Student Work Sample

Ms. Loux- Turner

Honors EnviSci H

11/24/14

Rooting For Black Oak

Harvard Forrest Project 2014

Tree Poem:

Come little leaves,
said the wind one day,
Come to the meadows
with me and play.
Put on your dresses
of red and gold,
for summer is past
and the days grow cold.

by George Cooper

Introduction:

Throughout the entire fall season I have been studying a Black Oak Tree, scientifically called *Quercus velutina,* with my group. The Black Oak tree grows very slowly and lives for up to 400 years. They have a growing period in which they do not drop all of their leaves for a long time and sometimes a few leaves may not drop at all in the winter. When the spring comes, the Black Oak tree will start to produce its fruit in the form of an acorn. The leaves will grow back bright green and slowly in the fall the leaves will change from red to orange to yellow and finally to brown. The goal of this project is to study the phenology of trees and the effect climate change has on the growing season. The data from the season will then be sent off to Harvard where all the data will be recorded and compared to other students' data in Massachusetts. Researchers will use this data to study how the phenology of trees has changed over the years. I think our leaves will fall off late in the season compared to classmates because oak trees are relatively strong trees. Sometimes, oak leaves take a lot of cold and wind to fall off which we have not had much of lately. This fits into the big picture that we are studying with the interrelations between climate change and the length of phenology cycles.

We were assigned two branches on this tree and we numbered the leaves from one to six so we could track them for the season. We made sure to exclude the first few leaves near the terminal bud because they will not grow again next year, so our data would be inaccurate. We took measurements of each leaf and took pictures of the branches. Because Black Oak trees are deciduous, we had to pay special attention to note when each leaf dropped or fell off the tree due to maturity or natural forces. When stepping away from our branches, we took a look at the full tree and recorded what percentage of the full tree was not green. The greenhouse gas effect is when heat from the sun is taken in by the lower atmosphere of the Earth and this helps maintain

the temperature of the Earth's surface. The enhanced greenhouse gas effect causes the surface of the Earth to warm. This signals to the tree that something is not right so they hold onto their leaves longer because they are used to having leaves in the a warm months. This is when the change in senescence can be noticeable. Senescence is the aging process of all living things so, when the weather is warm, the leaves do not turn colors as fast and then fall off therefore, we see leaves in late months like November. The enhanced greenhouse gas effect is due to human effects of burning fossil fuels and emitting more CO_2 and greenhouse gases. These gases trap more heat which warms the Earth's surface causing the earth to warm since not as much heat is being absorbed back into the atmosphere. Because of the greenhouse gas effects, the growing period is starting to increase by six days on average. My prediction is this will make my tree's leaves stay on longer since the tree is trying to deal with the warmer Earth and doesn't know when to drop its leaves.
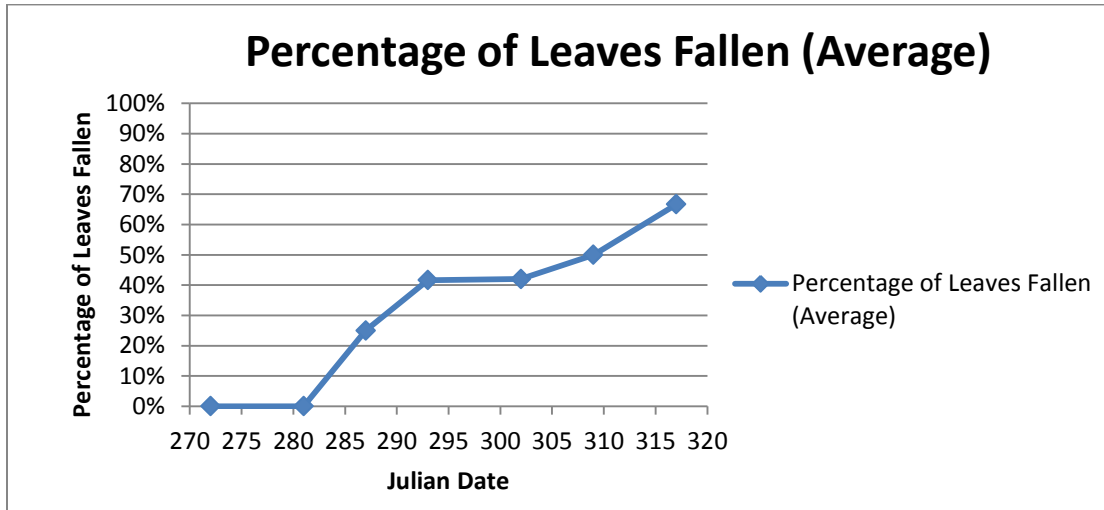
Results:

Weekly Observations-

Data Table 1: Collected Fall Data for MY Study Tree							
Observation Date	Percentage of Leaves Fallen			Tree Color (percentage not green)				Average Temp* (*F)
	Percentage of Leaves Fallen Branch A	Percentage of Leaves Fallen Branch B	Percentage of Leaves Fallen (Average of 2 branches, Overall)	Percentage of Branch A Not Green	Percentage of Branch B Not Green	Percentage of Branches (Average) Not Green	Percentage of Whole Tree Not Green	
9/29/14	0%	0%	0%	0-25%	0-25%	0-25%	0-25%	74.00
10/8/14	0%	0%	0%	0-25%	0-25%	0-25%	0-25%	71.00
10/14/14	0%	50%	25%	0-25%	0-25%	0-25%	0-25%	78.00
10/20/14	17%	67%	42%	0-25%	0-25%	0-25%	26-50%	58.00
10/29/14	17%	67%	42%	0-25%	26-50%	25.00%	26-50%	74.00
11/5/14	33%	67%	50%	76-100%	76-100%	76-100%	76-100%	66.00
11/13/14	33%	100%	67%	75-100%	n/a	76-100%	76-100%	50.00

Overall Results-

Data Table 4: Overall Data for Class (all 3 classes)				
Tree Common Name	Tree Number	Start of Growing Period (50% Leaf emergence) Julian Date	End of Growing Period (50% Leaf Drop 2014) Julian Date	Overall Growing Period 2014
Bitternut Hickory	7.00	132.00	299.00	167.00
Black Birch	12.00	126.00	284.00	158.00
Black Birch	15.00	127.00	274.00	147.00
Black Birch	16.00	126.50	280.00	153.50
Black Cherry	11.00	127.00	299.00	172.00
Black Cherry	2.00	122.00	287.00	165.00
Black Oak	14.00	128.00	292.00	164.00
Black Oak	1.00	127.00	317.00	190.00
Honey Loust	6.00	132.00	302.00	170.00
Pin Cherry	8.00	119.00	270.00	151.00
Red Maple	4.00	127.00	289.00	162.00
Scarlett Oak	9.00	129.00	303.00	174.00
Scarlett Oak	13.00	137.00	302.00	165.00

Shagbark Hickory	5.00	117.00	292.00	175.00
White Ash	17.00		293.00	293.00

Graph 1-

Percentage of Leaves Fallen (Average)

Graph 2-

Percentage of Tree Not Green converted to 1-4 codes
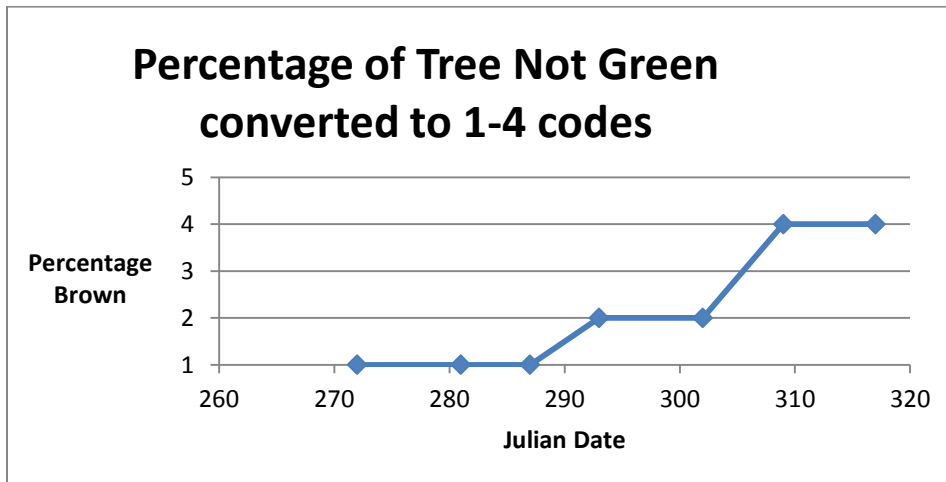
Interpretations:

Table 1-

Table one shows that the leaves on branch B fell off quicker than the leaves on branch A. On average, the leaves did not start falling off until a week and a half into the project. By the end of the project, leaves were falling a consistent rate and the average was 67% of leaves fell off. All the leaves fell off on branch B and 33% fell off on branch A. The tree stayed green for about three weeks of the project until a sudden decrease in temperature occurred and caused the tree to be 26-50% not green and by the time it was 50 degrees Fahrenheit the tree was completely brown.

Table 2-

Table 2 refers to the overall 50% leaf drop and 50% emergence along with class data. The average growing period is around 155-165 in Julian Dates. The shortest growing period was tree number 15 the black birch with 147 Julian date and the longest growing period was tree number 1 the black oak with 190 Julian date.

Graph 1-

Graph one shows the average leaf drop percentage. The data reveals that the leaves did not fall at all from 270 to 280 Julian dates. By the 290 Julian date, 40% of leaves had fallen. Then it was steady up until 300 Julian date. It ended with just under 70% of leaves falling by Julian date 317.

Graph 2-

Graph two shows the percentage of leaves not brown in 1-4 codes. Overall the tree was green until 287 Julian date. It went up to two by 302 Julian date and on 317, the last Julian date, code 4 of the tree was not green.

Conclusion:

The black oak tree has a very long phenology cycle compared to the other trees the class observed. It had the longest cycle out of 17 trees. I predict that the growing cycle next year will be longer than the cycle this year because the climate is getting warmer. Last year, the data shows that the start of the growing period was Julian date 127 and this year the end of the growing period is 317 Julian date causing a 190 Julian day long growing period. In my research I learned that because there are warmer temperatures, the tree will hold onto its leaves longer and the growing cycle will increase by six days.

I would suggest that there are no more Julian dates because they are complicated to understand. Other than that I would not change anything about the project.

Works Cited

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