Students' Perception of Public Green Open Space (GOS) Existence in Reducing Student Stress Levels in Surakarta

Agra Dewi Sabrina[a*], Aninda Maulidyna[a], Desta Eka Fahrurozi[a], Novania Cantika Widagdo[a], Nurma Chandrasari[a]

[a]*Departement of Environmental Science, Faculty of Mathematics and Natural Sciences, Sebelas Maret University, Indonesia*

ABSTRACT. Urban development and population increase, accompanied by developments in means of transportation, causing a decrease in environmental quality. Environmental degradation can be a stressor for students. The aim of this research is to know the effect of environmental factors, including air temperature, noise, air pollution, cleanliness in public areas, and residential density on the stress level of students in Surakarta and also to know the influence of public Green Open Space (GOS) in reducing student stress levels in the city of Surakarta. The research was conducted by distributing questionnaires to student living in Surakarta or students who has studies in Surakarta to find out what variables in Green Open Spaces (GOS) that affect stress levels in students. The results showed that environmental factors, including air temperature, noise, air pollution, cleanliness in public areas, and residential density, affect the college student's stress levels in Surakarta and the existence of public Green Open Space (GOS) effects on reducing student stress levels in Surakarta. These are shown by respondent's results questionnaire. Variables that affected their stress level is air temperature (88.3%), cleanliness in public areas (85.8%), air pollution (84.4%), noise (74.2%), residental density (64.9%), and 93% of respondents stated that their emotional condition improved after visiting GOS.

1. Introduction

By Surakarta is one of the biggest cities in Indonesia, with around 519,587 population of people in 2019 (Badan Pusat Statistik Kota Surakarta, 2020). The times have demanded large-scale development to improve the welfare of the community. This development is also accompanied by urbanization existence process which is continuously increasing the population density in Surakarta (Samsudi, 2010). As a big city, Surakarta has become an alternative destination for people who is seeking to work or taking education. The environmental existence problems such as rising air temperatures and psychological stress experienced in everyday life, increasing awareness of environmental management for human health and comfort (Xue, Gou, and Lau, 2017). Meanwhile, Beil & Hanes (2013) on their study, states that environmental design influence on human stress levels, environmental design with a natural background can help reduce stress levels.

Green open space (GOS) is part of open space in an area with the plant's vegetation to support ecological aspects (Pratomo. Soedwiwahjono, and Miladan, 2019). Public GOS can be used by everyone to carry out various activities, generally synonymous with shade trees, such as city parks, city forests, sports fields, pedestrian paths, riverbanks, and so on (Setyani,

Sitorus, and Panuju, 2017). Wahyuningsih's (2018) research concluded that based on GIS mapping, there were 427.88 a of GOS in Surakarta in 2015 or 9.17% of the total area of Surakarta. Meanwhile, in UU No. 26 Year 2007 about Spatial Planning, at least 30% of the total urban area is a public GOS. Some examples of green open spaces in Surakarta are Balekambang Park, Manahan Stadium, Jurug Animal Park, Sekartaji Park, and so on.

In this study, the authors want to examine more deeply how environmental quality, including air temperature, noise, air pollution levels, cleanliness in public areas, and density of settlements, can be a stressor and have an impact on college students' mental conditions in Surakarta. In addition, the author also wants to examine how the role of GOS in Surakarta in reducing college student's stress levels. Although there have been many studies on stressors which originating from the environment quality, but based on the author's knowledge, there has been no further research on the role of GOS in reducing stress levels that is caused by environmental quality degradation. The objectives of this study were (1) to determine the effect of air temperature, noise, air pollution, cleanliness in public areas, and residential density, on the stress level of students in the city of Surakarta, and (2) to determine the effect of Public GOS in reducing college student's stress levels in Surakarta.

---
[*]Corresponding author: agradewi@gmail.com

2. Materials and Methods

The material used in this research is a questionnaire using a Google Form, that contains 10 questions consisting abiotic factors variabel that can cause stress in college students. The abiotic factors variables including air temperature, noise, air pollution, cleanliness in public areas, and residential density. Questionnaires were distributed from October 9, 2020 to October 10, 2020, and obtained 127 respondents, that came from college students who live in Surakarta. Furthermore, questionnaire results tested for vaility and reliability using the IBM SPSS 25 software. Likert scale used for abiotic and sociocultural factor variables which include air temperature, noise, air pollution, level of cleanliness and residential density, using a scale of 14, with categories 1 = disagree, 2 = neutral, 3 = agree and 4= strongly agree. Based on data from Badan Pusat Satistik (2020), known that in 2019 the average temperature in Surakarta ranges from 26.0 °C to 29.2 °C. Population density is around 519,587 in 2019. Waste produced amount per day in Surakarta around 330 tons, while only 306 tons per day can be transported to landfills.

3. Results and Discussions

3.1. Abiotic and Sociocultural Factors

Table 1
Abiotic and Sociocultural Factors

Nr	Variable	Category								Total
		Disagree		Neutral		Agree		Strongly Agree		Total
		Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	%
1	Air Temperature	4	3,1	11	8,6	55	43	58	45,3	100
2	Noise	6	4,7	27	21,1	59	46,1	36	28,1	100
3	Air Pollution	4	3,1	16	12,5	55	43	53	41,4	100
4	Cleanliness in Public Areas	4	3,1	14	10,9	47	36,7	63	49,2	100
5	Residential Density	9	7	36	28,1	59	46,1	24	18,8	100

From the 11 questionnaire questions that were tested for validity using the IBM SPSS 25 software, there were 10 valid questions. Furthermore, from the 10 questions the reliability was tested and the results were all reliable. From the questionnaires that have been distributed for 128 respondents, who are college students in Surakarta, regarding the effect of air temperature on stress levels, the results obtained were 3.1% of respondents disagree, 8.6% of respondents said they were neutral, 43% agreed, and 45.3% strongly agreed. So, the conclusion is as many as 88.3% of respondents stated that the air air temperature in Surakarta has an influence on college student stress levels.

In this case, meant the average air temperature of Surakarta. The average of air temperature in Surakarta is about 26.0 °C to 29.2 °C in 2019 (Badan Pusat Statistik, 2020). According to Wandani et al (2017), stressful conditions can be the condition when the air temperature is too high has a greater effect on stress, because it affects the nervous system directly and will have an impact on delusional regulator functions (Heriziana and Ulfah, 2018). This resulting condition called heat stress, which is caused by the ambient air temperature that exceeds normal, which is more than 28 °C, so humans don't able to balance between production and dissipation of body heat.

Whereas in hypothermia, the body experiences stress due to the process excess metabolism in the body to retain body heat, during stressful situations due to cold temperatures, part sympathetic from the autonomic nervous system is stimulated. The postganglionic neurons release norepinephrine (NE) and also stimulates release the hormones epinephrine and norephinephrine (NE) by adrenal medulla thereby increasing metabolism rate of body cells. Increase in body temperature can increase metabolism rate, each increase 1% core body temperature will increase speed 10% biochemical reactions in the body. Hypothermia can also cause the body to experience decreased coordination for reduce body heat wasted into the environment around thus lowering productivity.

Meanwhile, for the noise effect on college student stress levels, as much as 4.7% respondents disagreed, 21.1% state their neutrality, 46.1% agreed, and 28.1% strongly agreed. Over all from the results of the questionnaire, as many as 74.2% respondents stated that noise in Surakarta has an influence on the stress levels experienced. Hearing excees noise–approximately more than 80dB–for a long time can cause discomfort, loss of concentration, and stress. Noise can be a source of stress because it increases alertness and psychological imbalance (Asmarani, 2017). Waves generated from noise will travel trough until it's captured by human hearing, activating the sympathetic nervous system and stress hormonal centers in the brain such as catecholamines and apinephire cortisol. The Hyphotalamic-Pituitary-Adrenal (HPA) system is the very important part of the neuroendocrine system which deals with stress (Budiyanto and Pratiwi, 2010). The noise thresold value according to Regulation of the Minister of Manpower and Transmigration Nr. 13 Year 2011 is 85dB with a maximum time of 8 hours per day.

Regarding the effect of Surakarta's air pollution on college student stress levels, 3.1% of respondents disagreed, 12.5% chose neutral, while 43% agreed and 41.4% strongly agreed. It can be concluded that 84.4% of respondents stated that air pollution in Surakarta has an influence on the stress levels experienced. According to Setiawan et al (2019), air circulation includes air pollution levels and air freshness levels, has an effect on causing stress. Air pollution particles such as $PM_{2.5}$ are very small, so they can enter blood vessels through the nose which can cause inflammation of the brain, damage nerve cells, and produce stress hormones such as cortisol, cortisone, epinephrine, and norepinephrine.

Air pollution is the entry of various types of poisonous gases that can cause respiratory problems or diseases, such as

carbon monoxide, nitrogenoxide, and hydrocarbons into the environment. Mental health problems such as stress and depression can result from air pollution. Air pollution can cause serious neurocognitive effects or organic brain disorders, ranging from behavioral variations to neurodegenerative disorders, which in turn can have a negative impact on mental health (Genc et al., 2012). Some of the main symptoms of mental disorders include: often forgetting things, often feeling confused, feeling often anxious. In addition, even though they enter mental health, people with organic mental disorders may also experience physical symptoms, such as: headache, difficulty concentrating, difficulty focusing, loss of body balance, difficulty carrying out daily activities.

The questionnaire results of the public areas cleanliness influence on college student in Surakarta stress levels, showed that 3.1% of respondents disagreed, 10.9% said they were neutral, while 36.6% agreed and 49.2% strongly agreed. It can be concluded that 85.8% of respondents stated that the public area cleanliness has an effect on stress. The surrounding environmental condition has a big influence, one of them is cleanliness and safety. A clean environment will increase comfort, creativity and productivity. So that the stress possibility is very small (Ramadhan, 2016).

Then for the residential density, 7% disagree, 28.1% are neutral, 46.1% agree, and 18.8% strongly agree. As many as 64.9% stated that residential density has an influence on the level of stress faced. Residential density shows the population density. When there is population density, the environmental pressure tends to be great. This will result in interactions between humans and the environment not running properly. If this is allowed to continue it will lead to stress (Prabawa et al., 2019).

3.2. Green Open Space Factors

Table 2
Conditions of Public Green Open Space Factors

Nr	Variable	Category										
		Very Poor		Poor		Enough		Good		Very Good		Total
		Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	%
1	GOS Condition	3	2	52	40,6	45	35,2	21	16,4	6	4,7	100

Table 3
Frequency of Visits to Public Green Open Space Factors

Nr	Variable	Category										
		Never		Rarely		Sometimes		Often		Always		Total
		Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	%
1	Frequency of GOS Visiting	1	0,1	30	23,4	70	54,7	23	18	3	2	100

Based on this study regarding public green open space (GOS) existence in Surakarta, is known that 2% of respondents felt very lacking, 40.6% felt insufficient, 35.2% felt sufficient, 16.4% felt good, and 4.7% felt very good. So, as many as 56.3% felt that the condition of GOS in Surakarta was good enough.

From the variable frequency of visiting public GOS, the data was obtained that 0.1% never and 23.4% rarely visited. Then as many as 54.7% sometimes visited, 18% often and 2% always visit green open spaces. The highest percentage is sometimes, as much as 54.7%.

Table 4
The Driving Factors for Visiting Public Green Open Space

Nr	Variable	Category						
		Good Emotion		Bad Emotion		No Answer		Total
		Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	%
1	Visiting to GOS	54	43	71	55,5	2	1,5	100

Table 5
Emotional State Change Factors

Nr	Variable	Category								
		Got Worse		No Effects		Getting Better		No Answer		Total
		Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	Total (Persons)	%	%
1	Emotional Changes	2	1,6	5	3,9	118	93	2	1,6	100

As many as 43% of respondents stated that they visited GOS in a bad emotional, and as many as 55% were in a good

emotional condition. While 1.5% had never been to public GOS. Then, for the variable changes in emotional conditions after

visiting GOS, 1.6% respondents felt worse, 3.9% experienced no change, 93% getting better, and as many as 1.6% chose not to answer. So, it can be concluded that as many as 93% of respondents feel that visiting GOS can improve their emotional condition.

Public GOS area in Surakarta reaches 529 hectares or 12.02% of the total area, can reach 21.02% if the river banks are calculated. While the target to be achieved is 30%, in accordance with the reference of the Spatial Planning Law. In addition, respondents are quite satisfied with the facilities available in the public GOS. This also enabled many respondents to visit green open space. Visiting green open space is the choice and a goal when 43% of respondents feel in a bad emotional state. In the end, it was proven that 93% of respondents felt that their emotional condition had improved after visiting green open space. This was possible because the public GOS conditions were different from where the respondents lived. In public green open space, there are more trees so the air is fresher, this is related to air pollution which has a role in stress levels. In addition, more relaxed, cooler, and cleaner green space creates a feeling of comfort which affects the emotional condition of visitors. The feeling they get when visiting green open space cannot be felt in the environment where the respondent lives.

4. Conclusion

Based on research that has been done, it can be concluded that environmental factors, including air temperature, noise, air pollution, cleanliness in public areas, and residential density, affect the college student's stress levels in Surakarta. These are shown by respondent's results questionnaire, where the highest value to the variables that affected their stress level is air temperature (88.3%), then followed by cleanliness in public areas (85.8%), air pollution (84.4%), noise (74.2%), and the lowest is residential density (64.9%). Public green open space (GOS) effects on reducing college student stress levels in Surakarta, where 93% of respondents stated that their emotional condition improved after visiting GOS.

References

Asmarani, R. 2017. Hubungan Antara Kemampuan Adaptasi terhadap Kebisingan dengan Stress Kerja Karyawan. *Jurnal Studia Insania*, 5(1), 71-93. https://dx.doi.org/10.18592/jsi.v5i1.1356. Accessed on 10 October 2020.

Badan Pusat Statistik Kota Surakarta. 2020. *Kota Surakarta dalam Angka 2020.* Surakarta: Badan Pusat Statistik.

Beil, K., & Hanes, D. 2013. The Influence of Urban Natural and Built Environments on Physiological and Psychological Measures of Stress—A Pilot Study. *Journal of Environmental Research and Public Health,* 10(4), 1250–1267. https://www.mdpi.com/1660-4601/10/4/1250. Accessed on 9 October 2020.

Budiyanto, T., & Pratiwi, E.Y. 2010. Hubungan Kebisingan dan Massa Kerja terhadap Terjadinya Stres Kerja pada Pekerja di Bagian Tenun Agung Saputra Tex Piyungan Bantul Yogyakarta. *Kes Mas: Jurnal Fakultas Kesehatan Masyarakat, 4(2), 76-143.* http://10.12928/kesmas.v4i2.2258 . Accessed on 28 October 2020.

Genc, S., Zadeoglulari, Z., Fuss, S. H., and Genc, K. 2012. The Adverse Effects of Air Pollution on the Nervous System. Journal of Toxicology, 1(2012) , 1-23. https://doi.org/10.1155/2012/782462. Accessed on 25 October 2020.

Heriziana & Ulfah, M. 2018. Analisis Faktor Lingkungan Fisik Terhadap Risiko Stress Kerja di Cv. Natural Palembang Tahun 2017. *Jurnal Formil (Forum Ilmiah) KesMas Respati*, 3(2), 111-116. https://doi.org/10.35842/formil.v3i2.179. Accessed on 11 October 2020.

Peraturan Menteri Tenaga Kerja dan Transmigrasi Nomor 13 Tahun 2011 tentang Nilai Ambang Batas Faktor Fisika dan Faktor Kimia di Tempat Kerja. http://ditjenpp.kemenkumham.go.id/arsip/bn/2011/bn684-2011.pdf&ved=2ahUKEwiOy-OLldTsAhWRYysKHVABDIMQFjAEegQIBRAB&usg=AOvVaw3h37uNjDr3ZeMSwTlRJ5_5. Acessed on 27 October 2020.

Prabawa, M.S., Indriani, W., & Dewiyanti, H. 2019. Mitigasi Spasial terhadap Bencana Sosial di Pemukiman Johar Baru, Jakarta Pusat. *Jurnal Arsitektur Zonasi (JAZ),* 2(1), 46-56. https://doi.org/10.17509/jaz.v2i1.15062. Accessed on 10 October 2020.

Pratomo, A., Soedwiwahjono, & Miladan, N. 2019. Kualitas Taman Kota sebagai Ruang Publik di Kota Surakarta Berdasarkan Persepsi dan Preferensi Pengguna. *Jurnal Desa-Kota*, 1(1), 84-95. https://doi.org/10.20961/desa-kota.v1i1.12494.84-95. Accessed on 9 October 2020.

Ramadanu, D. 2016. Pengaruh Konflik Kerja dan Stress Kerja terhadap Kepuasan Kerja (Studi Karyawan PT. Indah Logistik Cabang Pekanbaru). *JOM Fisip*, 3(2), 1-9. https://jom.unri.ac.id/index.php/JOMFSIP/article/view/11311. Accessed on 10 October 2020.

Samsudi. 2010. Ruang Terbuka Hijau Kebutuhan Tata Ruang Perkotaan Kota Surakarta. *Jurnal of Rural and Development*, 1(1), 11-19. https://jurnal.uns.ac.id/rural-and-development/article/view/1836. Accessed on 9 October 2020.

Setiawan, N., Ferine, K. F., & Rahayu, S. 2019. Analisis Pengaruh Faktor Lingkungan Fisik dan Non Fisik terhadap Stress Kerja Di Mana Komitmen Kerja sebagai Variabel Intervening pada Kantor Pelayanan Pajak Pratama Kota Medan. *Jurnal Manajemen Tools*, 11(1), 165-174. http://jurnal.pancabudi.ac.id/index.php/JUMANT/article/view/511. Accessed on 10 October 2020.

Setyani, W., Sitorus, S. R. P., & Panuju, D. R. 2017. Analisis Ruang Terbuka Hijau dan Kecukupannya di Kota Depok. *Jurnal Buletin Tanah dan Lahan*, 1(1), 121-127. https://journal.ipb.ac.id/index.php/btanah/article/view/17701. Accessed on 9 October 2020.

Undang-Undang Nomor 26 Tahun 2007 mengenai Perencanaan Tata Ruang. https://peraturan.bpk.go.id/Home/Details/39908/uu-no-26-tahun-2007. Accessed on 9 October 2020.

Wahyuningsih, H. 2018. Perhitungan Ruang Terbuka Hijau Perkotaan Jenis Publik (Stusi Kasus : Kota Surakarta). *Jurnal Arsitektur dan Perencanaan*, 1(1), 106-115. https://ejournal.unisayogya.ac.id/ejournal/index.php/JUARA/article/view/368. Accessed on 9 October 2020.

Wandani, D. T., Sabilu, Y., & Munandar, S. 2017. Hubungan Pencahayaan, Kebisingan, Suhu Udara, dan Terjaidnya Stress Kerja pada Pekerja di PT. Tofico Pelabukan Perikanan Samudera (PPS) tahun 2016. *Jurnal Ilmiah Mahasiswa Kesehatan (JIMKESMAS)*, 2(6), 1-9. http://ojs.uho.ac.id/index.php/JIMKESMAS/article/view/2933. Accessed on 10 October 2020.

Xue, F., Gou, Z., and Lau, S. S. Y. 2017. Green Open Space In High-Dense Asian Cities: Site Configurations, Microclimates and Users' Perceptions. Journal of Suistainable Cities and Society. 34(2017): 114-125. https://doi.org/10.1016/j.scs.2017.06.014. Accessed on 9 October 2020.