Delonix Regia (Poinciana): Red Flowers in Graduation Season

Student
Yu-Han Huang

Teachers
Lee, Yu-Hsien
Xiao, Jhong-Chun

National Kinmen Senior High School
Taiwan Partnership

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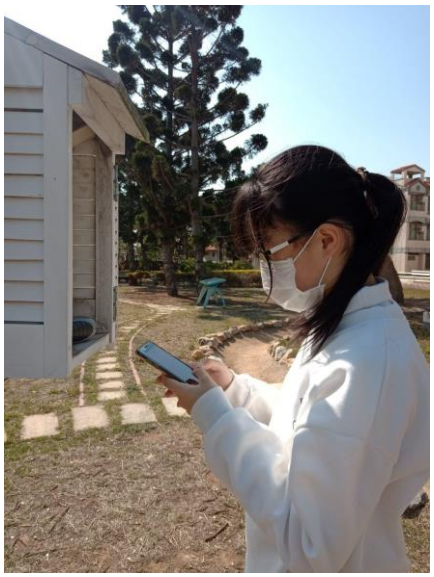
Team Photo

Doing Observe





Abstract

Every day when I walk past the Poinciana trees along the road during their flower season, I can not help wanting to know more about them.

This paper aims to study the Poinciana trees, including how they grow in every time of the year, their features, demands and other information like these.

By observing the three Poinciana trees in our school for a long time, we get to know air temperature, relief and the amount of sunshine will affect the blooming of Poinciana trees.

Background Introduction

1. Kinmen (Fu-Chien, Taiwan)

Kinmen (alternatively known as Quemoy), is a group of islands governed by the Republic of China (ROC) based in Taiwan.

The climate changes regularly here, the highest and the lowest average air temperatures mostly appear in July and January respectively, and the precipitation is low throughout every year.

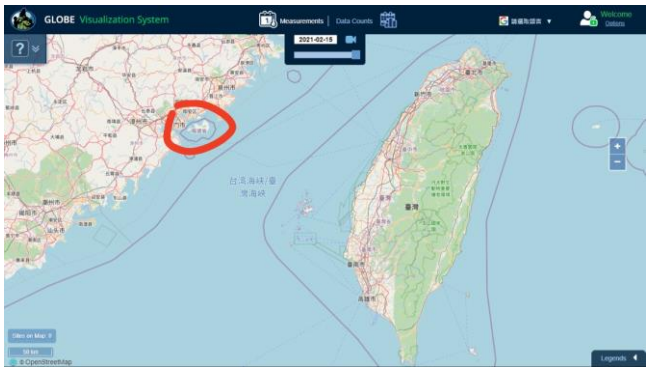
As a result of dramatic changes in the environment due to climate change, Kinmen attracts certain kinds of birds to come to reproduce or to get through the winter. You can see a variety of ecology in Kinmen.

The table below is some record of climate data for Kinmen over a long period of time.

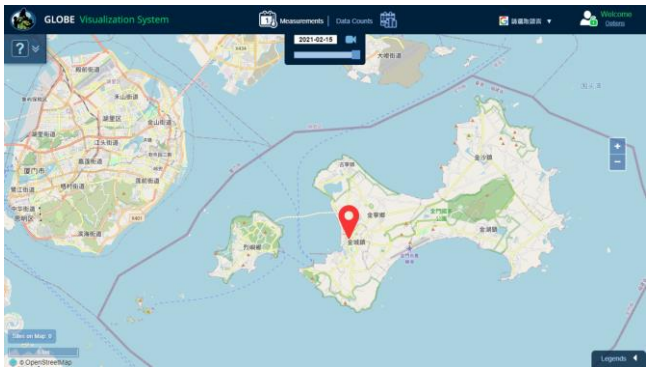
Climate data for Kinmen													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	27.0 (80.6)	25.5 (77.9)	28.1 (82.6)	31.6 (88.9)	32.7 (90.9)	38.4 (101.1)	39.1 (102.4)	36.3 (97.3)	36.7 (98.1)	34.0 (93.2)	31.0 (87.8)	26.6 (79.9)	39.1 (102.4)
Average high °C (°F)	16.8 (62.2)	16.5 (61.7)	18.8 (65.8)	22.8 (73.0)	25.8 (78.4)	29.3 (84.7)	31.9 (89.4)	32.0 (89.6)	31.6 (88.9)	27.4 (81.3)	23.5 (74.3)	19.5 (67.1)	24.6 (76.3)
Daily mean °C (°F)	12.7 (54.9)	12.9 (55.2)	15.0 (59.0)	19.1 (66.4)	23.1 (73.6)	26.1 (79.0)	28.2 (82.8)	28.2 (82.8)	26.8 (80.2)	23.5 (74.3)	19.4 (66.9)	15.5 (59.9)	20.8 (69.4)
Average low °C (°F)	10.0 (50.0)	10.1 (50.2)	12.2 (54.0)	16.2 (61.2)	20.6 (69.1)	23.8 (74.8)	25.8 (78.4)	25.7 (78.3)	24.3 (75.7)	20.7 (69.3)	16.5 (61.7)	12.5 (54.5)	18.2 (64.8)
Record low °C (°F)	1.3 (34.3)	3.6 (38.5)	3.0 (37.4)	9.0 (48.2)	15.0 (59.0)	18.0 (64.4)	20.0 (68.0)	22.4 (72.3)	17.5 (63.5)	13.0 (55.4)	11.0 (51.8)	3.8 (38.8)	1.3 (34.3)

2. KMSH (Kinmen Senior High School)

The position of Kinmen



The position of KMSH (Our School)

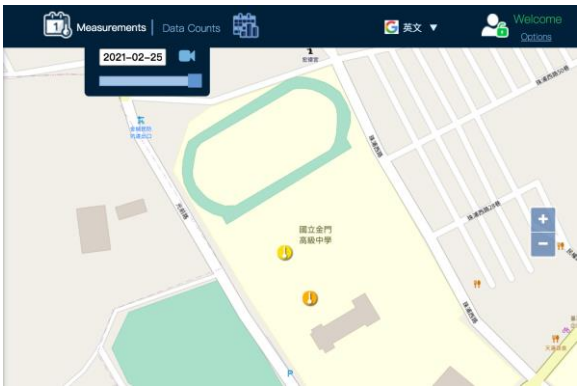


The manual meteorological station surroundings in KMSH

(1) Overview

KMSH (Kinmen Senior High School) is located west of the biggest Island of Kinmen, with longitude and latitude of about (24.4358°N, 118.3145°E), or (24° 26' 8.88", 118° 18' 52.2"). With hotter and wetter summers and colder and drier winters, the climate situation here is easy to distinguish.

(2) Two Data Stations in Our School



There are two observation stations in our school.

The left and the middle picture above is our GLOBE DAVIS automatic meteorological observation station (the yellow sign in the right picture) and instrument shelter site (the orange sign in the right picture), which does observations manually individually.

The two pictures below are the information about the two sites.

Instrument shelter site	DAVIS site
School: National Kinmen Senior High School **Site:** KMSH Ecological Pool Measurements | Data Counts | School Info | Site Info | Photos Site Information Site ID 102439 Name KMSH Ecological Pool Latitude 24.435467° Longitude 118.313914° Elevation 22.0m Location Source other Atmosphere Site Comments It is better to know the right data Activated At 2019-09-20 12:01:34.016912	**School:** National Kinmen Senior High School **Site:** 金門高中KMSH-DAVIS Measurements | Data Counts | School Info | Site Info | Photos Site Information Site ID 143543 Name 金門高中KMSH-DAVIS Latitude 24.435877° Longitude 118.313666° Elevation 35.0m Location Source other Atmosphere Site Activated At 2018-12-23 02:09:17.170704 Thermometer Type davis

Research Motivation

Every year when June comes around, which is the season for students to graduate, you can always hear the chirping sound from cicadas, going with the red flowers on the two opposite sides of the road, the plant and insect always bring joy and peace to everyone at the time.

After I did the research of Pistacia trees last year, I found investigating in a work interesting, and it led me to study about Poinciana trees, that is the above-mentioned trees that bloom red flowers, at this moment.

Research Purposes

Through observing Poinciana trees to

1. Sort out the growth law of them.
2. Find factors that affect their flowers' growth.
3. Know why they will bloom more than one time in a short period of time by contrast.

Research Method

Here are the studying steps of this paper:

1. Using the Internet, relative books or articles, and other ways to learn the basic knowledge and geographical distribution, etc. information about Poinciana trees, then do cross-reference with the photos of the trees.
2. Searching for GLOBE data bank and other kinds of meteorological records to cross-check, and discover the connection between them and the trees.
3. At the same time, do more observations for the Poinciana trees.
4. In the end, discuss and analyze the conclusion of our questions, and solve the research purposes one by one.

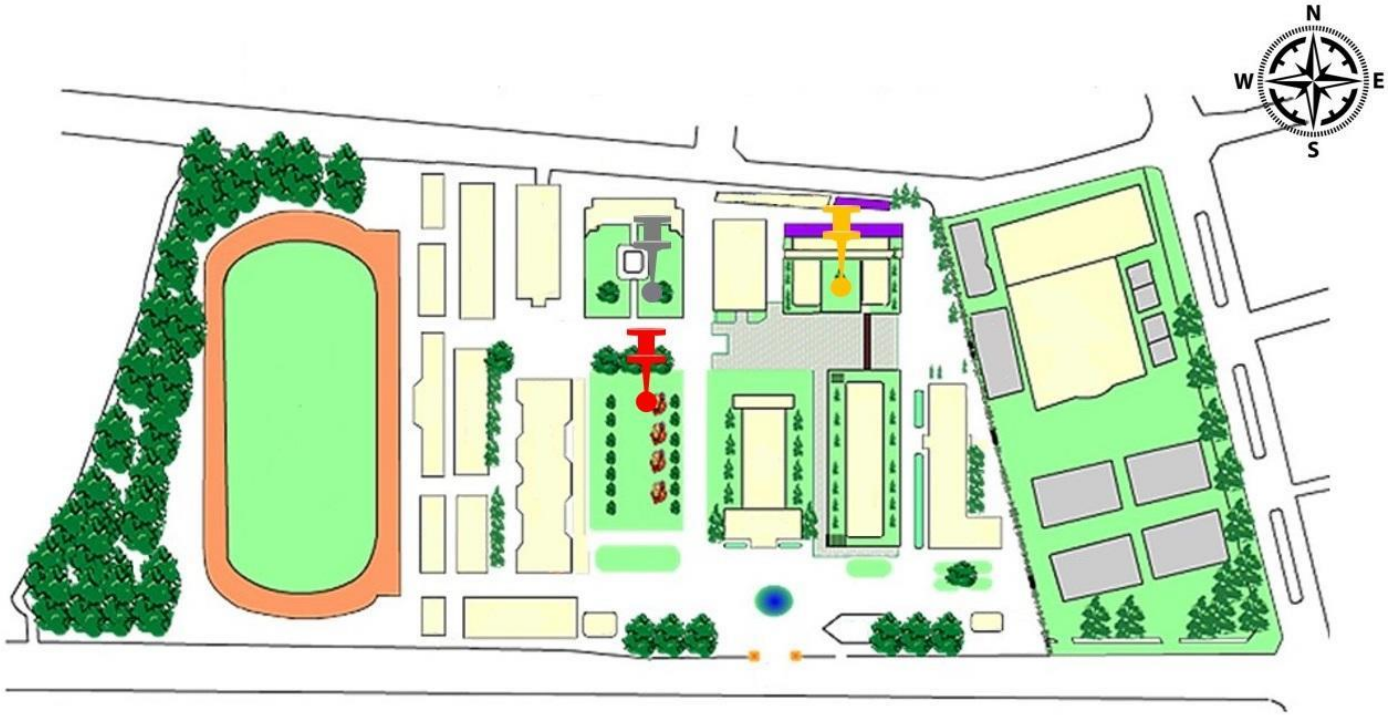
Instruments and Materials

Software
(1) Microsoft Office (Excel, Powerpoint, Word) (2) Ms Paint
Hardware
(1) Computers and Phone (2) Infrared Thermometer (3) Barometer (4) Instrument Shelter and Relative Measuring Instruments



Research Process and Results

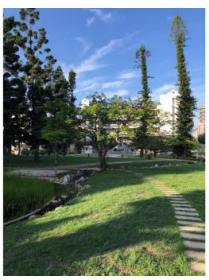
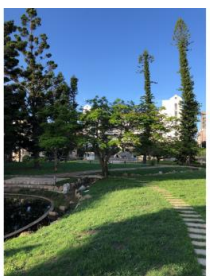
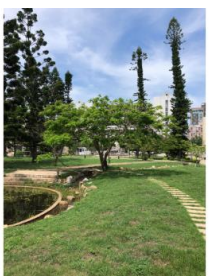
1. The location of three Poinciana trees in KMSH

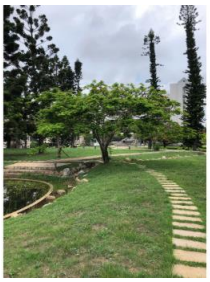
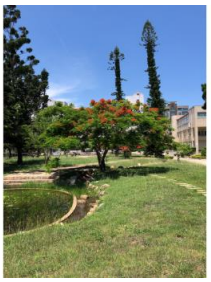
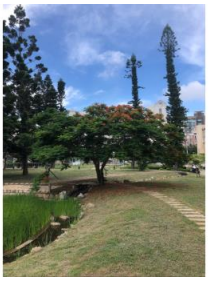
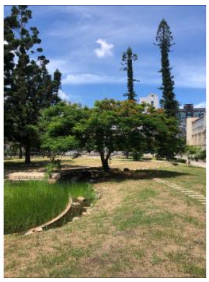
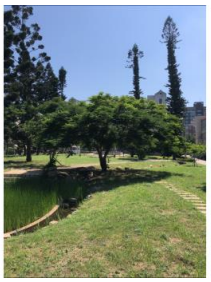
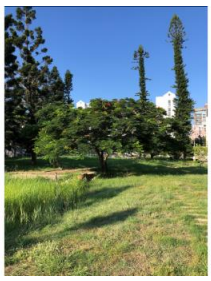


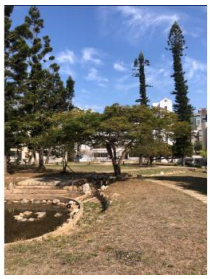
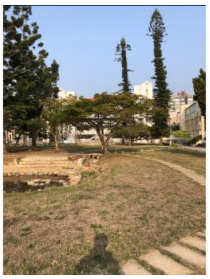
The location of the red, gray and yellow pin is at the two ecological pools and the main academic building in our school representatively.

2. The photos of the trees
(1) The red pin one (the ecological pools that manual instrument shelter site located)

Shot facing west (9/2/2021~2/4/2022)					
9/2/2021	9/5/2021	9/15/2021	9/23/2021	10/5/2021	10/07/2021
					
10/14/2021	10/19/2021	10/21/2021	11/2/2021	11/4/2021	11/11/2021

					
11/16/2021	11/23/2021	11/25/2021	11/30/2021	12/2/2021	12/7/2021
					
12/9/2021	12/14/2021	12/16/2021	12/23/2021	1/7/2022	2/4/2022
					
Shot facing east (4/25/2021~2/0/2022)					
4/25/2021	4/29/2021	5/4/2021	5/11/2021	5/14/2021	5/16/2021
					
5/18/2021	5/20/2021	5/22/2021	5/24/2021	5/26/2021	5/27/2021

					
5/28/2021	5/30/2021	6/1/2021	6/4/2021	6/7/2021	6/9/2021
					
6/10/2021	6/11/2021	6/15/2021	6/17/2021	6/21/2021	6/23/2021
					
6/25/2021	6/28/2021	7/7/2021	7/13/2021	7/27/2021	8/6/2021
					
8/10/2021	8/13/2021	8/26/2021	8/30/2021	9/11/2021	10/14/2021
					
9/15/2021	10/26/2021	10/1/2021	1/13/2022	1/18/2022	2/4/2022

(2) The gray pin one (near the ecological pool surrounded by cherry blossom trees)

5/14/2021	5/18/2021	5/19/2021	5/20/2021	5/22/2021	6/1/2021
					
6/8/2021	6/9/2021	6/10/2021	6/15/2021	6/29/2021	7/13/2021
					
7/17/2021	7/19/2021	8/5/2021	8/17/2021		
					

(3) The yellow pin one (near the main academic building)

3/19/2021	3/22/2021	4/12/2021	4/14/2021	4/19/2021	4/22/2021

					
4/23/2021	4/30/2021	5/4/2021	5/5/2021	5/7/2021	5/15/2021
					
5/18/2021	5/19/2021	5/20/2021	5/22/2021	5/27/2021	5/28/2021
					
6/1/2021	6/4/2021	6/7/2021	6/8/2021	6/9/2021	6/10/2021
					
6/15/2021	6/17/2021	6/21/2021	6/25/2021	6/29/2021	7/13/2021
					

7/17/2021	8/10/2021	8/30/2021	9/1/2021	9/2/2021	9/23/2021
					
10/5/2021	10/7/2021	10/8/2021	10/14/2021	10/19/2021	10/21/2021
					
11/2/2021	11/4/2021	11/16/2021	11/25/2021		
					

Discussion

Q1: Why does this one tree grow much taller (about 15 meters) than usual (about 5 to 10 meters)?

A1: The three sides of this one in front of the main academic building are covered, and because of the positive phototropism of Poinciana trees' trunks, it grows upward for more sunshine.

Q2: Is there anything special in the flowering season of the tree?

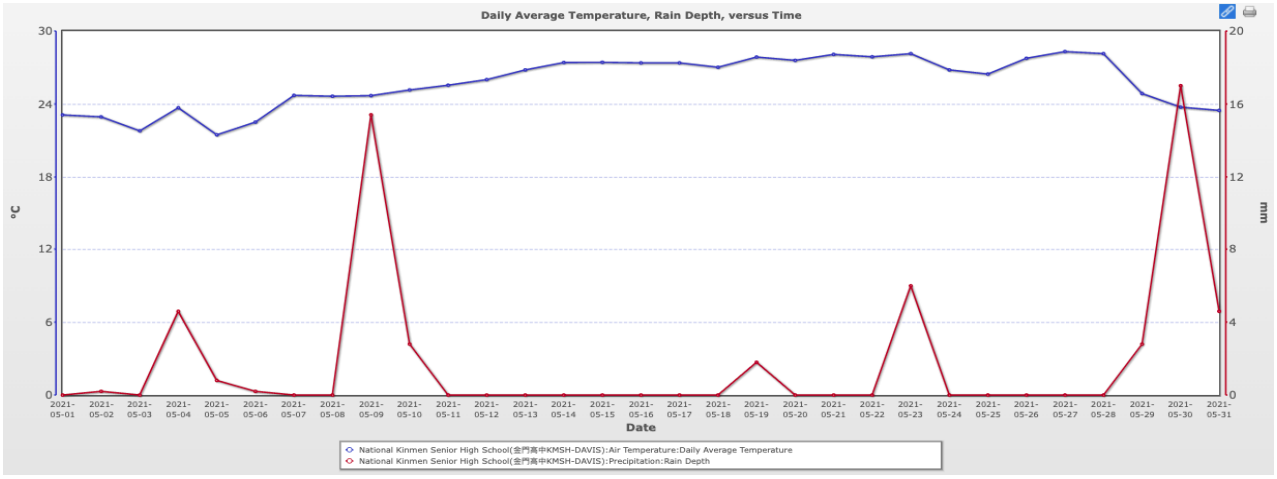
A2: In general, the Poinciana trees should bloom from June to July, but the trees here bloom from the end of May to the beginning of June, obviously moving forward.

Q3: Why did the flowering time of the trees happen earlier? Does air temperature have an effect on the tree's growth?

A3: The flowering time of plants is affected by the air temperature, and it will usually be forward when the temperature is lower,

After I searched for more relative information, I found that the Poinciana trees originated in Madagascar, and the average air temperature is about 75.2°F there, while it is about 69.8°F in Kinmen, which didn't show a large difference but the temperature was slightly lower here.

There was sometimes rain and the air temperature was moderate (about 77°F), and the insolation durations increased gradually here in May 2021, so it's also suitable for blooming when compared with June and July.



Q4: Will the relief of the tree also affect the speed of blooming?

A4: Poinciana trees, which originated in Madagascar (tropical rainforest climate), need a certain amount of water to bloom, so when they are located in a low-lying area, they will bloom completely faster than in a higher zone.

5/19/2021


5/20/2021



Q5: Will the amount of sunshine affect the flowers? Why didn't the flowers simultaneously show up all over the treetop?

A5: Flowers on the left side for the photographer of the pictures below, that is the side where the sun shines directly, blooms, and falls first.

05/07/2021	05/15/2021	05/18/2021	05/19/2021	05/20/2021

				
05/22/2021	05/27/2021	06/01/2021	06/04/2021	06/07/2021
				

(1) What Are Long-day (short night) Plants?

First, the table down here shows how to categorize long-day, short-day, and day-neutral plants.

Type	Flowering Condition	Flowering Season
Long-day plant (Short night plant)	Daylight length > critical day length	Usually spring and summer
	Nighttime length < critical night length	
Short-day plant (Long night plant)	Daylight length < critical day length	Usually autumn and winter
	Nighttime length > critical night length	
Day-neutral plant	Don't affect by the period of light	Depend on environment conditions

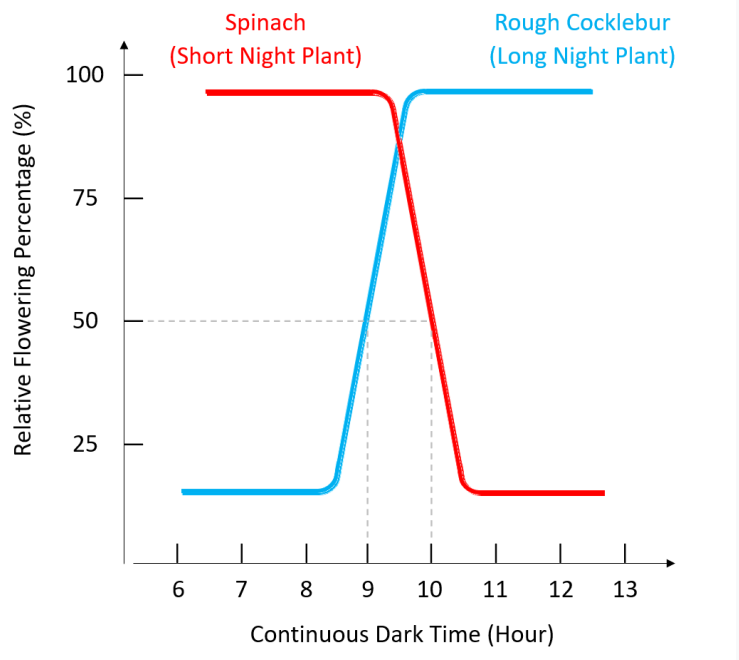
By means of this table and the information we have now, we can infer that the Poinciana tree is a long-day (short night) plant, which means more sunshine will make it bloom faster or earlier.

(2) What is Phytochrome?

a. Introduction: Phytochrome is basically a kind of chromoprotein that is sensitive to light, it can categorize into two types: P_r and P_{fr}, P_r make short night plants bloom slower, the long night plants faster, while P_{fr} is opposite to this. And they will transform mutually when shined by different wavelengths of light, changing the percentage of P_r in P_{total}, and resulting

in the physiological reactions of plants being different.

b. The Connection Between Phytochrome and the Plants



The graph on the left shows the connection between the relative flowering percentage and continuous dark time.

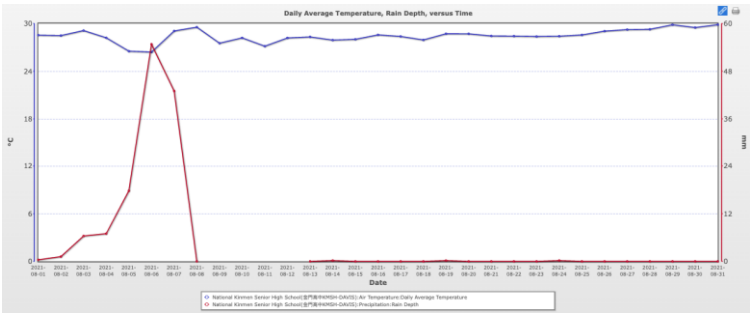
The Poinciana tree is a long-day (short night) plant, when it receives more sunshine, its proportion of P_{fr} will climb up (that is the proportion of P_r go down in comparison), so it blooms faster.

Q6: How did the rain affect the flowers of Poinciana?

A1: We can tell the two following situations
(1) Jun 8, 2021. All the flowers fell after the heavy rain.

Tree photo

The Precipitation (Rain Depth) in 6/8/2021

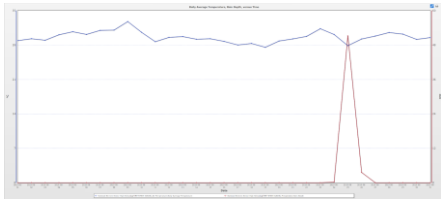
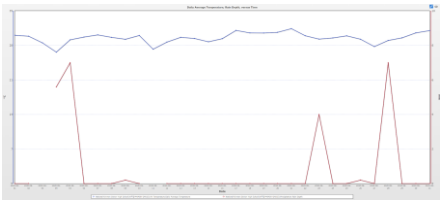
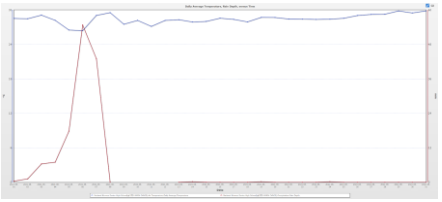


(2) Seems like the tree bloomed a second time (and it is probably due to higher precipitation these days).

The tree near the biological pool in our school on 8/14/2021:

It seems to bloom again lately, after I searched for the climate data and tree photos of 2019 and 2020, I found the same situation happened that time. Combining the above-mentioned information, we can infer the factors that affect the tree to bloom might be affected by average temperature and sunshine.

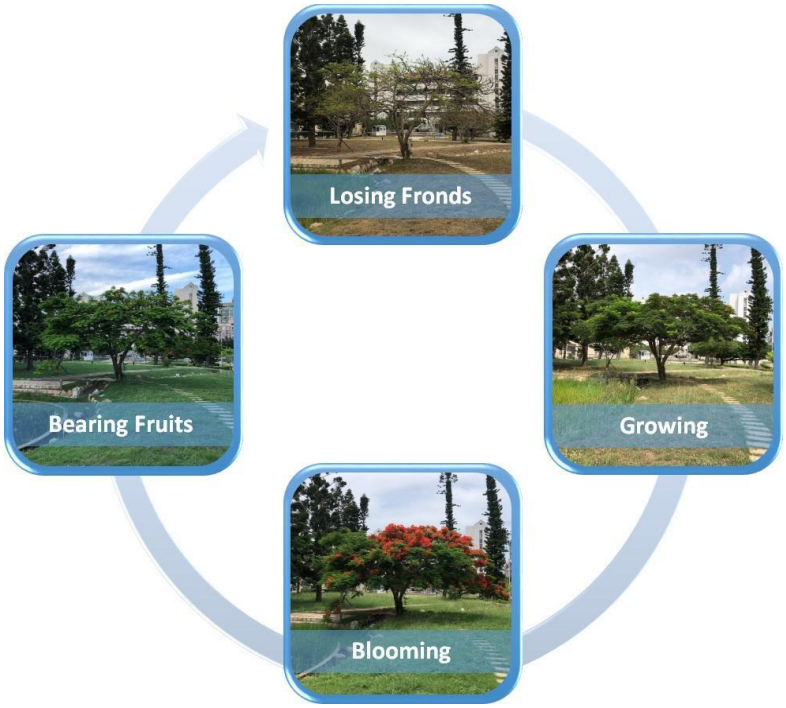
The air temperatures (blue lines) data of August in 2019, 2020, and 2021, telling the average monthly air temperatures are about 28.4℃.

August 2019	August 2020	August 2021
higher than 28℃ on average		lower than 30℃
		

Conclusion

1. The Growth Law of the Poinciana trees:

Because we don't have the pictures of the tree throughout all year, combining the information searched from the Internet and observing the pictures, we can sort the growth situation of the Poinciana tree out like the schematic on right:



2. The trunk of a Poinciana tree has phototropism.

3. Bloom the second time
When air temperature is marginally high and suitable for the tree, the more water-providing, the more flowers will appear.

4. The factors that involved the flower growth:

	value	flower
air temperature	↑	appear later
	↓	appear earlier
relief	↑	relative flowering percentage go lower
	↓	relative flowering percentage go higher
the amount of sunshine	↑	relative flowering percentage go higher
	↓	relative flowering percentage go lower

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