

# Comfort Evaluation of Some City Parks in Menteng Subdistrict Using Grid Method

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**Abstract.** This article aims to evaluate the thermal comfort in three parks at Menteng Sub District, Central Jakarta. The method used in this research is grid method that mapped the parks into squares. Grid method indicated the spread of temperature and humidity value with the canopy coverage. This study purposed to identify the distribution of temperature and humidity in Menteng Park, Suropati Park, and Situ Lembang Park. From the results, the highest temperature was in Menteng Park indicated by the average value of temperature is 35.6°C compared with Situ Lembang Park (34.7°C) and Suropati Park (34.3°C). The highest humidity was in Suropati Park indicated by the average value of humidity was 52.6% compared with Menteng Park (50.5%) and Situ Lembang Park (48.2%).

## 1. Introduction

Major cities in Indonesia are currently experiencing a significant development progress, especially in Jakarta. The environmental conditions of Jakarta mostly are being suppressed by the massive urban development. One of the impacts of urban development is environmental problem. The existence of green open space in the city is a must to be able to provide comfort for the residents. The health of city dwellers can also be obtained by the presence of urban green open space. Based on Law No. 26 of 2007 explains that the minimum proportion of green open space in a city is 30%, consist of 20% owned by the government and 10% owned by the private. Parks ideally contained in any hierarchy of the city, starting at the level of neighborhood, village, district, up to the city.

Jakarta as the capital of Indonesia has a high population density but still do not have adequate green open spaces that meet to the standards. Based on data from the Parks and Funerals Department, Jakarta only has about 9% green open space. Spatial Plan of the City of Jakarta (RTRW Jakarta) targeted to increase the percentage of green open space in Jakarta. This indicates the importance of the existence of a city park as a form of green open space to compensate for the physical development of urban areas.

Thermal comfort is a term used to express state of the physical environment influences the atmosphere and climate on humans. Humans as users of the landscape need comfort as one of their primary need. Comfort can be presented with vegetation as microclimate controller [1]. Menteng Subdistrict in Central Jakarta is the center of government and business that has many city parks. Some of the city parks in Menteng Subdistrict are Menteng Park, Suropati Park, and Situ Lembang Park. It is necessary to evaluate those city parks to determine the level of comfort based from the influence of canopy coverage, the temperature, and the humidity itself. This study purposed to evaluate the distribution of temperature and humidity in Menteng Park, Suropati Park, and Situ Lembang Park in Menteng Subdistrict, Central Jakarta.

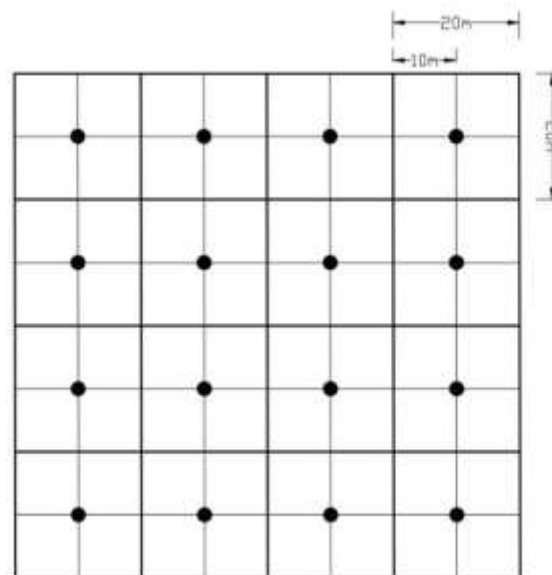


## 2. Methods

The research was conducted from March until April 2010 at Menteng Park, Suropati Park, and Situ Lembang Park at Menteng Subdistrict, Central Jakarta. The following methods were used quantitative method and analyzed descriptively [2]:

### 2.1 Preparation stage

The selected location for this study is Menteng Park, Suropati Park, and Situ Lembang Park at Menteng Subdistrict, Central Jakarta. Then, the permission for this study issued by the Parks and Funerals Department. The imageries data of Menteng Park, Suropati Park, and Situ Lembang Park was taken from Google Earth 2010 for the base map. Afterwards, the grid applied into the imageries data to determine the distribution of temperature and humidity inside the park connected with the canopy coverage. The grid method used the points as the representative's sample. The size of the grid was 20 x 20 m which has point in the center. Figure 1 illustrated the grid method used in this study. The grid plotted into the imageries data used AutoCAD 2007.



**Figure 1.** Grid method for the temperature and humidity data collection.

### 2.2 Survey stage

The quantitative data consists of temperature, humidity, and social data. The temperature and humidity data was taken during the midday when the weather was clear at 1 to 2 p.m used digital thermo-hygrometer. Each park was measured with the gauge in order to match it with the base map. It took 3 repetitions performed at each point. The map created by modeling the temperature and the humidity data to make grid function into *Surfer* version 8.0.

### 2.3 Analysis stage

Linear regression was conducted based on the data of average air temperature and humidity. Linear regression was used to assess the correlation between air temperature and humidity factor as the quantitative data with the canopy coverage of trees of each grid in the park. The linear regression equation is  $y = ax + b$ . Coefficient of determination ( $R^2$ ) indicates the degree of the effect of canopy coverage to change the temperature or humidity in the park. The temperature and humidity values using analyzed with Temperature Humidity Index (THI).  $THI = 0.8T + (T \times RH)/500$ , where  $T$  = temperature ( $^{\circ}C$ ),  $RH$  = relative humidity (%). THI value obtained from each park then was being analyzed using the standard of Laurie [3] which states that the environment has the ideal value of temperature ranged from

27 to 28 °C and humidity ranged from 40 to 75%. The temperature data and the humidity data from each park became the basis for the isotherm map and iso-hygro map to illustrate of the distribution of temperature and humidity value.

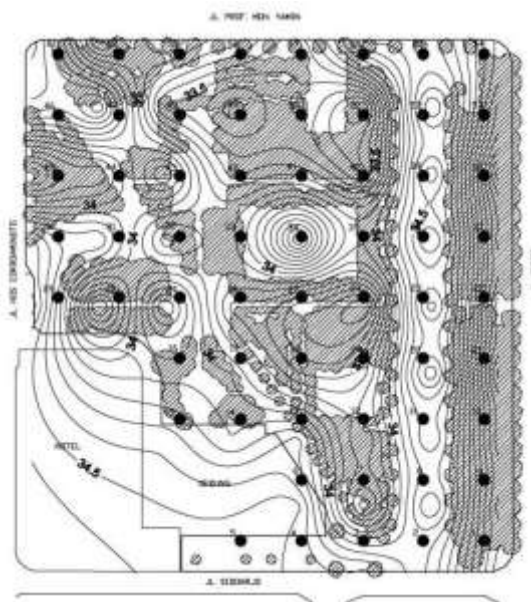
### 3. Results and Discussions

Menteng Subdistrict consists of settlement area, office buildings, and parks. Menteng Subdistrict was located in the heart of Jakarta and was designed by the Dutch when ruled Indonesia. The surrounding where the park located also affected the microclimate. Menteng Park located near Cokroaminoto Street and Prof. Moch. Yamin Street and it is quite crowded. Suropati Park and Situ Lembang were located on Taman Suropati Street and surrounded with settlements area.

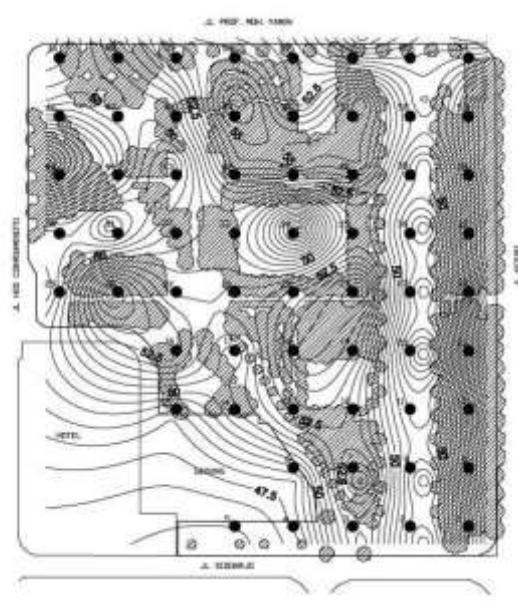
In Menteng Park, the canopy coverage was not massive enough. Menteng Park was built in 2007. It used to be as a stadium of Persija Jakarta. In Suropati Park, the canopy coverage was massive enough because of the vegetation planted for years. In Situ Lembang Park, the vegetation coverage was only on the border side of the park because there is a lake in the middle of the park.

Menteng Subdistrict classified as tropical climate type [4]. The highest temperature reached 33.4°C in October and the lowest 24°C in February. The average temperature during 2008 in Central Jakarta is 25.2 °C. The average rainfall is 159.1 mm with the highest rainfall in February amounted to 677.6 mm and lowest in July of 9.5 mm with an average humidity of 68% to 79%. The average wind speed 5.3 km/h.

The average of temperature in Menteng Park was 33.6°C. Figure 2 described the distribution of temperature in Menteng Park and figure 3 described the distribution of humidity. With a total area of 24 546 m<sup>2</sup> park, Menteng Park has canopy coverage area of 11 676 m<sup>2</sup>. The linear regression equation between the temperature and the canopy coverage in Menteng Park is  $y = -0.004x + 34.72$  with  $R^2 = 0.801$ . For the humidity, the equation is  $y = 0.025x + 46.55$  with  $R^2 = 0.864$ . From these results it can be concluded that 80% of decreased temperature was influenced by the canopy coverage and 86% of increased humidity in the park was affected by canopy coverage.



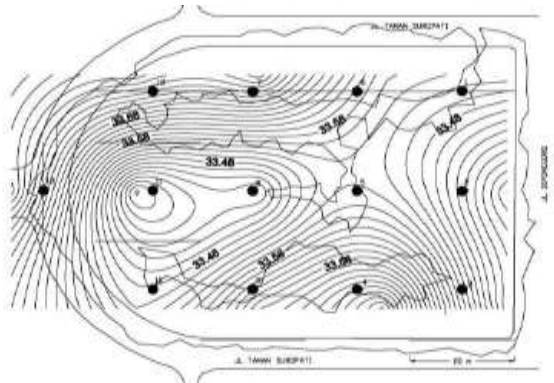
**Figure 2.** Isotherm map of Menteng Park.



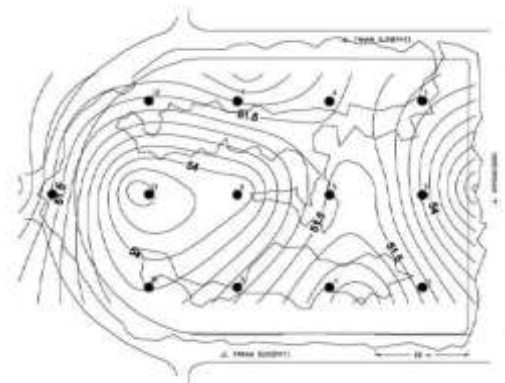
**Figure 3.** Iso-hygro map of Menteng Park.

Suropati Park has total area of 16 328 m<sup>2</sup>. Figure 4 describes the distribution of temperature in Suropati Park and figure 5 describes the distribution of humidity. Suropati Park has canopy coverage area of 3 944 m<sup>2</sup>. The linear regression equation between the temperature and the canopy coverage in

Suopati Park is  $y = -0.003x + 34.52$  with  $R^2 = 0.962$ . For the humidity, the equation is  $y = 0.032x + 42.21$  with  $R^2 = 0.901$ . From these results it can be concluded that 96% of decreased temperature was influenced by the canopy coverage and 90% of increased humidity in the park was affected by canopy coverage.



**Figure 4.** Isotherm map of Suopati Park.

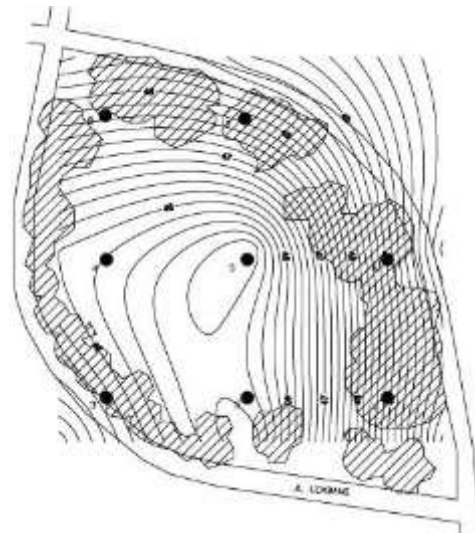


**Figure 5.** Iso-hygro map of Suopati Park.

Situ Lembang Park has total area of 14 700 m<sup>2</sup>. Situ Lembang Park has canopy coverage area of 1 074 m<sup>2</sup>. Figure 6 described the distribution of temperature in Suopati Park and figure 7 describes the distribution of humidity. The linear regression equation between the temperature and the canopy coverage in Situ Lembang Park is  $y = -0.002x + 34.7$  with  $R^2 = 0.936$ . For the humidity, the equation is  $y = 0.027x + 44.09$  with  $R^2 = 0.891$ . From these results it can be concluded that 93% of decreased temperature was influenced by the canopy coverage and 89% of increased humidity in the park was affected by canopy coverage.



**Figure 6.** Isotherm map of Situ Lembang Park.



**Figure 7.** Iso-hygro map of Situ Lembang Park.

From the calculation, the THI value of Situ Lembang Park (30.76) is the highest when compared to Menteng Park (30.64) and Suopati Park (30.3). THI value from the three parks exceeded the THI comfort value which is 21 to 27. The ideal climate for people ranged from 27 to 28°C for the temperature



and 40 to 75% for the humidity. Compared with the standard, it could be inferred that the three parks were not comfort enough.

The comfort factors not only from temperature but also from humidity, solar radiation, vegetation, and air movement. The pavement in the park made the temperature at some points in Menteng Park become hot. Beside the pavement, there were sports area, walkways, plazas, office building, and greenhouse area. Some of the existing vegetation in Menteng Park, Suropati Park, and Situ Lembang were *Swietenia macrophylla* and *Samanea saman*. Their canopies intersect each other and created a great shade at some parts in the park. The shaded area ameliorated the microclimate so that decreased the temperature and increased the humidity level.

#### 4. Conclusions

The result of this study showed that from 3 repetitions of collected data, the average temperature and humidity in Menteng Park, Suropati Park, and Situ Lembang Park exceeded the THI comfort value. The grid method helps in order to analyze the distribution of temperature and humidity in the parks connected with the canopy coverage. The area under the canopy coverage mostly has lower temperature and higher humidity value.

#### References

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