Title: The study of efficiency in remediating air quality of tree plants in the green areas of Chiang Mai.

Research team: Parinda Thongsanti, Prana Panart, Sirithat Bunthitiwat

Project advisor: Bannruck Tanjaphatkul

School: Varee Chiang Mai School

Abstract

Chiang Mai Province is one area that has been experiencing air pollution problems regularly over the years and efforts are now being made to deal with this problem on a sustainable basis because it affects everyone in many ways. According to many research papers, plants can treat air quality through a process known as "Phytoremediation". Therefore, increasing public green areas is an interesting idea to solve the problem. According to this information we are interested in studying tree plants efficiency in green areas, along with studying air quality, plant leaf anatomy, and morphology. The results are expected to be used as basic information for the selection of ree plants in the development green areas in Chiang Mai province. The study process does by comparing the air quality data and leaf anatomy and morphology, it was found that Raintree was better at filtering particulate matters, while Golden shower tree was better at reducing the temperature and CO_2 level, along with increasing humidity. The researcher expected that this was due to the different leaf-surface structures of both plants. Raintree leaf surface is composed of density trichomes and hairs that make it trap dust well, while Golden shower tree leaf has wide stomata that affect photosynthesis and gas exchange ratio. In conclusion, a variety of plant types should be considered for the most effective treatment of air quality in green area development due to the different air quality treatment properties factor of each plant.

Keywords: Air quality treatment, Public green area, Leaf anatomy, Plant remediation

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The study of efficiency in remediating the air quality of tree plants in the green areas of Chiang Mai has been completed thanks to a great deal of support and assistance.

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Research Team

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Introduction

Currently, large cities with economic prosperity that has set the city into a tourist attraction, often have issues with air quality. As a result, people in the area have to face the impact of such problems, especially from an air quality problem. Chiang Mai is the economic center of Northern Thailand, which is currently facing the problem of air pollution that occurs annually. Small dust or particulate matters are environmental problems that consequently affect many aspects of health problems, economy, and visibility. The study of Academic Working Group to Support Northern Haze Problem Solving Chiang Mai University found that every 10 micrograms of PM2.5 increase the mortality rate will increase by 0.15% and is also related to hospital admissions that are also increasing. This can be seen from the number of patients in the upper northern region, both 8 provinces from January to April 2017 when the PM2.5 crisis occurred, up to 40,000 people have symptoms of inflammatory eye disease, 580,000 cardiovascular diseases. 330,000 respiratory tract and 25,000 dermatitides (Somporn Chantara,2020).

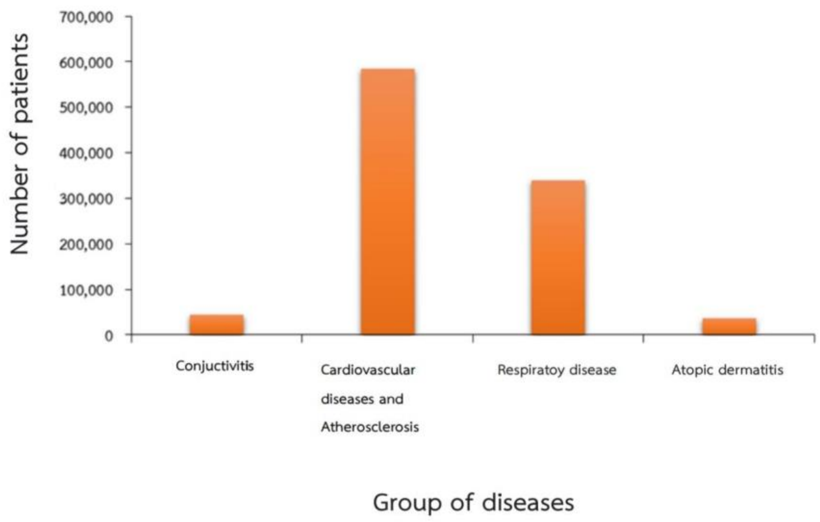

Figure 1 the number of cases in the upper northern region from January to April 2017.

(Source : Somporn Chantara,2020)

The cause of PM2.5 is the burning of carbon-containing materials, including forest fires and burning to adjust farmland after harvest. Although there is currently a campaign to reduce the burning and watch out for forest fires to reduce the amount of PM10 and PM2.5 in the northern areas, the root of the problem is not just the source of burning in the area of Thailand only. From the surveying of the accumulated heat points by TERRA and AQUA satellites, MODIS systems in Thailand and neighboring countries such as Myanmar, Laos, Cambodia, and Vietnam. Between January 1 - May 31, 2019, found that over 5 months Myanmar has the most accumulated heat points with 57,533 heat points, followed by Laos with 48,120 points, Thailand 29,251 points, Cambodia 27,157 points, respectively. Vietnam has the least heat points accumulated amount was 12,680 points as shown in the table.

Table 1 Accumulated heat points of 5 countries between January 1 - May 31, 2019 (monthly)

Mouth	Heat points of 5 countries (point)					Total
	Thai	Myanmar	Lao	Cambodia	Vietnam	
January	4,407	1,586	1,428	12,716	780	20,917
February	7,245	6,137	5,409	6,319	2,521	27,631
March	10,810	26,501	23,071	5,521	4,040	69,943
April	5,283	20,988	16,753	1,705	3,671	48,400
May	1,506	2,321	1,459	896	1,668	7,850
Total	**29,251**	**57,533**	**48,120**	**27,157**	**12,680**	**174,741**

(Source: Geo-Informatics and Space Technology Development Agency (Public Organization), 2019)

And when considering the number of heat points each month, it was found that Thailand would find a lot of heat points best in February. But there is still a number similar to that of Myanmar, Laos, and Cambodia, while there will be more heat points in neighboring countries than in Thailand in other months.

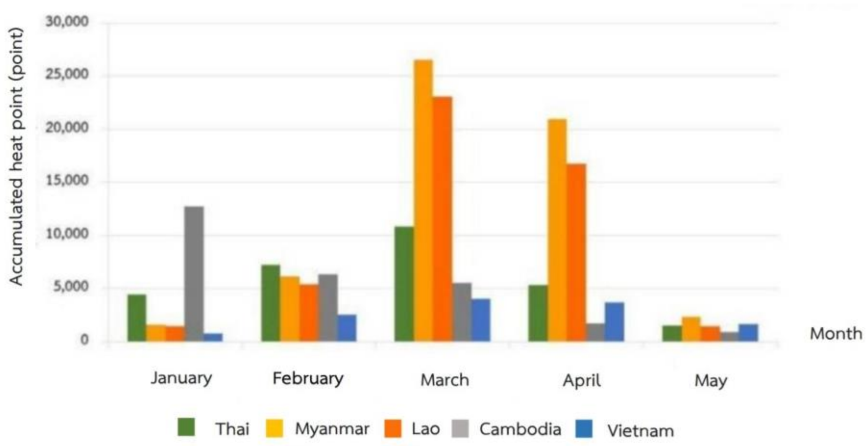

Figure 2 Cumulative heat points of 5 countries between January 1 - May 31, 2019.

(Source: Geo-Informatics and Space Technology Development Agency (Public Organization), 2019)

In addition, the current climate change problem has resulted in temperature phenomena. Temperature inversion affects the temperature in the troposphere. Normally if height increase the temperature is reduced thus allowing the dust with small particles to be carried through the circulation. The air currents cause the amount of dust near the earth's surface to be reduced, but this inverse temperature phenomenon will do causing a layer of hot air to be inserted between the cold air layer. As a result air current cannot carry PM10 and PM2.5 and up, these specks of dust are trapped at heights near the earth's surface and cause air pollution, as shown in the figure.

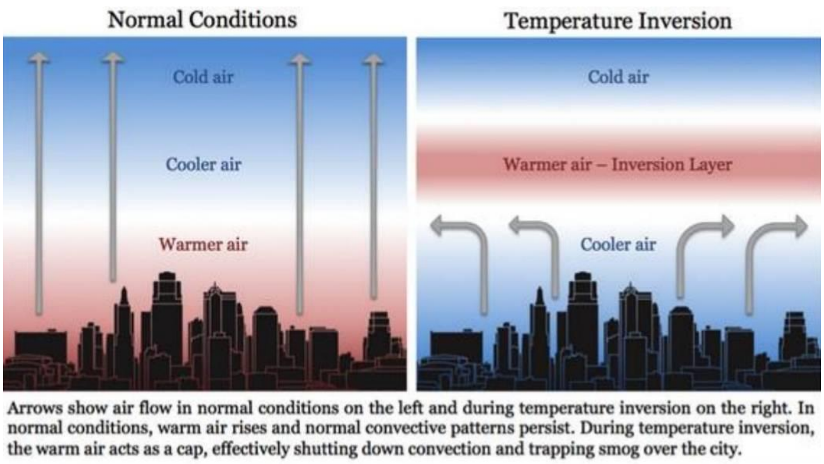

Figure 3 Temperature inversion phenomenon

(Source: https://stem.in.th/temperature-inversion/)

Therefore the campaign to stop burning and watch out for forest fires in the area is only a reaction that helps alleviate the problem of air pollution to a certain extent which cannot cover the cause of PM2.5 from the area and the retention of PM10 and PM2.5 near the Earth's surface from temperature inverse phenomena. Therefore the way to prevent and solve the problem of PM2.5 in a variety of ways should go hand in hand. At present, Chiang Mai has a group of many organizations, both the government, private sector, and the public sector who join and create guidelines together for dealing sustainably with the problem of air pollution, one of the interesting ways is the increase in public green spaces in city areas. From researching various sources, it was found that many plants species can treat air quality by decomposing or transforming pollutants into less polluting forms or non-toxic forms (Phytoremediation). The ability of plants to treat air quality depends on many factors such as leaf appearance, leaf surface area, leaf coating, leaf density, pubescence, and transpiration water due to photosynthesis, etc. (Xiangying Wei et al,2017).

As the ones who have been affected by this dust problem and noticeable from the changing environment makes we realize that these problems are likely to escalate continuously if not seriously addressed. According to solutions, we are interested in using plants to treat air quality. Although this solution may not be effective for some time short, it has many advantages in addition to solving the problem of PM2.5. It also does not cause environmental impacts in other areas. Therefore, our team has an idea to do a comparative study efficacy in air quality treatment of different trees in a public green area and the relation between plant efficacy and leaf structure. It is expected that the results of the study can be used as the basis for selecting plant species in the design and development of public green spaces in our city.

Research questions

1. Each type of tree species has a different air quality treatment ability?
2. How the leaf anatomy is related to the ability of trees in the air quality?

Research hypothesis

1. Different types of tree species have different abilities in air-quality treatments.
2. Plants with different leaf anatomy are effective for different air-quality treatments.

Variables studied

Independent variable – types of tree

Dependent variable – air treatment efficiency of plants (Assessed by the ability to dust trap, amount of carbon dioxide, air temperature, and relative humidity)

Control variable – equipment to measure air quality, time

Objective

1. To study and compare the efficiency of maintaining the air quality of each tree species in the public green area.
2. To study the relation between leaf surface structure and the efficiency of treating the air quality of each plant.

Benefits of Research

1. Get to know the efficiency of each tree in the air quality treatment in the green area of Chiang Mai city.
2. Get to know the relation between leaf surface structure and the efficiency of air quality treatment.
3. Get the database of air quality treatment of plant species for selecting plants for design and developing public green areas in our city.

Research Scope

Scope of a study

1. Study morphology such as the height of the plant, the stem circumference, width, and height of the canopy, anatomy of the leaf surface of each tree to compare the ability to air treatment of different plants and the same plant with different morphology.
2. Collect air quality data to compare the ability of air quality treatment in each plant species.
3. Analyze the relationship between the efficiency of air quality treatment and leaf surface structure of each plant species.

Study site

1. Varee Chiang Mai School
2. Charoen Prathet Park
3. King Kawila Monument
4. Chiang Mai 700th Anniversary Garden

Duration

November 2021– February 2022

Literature Review

PMs or Particulate Matters is a term used to refer to the standard values of small particulate matter. There are two types of PMs, the particles are smaller than 10 micrometers, and PM2.5 which particles are smaller than 2.5 micrometers. These particles are suspended in the atmosphere, not visible to the naked eye but when there is a large amount, it will create smog.

Figure 4 The atmosphere is covered with microscopic dust.

Compared both particulate matters to the average size of human hair with about 50-70 microns. Therefore, these two types are smaller than the hair, especially PM2.5, which is at least 20 times smaller than the hair. This allows them to penetrate through the nose hair into the body and affect health easily.

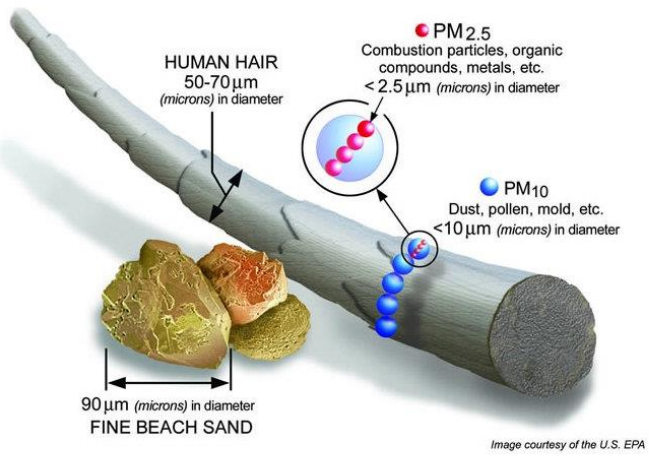

Figure 5 The size of PM10 and PM2.5 dust compared to hair

(Source: U.S. EPA, 2021)

Effects of PM10 and PM2.5

Health

PM10 and PM2.5 are considered pollutants to human health according to the World Health Organization due to the very small particle size, especially PM2.5. It can pass through the body easily to the lungs' alveoli and enter the circulatory system. With particle size smaller than red blood cells, it can quickly enter the body cells and organs. The impact of PM2.5 on health has taken many forms, from mild symptoms to death. If inhaled PM2.5 entering the body will affect the respiratory system as follow; irritation of the skin and mucous membranes things such as conjunctiva and cause coughing, sneezing runny nose, sinus inflammation, sore throat, and difficulty breathing. Furthermore, it causes diseases of various systems such as the respiratory system, cardiovascular system, nervous system, and brain. There are also studies showing the association of PM2.5 with systemic carcinogenesis respiratory by the International Agency for Research on Cancer (IARC) says that air pollution is a factor that can cause cancer in humans, especially PM2.5. It has been classified as a human carcinogen in Group 1 as reported by the IARC, the monograph says that the burden of pollution from exposure to PM2.5. causing premature deaths around the world by 3.2 million in 2008 (estimated). Most of them died from cardiovascular disease and 223,000 people died from lung cancer, more than half of them occurring in China and East Asia, including the relationship of diabetes slow-growing fetus miscarriage, and increased mortality perinatal (Ministry of Public Health, 2019). In addition, in research by Itai Kloog et al. (2015) it was found that in the short term, every 10 μg/m3 of PM2.5 increase will result in related mortality rates, it rose 2.8%, and over the long term, the PM2.5-related mortality rate also increased.

Economics

The obvious impact of the small dust problem on the economy is tourism. Due to poor visibility and the risk of pollution illnesses, the desire to visit Thailand has decreased, leading to a recession of the tourism business and further affecting economic growth as can be seen from January 2020 which is during the high amount of PM2.5, tourists choose to cancel their travel to reduce their health risks. Due to the PM2.5 that occurs, the lost value income is approximately 3.2 - 6 billion baht, which is the tourism sector 1-2.4 billion baht.

Environment

Small dust particles in the atmosphere may cause climate change problems. Because dust can absorb and refract light, as a result, the amount of solar energy that hits the earth's surface decreases. Furthermore, the area where an accumulation of acids in the atmosphere, Acidic dust, and microscopic particles may form and become acid dust (Acid aerosol) which can cause many damages, such as corrosion on the metal surface buildings or other objects. If this dust settles into water bodies. It will affect the quality of water and the organisms that live in them. In the case of effects on plants, it was found that dust particles accumulated on the leaves, may cause a change in the amount and intensity of light decreasing the rate of photosynthesis. In addition, the particles of dust also change the pH of the leaf surface or are involved in the destruction of the leaf coating of the plant causing the water balance in the leaves to change (Tidarat et al,2014).

Phytoremediation

It is a technology that uses plants to treat and rehabilitate areas contaminated with various pollutants aims to reduce the toxicity of pollutants that affect people and the environment. It can be used to treat and remove various forms of pollutants both organic and inorganic substances. An important caution in plant-based treatment technology is the selection of plant types that are suitable for the treatment of each pollutant in each area. This treatment technology is another approach that has received interest in solving environmental problems because it has a low cost cause it relies on what is already in the environment and the most important thing is it’s not leading to other environmental destruction.

Types of plant-based treatment technologies can be categorized according to the plant mechanism used for removing various toxic substances contaminated in the environment are as follows:

The process occurring outside the plant

1) Fixation of pollutants by plants (Phytostabilization) is to reduce and limit the movement of pollutants in contaminated areas by fixing pollutants in the roots of plants.
2) Degradation of pollutants by plant roots (Rhizodegradation) is the decomposition of pollutants with microorganisms around the roots of plants.

The process occurring within plants

1) Degradation of pollutants by plants (Phytodegradation) is the absorption of pollutants into plants and degraded by metabolic processes from various enzymes.

2) Evaporation of pollutants by plants (Phytovolatilization) is a change in chemical bonds of pollutants within plants and evaporate through the stomata into the atmosphere.

3) Filtering of pollutants by plant roots (Rhizofiltration) is to filter and absorb pollutants, collected only in the root area of the plant.

4) Extraction of pollutants by plants (Phytoextraction) is the attraction that moves pollutants and accumulates in the root and leaf areas, where plants used are usually hyper-accumulators.

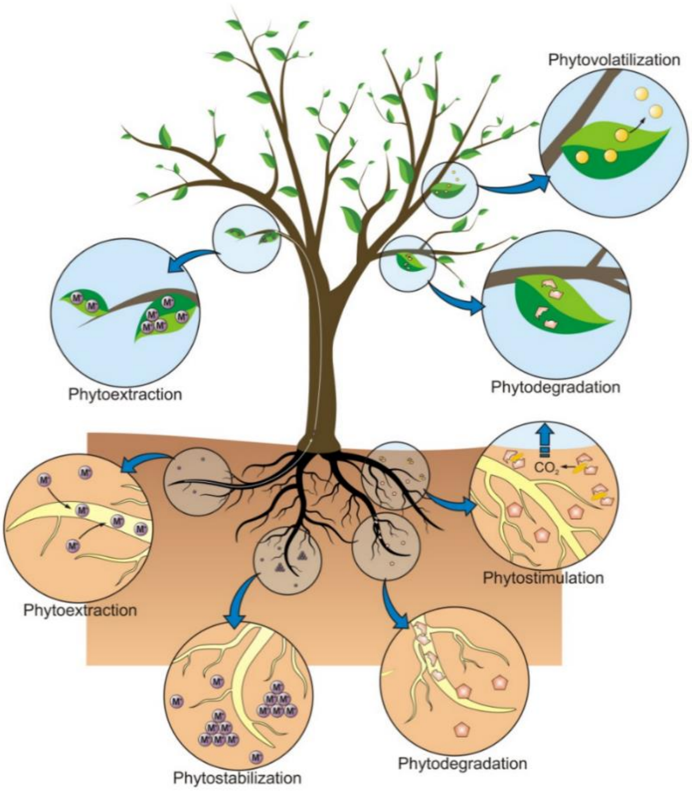

Figure 6 Plant therapy process (Phytoremediation)

(Source: Krisdi Wanichsawatwichai and Panthawat Samphan Panich,2019)

Research

Pasinee Sunakorn et al. (2016) conducted a comparative study of the dust capturing ability of Ivy species found that Soi Inthanin has a speck of dust-trap up to 63% due to its rough leaf surface, and covered with hair, causing a lot of friction. Therefore it can trap dust well, the leaf surface and the clear sky sandalwood are plants with glossy leaves. Has the ability to trap dustless with the amount of dust trapping 57.89% and 66.27.

Xiangying Wei et al (2016) studied the dust trapping ability of different plants, different species found that the leaves of each plant have differences in leaf surface structure and secretions, including the composition of microorganisms that live on or in the leaves. The study of the accumulation of PMs of leaves in perennial plants and shrubs in Norway and Poland were found that factors related to a cumulative capacity of fine particulate matter (PMs) are the shape of the leaves and the surface area of the leaves. The composition of the leaf coating its density of hair cells and trichomes on the leaf surface, and the density of the stomata by non-deciduous trees traps dust better than deciduous trees. In terms of leaf shape, it was found that Needle-shaped leaves can accumulate PMs more than broad leaves. In addition, the leaves are rough there is a quantity of leaf coating (Cuticle), the higher the density of hair cells and the trichomes, the more PMs can accumulate. In this study, PMs were also found as large as 2 micrometers in the space under the stomata.

Thanakorn Rattanaphan et al (2017) conducted a research study on the trapping of PM2.5 dust particles in trees’ indoor decoration to assess the ability of trees to trap smaller particles. 2.5 microns (PM2.5) with a large test chamber by focusing on the study of factors affecting the tree's ability to trap particles are leaf surface area and leaf characteristics. The results of the study found that Ornamental plants can help reduce indoor pollution. However, no measurements have been made in the study of the ability of trees to trap small particles indoors in a standardized way.

Manop Phophat et al (2019) gave their opinions on the joint action to solve the problems both In the short term, the immediate and long term approach to the problem of micro-dust in the air by the concept that widely offered including adding green areas in the city wall planting or vertical gardening on the roof or around buildings to reduce the amount of small dust in the air because the leaves of the tree have the ability to trap small dust particles in the air. The efficiency will depend on the nature of the leaves or the type of tree planted.

Research Methodology

Materials

1. Thermometer and relative humidity
2. PM2.5 and PM10 meter
3. UV meter
4. Carbon Dioxide Meter
5. Canopy Density Measurement Device (Densitometer)
6. Device to measure tree height (Clinometer)
7. Tape measure
8. Equipment for inventing automatic air data measurement kits:

- Arduino Uno R3
- CO2 sensor
- Relative humidity and temperature sensors
- PM dust sensor
- UV sensor
- Module saves data to Micro SD card and Micro SD card
- BreadBoard Experiment Board
- Jump wire
- soldering iron and soldering iron
- Glue gun and silicone glue sticks
- USB cable for connecting battery and Arduino board
- Power bank

Method

1. Choose the green area for a study site which are Charoen Prathet Park, King Kawila Monument, Chiang Mai 700th Anniversary Garden, and the green area next to our school (Varee Chiang Mai School).

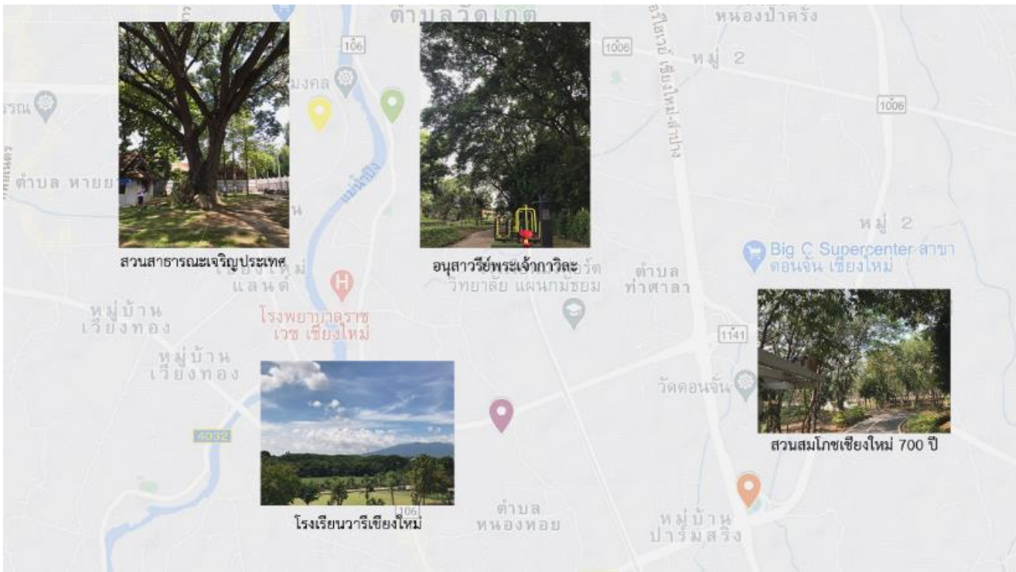

Figure 7 Location and general condition of the study area

2. Observe and collect the information of trees as follows:
   - circumference of the trunk
   - the height of the tree
   - density of the canopy
3. Measure the air quality outside the canopy and under the canopy of each tree species with standard equipment such as temperature and humidity, PM2.5 and PM10 content, Carbon dioxide content at 10 am, 12 am, and 2 pm.

Figure 8 Measurement of physical characteristics of trees and air data in the study area.

4. Create a device for measuring air data in an automated system from the Arduino Uno R3 module and various air data sensors. Then write code order and test the instruction set before implementing it.

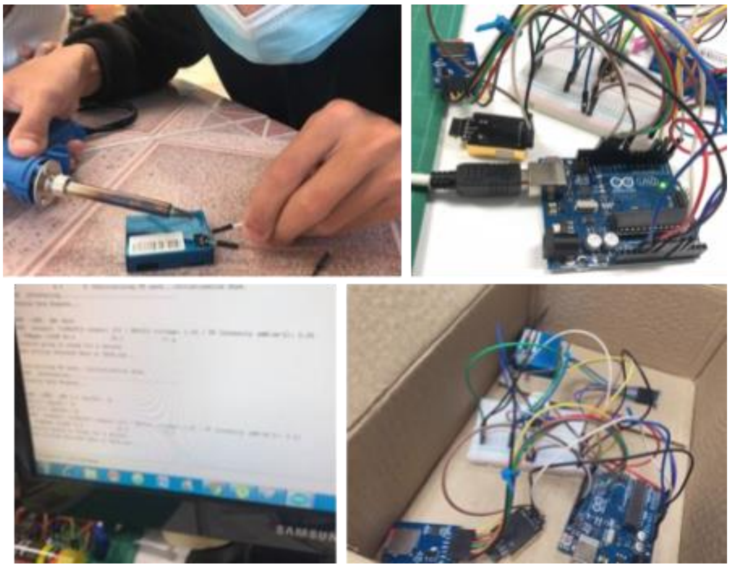

Figure 9 Fabrication of an Air Data Sensor from an Arduino Module and an Air Data Sensor.

5. Install equipment to collect air data at the study site. The devices will be installed to collect data both under the canopy and outside the canopy from each area for at least 24 hours continuously.

Figure 10 Installation of equipment to collect air data in the study area.

6. The anatomy of each plant leaf was studied through a light microscope and scanning electron microscope (SEM).
7. Analyze the data to compare the efficiency of the air quality treatment of each tree species.
8. Discussion and Conclusion

Figure 11 Study of plant leaf anatomy under light microscopy and electron microscopy.

Result and Discussion

From observing and collecting the air data at Charoen Prathet Park and Chiang Mai 700th Anniversary Garden by using standard tools between 3 time periods, 10.00 a.m., 12:00 p.m., and 2:00 p.m. It was found that the air quality under the tree canopy, outside the tree canopy (inside the park), and the open space outside the park, there are different as shown in the graph.

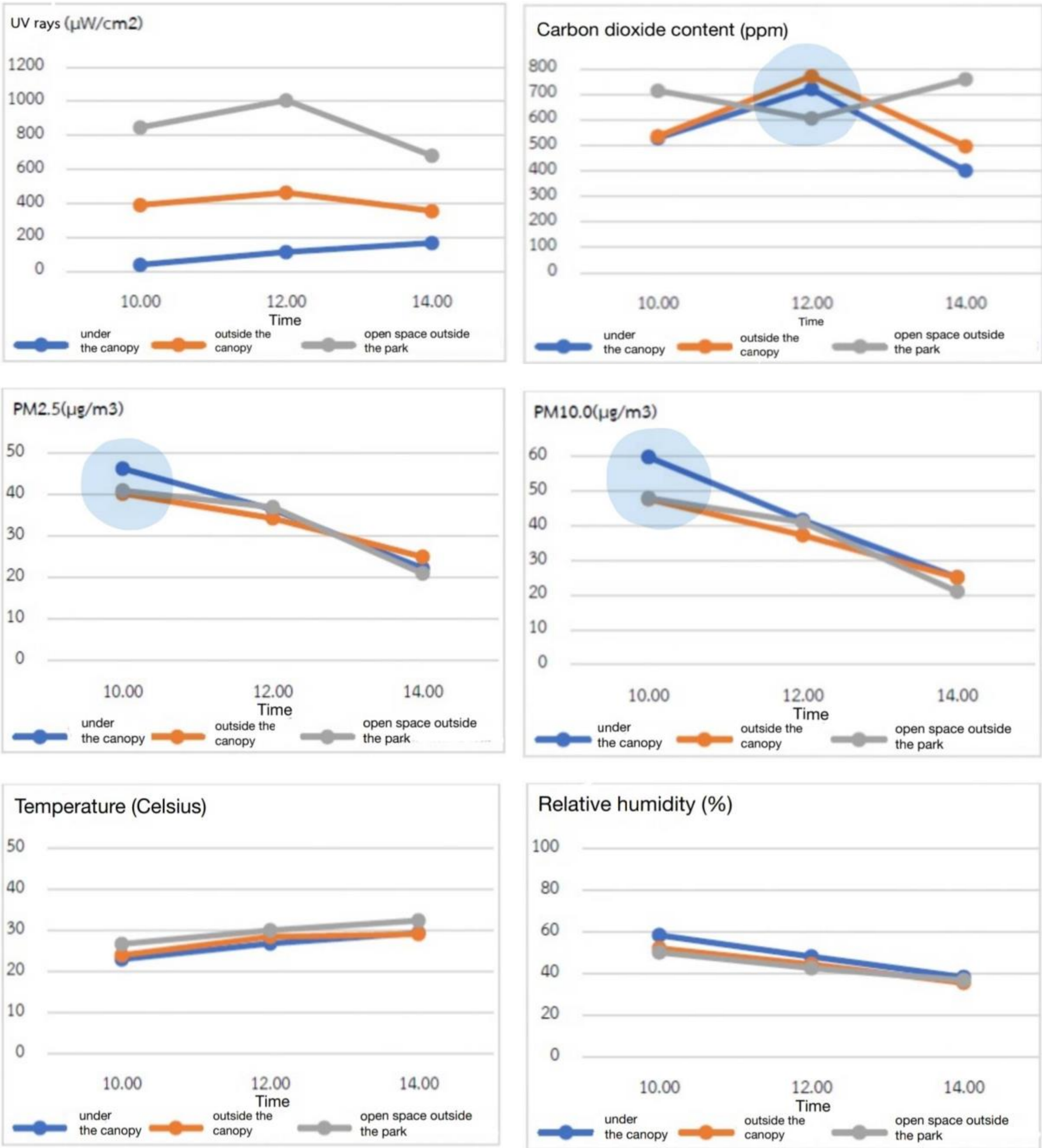

Figure 12 Graph showing the measured air data around Charoen Prathet Park

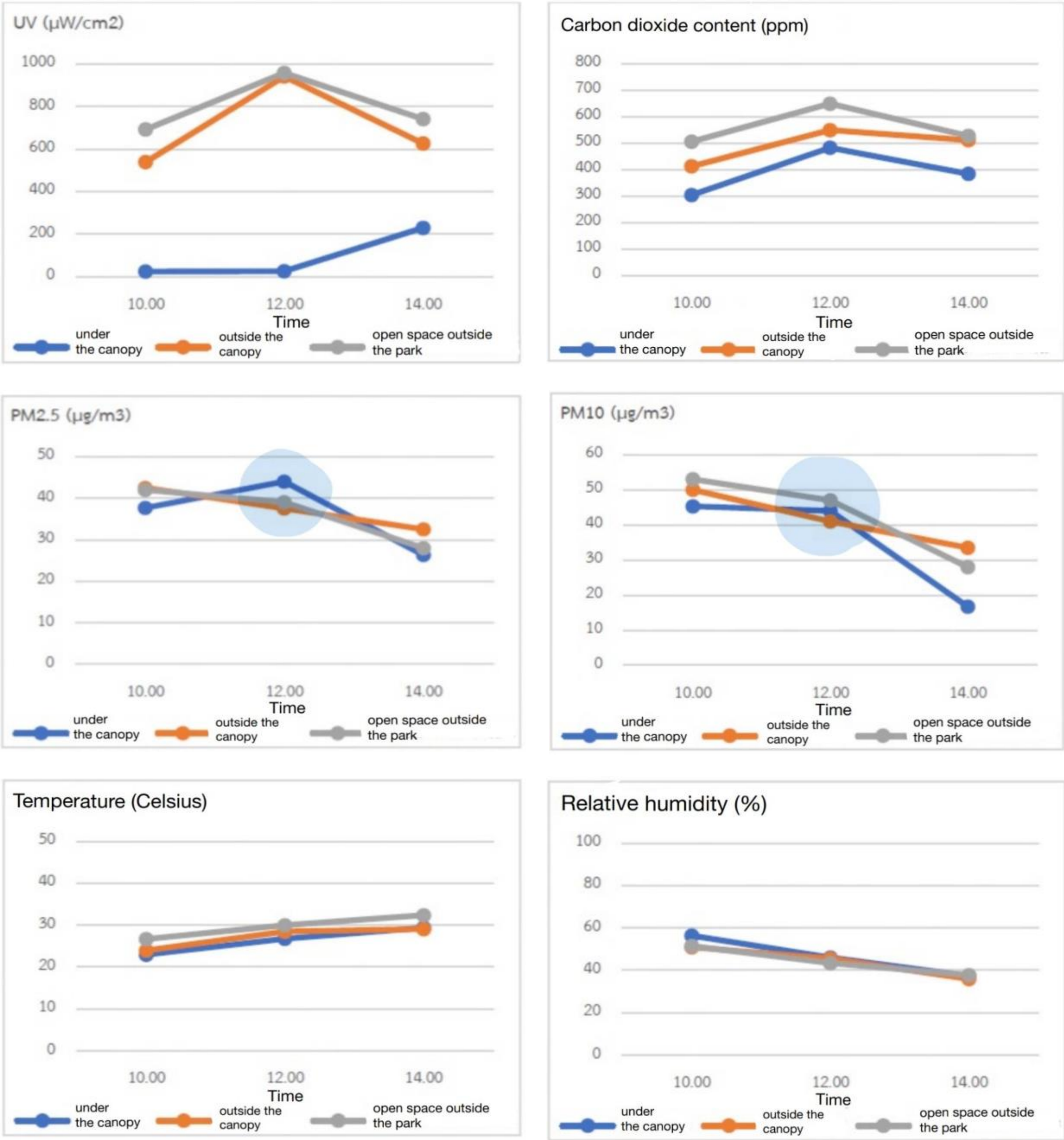

Figure 13 Graph showing the weather data measured in the 700th Anniversary Garden

However, we are found that some data did not follow other air quality values ( ). It is likely since air data is easily changed up to wind direction and speed factors. Measurements of data over time intervals may not provide sufficient data for analysis. Therefore, we have created a device to measure air data from an Arduino board, and sensors, including CO2 content, air temperature, relative humidity, dust content, PMs, are expected to measure the data continuously. As a result, the analysis of trees' air quality treatment efficiency in the study was more accurate.

Air data measurement results with this equipment were found that was different air quality in each area as follows:

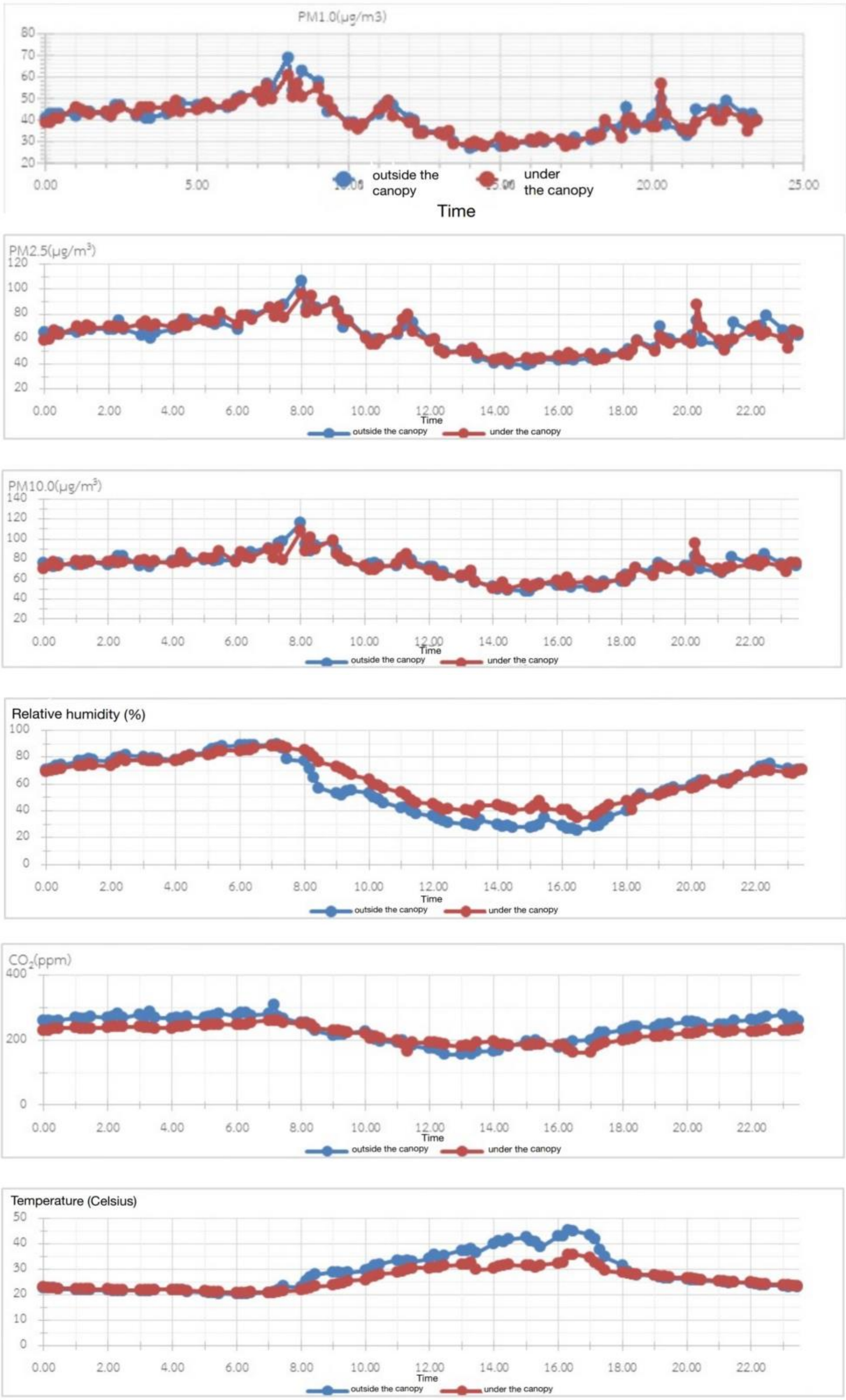

Figure 14 Graph showing air data measured in the 700th Anniversary Garden

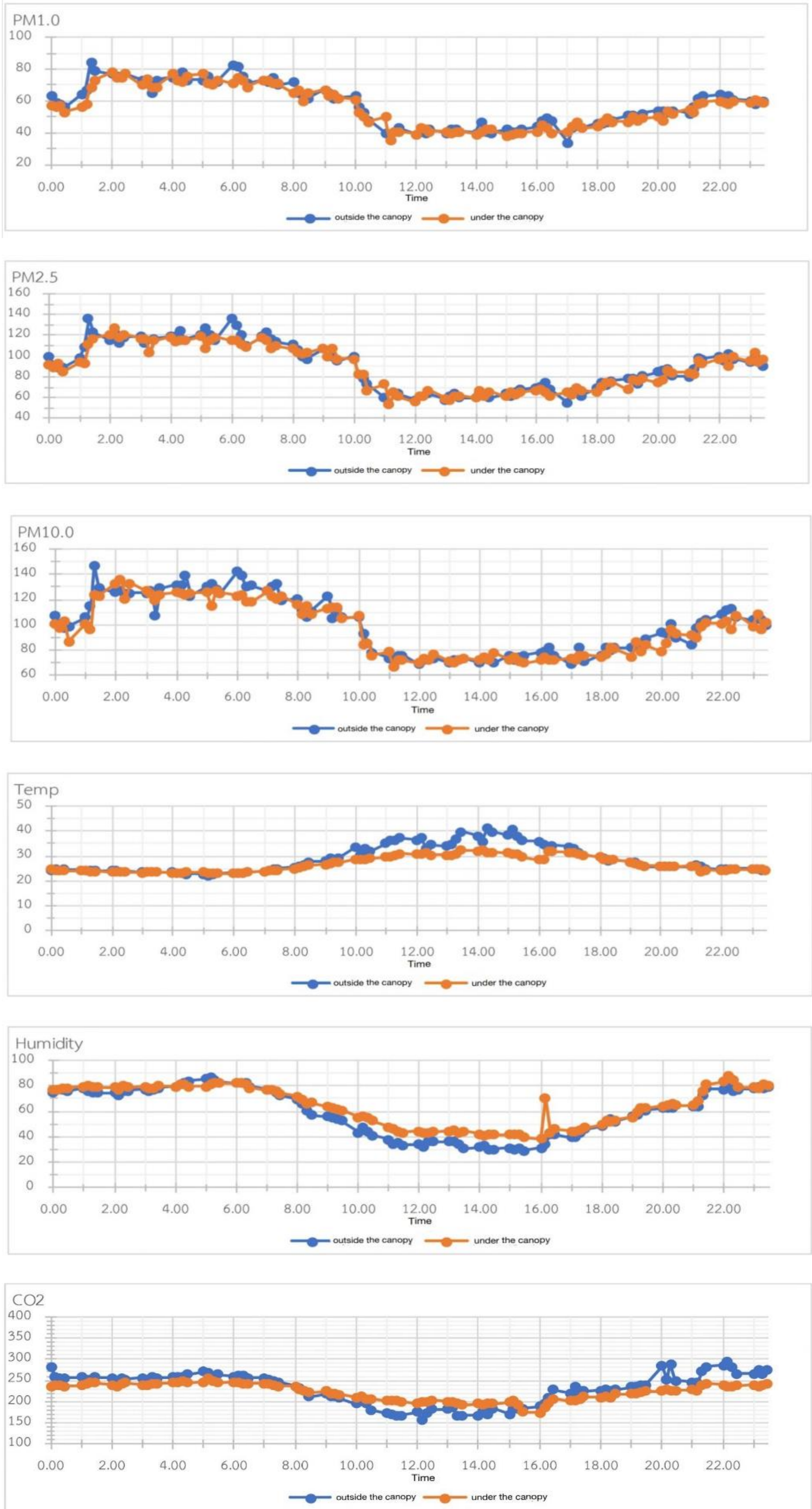

Figure 15 Graph showing air data measured around Varee Chiang Mai School

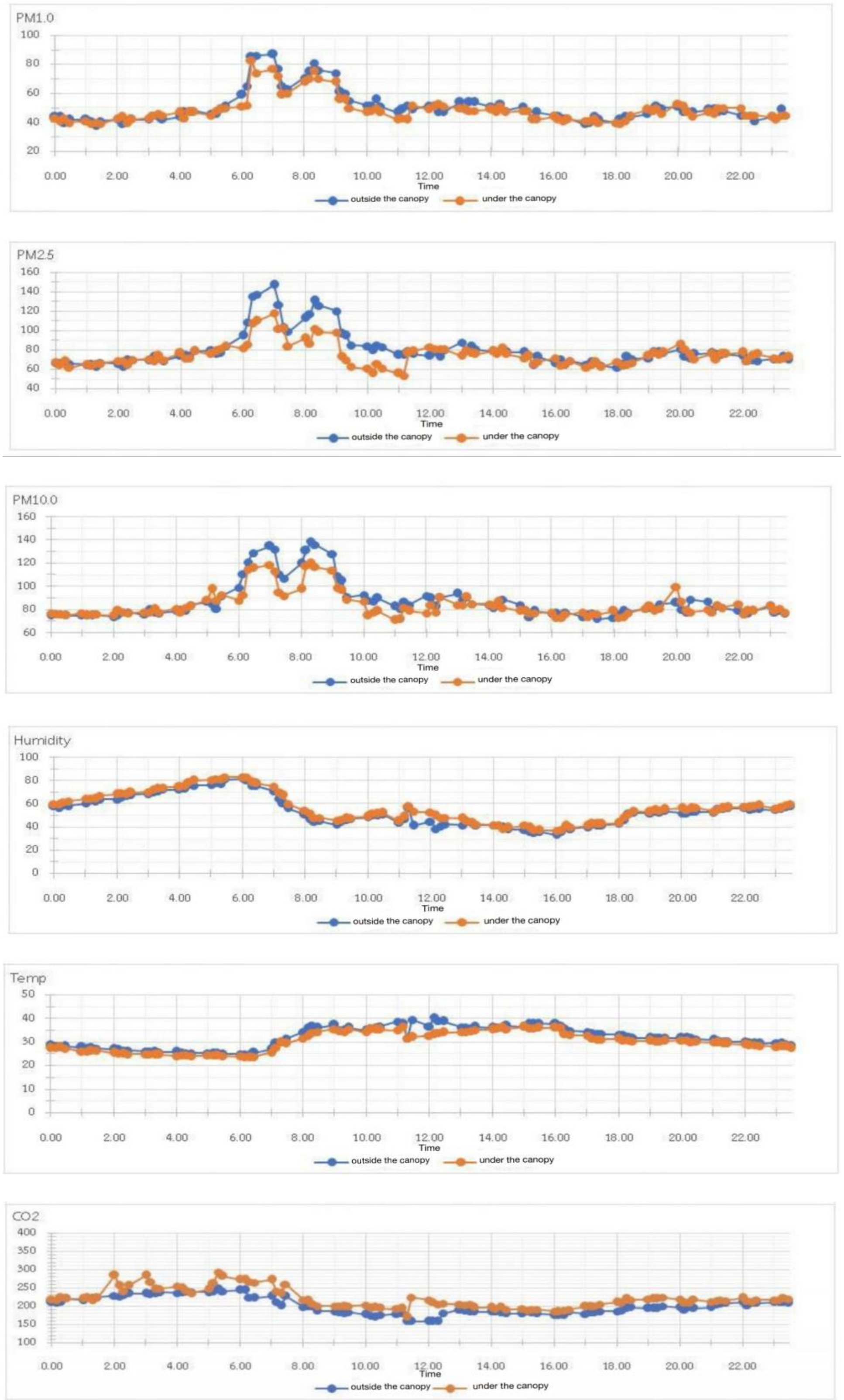

Figure 16 Graph showing the measured air data around Charoen Prathet Park

From the graph. It can see that the air quality under the canopy and outside the roof of the three public green areas are different as follows:

Table 2: Comparison of overall air quality under the canopy and outside canopy

Study Site	Air quality under the canopy VS outside the canopy		
	Chiang Mai 700th Anniversary Garden	Green area Next to Varee Chiang Mai School	Charoen Prathet Park
PM1.0 dust content	lower	lower	lower
PM2.5 dust content	lower	lower	lower
PM10.0 dust content	lower	lower	lower
Relative humidity	higher	higher	higher
Air temperature	lower	lower	lower
CO2 gas content	lower	lower	lower

Conclusion

The results of the air quality measurements at the 3 research sites illustrate that the plants studied were able to treat air quality. Additionally, each plant has a different ability in treating air quality. This can be observed by the comparison between air quality data measured beneath and outside the canopy in 2 research sites with different species of dominant tree, Raintree (*Samanea saman* (Jacq.) Merr.), and Golden shower (*Cassia fistula* L.) It was found that the Raintree was better at filtering particulate matters than the Golden shower, while the Raintree was better at reducing the temperature and CO_2 level, along with increasing humidity, as shown in the following table:

Table 3 The difference in air quality between beneath and outside the canopy at study sites with different dominant plants.

Weather information	The difference in air quality under the canopy and outside the canopy (percent)	
	Chamchuri tree	Ratchaphruek tree
PM1.0	2.7	1.5
PM2.5	2.1	0.1
PM10.0	2.9	0.4
Temperature	6.4	8.7
Relative humidity	6.1	7.1
CO_2 content	3.6	7.2

We suspected that this was due to the different leaf surface anatomy of the two plants. It was found that the leaf surface of the Raintree has a large number of trichomes and small hairs, thus, having the ability to filter out particulate matters better than the Golden shower. On the other hand, the leaf surface of the Golden shower has wide stomata, thus, more efficient transpiration and gas exchange than Raintree.

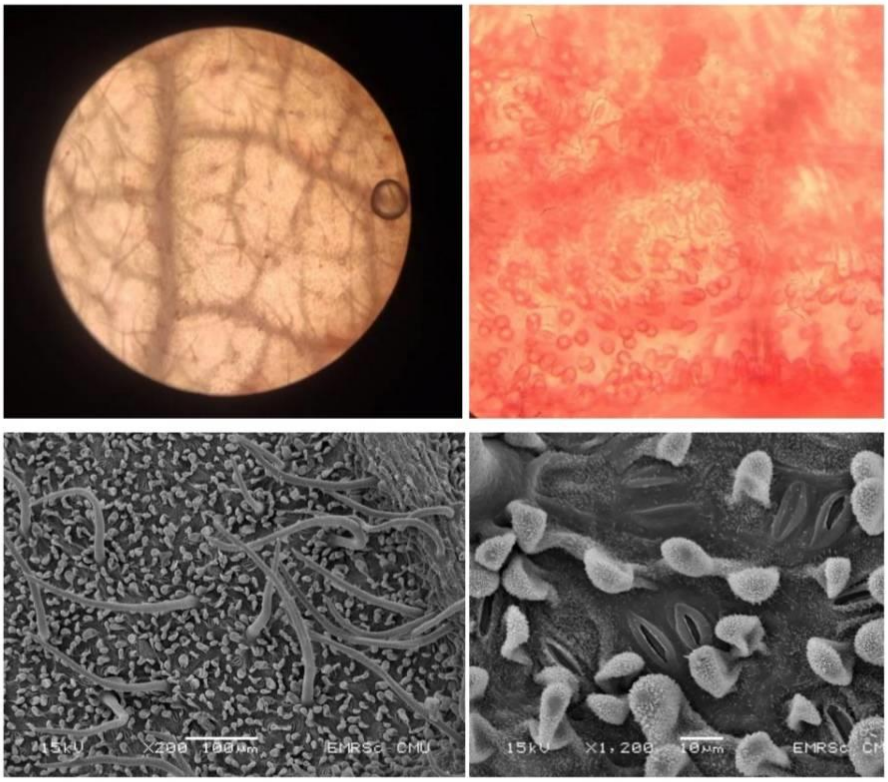

Figure 17 Anatomy of the leaf surface of Chamchuri

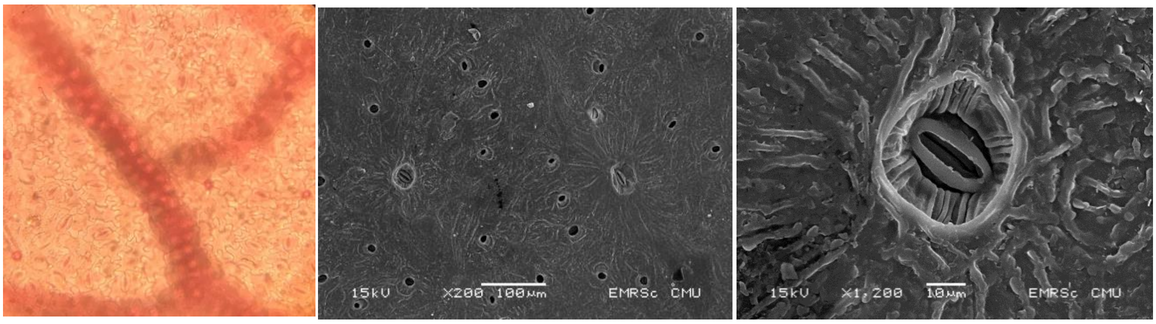

Figure 18 Anatomy of the leaf surface of Ratchaphruek

In addition, the researchers compared the particulate matters filtration efficiency between the public green areas where the Raintree is the same prominent plant, namely Charoen Prathet Park, and the public green area beside Varee Chiang Mai School, the data are shown in the following table:

Table 4 Efficiency in particulate matter filtration between public green areas with the same dominant plants.

Weather information	The difference in the amount of dust under the canopy and outside the canopy (percent)	
	The public green area next to the school	Charoen Prathet Park
PM1.0	16.27	3.61
PM2.5	13.30	6.79
PM10.0	11.88	3.54

The researcher suspected that this was likely due to the denser canopy of the public green area beside the school, which is 95.80%, while the density of the canopy in the Charoen Prathet Park is 76.33%.

Figure 19 Satellite image showing canopy densities of two study areas.

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Appendix

Temperature data

School Name Varee Chiang Mai School **Site Name** Varee Chiang Mai **User ID** 66868386

Latitude 18.75835 **Longitude** 99.01542 **Elevation** 302.5m

Measured At	Solar Measured At	Current Temp (degree celsius)
1/1/2022 1:00	1/1/2022 7:32	20
1/17/2022 9:00	1/17/2022 15:25	28.8
1/22/2022 9:00	1/22/2022 15:23	30
2/25/2022 1:00	2/25/2022 7:20	20
1/18/2022 1:00	1/18/2022 7:24	20
1/19/2022 9:00	1/19/2022 15:24	27.2
1/30/2022 1:00	1/30/2022 7:21	17.2
1/1/2022 9:00	1/1/2022 15:32	28.8
1/3/2022 1:00	1/3/2022 7:31	18.8
1/4/2022 1:00	1/4/2022 7:30	17.7
1/5/2022 9:00	1/5/2022 15:30	30
1/7/2022 1:00	1/7/2022 7:29	17.7
1/8/2022 9:00	1/8/2022 15:28	31.1
1/10/2022 1:00	1/10/2022 7:27	18.8
1/12/2022 1:00	1/12/2022 7:27	18.8
1/14/2022 1:00	1/14/2022 7:26	20
1/2/2022 9:00	1/2/2022 15:31	28.8
1/3/2022 9:00	1/3/2022 15:31	28.8
1/5/2022 1:00	1/5/2022 7:30	17.7
1/6/2022 9:00	1/6/2022 15:29	30
1/8/2022 1:00	1/8/2022 7:28	18.8
1/9/2022 1:00	1/9/2022 7:28	18.8
1/11/2022 1:00	1/11/2022 7:27	17.2
1/13/2022 1:00	1/13/2022 7:26	22.2
1/15/2022 1:00	1/15/2022 7:25	20
1/18/2022 9:00	1/18/2022 15:24	27.7
1/20/2022 9:00	1/20/2022 15:23	27.7
1/24/2022 1:00	1/24/2022 7:22	16.1
1/27/2022 1:00	1/27/2022 7:21	16.1
1/2/2022 1:00	1/2/2022 7:31	21.1

Measured At	Solar Measured At	Current Temp (degree celsius)
1/4/2022 9:00	1/4/2022 15:30	30
1/6/2022 1:00	1/6/2022 7:29	17.7
1/7/2022 9:00	1/7/2022 15:29	30
1/10/2022 9:00	1/10/2022 15:27	31.1
2/14/2022 9:00	2/14/2022 15:19	32.7
2/16/2022 9:00	2/16/2022 15:19	32.2
2/18/2022 9:00	2/18/2022 15:19	32.2
1/12/2022 9:00	1/12/2022 15:27	30
1/14/2022 9:00	1/14/2022 15:26	28.8
1/9/2022 9:00	1/9/2022 15:28	31.1
1/11/2022 9:00	1/11/2022 15:27	31.1
1/13/2022 9:00	1/13/2022 15:26	27.7
1/15/2022 9:00	1/15/2022 15:25	30
1/16/2022 1:00	1/16/2022 7:25	21.1
1/19/2022 1:00	1/19/2022 7:24	18.8
1/21/2022 1:00	1/21/2022 7:23	20
1/17/2022 1:00	1/17/2022 7:25	21.1
1/20/2022 1:00	1/20/2022 7:23	18.8
1/22/2022 1:00	1/22/2022 7:23	17.7
1/23/2022 9:00	1/23/2022 15:23	28.8
1/25/2022 9:00	1/25/2022 15:22	31.1
1/28/2022 9:00	1/28/2022 15:21	31.1
1/16/2022 9:00	1/16/2022 15:25	27.2
1/21/2022 9:00	1/21/2022 15:23	27.2
1/23/2022 1:00	1/23/2022 7:23	16.1
1/25/2022 1:00	1/25/2022 7:22	17.2
1/26/2022 9:00	1/26/2022 15:22	30
1/28/2022 1:00	1/28/2022 7:21	16.1
1/24/2022 9:00	1/24/2022 15:22	28.8
1/26/2022 1:00	1/26/2022 7:22	17.2
1/27/2022 9:00	1/27/2022 15:21	30
1/29/2022 9:00	1/29/2022 15:21	32.2
1/29/2022 1:00	1/29/2022 7:21	17.7
1/31/2022 1:00	1/31/2022 7:21	15
2/2/2022 1:00	2/2/2022 7:20	16.1

Measured At	Solar Measured At	Current Temp (degree celsius)
2/4/2022 1:00	2/4/2022 7:20	17.2
1/30/2022 9:00	1/30/2022 15:21	31.1
2/1/2022 9:00	2/1/2022 15:20	32.2
1/31/2022 9:00	1/31/2022 15:21	30
2/1/2022 1:00	2/1/2022 7:20	17.2
2/2/2022 9:00	2/2/2022 15:20	32.2
2/3/2022 1:00	2/3/2022 7:20	16.1
2/5/2022 1:00	2/5/2022 7:20	21.1
2/3/2022 9:00	2/3/2022 15:20	31.1
2/5/2022 9:00	2/5/2022 15:20	23.8
2/6/2022 9:00	2/6/2022 15:20	30
2/8/2022 9:00	2/8/2022 15:19	31.1
2/10/2022 9:00	2/10/2022 15:19	32.7
2/12/2022 9:00	2/12/2022 15:19	32.7
2/4/2022 9:00	2/4/2022 15:20	31.1
2/7/2022 9:00	2/7/2022 15:20	32.2
2/9/2022 9:00	2/9/2022 15:19	32.2
2/11/2022 9:00	2/11/2022 15:19	32.2
2/13/2022 9:00	2/13/2022 15:19	31.1
2/15/2022 9:00	2/15/2022 15:19	32.2
2/17/2022 9:00	2/17/2022 15:19	30
2/19/2022 9:00	2/19/2022 15:20	25
2/7/2022 1:00	2/7/2022 7:20	18.8
2/9/2022 1:00	2/9/2022 7:19	17.7
2/11/2022 1:00	2/11/2022 7:19	17.2
2/6/2022 1:00	2/6/2022 7:20	21.1
2/8/2022 1:00	2/8/2022 7:19	17.7
2/10/2022 1:00	2/10/2022 7:19	15
2/12/2022 1:00	2/12/2022 7:19	17.7
2/14/2022 1:00	2/14/2022 7:19	17.2
2/16/2022 1:00	2/16/2022 7:19	22.7
2/18/2022 1:00	2/18/2022 7:19	23.8
2/13/2022 1:00	2/13/2022 7:19	17.7
2/15/2022 1:00	2/15/2022 7:19	20
2/17/2022 1:00	2/17/2022 7:19	23.8

Measured At	Solar Measured At	Current Temp (degree celsius)
2/19/2022 1:00	2/19/2022 7:20	23.8
2/21/2022 1:00	2/21/2022 7:20	18.8
2/22/2022 1:00	2/22/2022 7:20	22.2
2/23/2022 1:00	2/23/2022 7:20	21.1
2/24/2022 1:00	2/24/2022 7:20	20
2/20/2022 9:00	2/20/2022 15:20	32.7
2/21/2022 9:00	2/21/2022 15:20	31.1
2/22/2022 9:00	2/22/2022 15:20	30
2/23/2022 9:00	2/23/2022 15:20	30
2/26/2022 9:00	2/26/2022 15:20	32.7
2/20/2022 1:00	2/20/2022 7:20	22.2
2/24/2022 9:00	2/24/2022 15:20	30
2/25/2022 9:00	2/25/2022 15:20	31.1
2/26/2022 1:00	2/26/2022 7:20	20
2/28/2022 1:00	2/28/2022 7:21	22.2
3/2/2022 1:00	3/2/2022 7:21	22.7
3/3/2022 9:00	3/3/2022 15:21	35
3/5/2022 9:00	3/5/2022 15:22	36.1
3/7/2022 9:00	3/7/2022 15:22	36.1
2/28/2022 9:00	2/28/2022 15:21	32.7
3/2/2022 9:00	3/2/2022 15:21	35
3/4/2022 1:00	3/4/2022 7:22	23.8
3/6/2022 1:00	3/6/2022 7:22	23.8
3/7/2022 5:30	3/7/2022 11:52	30
2/27/2022 9:00	2/27/2022 15:21	32.7
3/1/2022 9:00	3/1/2022 15:21	35
3/5/2022 1:00	3/5/2022 7:22	23.8
3/7/2022 1:00	3/7/2022 7:22	26.1
2/27/2022 1:00	2/27/2022 7:21	20
3/1/2022 1:00	3/1/2022 7:21	22.2
3/3/2022 1:00	3/3/2022 7:21	23.8
3/4/2022 9:00	3/4/2022 15:22	36.1
3/6/2022 9:00	3/6/2022 15:22	37.2
3/8/2022 1:00	3/8/2022 7:23	22.7
3/6/2022 5:30	3/6/2022 11:52	33.8

Measured At	Solar Measured At	Current Temp (degree celsius)
3/5/2022 5:30	3/5/2022 11:52	33.8
3/1/2022 5:30	3/1/2022 11:51	32.2
3/4/2022 5:30	3/4/2022 11:52	32.2
2/28/2022 5:30	2/28/2022 11:51	31.1
2/24/2022 5:30	2/24/2022 11:50	27.7
2/20/2022 5:30	2/20/2022 11:50	27.7
3/2/2022 5:30	3/2/2022 11:51	32.2
2/26/2022 5:30	2/26/2022 11:50	30
2/22/2022 5:30	2/22/2022 11:50	27.7
3/3/2022 5:30	3/3/2022 11:51	32.7
2/27/2022 5:30	2/27/2022 11:51	30
2/25/2022 5:30	2/25/2022 11:50	28.8
2/21/2022 5:30	2/21/2022 11:50	27.7
2/23/2022 5:30	2/23/2022 11:50	27.7
2/18/2022 5:30	2/18/2022 11:49	31.1
2/14/2022 5:30	2/14/2022 11:49	27.7
2/7/2022 5:30	2/7/2022 11:50	27.7
2/3/2022 5:30	2/3/2022 11:50	27.7
1/30/2022 5:30	1/30/2022 11:51	27.2
2/16/2022 5:30	2/16/2022 11:49	30
2/12/2022 5:30	2/12/2022 11:49	30
2/9/2022 5:00	2/9/2022 11:19	27.7
2/5/2022 5:30	2/5/2022 11:50	27.2
2/1/2022 5:30	2/1/2022 11:50	27.2
1/28/2022 5:30	1/28/2022 11:51	26.1
2/17/2022 5:30	2/17/2022 11:49	27.7
2/13/2022 5:30	2/13/2022 11:49	28.8
2/10/2022 5:30	2/10/2022 11:49	28.8
2/6/2022 5:30	2/6/2022 11:50	26.1
2/2/2022 5:30	2/2/2022 11:50	27.7
1/29/2022 5:30	1/29/2022 11:51	28.8
1/26/2022 5:30	1/26/2022 11:52	27.2
2/19/2022 5:30	2/19/2022 11:50	26.1
2/15/2022 5:30	2/15/2022 11:49	30
2/11/2022 5:30	2/11/2022 11:49	30

Measured At	Solar Measured At	Current Temp (degree celsius)
2/8/2022 5:30	2/8/2022 11:49	27.2
2/4/2022 5:30	2/4/2022 11:50	28.8
1/31/2022 5:30	1/31/2022 11:51	26.1
1/27/2022 5:30	1/27/2022 11:51	27.2
1/22/2022 5:30	1/22/2022 11:53	27.2
1/5/2022 5:30	1/5/2022 12:00	27.2
1/1/2022 5:30	1/1/2022 12:02	27.2
1/24/2022 5:30	1/24/2022 11:52	26.1
1/20/2022 5:30	1/20/2022 11:53	26.1
1/16/2022 5:30	1/16/2022 11:55	25
1/25/2022 5:30	1/25/2022 11:52	27.2
1/21/2022 5:30	1/21/2022 11:53	25
1/17/2022 5:30	1/17/2022 11:55	27.2
1/23/2022 5:30	1/23/2022 11:53	26.1
1/19/2022 5:30	1/19/2022 11:54	26.1
1/18/2022 5:30	1/18/2022 11:54	27.2
1/12/2022 5:30	1/12/2022 11:57	28.8
1/9/2022 5:30	1/9/2022 11:58	27.7
1/3/2022 5:30	1/3/2022 12:01	27.7
1/13/2022 5:30	1/13/2022 11:56	27.7
1/6/2022 5:30	1/6/2022 11:59	27.2
1/14/2022 5:30	1/14/2022 11:56	28.8
1/10/2022 5:30	1/10/2022 11:57	28.8
1/7/2022 5:30	1/7/2022 11:59	27.7
1/4/2022 5:30	1/4/2022 12:00	27.2
1/2/2022 5:30	1/2/2022 12:01	27.2
1/15/2022 5:30	1/15/2022 11:55	27.2
1/11/2022 5:30	1/11/2022 11:57	27.7
1/8/2022 5:30	1/8/2022 11:58	27.7

Relative humidity data

School Name Varee Chiang Mai School **Site Name** Varee Chiang Mai **User ID** 66868386

Latitude 18.75835 **Longitude** 99.01542 **Elevation** 302.5m

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
1/31/2022 9:00	1/31/2022 15:21	1/31/2022 5:37	23	7
2/2/2022 9:00	2/2/2022 15:20	2/2/2022 5:37	17	4.5
3/2/2022 1:00	3/2/2022 7:21	3/2/2022 5:36	69	16.8
3/3/2022 9:00	3/3/2022 15:21	3/3/2022 5:35	30	15.3
3/4/2022 1:00	3/4/2022 7:22	3/4/2022 5:35	73	18.8
3/5/2022 9:00	3/5/2022 15:22	3/5/2022 5:35	28	15.2
3/6/2022 1:00	3/6/2022 7:22	3/6/2022 5:35	69	17.9
3/7/2022 9:00	3/7/2022 15:22	3/7/2022 5:34	37	19.5
3/7/2022 5:30	3/7/2022 11:52	3/7/2022 5:34	55	20.2
3/6/2022 5:30	3/6/2022 11:52	3/6/2022 5:35	36	17
3/5/2022 5:30	3/5/2022 11:52	3/5/2022 5:35	41	19
3/1/2022 5:30	3/1/2022 11:51	3/1/2022 5:36	36	15.6
2/22/2022 5:30	2/22/2022 11:50	2/22/2022 5:37	54	17.7
1/29/2022 5:30	1/29/2022 11:51	1/29/2022 5:37	42	14.9
1/26/2022 5:30	1/26/2022 11:52	1/26/2022 5:36	42	13.4
1/17/2022 9:00	1/17/2022 15:25	1/17/2022 5:34	48	16.9
1/22/2022 9:00	1/22/2022 15:23	1/22/2022 5:35	35	13.2
2/25/2022 1:00	2/25/2022 7:20	2/25/2022 5:36	83	17.1
1/18/2022 1:00	1/18/2022 7:24	1/18/2022 5:34	83	17.1
1/19/2022 9:00	1/19/2022 15:24	1/19/2022 5:34	61	19.2
1/30/2022 1:00	1/30/2022 7:21	1/30/2022 5:37	77	13.2
1/1/2022 1:00	1/1/2022 7:32	1/1/2022 5:27	88	18
1/1/2022 9:00	1/1/2022 15:32	1/1/2022 5:27	48	16.9
1/2/2022 9:00	1/2/2022 15:31	1/2/2022 5:27	42	14.9
1/3/2022 9:00	1/3/2022 15:31	1/3/2022 5:28	42	14.9
1/5/2022 1:00	1/5/2022 7:30	1/5/2022 5:29	88	15.7
1/6/2022 9:00	1/6/2022 15:29	1/6/2022 5:29	35	13.2
1/8/2022 1:00	1/8/2022 7:28	1/8/2022 5:30	88	16.8
1/3/2022 1:00	1/3/2022 7:31	1/3/2022 5:28	88	16.8
1/4/2022 1:00	1/4/2022 7:30	1/4/2022 5:28	88	15.7
1/5/2022 9:00	1/5/2022 15:30	1/5/2022 5:29	37	14

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
1/7/2022 1:00	1/7/2022 7:29	1/7/2022 5:30	88	15.7
1/8/2022 9:00	1/8/2022 15:28	1/8/2022 5:30	35	14.2
1/4/2022 9:00	1/4/2022 15:30	1/4/2022 5:28	40	15.2
1/6/2022 1:00	1/6/2022 7:29	1/6/2022 5:29	83	14.8
1/7/2022 9:00	1/7/2022 15:29	1/7/2022 5:30	43	16.3
1/10/2022 9:00	1/10/2022 15:27	1/10/2022 5:31	33	13.3
2/14/2022 9:00	2/14/2022 15:19	2/14/2022 5:38	28	12.2
2/16/2022 9:00	2/16/2022 15:19	2/16/2022 5:38	38	16.4
2/18/2022 9:00	2/18/2022 15:19	2/18/2022 5:37	49	20.4
1/2/2022 1:00	1/2/2022 7:31	1/2/2022 5:27	88	19.1
1/10/2022 1:00	1/10/2022 7:27	1/10/2022 5:31	83	15.9
1/12/2022 1:00	1/12/2022 7:27	1/12/2022 5:32	88	16.8
1/14/2022 1:00	1/14/2022 7:26	1/14/2022 5:32	88	18
1/16/2022 9:00	1/16/2022 15:25	1/16/2022 5:33	58	18.4
1/21/2022 9:00	1/21/2022 15:23	1/21/2022 5:35	61	19.2
1/23/2022 1:00	1/23/2022 7:23	1/23/2022 5:35	82	13.1
1/25/2022 1:00	1/25/2022 7:22	1/25/2022 5:36	82	14.1
1/26/2022 9:00	1/26/2022 15:22	1/26/2022 5:36	35	13.2
1/28/2022 1:00	1/28/2022 7:21	1/28/2022 5:36	88	14.1
1/9/2022 1:00	1/9/2022 7:28	1/9/2022 5:31	83	15.9
1/11/2022 1:00	1/11/2022 7:27	1/11/2022 5:31	88	15.2
1/13/2022 1:00	1/13/2022 7:26	1/13/2022 5:32	83	19.2
1/15/2022 1:00	1/15/2022 7:25	1/15/2022 5:33	94	19
1/18/2022 9:00	1/18/2022 15:24	1/18/2022 5:34	51	16.9
1/20/2022 9:00	1/20/2022 15:23	1/20/2022 5:34	51	16.9
1/24/2022 1:00	1/24/2022 7:22	1/24/2022 5:36	82	13.1
1/27/2022 1:00	1/27/2022 7:21	1/27/2022 5:36	88	14.1
1/29/2022 1:00	1/29/2022 7:21	1/29/2022 5:37	83	14.8
1/5/2022 5:30	1/5/2022 12:00	1/5/2022 5:29	54	17.3
1/12/2022 9:00	1/12/2022 15:27	1/12/2022 5:32	43	16.3
1/14/2022 9:00	1/14/2022 15:26	1/14/2022 5:32	48	16.9
1/9/2022 9:00	1/9/2022 15:28	1/9/2022 5:31	35	14.2
1/11/2022 9:00	1/11/2022 15:27	1/11/2022 5:31	33	13.3
1/13/2022 9:00	1/13/2022 15:26	1/13/2022 5:32	51	16.9
1/15/2022 9:00	1/15/2022 15:25	1/15/2022 5:33	48	18

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
1/17/2022 1:00	1/17/2022 7:25	1/17/2022 5:34	88	19.1
1/20/2022 1:00	1/20/2022 7:23	1/20/2022 5:34	94	17.8
1/22/2022 1:00	1/22/2022 7:23	1/22/2022 5:35	88	15.7
1/16/2022 1:00	1/16/2022 7:25	1/16/2022 5:33	88	19.1
1/19/2022 1:00	1/19/2022 7:24	1/19/2022 5:34	100	18.8
1/21/2022 1:00	1/21/2022 7:23	1/21/2022 5:35	94	19
1/24/2022 9:00	1/24/2022 15:22	1/24/2022 5:36	33	11.2
1/26/2022 1:00	1/26/2022 7:22	1/26/2022 5:36	77	13.2
1/27/2022 9:00	1/27/2022 15:21	1/27/2022 5:36	31	11.4
1/29/2022 9:00	1/29/2022 15:21	1/29/2022 5:37	26	10.7
1/23/2022 9:00	1/23/2022 15:23	1/23/2022 5:35	25	7.1
1/25/2022 9:00	1/25/2022 15:22	1/25/2022 5:36	25	9.1
1/28/2022 9:00	1/28/2022 15:21	1/28/2022 5:36	31	12.3
2/1/2022 1:00	2/1/2022 7:20	2/1/2022 5:37	77	13.2
2/3/2022 1:00	2/3/2022 7:20	2/3/2022 5:37	77	12.1
2/5/2022 1:00	2/5/2022 7:20	2/5/2022 5:37	88	19.1
1/31/2022 1:00	1/31/2022 7:21	1/31/2022 5:37	77	11
2/2/2022 1:00	2/2/2022 7:20	2/2/2022 5:37	72	11.1
2/4/2022 1:00	2/4/2022 7:20	2/4/2022 5:37	77	13.2
2/4/2022 9:00	2/4/2022 15:20	2/4/2022 5:37	38	15.4
1/30/2022 9:00	1/30/2022 15:21	1/30/2022 5:37	25	9.1
2/1/2022 9:00	2/1/2022 15:20	2/1/2022 5:37	20	6.8
2/3/2022 9:00	2/3/2022 15:20	2/3/2022 5:37	27	10.3
2/5/2022 9:00	2/5/2022 15:20	2/5/2022 5:37	78	19.8
2/6/2022 9:00	2/6/2022 15:20	2/6/2022 5:38	51	19
2/8/2022 9:00	2/8/2022 15:19	2/8/2022 5:38	22	7.3
2/10/2022 9:00	2/10/2022 15:19	2/10/2022 5:38	17	4.9
2/12/2022 9:00	2/12/2022 15:19	2/12/2022 5:38	28	12.2
2/7/2022 9:00	2/7/2022 15:20	2/7/2022 5:38	27	11.2
2/9/2022 9:00	2/9/2022 15:19	2/9/2022 5:38	24	9.5
2/11/2022 9:00	2/11/2022 15:19	2/11/2022 5:38	29	12.3
2/13/2022 9:00	2/13/2022 15:19	2/13/2022 5:38	18	4.4
2/15/2022 9:00	2/15/2022 15:19	2/15/2022 5:38	43	18.3
2/17/2022 9:00	2/17/2022 15:19	2/17/2022 5:37	55	20.2
2/19/2022 9:00	2/19/2022 15:20	2/19/2022 5:37	74	20.1

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
2/6/2022 1:00	2/6/2022 7:20	2/6/2022 5:38	94	20.1
2/8/2022 1:00	2/8/2022 7:19	2/8/2022 5:38	77	13.7
2/10/2022 1:00	2/10/2022 7:19	2/10/2022 5:38	77	11
2/12/2022 1:00	2/12/2022 7:19	2/12/2022 5:38	77	13.7
2/7/2022 1:00	2/7/2022 7:20	2/7/2022 5:38	83	15.9
2/9/2022 1:00	2/9/2022 7:19	2/9/2022 5:38	73	12.9
2/11/2022 1:00	2/11/2022 7:19	2/11/2022 5:38	68	11.3
2/20/2022 1:00	2/20/2022 7:20	2/20/2022 5:37	94	21.2
2/24/2022 9:00	2/24/2022 15:20	2/24/2022 5:37	37	14
2/25/2022 9:00	2/25/2022 15:20	2/25/2022 5:36	35	14.2
2/14/2022 1:00	2/14/2022 7:19	2/14/2022 5:38	72	12.2
2/16/2022 1:00	2/16/2022 7:19	2/16/2022 5:38	83	19.7
2/18/2022 1:00	2/18/2022 7:19	2/18/2022 5:37	83	20.8
2/13/2022 1:00	2/13/2022 7:19	2/13/2022 5:38	73	12.9
2/15/2022 1:00	2/15/2022 7:19	2/15/2022 5:38	73	15.1
2/17/2022 1:00	2/17/2022 7:19	2/17/2022 5:37	78	19.8
2/19/2022 1:00	2/19/2022 7:20	2/19/2022 5:37	94	22.8
2/26/2022 1:00	2/26/2022 7:20	2/26/2022 5:36	71	14.7
2/21/2022 1:00	2/21/2022 7:20	2/21/2022 5:37	83	15.9
2/22/2022 1:00	2/22/2022 7:20	2/22/2022 5:37	78	18.3
2/23/2022 1:00	2/23/2022 7:20	2/23/2022 5:37	78	17.2
2/24/2022 1:00	2/24/2022 7:20	2/24/2022 5:37	88	18
2/20/2022 9:00	2/20/2022 15:20	2/20/2022 5:37	34	15.1
2/21/2022 9:00	2/21/2022 15:20	2/21/2022 5:37	33	13.3
2/22/2022 9:00	2/22/2022 15:20	2/22/2022 5:37	43	16.3
2/23/2022 9:00	2/23/2022 15:20	2/23/2022 5:37	37	14
2/26/2022 9:00	2/26/2022 15:20	2/26/2022 5:36	34	15.1
2/28/2022 1:00	2/28/2022 7:21	2/28/2022 5:36	69	16.3
2/28/2022 9:00	2/28/2022 15:21	2/28/2022 5:36	31	13.7
3/2/2022 9:00	3/2/2022 15:21	3/2/2022 5:36	32	16.2
2/27/2022 9:00	2/27/2022 15:21	2/27/2022 5:36	29	12.7
3/1/2022 9:00	3/1/2022 15:21	3/1/2022 5:36	25	12.5
3/5/2022 1:00	3/5/2022 7:22	3/5/2022 5:35	69	17.9
3/7/2022 1:00	3/7/2022 7:22	3/7/2022 5:34	69	20.1
2/27/2022 1:00	2/27/2022 7:21	2/27/2022 5:36	83	17.1

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
3/1/2022 1:00	3/1/2022 7:21	3/1/2022 5:36	73	17.2
3/3/2022 1:00	3/3/2022 7:21	3/3/2022 5:35	69	17.9
3/4/2022 9:00	3/4/2022 15:22	3/4/2022 5:35	27	14.6
3/6/2022 9:00	3/6/2022 15:22	3/6/2022 5:35	27	15.5
3/8/2022 1:00	3/8/2022 7:23	3/8/2022 5:34	94	21.7
3/2/2022 5:30	3/2/2022 11:51	3/2/2022 5:36	38	16.4
2/26/2022 5:30	2/26/2022 11:50	2/26/2022 5:36	43	16.3
3/3/2022 5:30	3/3/2022 11:51	3/3/2022 5:35	41	18
2/27/2022 5:30	2/27/2022 11:51	2/27/2022 5:36	43	16.3
3/4/2022 5:30	3/4/2022 11:52	3/4/2022 5:35	43	18.3
2/28/2022 5:30	2/28/2022 11:51	2/28/2022 5:36	38	15.4
2/24/2022 5:30	2/24/2022 11:50	2/24/2022 5:37	51	16.9
2/20/2022 5:30	2/20/2022 11:50	2/20/2022 5:37	62	19.9
2/25/2022 5:30	2/25/2022 11:50	2/25/2022 5:36	45	15.9
2/21/2022 5:30	2/21/2022 11:50	2/21/2022 5:37	37	12
2/23/2022 5:30	2/23/2022 11:50	2/23/2022 5:37	51	16.9
2/18/2022 5:30	2/18/2022 11:49	2/18/2022 5:37	55	21.2
2/14/2022 5:30	2/14/2022 11:49	2/14/2022 5:38	50	16.5
2/7/2022 5:30	2/7/2022 11:50	2/7/2022 5:38	51	16.9
2/3/2022 5:30	2/3/2022 11:50	2/3/2022 5:37	28	7.8
1/30/2022 5:30	1/30/2022 11:51	1/30/2022 5:37	39	12.3
2/17/2022 5:30	2/17/2022 11:49	2/17/2022 5:37	66	20.9
2/13/2022 5:30	2/13/2022 11:49	2/13/2022 5:38	23	5.9
2/10/2022 5:30	2/10/2022 11:49	2/10/2022 5:38	33	11.2
2/6/2022 5:30	2/6/2022 11:50	2/6/2022 5:38	69	20.1
2/2/2022 5:30	2/2/2022 11:50	2/2/2022 5:37	30	8.8
2/19/2022 5:30	2/19/2022 11:50	2/19/2022 5:37	83	23.1
2/15/2022 5:30	2/15/2022 11:49	2/15/2022 5:38	55	20.2
2/11/2022 5:30	2/11/2022 11:49	2/11/2022 5:38	27	9.3
2/8/2022 5:30	2/8/2022 11:49	2/8/2022 5:38	42	13.4
2/4/2022 5:30	2/4/2022 11:50	2/4/2022 5:37	33	11.2
1/31/2022 5:30	1/31/2022 11:51	1/31/2022 5:37	34	9.3
1/27/2022 5:30	1/27/2022 11:51	1/27/2022 5:36	45	14.5
2/16/2022 5:30	2/16/2022 11:49	2/16/2022 5:38	51	19
2/12/2022 5:30	2/12/2022 11:49	2/12/2022 5:38	35	13.2

Measured At	Solar Measured At	Solar Noon At	Relative Humidity Percent	Dewpoint
2/9/2022 5:00	2/9/2022 11:19	2/9/2022 5:38	37	12
2/5/2022 5:30	2/5/2022 11:50	2/5/2022 5:37	65	20.2
2/1/2022 5:30	2/1/2022 11:50	2/1/2022 5:37	34	10.3
1/28/2022 5:30	1/28/2022 11:51	1/28/2022 5:36	47	14.1
1/24/2022 5:30	1/24/2022 11:52	1/24/2022 5:36	42	12.4
1/20/2022 5:30	1/20/2022 11:53	1/20/2022 5:34	57	17.1
1/16/2022 5:30	1/16/2022 11:55	1/16/2022 5:33	69	19
1/1/2022 5:30	1/1/2022 12:02	1/1/2022 5:27	58	18.4
1/25/2022 5:30	1/25/2022 11:52	1/25/2022 5:36	45	14.5
1/21/2022 5:30	1/21/2022 11:53	1/21/2022 5:35	69	19
1/17/2022 5:30	1/17/2022 11:55	1/17/2022 5:34	54	17.3
1/23/2022 5:30	1/23/2022 11:53	1/23/2022 5:35	44	13.1
1/19/2022 5:30	1/19/2022 11:54	1/19/2022 5:34	61	18.1
1/22/2022 5:30	1/22/2022 11:53	1/22/2022 5:35	51	16.4
1/18/2022 5:30	1/18/2022 11:54	1/18/2022 5:34	54	17.3
1/13/2022 5:30	1/13/2022 11:56	1/13/2022 5:32	54	17.7
1/6/2022 5:30	1/6/2022 11:59	1/6/2022 5:29	51	16.4
1/15/2022 5:30	1/15/2022 11:55	1/15/2022 5:33	61	19.2
1/11/2022 5:30	1/11/2022 11:57	1/11/2022 5:31	48	15.9
1/8/2022 5:30	1/8/2022 11:58	1/8/2022 5:30	54	17.7
1/12/2022 5:30	1/12/2022 11:57	1/12/2022 5:32	45	15.9
1/9/2022 5:30	1/9/2022 11:58	1/9/2022 5:31	51	16.9
1/3/2022 5:30	1/3/2022 12:01	1/3/2022 5:28	48	15.9
1/14/2022 5:30	1/14/2022 11:56	1/14/2022 5:32	55	19.1
1/10/2022 5:30	1/10/2022 11:57	1/10/2022 5:31	48	16.9
1/7/2022 5:30	1/7/2022 11:59	1/7/2022 5:30	48	15.9
1/4/2022 5:30	1/4/2022 12:00	1/4/2022 5:28	54	17.3
1/2/2022 5:30	1/2/2022 12:01	1/2/2022 5:27	51	16.4