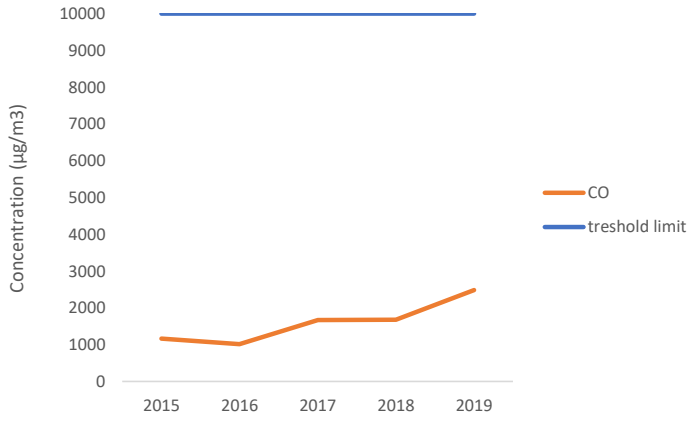

Figure 5. The concentration of CO.

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

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SO_2 (Sulfur Dioxide)

Sulfur dioxide (SO_2) is a species of sulfur oxide gas (SO_X). This gas is very easily dissolved in water, and has an odor but is colorless. Like O_3, secondary pollutants formed from SO_2, such as sulfate particles, can migrate and be deposited away from their source. Threshold Value SO_2 is 365 µg/m_3. In the following tables and graphs are the results of measuring SO_2 parameters for 2015 – 2019 period. It varied from 7,28-20,11 µg/m^3. The highest concentration was in 2019. Concentration of SO2 increased every year, it can be seen from Figure 6 But the results of SO_2 measurement are still safe because they are below the threshold value from PP No 41/1999 365 µgram/m^3.

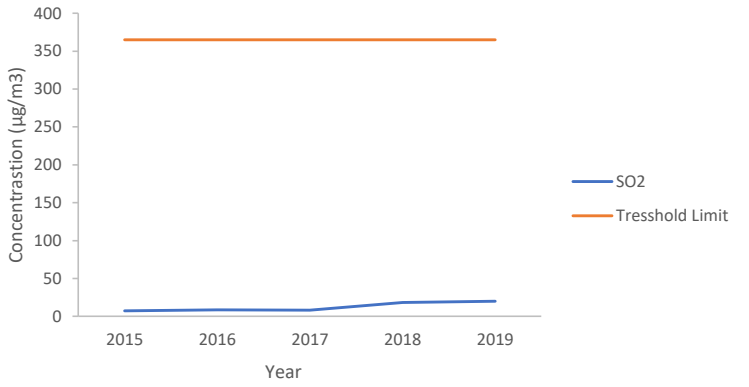

Figure 6. The concentration of SO_2.

NO2 (Nitrogen Dioxide)

The threshold value for NO_2 is 150µg/m^3. The following tables and graphs are the results of NO_2 parameter measurements for 2015 – 2019 period. The results of the measurement of NO_2 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^3).

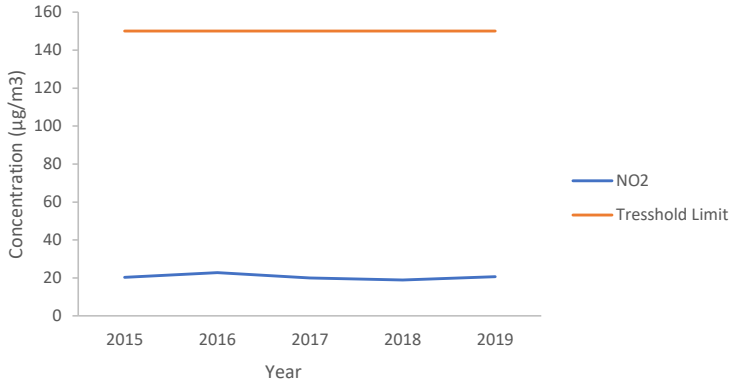

Figure 7. Concentration of NO_2.

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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_{10} in 2015 at moderate condition. The highest PM_{10} concentration was measured in 2015, while the lowest PM_{10} concentration was in 2019. Meanwhile, the highest concentration of SO_2 was in 2019 and the lowest concentration was in 2015. Concentration of O_3 is quite fluctuative.

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

Year	PM_{10} ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)
2015	54	5	-	27	-
2016	45	5	-	30	-
2017	30	5	-	24	-
2018	24	12	-	24	-
2019	21	13	-	19	-

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

Year	PM_{10} ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO ($\mu g/m^3$)	O_3 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)
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

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_2 from a tree is 129,92 kg/ha/hour. If all the green open space is assumed as a tree, then the total CO_2 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.

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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 0f 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 0f 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_2 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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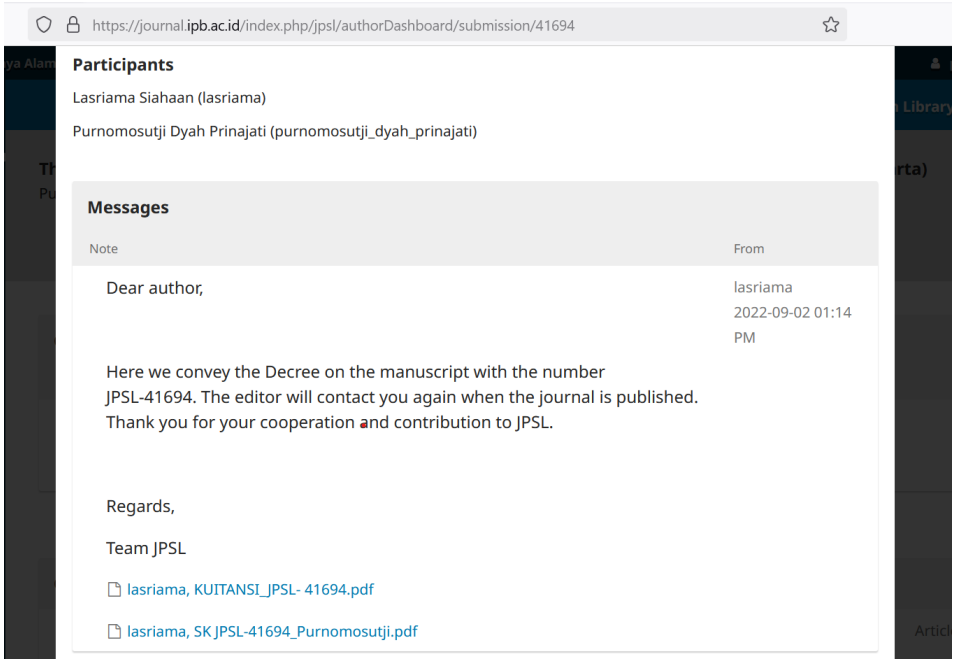

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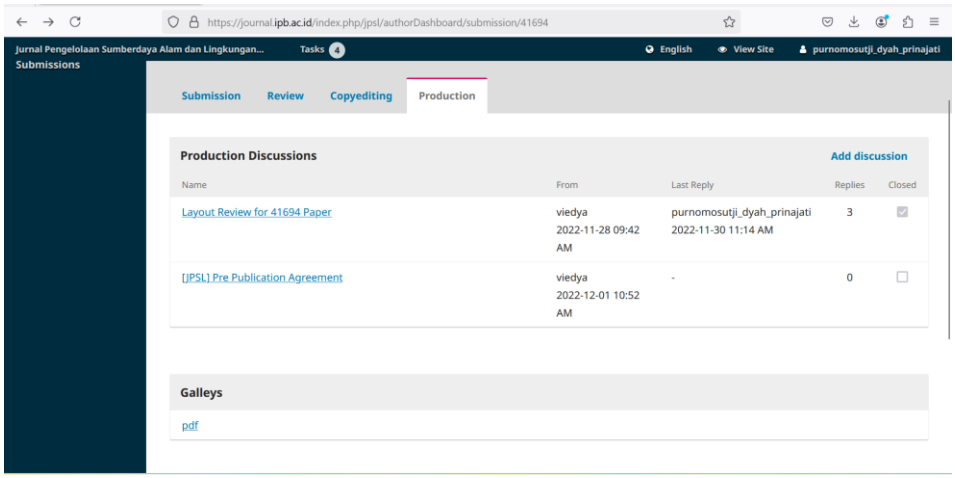

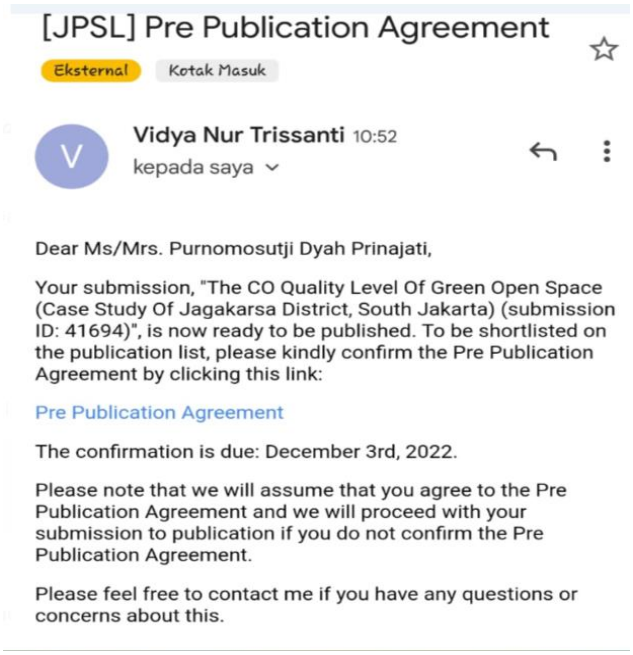

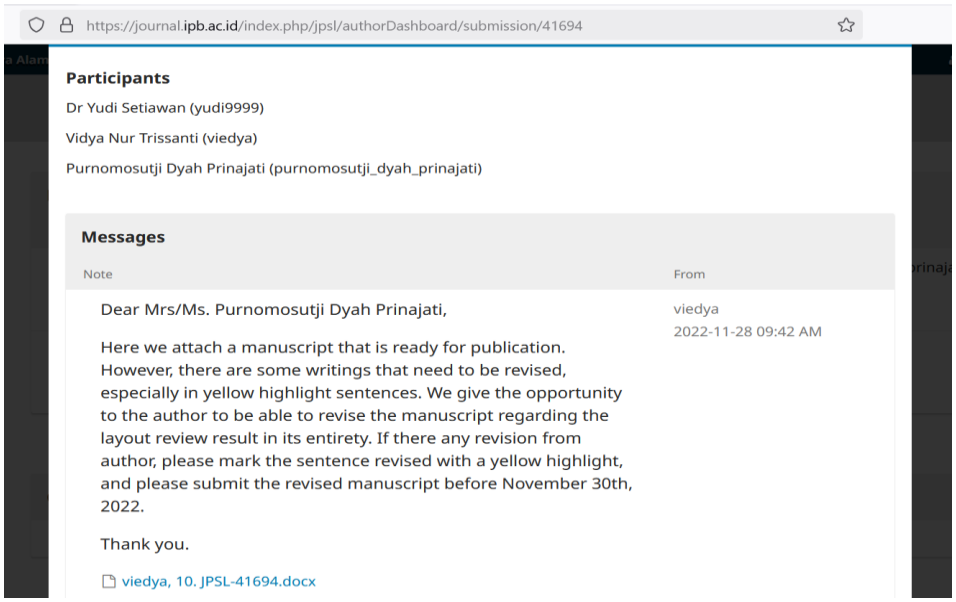
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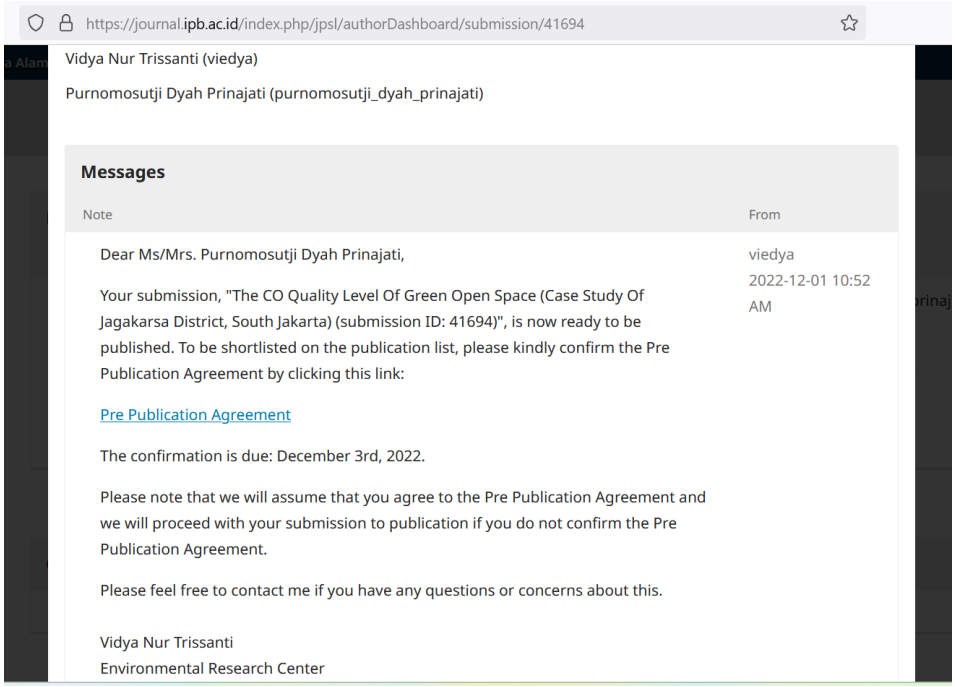

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